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Specification (Measurement)

Transport and Main Roads Specifications
MRS96 Management and Removal of Asbestos

July 2017

Queensland
Government

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Contents

1 Introduction 1

2 Measurement of Work 1

2.1 Standard Work Items 1

2.2 Work Operations 1

2.3 Rate of Payment for Item 21301 2

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the management and safe removal of asbestos from existing transport infrastructure including:

- bridges (for example, rehabilitation works including widening, strengthening and damage due to vehicle impact)
- electrical conduits and pits
- water mains, sewer mains and drainage pipes, and
- miscellaneous products.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of Work

2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS01 *Introduction to Specifications,* the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Managing and Removing Asbestos		
21301	Identifying and managing asbestos on Site [*description*]	lump sum
21302	Removing and disposing of Asbestos Containing Material on Site [*description*]	lump sum

2.2 Work Operations

Item 21301 Identifying and managing asbestos on Site [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) all activities associated with the identification and management of asbestos on the Site, and

c) supply of all documentation including updated asbestos register.

Item 21302 Removing and disposing Asbestos Containing Material on Site [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and transport of all personnel, plant, equipment and materials to and from the Site

c) obtaining all necessary licenses and permits under relevant legislation

d) removal of all Asbestos Containing Material as shown in the Contract

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e) safe disposal of Asbestos Containing Material in accordance with WHS requirements, and

f) supply of all documentation including certificates and registers.

2.3 Rate of Payment for Item 21301

Payment for Item 21301 will be made by the Principal in three stages in accordance with the provisions of this clause.

Provided the Contractor is fulfilling all its obligations under the Contract, one-third of the Lump Sum amount will be included in the Payment Certificate at the end of the month when one third of the total work on Site (including rehabilitation works) has been completed. The next two components will be included in the Payment Certificate at the end of the month on completion of each portion of total work.

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Specification (Measurement)

MRS170 Public Utilities in Road Projects Site Works

March 2021

Queensland Government

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Payment for Works from other Specifications 7

2.3 Work Operations 7

2.3.1 Road Project Site Works – General 7

2.3.2 Street Lighting Rate 2 (NPL2) owned and maintained by an Electricity Entity (Public Utility) 16

2.3.3 Electricity Assets (LV/HV Electricity Network Assets) 17

2.3.4 Telecommunications Network 28

2.3.5 Water 38

2.3.6 Waste water / Sewer 47

2.3.7 Gas Utility network 57

3 Temporary Support of Utility Assets 64

4 Public Utility Authorities fees for representatives on Site 65

5 Damage and Repair of PUP 65

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

1 Introduction

This Specification applies to the management, coordination and implementation of Public Utility Plant (PUP) works undertaken by the Principal Contractor and the various Public Utility Authorities in conjunction with the works under the Contract. It does not include local government owned stormwater assets or other third party assets that are not PUP.

> Please note: Essential services are not to be disconnected or placed at unnecessary risk of damage (particularly those servicing medical centres, hospitals, emergency services, defence and so on) unless otherwise negotiated and agreed by the relevant parties.
>
> Additionally, more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate. Reference should be made to the associated Technical Specifications suites (MRTS, MRS and Annexures) when developing a schedule for PUP relocation.

This Specification forms part of the Transport and Main Roads Specification Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Road Project Site Works - General		
22101	Management of PUP authorities [*description*] (road construction contractor only)	lump sum
22102	Project Management / Design review [*Utility Authority*] (Utility Authority only)	lump sum
22103	Location of overhead and underground utility assets as per Quality Level B, AS 5488	m
22104	Location of underground utility assets using ground penetrating radar or similar non-destructive method	m
22105	Installation of identification markers for underground and/or overhead utility assets	lump sum
22106	Protection of all existing, temporary or permanent utility assets during construction (as per individual Utility Authority requirements)	lump sum
22107	Design [*Utility Authority*] (Utility Authority Only, excluding Electrical and Telecommunication authorities)	lump sum

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FOI 26-292 - Document 21

Standard Item No.	Description	Unit of Measurement
22108	Excavation [*manual* | *mechanical* | *manual and mechanical*] process to expose and locate underground utility assets as per Quality Level A, AS 5488	m³
22109	Supply and install of permanent reinforced concrete encasement / protection slab [*description*]	m³
22110	Supply, install and commissioning of [*material*] enveloper components for [*Utility Asset type*], Class [*class*], [*diameter*] mm diameter, [*environment*] environment in accordance with [*reference design*] (includes all vent pipes associated with enveloper and grouting)	m
22111	[*Raise* | *Remove* | *Lower*] existing [*Utility Authority Asset*] by [*height*] mm [*description*]	m
22112	Modification / adjustment of pits / chambers to final surface level in accordance with [*Reference Drawings*]	each
22113	Reinstate existing [*diameter*] mm [*material*] property service connection arrangement in accordance with [*Reference Drawings*]	each
22114	Removal and disposal of property service connections [*size*] mm to private property in accordance with [*Reference Drawings*]	each
22115	Preparation and supply of certified As Constructed drawings including Asset Design and As Constructed (ADAC) documentation, and certified survey (including survey pick up) for relocation and protected underground or overhead utility assets as needed to MRTS56 *Construction Surveying*.	lump sum
Street Lighting Rate 2 (NPL2) owned and maintained by an Electricity Entity (Public Utility)		
22201	Rate 2 (NPL2) street lighting design (owned and maintained by Electricity Entity)	lump sum
22202	Rate 2 (NPL2) lighting design approval, acceptance or abolishment in accordance with [*Electricity Entity*] standards and requirements	lump sum
Electricity Assets (LV/HV Electricity Network Assets)		
22251	Electrical Design [*voltage*] kV, [*overhead* | *underground*]	lump sum
22252	Supply, install, test and commissioning of [*product type*] [*electrical conduit* | *communications conduit*], DN [*diameter*] mm in accordance with [*reference design*] and [*Electricity Entity*] standard (trenching only)	m
22253	Supply, install, test and commissioning of [*product type*] [*electrical conduit* | *communications conduit*], DN [*diameter*] mm in accordance with [*reference design*] and [*Electricity Entity*] standard (directional drilling / micro tunnelling only)	m
22254	Supply, install, test and commissioning of service pit [*type*] in accordance with [*reference design*] and [*Electricity Entity*] standard	each
22255	Supply, install (haul) [*voltage* | *type*] kV [*type*] [*electrical cable* | *communication cable*] in underground conduits in accordance with [*Electricity Entity*] standard	m

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FOI 26-292 - Document 21

Standard Item No.	Description	Unit of Measurement
22256	Supply, install, test and commissioning of [*height*] m [*type*] power pole in accordance with [*reference design*] and [*Electricity Entity*] standard	each
22257	Supply, install, test and commissioning of [*height*] m [*type*] transmission tower in accordance with [*reference design*] and [*Electricity Entity*] standard	each
22258	Supply, install (haul) [*voltage* | *type*] kV [*type*], [*electrical cable* | *communication cable*] on [*power pole* | *transmission tower*] in accordance with [*Electricity Entity*] standard	m
22259	Supply, install, test, commissioning of [*voltage*] kV [*pad mounted* | *pole mount*] transformer in accordance with [*Electricity Entity*] standard	each
22260	Live Connection works [*voltage*] kV [*overhead*]	lump sum
22261	Live Connection works [*voltage*] kV [*underground*]	lump sum
22262	Removal and disposal of abandoned [*electrical pits* | *AC electrical pits*] in accordance with [*reference design*]	each
22263	Removal and disposal of abandoned electrical conduits and electrical communications conduits [*including AC* | *excluding AC*] in accordance with [*reference design*]	m
22264	Removal and disposal of redundant electrical and communications cable [*above ground* | *underground*]	m
22265	Removal and disposal of abandoned power pole	each
22266	Removal and disposal of abandoned transmission tower	each
22267	Removal and disposal of abandoned [*pole mounted* | *pad mounted*] transformer	each
Telecommunications Network		
22351	Telecommunications design	lump sum
22352	Supply, install, test and commissioning of [*product type*] communications conduit, DN [*diameter*] mm in accordance with [*reference design*] and to [*Telecommunications Authority*] standard (trenching only)	m
22353	Supply, install, test and commissioning of [*product type*] communications conduit, DN [*diameter*] mm in accordance with [*reference design*] and to [*Telecommunications Authority*] standard (directional drilling / micro tunnelling)	m
22354	Supply, install test and commissioning of service pit [*type*] in accordance with [*reference design*] and [*Telecommunications Authority*] standard	each
22355	Supply, install, test and commissioning of access / service chamber in accordance with [*reference design*] and [*Telecommunications Authority*] standard	each
22356	Supply, install (haul) [*size* | *type*] communications cable in underground conduits in accordance with [*Telecommunications Authority*] standard (excluding fibre optic)	m

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Standard Item No.	Description	Unit of Measurement
22357	Supply, install (haul) [*size* | *type*] fibre optic communications cable in underground conduits in accordance with [*Telecommunications Authority*] standard	m
22358	Supply, install, test and commissioning of Mobile Tower in accordance with [*reference design*] and [*Telecommunications Authority*] standard	lump sum
22359	Jointing / connection, test and commissioning of telecommunication cable to live network [*size* | *type*] [*fibre optic* | *other*]	lump sum
22360	[*Raising* | *Lowering*] telecommunications access / service chamber in accordance with [*reference design*]	lump sum
22361	Removal and disposal of abandoned telecommunication [*AC pits* | *pits*] in accordance with [*reference design*]	each
22362	Removal and disposal of abandoned telecommunication [*AC conduits* | *conduits*] in accordance with [*reference design*]	m
22363	Removal and disposal of redundant telecommunications cable (above ground)	m
22364	Removal and disposal of redundant telecommunications cable (underground)	m
22365	Demolition, removal and disposal of telecommunication access chamber in accordance with [*reference design*]	lump sum
22366	Demolition, removal and disposal of telecommunication Mobile tower in accordance with [*reference design*]	lump sum
Water		
22451	Supply, install, test and commissioning of [*product type*] water main, DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes valves)	m
22452	Supply, install, test and commissioning of water [*valve type* | *size*], in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]	each
22453	Supply, install, test and commissioning of [*diameter*] mm access chamber in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes aspro risers and chamber cover)	each
22454	Supply, install, test and commissioning of [*diameter*] mm [*type*]. Fire Hydrant Arrangement in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]	each
22455	Supply and install thrust block in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] if not order as part of item 22451	m^3

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Standard Item No.	Description	Unit of Measurement
22456	Live Connection works DN [*diameter*] mm [*type* | *material*] water [*transmission* | *distribution*] main in accordance with [*reference design*]	lump sum
22457	Structural relining DN [*diameter*] mm water main in accordance with [*reference design*]	m
22458	Modification / adjustment of existing scour valves in accordance with [*Reference Drawings*]	lump sum
22459	Treatment of abandoned [*type*] DN [*diameter*] mm water main left insitu [*including AC* | *excluding AC*] in accordance with [*reference design*]	m
22460	Removal and disposal of redundant OD [*diameter*] mm [*type* | *material*] water main [*including AC* | *excluding AC*] in accordance with [reference design] undertaken as per [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] including pits, valves and hydrants	m
22461	Removal and disposal of abandoned thrust blocks	m^3
22462	Removal and disposal of abandoned pits, valves, hydrants	each
Waste water / Sewer		
22551	Supply, install, test and commissioning of [*product type*] rising sewer, DN [*diameter*] mm [*pressure rating*] in accordance with [reference design]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes valves, vents, chambers)	m
22552	Supply, install, test and commissioning of rising sewer [*valve type* | *size*], in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]	each
22553	Supply, install, test and commissioning of rising sewer chamber in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]	lump sum
22554	Supply, install, test, and commissioning of rising sewer vent in accordance with [*reference design*]	each
22555	Supply, install, test and commissioning of [*product type*] gravity sewer, DN [*diameter*] mm in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes access chambers)	m
22556	Supply and install thrust block in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] if not order as part of item 22551	m^3
22557	Structural relining DN [*diameter*] mm sewer in accordance with [*reference design*]	m
22558	Treatment of abandoned [*type*] DN [*diameter*] mm [*waste water* | *sewer*] main left insitu [*including AC* | *excluding AC*] in accordance with [*reference design*]	m

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Standard Item No.	Description	Unit of Measurement
22559	Treatment of abandoned sewer access chambers left insitu in accordance with [*reference design*]	m³
22560	Removal and disposal of redundant OD [*diameter*] mm [*type* | *material*] sewer mains [*including AC* | *Sewer Main*] in accordance with [*reference design*] undertaken as per [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] including pits and valves (excluding access chambers)	m
22561	Removal and disposal of abandoned thrust blocks	m³
22562	Demolition, removal and disposal of existing rising sewer vent / odour chamber in accordance with [*reference design*]	each
22563	Demolition, removal and disposal of existing [*sewer access chambers* | *rising sewer chamber*] in accordance with [*reference design*]	m³
Gas Utility network		
22651	Supply [*product type*] gas pipeline, [*transmission* | *distribution*] DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*] addressing [*AS 2943* | *AS 4645* | *Utility Owner specific standard*] requirements	m
22652	Supply, gas [*valve type* | *size*] for gas pipeline, *[transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 2885* | *AS 2943* | *AS 4645* | *AS 4853* | *Utility Owner specific standard*] requirements	each
22653	Supply, install, test and commissioning of other gas fittings / access chamber / or asset [*type* | *size*] for gas pipeline, [*transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 2885* | *AS 2943* | *AS 4645* | *AS 4853* | *Utility Owner specific standard*] requirements	each
22654	Install, test and commissioning of [*product type*] gas pipeline, [*transmission* | *distribution*] DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*]. Constructed to [*AS 2885* | *AS 4645* | *Utility Owner specific standard*] (includes all welding / jointing, marker boards, protection tape and posts) (excludes valves)	m
22655	Install, test and commissioning of gas [*valve type* | *size*] for gas pipeline, [*transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 2885* | *AS 4645* | *Utility Owner specific standard*] requirements	each
22656	Live Connection [*high* | *medium* | *low*] pressure [*product type*] DN [*diameter*] mm gas pipeline [*transmission* | *distribution*] (including all valves, fittings and welding)	lump sum
22657	Treatment of abandoned [*type*] DN [*diameter*] mm for gas pipeline left insitu in accordance with [*reference design*]	m
22658	Treatment of abandoned other gas fitting / access chamber / or asset [*type* | *size*] for gas pipeline left insitu in accordance with [*reference design*]	m
22659	Removal and disposal of redundant DN [*diameter*] mm [*type* | *material*] gas pipeline [*transmission* | *distribution*] in accordance with [*reference design*] including valves (excluding access chambers)	m

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FOI 26-292 - Document 21

Standard Item No.	Description	Unit of Measurement
22660	Removal and disposal of other gas fitting / access chamber / or asset [*type* | *size*] for gas pipeline [*transmission* | *distribution*] in accordance with [*reference design*]	each

2.2 Payment for Works from other Specifications

Payment Items shall include all applicable work operations as described in this Specification or other relevant Specification (Measurement) schedules. These shall be paid on a progress of work basis, based on amount of work activity completed at date of claim.

Below is an example of works covered in other Specifications:

- Payment for traffic management will be in accordance with MRS02 *Provision for Traffic*
- Payment for modifications to existing drainage will be measured separately for each work item and in accordance with MRS03 *Drainage, Returning Structures and Protective Treatments*
- Payment for earthworks will in accordance with MRS04 *General Earthworks*
- Payment for unbound pavement will be in accordance with MRS05 *Unbound Pavements*
- Payment for asphalt shall be in accordance with MRS30 *Asphalt Pavements*
- Payment for environmental management will be in accordance with MRS51 *Environmental Management*
- Payment for conduits and pits will be in accordance with MRS91 *Conduits and Pits*
- Payment for horizontal directional drilling shall be in accordance with MRS140 *Horizontal Directional Drilling (HDD)*
- Payment for micro-tunnelling and pipe jacking shall be in accordance with MRS141 *Microtunnelling and Pipe Jacking*
- Payment for thrust bore and auger boring shall be in accordance with MRS142 *Thrust Boring and Auger Boring*.

2.3 Work Operations

Work Operations included in the Standard Work Items are specified in the relevant clause adjacent to each Standard Work Item listed in Table 2.1.

2.3.1 Road Project Site Works – General

Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22101 Management of PUP authorities [*description*] (road construction contractor only)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) appointment of a Utility coordination representative

c) preparation, submission, monitoring and updating of Utility Relocation Management Plan

d) obtaining information regarding existing Utilities from the relevant Utility Owner / authority

e) management of relocations and/or modifications to Utilities including all costs associated with the provisioning of the Utility Authorities and/or their appointed specialist contractors unrestricted access to the site to perform their works and inspections; in accordance with the relocation design drawings appended to this Specification

f) liaison and negotiation with Utility Authorities and/or their Contractors

g) provision of traffic control for the relocation works to be undertaken by the Principal Contractor within the site (Refer to MRS02 *Provision for Traffic*). Note: Any additional traffic control for Utility Authorities or their appointed specialist contractor as directed by the Administrator shall be provided by the Contractor and shall be paid as Day Works

h) supply of all necessary information and survey set out associated with the relocation works, to the Utility Authority (as required) to enable the Public Utility Authority to complete its work

i) coordinate works by the respective Utility Authorities

j) verification and checking of proposed works against all available information relating to existing overhead or underground utility assets in close proximity to pavement / civil works

k) provision of engineering survey in accordance with *TMR Surveying Standards* showing the alignment and depth of all utility assets that the Contractor believes are in conflict with the works. The survey file shall be in 12d format and shall be supplied to the Administrator on the same day that any previously unidentified conflict is identified

l) facilitation of a joint inspection with the Administrator to determine scope of all likely impacts / relocations works

m) all costs associated with the support of existing power poles by Energex / Ergon / Powerlink, as required, and

n) all other activities not covered by a separate pay item identified elsewhere within this Specification.

Item 22102 Project Management / Design review [*Utility Authority*] (Utility Authority only)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) appointment of a Utility Authority representative

c) facilitation of a joint inspection with the Administrator / nominated Transport and Main Roads representative to determine scope of all likely impacts / relocations works

d) reviewing, and endorsing Utility asset protection/ relocation designs associated with their assets

e) verification and checking of proposed works against all available information relating to existing overhead or underground utility assets in close proximity to pavement / civil works

f) providing information regarding existing utility assets

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g) management of relocations and/or modifications to utility assets including all costs associated with the provisioning of the Utility Authorities and/or their appointed specialist contractors in accordance with the endorsed relocation / protection design drawings

h) liaison and negotiation with Transport and Main Roads Contractors, other Utility Authorities and/or their nominated contractors

i) written agreement from each utility of the future location of the utility's assets and the scope of works required in conjunction with any specific district or region authorisation requirements

j) provision of traffic control for the relocation works to be undertaken (Refer to MRS02 *Provision for Traffic*) as required (if Utility Authority is undertaking the works as the nominated Principal Contractor then they are responsible for provision of traffic control)

k) supply of all necessary information and survey set out associated with the relocation works, as required

l) coordinate works undertaken by the respective Utility Authority contractor

m) all costs associated with the support of all existing utility assets, as required

n) survey pick up and provision of as constructed drawings in accordance with MRTS56 *Construction Surveying* showing the alignment and depth of all relocated / protected utility assets. The survey file shall be in 12d format and shall be supplied to the Administrator within two weeks after completing relocation / protection works

o) legal services and other contract management costs as required

p) issuing of completion stage certificate, confirming Utility Authority acceptance of unencumbered relocated / protected utility asset, and

q) all other activities not covered by a separate pay item identified elsewhere within this Specification.

Item 22103 Location of overhead and underground utility assets as per Quality Level B, AS 5488

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply / coordinate plant and works required to undertake the physical locating of all existing services located within the [*refence design*] using methods accepted as Level B quality in AS 5488. These locating works are to be undertaken by a suitably qualified Contractor to confirm the asset type, location, size and depth / height in accordance with *TMR Surveying Standards* and Quality Level B, AS 5488

c) preparation, monitoring and updating of utility conflict matrix and drawings based on Quality Level B AS 5488 information. Data obtained using Quality Level B methods must be identified with the acronym QL-B, and

d) survey file shall be in 12d format and shall be supplied to the Transport and Main Roads representative every two weeks until the identification works have been completed.

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Item 22104 Location of underground utility assets using ground penetrating radar or similar non-destructive method

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply / coordinate plant and works required to undertake the physical locating of all existing services located within the [reference design] using ground penetrating radar. These locating works are to be undertaken by a suitably qualified Contractor to confirm the asset type, location, size and depth/height in accordance with *TMR Surveying Standards*. It is acknowledged that ground penetrating radar is no longer considered Level B quality data however x, y and z data must be provided

c) preparation, monitoring and updating of utility conflict matrix and drawings based on ground penetrating radar information. Data obtained using ground penetrating radar must be identified with the acronym GPR, and

d) survey file shall be in 12d format and shall be supplied to the Transport and Main Roads representative every two weeks until the identification works have been completed.

Item 22105 Installation of identification markers for underground and/or overhead utility assets

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply, coordinate / install and maintain markers, tiger tails, flagging and so on required to identify existing and/or relocated underground and/or overhead utility assets located within the project site, that may be impacted directly or inadvertently by the project works.

Item 22106 Protection of all existing, temporary or permanent utility assets during construction (as per individual Utility Authority requirements)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials, including all reinforcement and road pavement materials as required

c) undertaking all necessary excavations and/or protection works required to protect all temporary and permanent utility assets during construction, and

d) removal of all unused materials from site including transportation as a result of undertaking utility protection.

Item 22107 Design [*Utility Authority*] (Utility Authority Only, excluding Electrical and Telecommunication authorities)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) participate in a joint inspection with the nominated Transport and Main Roads representative, Utility Authority representatives and Transport and Main Roads contractor, to determine scope of all likely impacts associated with the protection / relocations works

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c) review of all utility asset location data and identify any additional data required for design development

d) preparation, of protection and/or relocation designs for impacted utility assets / networks in accordance with the project brief and specified standards

e) liaison and negotiation with Transport and Main Roads contractors, other Utility Authorities and/or their nominated contractors

f) coordinate, negotiate and obtain alignment approval for relocated utility assets with the relevant road authority

g) identify project constraints with regards to available utility corridors and propose/ develop cost effective solutions, and

h) preparation, review and endorsement of works schedule, identifying work items as per Transport and Main Roads Specifications and relevant Supplementary Specifications.

Item 22108 Excavation [*manual* | *mechanical* | *manual and mechanical*] process to expose and locate underground utility assets as per Quality Level A, AS 5488

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply / coordinate plant and works required to undertake the physical locating and exposing all existing utility assets within 3.0 m of proposed excavations using vacuum / hydro excavation (potholing) by a suitably qualified Contractor to confirm the asset type, location, material, size and depth in accordance with *TMR Surveying Standards* to Quality Level A, AS 5488

c) supply / coordinate plant and works required to undertake the physical locating and exposing of high-risk utility assets identified in the [reference design] using vacuum/hydro excavation (potholing) by a suitably qualified Contractor to confirm the asset type, location, material, size and depth in accordance with *TMR Surveying Standards* to Quality Level A, AS 5488

d) dispose of the excavated material offsite and backfill the excavation with a material approved by the relevant Utility Authority and the Administrator.

e) preparation, monitoring and updating of utility conflict matrix and drawings based on Quality Level A, AS 5488 information. Data obtained using Quality Level A methods must be identified with the acronym QL-A, and

f) survey file shall be in 12d format and shall be supplied to the Transport and Main Roads representative every two weeks until the identification works have been completed.

Item 22109 Supply and install of permanent reinforced concrete encasement / protection slab [*description*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials, including all reinforcement (concrete, bar chairs, ties etc.) road pavement and driveway materials as required

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c) carrying out localised excavations, including all necessary road / driveway pavement materials and bound material

d) temporary support of all conduits, cables, pipes where/as required

e) placement of sand / stabilised sand / flowable fill as required and as specified in design drawings

f) undertake construction activities associated with concrete encasement / placement of protection slab, to finish surface level, including construction of falsework / formwork, compacting of concrete, finishing of concrete, placement of marker tape as required and further details as specified in [*reference design*]

g) utilising or disposing of excavated material

h) prefabricating materials where required

i) cartage of components from the storage site

j) reinstating all areas affected by the works including verge, drainage and any pavement materials where required, and

k) removal and disposal of all demolished/unused materials from site including transportation.

Item 22110 Supply, install and commissioning of [*material*] enveloper components for [*Utility Asset type*], Class [*class*], [*diameter*] mm diameter, [*environment*] environment in accordance with [*reference design*] (includes all vent pipes associated with enveloper and grouting)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road / driveway pavement materials and bound material

d) mobilise / supply / coordinate plant and works required to undertake drilling operations, if required

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) cartage of components from the storage site

h) installing pipe envelopers as specified on design drawings. This shall include supply, installation and commissioning of plastic spacers, grout annulus between encasing pipe and water pipes and waterproofing foam sealants etc

i) placing detectable marker tape above pipe (entire length) as per relevant Utility Authority code, if required

j) supply, place and compact backfill material (including side zone and overlay zones), and

k) reinstatement of turf / garden / and so on where/as required.

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Item 22111 [*Raise* | *Remove* | *Lower*] existing [*Utility Authority Asset*] by [*height*] mm [*description*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) undertaking all work in accordance with relative utility authority requirements

c) supply of all materials, including all reinforcement and road pavement materials to carry out any raising / lowering / removing activities

d) carrying out localised excavations as required

e) utilising or disposing of excavated material

f) temporary support of conduits, cables, pipes where/as required

g) removal of utility authority asset from site where/as required

h) placing and compacting foundation / bedding material and haunch zones where/as required

i) placing formwork / falsework where/as required

j) prefabricating materials where required

k) placing of reinforcement where/as required

l) placing and compacting concrete where/as required

m) cartage of fitting components from the storage site where/as required

n) laying and jointing including butt welding, collar welding as per the design drawings where/as required

o) placing and assembling fitting components where/as required

p) constructing thrust blocks where/as required

q) finishing and curing concrete where/as required

r) replacing pit / manhole lids with new load rated concrete lids (colour and finish to match adjoining new pavement) where/as required

s) cutting pipe components where necessary where/as required

t) supply, placing and compacting backfill material (including side zone and overlay zones) where/as required

u) installing surface boxes, pit lids and surface fittings where/as required, and

v) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, bacteriological testing, pressure testing and any other testing as required were/as required.

Item 22112 Modification / adjustments of pits / chambers to final surface level in accordance with [*Reference Drawings*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) undertaking all work in accordance with relative utility authority requirements

c) supply of all materials, including all reinforcement and road pavement materials to carry out any raising / lowering / removing activities

d) carrying out localised excavations as required

e) utilising or disposing of excavated material

f) temporary support of conduits, cables, pipes where/as required

g) removal of utility authority asset from site where/as required

h) placing and compacting foundation / bedding material where/as required

i) placing formwork / falsework where/as required

j) prefabricating materials where required

k) placing of reinforcement where/as required

l) placing and compacting concrete where/as required

m) cartage of fitting components from the storage site where/as required

n) laying and jointing including butt welding, collar welding as per the design drawings where/as required

o) placing and assembling fitting components where/as required

p) finishing and curing concrete where/as required

q) supply, placing and compacting backfill material where/as required

r) installing surface boxes, pit lids and surface fittings where/as required, and

s) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, and any other testing where/as required.

Item 22113 Reinstate existing [*diameter*] mm [*material*] property service connection arrangement in accordance with [*Reference Drawings*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and install all pipes, valves, and associated fittings as required by the relevant Utility Authority, including road crossing where required

c) relocation of existing / installation of new service meter, where required, in accordance with relevant Utility Authority code / specifications

d) carrying out localised excavations, including all necessary road pavement materials and bound material

e) prefabricating fitting components where required

f) cartage of fitting components from the storage site

g) laying and jointing including butt welding, collar welding as per the design drawings

h) placing and assembling fitting components

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i) cutting pipe components where necessary

j) supply, placing and compacting backfill material (including side zone and overlay zones)

k) installing surface boxes and surface fittings where specified

l) reinstatement of turf / garden / and so on where/as required, and

m) testing by an approved NATA approved authority as per the relevant Utility Authority Code / specification including soil compaction, bacteriological testing, pressure testing and any other testing as required.

Item 22114 Removal and disposal of property service connections [*size*] mm to private property in accordance with [*Reference Drawings*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) verify in writing with the relevant Utility Authority and with the Transport and Main Roads Representative that the property service is no longer required and can be removed

c) undertaking all work in accordance with relative Utility Authority requirements

d) carrying out localised excavations, as required

e) utilising or disposing of excavated material

f) temporary support of conduits, cables, pipes where/as required

g) removal of Utility Authority assets from site where/as required

h) cartage of fitting components from the storage site where/as required

i) cutting pipe components where necessary where/as required

j) removal of redundant pipe, pits, valves stopcocks, and so on associated with redundant house connection

k) supply, placing and compacting backfill material

l) reinstatement of turf / garden and so on where/as required, and

m) installing surface boxes, pit lids and surface fittings where/as required.

Item 22115 Preparation and supply of certified As Constructed drawings including Asset Design and As Constructed (ADAC) documentation, and certified survey (including survey pick up) for relocation; and protected underground or overhead utility assets as needed to MRTS56 *Construction Surveying*.

Note: Building Information Management (BIM) requirements may need to be addressed depending on the project type and size.

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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FOI 26-292 - Document 21

b) preparation of RPEQ Certified As Constructed drawings as per the current Utility Authority standard / code requirements

c) survey pick up of all relocated and/or protected utility assets in accordance with the *TMR Surveying Standards* and Quality Level A, AS 5488. Survey file shall be provided to Transport and Main Roads in 12d format

d) ground penetrating radar pick up of all abandoned utility assets, identifying x, y and z data. Data obtained using ground penetrating radar must be identified with the acronym GPR

e) As Constructed drawings shall be provided to Transport and Main Roads within one month of the relocation / protection works being completed

f) preparation of RPEQ Certified ADAC documentation as per the relevant Utility Authority standard / code requirements (if ordered), and

g) Building Information Management (BIM) requirements where requested in the project documents.

2.3.2 Street Lighting Rate 2 (NPL2) owned and maintained by an Electricity Entity (Public Utility)

Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22201 Rate 2 (NPL2) street lighting design (owned and maintained by Electricity Entity)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) participate in a joint inspection with the nominated Transport and Main Roads representative, Utility Authority representatives and Transport and Main Roads contractor, to determine scope of all likely impacts associated with the protection / relocations works

c) review of all utility asset location data and identify any additional data required for design development

d) survey pick up of all relocated and/or protected utility assets in accordance with the *TMR Surveying Standards* and Quality Level A, AS 5488. Survey file shall be provided to Transport and Main Roads in 12d format

e) preparation, of protection and/or relocation designs for impacted utility assets / networks in accordance with the project brief and specified standards

f) liaison and negotiation with Transport and Main Roads Contractors, other Utility Authorities and/or their nominated contractors

g) coordinate, negotiate and obtain alignment approval for relocated utility assets with the relevant road authority

h) identify project constraints with regards to available utility corridors and propose / develop cost effective solutions

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i) preparation of RPEQ Certified As Constructed drawings as per the current Utility Authority standard / code requirements

j) ground penetrating radar (GPR) pick up of all abandoned utility assets to MRTS56 *Construction Surveying* requirements and AS 5488 Quality Level B. Data obtained using ground penetrating radar must be identified with the acronym GPR

k) As Constructed drawings shall be provided to Transport and Main Roads within one month of the relocation/ protection works being completed, and

l) preparation of RPEQ Certified ADAC documentation as per the relevant Utility Authority standard/ code requirements (if ordered).

Item 22202 Rate 2 (NPL2) lighting design approval, acceptance or abolishment in accordance with [*Electricity Entity*] standards and requirements

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) lighting design agreement obtained from the electricity entity

c) new connection or abolishment of existing electrical connections, including:

i. submission of an electrical new connection request/connection abolishment request through the electricity entities online portal

ii. once accepted, submit the electrical works request through the electricity entity online portal

iii. the region/district to direct whoever submits these requests to provide a copy to Procurement_Requests@tmr.qld.gov.au, and

iv. Please note: there will then be liaison and follow up between the Transport and Main Roads Utility Management Advisor in the Chief Procurement Office and retailer to ensure that the correct Transport and Main Roads processes are followed.

2.3.3 Electricity Assets (LV/HV Electricity Network Assets)

In addition to the design drawings, all civil works associated with electrical relocation works (including material properties) shall be in accordance with the relevant Utility Authority specifications, standards and typical details. The contractor shall ensure all work method statements and inspection hold point documentation is built around the relevant Utility Authority's specifications to ensure that the design intent is met.

Contractor to confirm location of all electrical asset (underground and overhead) prior to undertaking earthworks/auxiliary activities within the works area. Where assets are found to conflict with proposed design, contractor must notify the Administrator immediately advising on location and nature of the conflict.

Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

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FOI 26-292 - Document 21

Contractors to ensure that clearances to electrical infrastructure is maintained during construction in accordance with the relevant Utility Authority requirements to ensure that the proposed works do not impact on existing infrastructure.

Item 22251 Electrical Design [*voltage*] kV, [*overhead* | *underground*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) all design work associated with relocation / protection of electricity network assets.

Item 22252 Supply, install, test and commissioning of [*product type*] [*electrical conduit* | *communications conduit*], DN [*diameter*] mm in accordance with [*reference design*] and [*Electricity Entity*] standard (trenching only)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) prefabricating materials where required

h) cartage of all components from the storage site

i) placing detectable marker tape, hazard board, etc above conduit, as per relevant code

j) laying and jointing or placing and assembling all conduit components including service pits, hauling ropes, etc

k) temporary support of other utility authority conduits, cables, pipes where required

l) cutting conduit components as required

m) supply, place, finish and cure concrete, as required

n) performing plastic welding / jointing as required for the works

o) supply and placing Geotextile or equivalent where required as specified on design drawings

p) supply, placing and compacting backfill material (side zone and overlay zones)

q) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code/ Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

r) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22253 Supply, install, test and commissioning of [*product type*] [*electrical conduit* | *communications conduit*], DN [*diameter*] mm in accordance with [*reference design*] and [*Electricity Entity*] standard (directional drilling / micro tunnelling only)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) mobilise drilling / micro tunnelling rig

f) undertaking all drilling / micro tunnelling works (and associated works) required for the works

g) stringing and installation of conduits, assembling all conduit components including service pits, hauling ropes, etc

h) grouting

i) cutting conduit components as required

j) performing plastic welding / jointing as required for the works

k) utilising or disposing of excavated material

l) prefabricating materials where required

m) cartage of all components from the storage site

n) placing detectable marker tape, hazard board, etc above conduit exit / entrance, as per relevant code

o) temporary support of other utility authority conduits, cables, pipes where required

p) supply, place, finish and cure concrete, as required

q) supply and placing Geotextile or equivalent where required as specified on design drawings

r) supply, place and compact backfill [*material*]

s) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

t) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22254 Supply, install, test and commissioning of service pit [*type*] in accordance with [*reference design*] and [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) carrying out localised excavations, including all necessary road pavement materials and bound material

c) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

d) utilising or disposing of excavated material

e) placing and compacting foundation bedding material

f) prefabricating materials where required

g) cartage of all components from the storage site

h) placing detectable marker tape, hazard board, signage, pavement markers, etc as per relevant code

i) laying and jointing or placing and assembling all service pit components

j) temporary support of other utility authority conduits, cables, pipes where required

k) cutting conduit components as required

l) supply, place, finish and cure concrete, as required

m) performing plastic welding / jointing as required for the works

n) supply and placing Geotextile or equivalent where required as specified on design drawings

o) supply, placing and compacting backfill material (side zone and overlay zones)

p) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

q) Reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22255 Supply, install (haul) [*voltage* | *type*] kV [*type*] [*electrical cable* | *communication cable*] in underground conduits in accordance with [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate hauling of cable

e) all works and plant required for hauling activity

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22256 Supply, install, test and commissioning of [*height*] m [*type*] power pole in accordance with [*reference design*] and [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate power pole installation

e) all works and plant required for power pole installation activity, (including fixing and installation of stays, mast arms, insulators, and so on)

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22257 Supply, install, test and commissioning of [*height*] m [*type*] transmission tower in accordance with [*reference design*] and [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate transmission tower installation

e) all works and plant required for transmission tower footing installation

f) place, finish and cure concrete, as required

g) all works and plant required for transmission tower installation activity, (including fixing and installation of stays, insulators, and so on)

h) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

i) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22258 Supply, install (haul) [*voltage* | *type*] kV [*type*], [*electrical cable* | *communication cable*] on [*power pole* | *transmission tower*] in accordance with [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate hauling and installation of cable

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e) all works and plant required for hauling and installation activity

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22259 Supply, install, test, commissioning of [*voltage*] kV [*pad mounted* | *pole mount*] transformer in accordance with [*Electricity Entity*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) all surface preparation works to facilitate installation of pad mount transformer

e) all works and plant required for installation and commissioning of pad mount transformer

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22260 Live Connection works [*voltage*] kV [*overhead*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) temporary support / protect other utility authority conduits, cables, pipes where/as required

d) all Intervention planning and community notification requirements to maintain electricity supply / service to Electrical Authority customers

e) energising and de-energising electrical components

f) cutting cable components where necessary

g) all jointing as specified in [*reference design*]

h) temporary surface treatment where required, to facilitate live connection works

i) prefabricating fitting components where required

j) cartage of fitting components from the storage site

k) placing and assembling components

l) all commissioning processes as required, and

m) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Electrical Authority's representative and the Transport and Main Roads Representative/ Administrator.

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FOI 26-292 - Document 21

Item 22261 Live Connection works [*voltage*] kV [*underground*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) temporary support of other utility authority conduits, cables, pipes where/as required

f) all Intervention planning and community notification requirements to maintain electricity supply / service to Electrical Authority customers

g) energising and de-energising electrical components

h) cutting conduit / cable components where necessary

i) all jointing as specified in [*reference design*]

j) temporary surface treatment where required, to facilitate live connection works

k) prefabricating fitting components where required

l) cartage of fitting components from the storage site

m) placing and assembling components

n) placing, finishing and curing concrete (including reinforcement)

o) all commissioning processes as required

p) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction and any other testing as required

q) utilise or dispose of excavated material

r) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

s) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

t) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Electrical Authority's representative and the Transport and Main Roads Representative / Administrator, and

u) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22262 Removal and disposal of abandoned [*electrical pits* | *AC electrical pits*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

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c) verify with relevant Electrical Authority and the Transport and Main Roads Representative / Administrator that the electrical conduit is dead and abandoned

d) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the length of electrical conduit to be removed

e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) demolish, remove and dispose identified electrical surface / location markers, conduits, envelopers, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) cutting conduit components as required

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned electrical conduits left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned electrical conduits

k) utilise or dispose of excavated material not contaminated by AC material

l) disposal of AC material in accordance with the current legislation

m) dispose of all potentially contaminated AC excavated material in accordance with the current legislation

n) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

o) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

p) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22263 Removal and disposal of abandoned electrical conduits and electrical communications conduits [*including AC* | *excluding AC*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Electrical Authority and the Transport and Main Roads Representative / Administrator that the electrical conduit is dead and abandoned

d) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the length of electrical conduit to be removed

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e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) demolish, remove and dispose identified electrical surface / location markers, conduits, envelopers, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) cutting conduit components as required

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned electrical conduits left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned electrical conduits

k) utilise or dispose of excavated material

l) disposal of AC material in accordance with the current legislation

m) dispose of all potentially contaminated AC excavated material in accordance with the current legislation

n) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

o) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

p) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22264 Removal and disposal of redundant electrical and communications cable [*above ground* | *underground*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all plant and materials required for the works

c) verify with relevant Electrical Authority and the Transport and Main Roads Representative / Administrator that the electrical cable is dead and abandoned

d) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the length of electrical cable to be removed

e) all surface preparation works to facilitate removal or redundant electrical and communications cable

f) localised excavation to facilitate removal of redundant cable

g) dispose or utilise excavated material

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h) all works required for removal of redundant electrical and communications cable, including de-energising

i) undertaking all testing and de-commissioning requirements as per the relevant Electrical Authority Code / Standard

j) remove and dispose of redundant electrical cable, earthing wires, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

k) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

l) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*], and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22265 Removal and disposal of abandoned power pole

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) verify with relevant Electrical Authority the Transport and Main Roads Representative / Administrator that the asset is dead and abandoned

c) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned asset to be removed

d) carrying out all necessary excavations and works required to facilitate complete removal of pole. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

e) provide all plant required to facilitate complete removal of power pole

f) temporary support / protect all other utility authority conduits, cables, pipes where/as required

g) all surface preparation works to facilitate removal or redundant asset

h) disposal of contaminated material

i) disposal of abandoned / decommissioned assets

j) use or dispose of excavated materials in accordance with the current legislation

k) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

l) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*], and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22266 Removal and disposal of abandoned transmission tower

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) verify with relevant Electrical Authority the Transport and Main Roads Representative / Administrator that the asset is dead and abandoned

c) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned asset to be removed

d) carrying out all necessary excavations required to facilitate demolition and removal of transmission tower and/or transmission tower footings. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

e) carrying out all necessary works required to facilitate demolition and complete removal of transmission tower. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

f) carrying out all necessary works required to facilitate demolition and removal of transmission tower footings as specified in [*reference design*]. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

g) temporary support / protect all other utility authority conduits, cables, pipes where/as required

h) all surface preparation works to facilitate removal or redundant asset

i) disposal of contaminated material

j) disposal or salvage and abandoned / decommissioned assets

k) use or dispose of excavated materials in accordance with the current legislation

l) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

m) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*], and

n) Reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22267 Removal and disposal of abandoned [*pole mounted* | *pad mounted*] transformer

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) verify with relevant Electrical Authority the Transport and Main Roads Representative / Administrator that the asset is dead and abandoned

c) verify with the relevant Electrical Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned asset to be removed

d) carrying out all necessary works and provide all plant required to facilitate removal of abandoned pad mount transformer. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

e) all surface preparation works to facilitate removal or redundant asset

f) demolition, removal and disposal of concrete pad

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FOI 26-292 - Document 21

g) cutting of conduits

h) temporary support / protection of other utility assets

i) disposal or salvage and abandoned / decommissioned assets, and

j) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

2.3.4 Telecommunications Network

Contractor to confirm location of all telecommunication (underground and overhead) prior to undertaking earthworks/auxiliary activities within the works area. Where telecommunication assets are found to conflict with proposed design, contractor must notify the Administrator immediately advising on location and nature of the conflict.

Contractors to ensure that clearances to Telecommunication infrastructure is maintained during construction in accordance with Utility Authority requirements and vibration around conduits is minimised and adheres to Utility Owner specifications to ensure that the proposed works do not impact on existing infrastructure.

> Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22351 Telecommunications design

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) all design work associated with relocation / protection of electricity network assets.

Item 22352 Supply, install, test and commissioning of [*product type*] communications conduit, DN [*diameter*] mm in accordance with [*reference design*] and to [*Telecommunications Authority*] standard (trenching only)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) prefabricating materials where required

h) cartage of all components from the storage site

i) placing detectable marker tape, hazard board, etc above conduit, as per relevant code

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j) laying and jointing or placing and assembling all conduit components including service pits, hauling ropes, etc

k) temporary support of other utility authority conduits, cables, pipes where required

l) cutting conduit components as required

m) supply, place, finish and cure concrete, as required

n) performing plastic welding / jointing as required for the works

o) supply and placing Geotextile or equivalent where required as specified on design drawings

p) supply, placing and compacting backfill material (side zone and overlay zones)

q) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard and road authority standard, (including soil compaction, concrete testing, and any other testing process as specified), and

r) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22353 Supply, install, test and commissioning of [*product type*] communications conduit, DN [*diameter*] mm in accordance with [*reference design*] and to [*Telecommunications Authority*] standard (directional drilling / micro tunnelling)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) mobilise drilling / micro tunnelling rig

f) undertaking all drilling / micro tunnelling works (and associated works) required for the works

g) stringing and installation of conduits, assembling all conduit components including service pits, hauling ropes, etc

h) grouting

i) cutting conduit components as required

j) performing plastic welding / jointing as required for the works

k) utilising or disposing of excavated material

l) prefabricating materials where required

m) cartage of all components from the storage site

n) placing detectable marker tape, hazard board, surface markers, etc above conduit entrance / exit, as per relevant code

o) temporary support of other utility authority conduits, cables, pipes where required

p) supply, place, finish and cure concrete, as required

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q) supply and placing Geotextile or equivalent where required as specified on design drawings

r) supply, place and compact backfill [*material*]

s) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard and road authority standard, (including soil compaction, concrete testing, and any other testing process as specified), and

t) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22354 Supply, install test and commissioning of service pit [*type*] in accordance with [*reference design*] and [*Telecommunications Authority*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) utilising or disposing of excavated material

e) placing and compacting foundation bedding material

f) prefabricating materials where required

g) cartage of all components from the storage site

h) placing detectable marker tape, hazard board, signage, pavement markers, etc as per relevant code

i) laying and jointing or placing and assembling all service pit components

j) temporary support of other utility authority conduits, cables, pipes where required

k) cutting conduit components as required

l) supply, place, finish and cure concrete, as required

m) performing plastic welding / jointing as required for the works

n) supply and placing Geotextile or equivalent where required as specified on design drawings

o) supply, placing and compacting backfill material (side zone and overlay zones)

p) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22355 Supply, install, test and commissioning of access / service chamber in accordance with [*reference design*] and [*Telecommunications Authority*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

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c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material

g) placing and compacting backfill material (side zone and overlay zones)

h) placing Geotextile or equivalent as specified on design drawings

i) prefabricating materials where required

j) cartage of materials from the storage site

k) placing detectable marker tape, hazard board, signage, and so on, as per relevant code

l) supplying laying and jointing or placing and assembling access chamber components, and so on as specified in [*reference design*]

m) temporary support of other utility authority conduits, cables, pipes where/as required

n) cutting conduit and access chamber components as required

o) supply, place, finish and cure concrete

p) supply, place finish blockwork

q) performing butt welding, collar welding jointing and all other jointing / welding as required for the works

r) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard and road authority standard, (including soil compaction, concrete testing, and any other testing process as specified), and

s) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22356 Supply, install (haul) [*size* | *type*] communications cable in underground conduits in accordance with [*Telecommunications Authority*] standard (excluding fibre optic)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate hauling and installation of cable

e) all works and plant required for hauling and installation activity

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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FOI 26-292 - Document 21

Item 22357 Supply, install (haul) [*size* | *type*] fibre optic communications cable in underground conduits in accordance with [*Telecommunications Authority*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) cartage of all components from the storage site

d) surface preparation works to facilitate hauling and installation of cable

e) all works and plant required for hauling and installation activity

f) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22358 Supply, install test and commissioning of Mobile Tower in accordance with [*reference design*] and [*Telecommunications Authority*] standard

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) verify Transport and Main Roads Strategic Property Management has provided a licence agreement for installation of telecommunication mobile phone transmission tower

c) supply all materials

d) cartage of all components from the storage site

e) surface preparation works to facilitate transmission tower installation

f) carrying out all necessary works and supply all necessary plant required for mobile phone transmission tower footings and earth grid as specified in [*reference design*]. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

g) temporary support / protect all other utility authority conduits, cables, pipes where/as required

h) disposal of contaminated material

i) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

j) all works and plant required for transmission tower assembly and installation

k) place, finish and cure concrete, as required

l) all works and plant required for transmission tower commissioning

m) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, concrete testing, and any other testing process as specified), and

n) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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FOI 26-292 - Document 21

Item 22359 Jointing / connection, test and commission of telecommunication cable to live network [*size* | *type*] [*fibre optic* | *other*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) temporary support of other utility authority conduits, cables, pipes where/as required

d) all Intervention planning and community notification requirements to maintain telecommunication service

e) all commissioning and de-commissioning requirements

f) cutting conduit/ cable components where necessary

g) all jointing as specified in [*reference design*]

h) temporary surface treatment where required, to facilitate connection works

i) cartage of fitting components from the storage site

j) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant telecommunication authority's representative and the Transport and Main Roads Representative / Administrator, and

k) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22360 [*Raising* | *Lowering*] telecommunications access / service chamber in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all plant and materials required for the works

c) verify with Transport and Main Roads Representative / Administrator the finished surface level required for the access / service chamber

d) carrying out localised excavations, including all necessary road pavement materials and bound material

e) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

f) utilising or disposing of excavated material

g) placing and compacting backfill material (side zone and overlay zones)

h) placing Geotextile or equivalent as specified on design drawings

i) prefabricating materials where required

j) cartage of materials from the storage site

k) demolish, remove and dispose of redundant access / service chamber components, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

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l) placing detectable marker tape, hazard board, signage, and so on, as per relevant code

m) supplying laying and jointing or placing and assembling access chamber components, and so on as specified in [*reference design*]

n) supply assemble and install temporary protection for telecommunication cable

o) temporary support of other utility authority conduits, cables, pipes where/as required

p) cutting conduit and access chamber components as required

q) supply, place, finish and cure concrete

r) supply, place finish blockwork

s) performing butt welding, collar welding jointing and all other jointing / welding as required for the works

t) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard and road authority standard, (including soil compaction, concrete testing, and any other testing process as specified), and

u) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22361 Remove and dispose of abandoned telecommunication [*AC pits* | *pits*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Telecommunication Authority the Transport and Main Roads Representative / Administrator that the telecommunication pits are dead and abandoned

d) verify with the relevant Telecommunication Authority and the Transport and Main Roads Representative / Administrator the telecommunication pits to be removed.

e) carrying out all necessary excavations;

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) demolish, remove and dispose identified telecommunication surface / location markers, concrete surrounds, surface boxes, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) cutting conduit components as required

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned telecommunication conduits left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned telecommunication pits

k) utilise or dispose of excavated material not contaminated by AC material

l) disposal of AC material in accordance with the current legislation

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m) dispose of all potentially contaminated AC excavated material in accordance with the current legislation

n) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

o) supply, place and compact with [material] backfill to natural surface as specified in [*reference design*]

p) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22362 Removal and disposal of abandoned telecommunication [*AC conduits* | *conduits*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant telecommunication authority and the Transport and Main Roads Representative / Administrator that the telecommunication conduit is dead and abandoned

d) verify with the relevant telecommunication authority and the Transport and Main Roads Representative / Administrator the length of telecommunication conduit to be removed

e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) demolish, remove and dispose identified telecommunication surface / location markers, conduits, envelopers, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) cutting conduit components as required

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned telecommunication conduits left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned telecommunication conduits

k) utilise or dispose of excavated material not contaminated by AC material

l) disposal of AC material in accordance with the current legislation

m) dispose of all potentially contaminated AC excavated material in accordance with the current legislation

n) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

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o) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

p) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22363 Removal and disposal of redundant telecommunications cable (above ground)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all plant and materials required for the works

c) verify with relevant telecommunication authority and the Transport and Main Roads Representative / Administrator that the telecommunication cable is dead and abandoned

d) verify with the relevant telecommunication authority and the Transport and Main Roads Representative / Administrator the length of telecommunication cable to be removed

e) all surface preparation works to facilitate removal or redundant telecommunication cable

f) all works required for removal of redundant telecommunication cable, including decommissioning

g) undertaking all testing and de-commissioning requirements as per the relevant telecommunication authority Code / Standard

h) remove and dispose of redundant telecommunication cable, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*, and

i) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22364 Removal and disposal of redundant telecommunications cable (underground)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all plant and materials required for the works

c) verify with relevant telecommunication authority and the Transport and Main Roads Representative / Administrator that the telecommunication cable is dead and abandoned

d) verify with the relevant telecommunication authority and the Transport and Main Roads Representative / Administrator the length of telecommunication cable to be removed

e) all surface preparation works to facilitate removal or redundant telecommunication cable

f) localised excavation to facilitate removal of redundant cable

g) dispose or utilise excavated material

h) all works required for removal of redundant telecommunication cable, including decommissioning

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i) undertaking all testing and de-commissioning requirements as per the relevant telecommunication authority Code / Standard

j) remove and dispose of redundant telecommunication cable, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

k) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

l) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*], and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22365 Demolition, removal and disposal of telecommunication access chamber in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all plant and materials required for the works

c) verify with Transport and Main Roads Representative / Administrator the extent of the chamber to be demolished and removed

d) carrying out localised excavations, including all necessary road pavement materials and bound material

e) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

f) utilising or disposing of excavated material

g) cartage of materials from the storage site

h) demolish, remove and dispose of redundant access / service chamber components, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

i) temporary support of other utility authority conduits, cables, pipes where/as required

j) cutting conduit and access chamber components as required

k) undertaking all testing and de-commissioning requirements as per the relevant telecommunication authority Code / Standard

l) remove and dispose of redundant telecommunication cable, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

m) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [reference design]

n) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

o) placing Geotextile or equivalent as specified on design drawings

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p) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard and road authority standard, (including soil compaction, and any other testing process as specified)

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22366 Demolition, removal and disposal of telecommunication Mobile tower in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply all materials

c) verify with relevant telecommunication authority the Transport and Main Roads Representative / Administrator that the asset is dead and abandoned

d) verify with the relevant telecommunication authority and the Transport and Main Roads Representative / Administrator the extent of abandoned asset to be removed

e) all decommissioning works, including removal of all electrical supply connections

f) carrying out all necessary excavations required to facilitate demolition and removal of mobile phone transmission tower. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

g) carrying out all necessary works and supply all necessary plant required to facilitate demolition and removal of mobile phone transmission tower footings and earth grid as specified in [*reference design*]. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) temporary support / protect all other utility authority conduits, cables, pipes where/as required

i) all surface preparation works to facilitate removal or redundant asset

j) disposal of contaminated material

k) disposal or salvage and abandoned / decommissioned assets

l) use or dispose of excavated materials in accordance with the current legislation

m) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

n) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*], and

o) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

2.3.5 Water

In addition to the design drawings, all Water Main Relocation Works (including material properties) shall be in accordance with the relevant Utility Authority specifications, standards and typical details. The contractor shall ensure all work method statements and inspection hold point documentation is built around the relevant Utility Authority's specifications to ensure that the design intent is met.

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Contractor to confirm location of all water assets prior to undertaking earthworks / auxiliary activities within the works area. Where assets are found to conflict with proposed design, contractor must notify the Administrator immediately advising on location and nature of the conflict.

Contractors to ensure that clearances to water and sewer infrastructure is maintained during construction in accordance with the relevant Utility Authority requirements to ensure that the proposed works do not impact on existing infrastructure.

> Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22451 Supply, install, test and commissioning of [*product type*] water main, DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*]. Constructed to [*SEQ Code Standards | Water Supply Code of Australia | Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes valves)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) prefabricating materials where required

h) cartage of pipe components from the storage site

i) installing pipe envelopers as specified on design drawings. This shall include supply, installation and commissioning of plastic spacers, grout annulus between encasing pipe and water pipes, waterproofing foam sealants and any other requirements specified in the design

j) placing detectable marker tape above pipe (entire length) as per SEQ or relevant code

k) supply, placing and compacting backfill material (including side zone and overlay zones)

l) laying and jointing or placing and assembling pipe components including support pads, saddle clamp pipe supports where specified

m) temporary support of other utility authority conduits, cables, pipes where/as required

n) cutting pipe components where necessary

o) constructing thrust blocks as per design requirements

p) finishing and curing concrete

q) performing butt welding, collar welding jointing where necessary

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r) supply and placing Geotextile or equivalent where required as specified on design drawings

s) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

t) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22452 Supply, install, test and commissioning of water [*valve type* | *size*], in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material, as required

g) prefabricating materials where required

h) cartage of valve components from the storage site

i) placing detectable valve markers / posts as per SEQ or relevant code

j) laying and jointing or placing and assembling of valve components including support pads, saddle clamp pipe supports where specified

k) temporary support of other utility authority conduits, cables, pipes where/as required

l) cutting pipe components where necessary

m) constructing thrust blocks as per design requirements

n) constructing valve pits, as required

o) installing surface boxes and surface fittings where specified

p) finishing and curing concrete

q) performing butt welding, collar welding jointing where necessary

r) supply and placing Geotextile or equivalent where required as specified on design drawings

s) supply, placing and compacting backfill material (including side zone and overlay zones)

t) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

u) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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FOI 26-292 - Document 21

Item 22453 **Supply, install, test and commissioning of [*diameter*] mm access chamber in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes aspro risers and chamber cover)**

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material, as required

g) prefabricating materials where required

h) cartage of all components from the storage site

i) laying and jointing or placing and assembling of access chamber components including epoxy sealing, trafficable lids, and so on as specified in [*reference design*]

j) temporary support of other utility authority conduits, cables, pipes where/as required

k) cutting pipe components where necessary

l) finishing and curing concrete

m) supply and placing Geotextile or equivalent where required as specified on design drawings

n) supply, placing and compacting backfill material as specified in [*reference design*]

o) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

p) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22454 **Supply, installation, testing and commissioning of [*diameter*] mm [*type*]. Fire Hydrant Arrangement in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]**

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) supply and installation of temporary blank flanges where required

d) carrying out localised excavations, including all necessary road pavement materials and bound material

e) temporary support of other utility authority conduits, cables, pipes where/as required

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f) surface treatment where required, including scour protection at scour valve discharging points, restoration of existing / proposed surface as required

g) prefabricating fitting components where required

h) cartage of fitting components from the storage site

i) laying and jointing including butt welding, collar welding as per the design drawings

j) placing and assembling fitting components

k) constructing thrust blocks where specified

l) finishing and curing concrete

m) cutting pipe components where necessary

n) supply, placing and compacting backfill material (including side zone and overlay zones)

o) installing surface boxes and surface fittings where specified

p) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, bacteriological testing, pressure testing and any other testing as required, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22455 Supply and install thrust block in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] if not order as part of item 22451

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and install of all materials including all reinforcement, formwork and false work

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) temporary support of other utility authority conduits, cables, pipes where/as required

e) supply, place and compact backfill material

f) undertaking all work in accordance with relative utility authority requirements, and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22456 Live Connection works DN [*diameter*] mm [*type* | *material*] water [*transmission* | *distribution*] main in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

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e) temporary support of other utility authority conduits, cables, pipes where/as required

f) all Intervention planning and community notification requirements to maintain water supply to Utility Authority customers

g) cutting pipe components where necessary

h) all welding and/or jointing as specified in [*reference design*]

i) temporary surface treatment where required, to facilitate live connection works

j) prefabricating fitting components where required

k) cartage of fitting components from the storage site

l) placing and assembling fitting components

m) constructing thrust blocks where specified (including reinforcement)

n) placing, finishing and curing concrete (including reinforcement)

o) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, bacteriological testing, pressure testing and any other testing / decontamination process as required

p) utilise or dispose of excavated material

q) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

r) supply, place and compact with [material] backfill to natural surface as specified in [*reference design*]

s) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

t) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22457 Structural relining DN [*diameter*] mm water main in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) prefabricating materials where required

d) cartage of all components from the storage site

e) laying and jointing or placing and assembling of structural relining components as specified in [*reference design*]

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) cutting pipe components where necessary

h) placing, finishing and curing concrete, as required

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i) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

j) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22458 Modification / adjustment of existing scour valves in accordance with [*Reference Drawings*].

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) temporary support of other utility authority conduits, cables, pipes where/as required

e) all works and disposal of contaminated material associate with cutting, dewater and decontaminating scour valve and associate water main

f) temporary surface treatment where required, including scour protection at scour valve discharging points

g) prefabricating fitting components where required

h) cartage of fitting components from the storage site

i) placing and assembling fitting components

j) placing, finishing and curing concrete (including all reinforcement requirements)

k) cutting pipe components where necessary

l) installing surface boxes and surface fittings where specified

m) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, bacteriological testing, pressure testing and any other testing as required

n) utilise or dispose of excavated material

o) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

p) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

q) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

r) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22459 Treatment of abandoned [*type*] DN [*diameter*] mm water main left insitu [*including AC | excluding AC*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the water / sewer main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the abandoned water / sewer main to be left in situ/ grouted/ plugged

e) all careful excavation operations to expose the abandoned section of water / sewer main to allow for flowable filling / grouting and/or plugging

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) all works associated with the cutting, dewatering and decontamination of the abandoned section of water/ sewer main and the removal of cut ends, if ordered. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned water / sewer mains left in place. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains, if ordered

i) backfill nominated abandoned water / sewer mains with flowable fill / grout as detailed in [*reference design*]

j) supply, place and compact excavations with [*material*]

k) disposal of excavated material

l) disposal of all removed AC material

m) all work shall be carried out in accordance with the relevant provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

n) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22460 Removal and disposal of redundant OD [*diameter*] mm [*type* | *material*] water main [*including AC* | *excluding AC*) in accordance with [*reference design*] undertaken as per [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] including pits, valves and hydrants

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator that the water main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned water main to be removed

e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

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g) remove identified water mains including any surface / underground fittings, concrete surrounds, surface boxes, location markers, thrust blocks, envelopers, valves, pits, hydrants, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned mains left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

i) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommission water lines

j) utilise or dispose of excavated materials

k) stack removed pipes or end structure components

l) transport of all materials selected for salvage to the nominated storage site. Dispose of all material not identified for salvage

m) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

n) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

o) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

p) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22461 Removal and disposal of abandoned thrust blocks

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with the relevant utility authority and with the Transport and Main Roads Representative / Administrator that the thrust block is no longer required

d) verify with the Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the thrust block to be removed

e) all careful excavation operations to expose the abandoned thrust block to be removed (including shoring, if required)

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) removal and disposal of the thrust block material. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) utilise or dispose of excavated material

i) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

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j) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

k) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

l) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22462 Removal and disposal of abandoned pits, valves, hydrants

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with the relevant utility authority and with the Transport and Main Roads Representative / Administrator that the pits / valves / hydrants are / is no longer required

d) verify with the Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the pits / valves / hydrants to be removed

e) all careful excavation operations to expose the abandoned pits / valves / hydrants be removed (including shoring, if required)

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) transport of all materials selected for salvage to the nominated storage site

h) removal and disposal all pits, valves, hydrants not identified for salvage. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

i) utilise or dispose of excavated material

j) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

k) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

l) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

2.3.6 Waste water / Sewer

In addition to the design drawings, all Sewer Main Relocation Works (including material properties) shall be in accordance with the relevant Utility Authority specifications, standards and typical details. The contractor shall ensure all work method statements and inspection hold point documentation is built around the relevant Utility Authority's specifications to ensure that the design intent is met.

Contractor to confirm location of all sewer assets prior to undertaking earthworks/auxiliary activities within the works area. Where assets are found to conflict with proposed design, contractor must notify the Administrator immediately advising on location and nature of the conflict.

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FOI 26-292 - Document 21

Contractors to ensure that clearances to water and sewer infrastructure is maintained during construction in accordance with the relevant Utility Authority requirements to ensure that the proposed works do not impact on existing infrastructure.

> Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22551 **Supply, install, test and commissioning of [*product type*] rising sewer, DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes valves, vents, chambers)**

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) prefabricating materials where required

h) cartage of pipe components from the storage site

i) installing pipe envelopers as specified on design drawings. This shall include supply, installation and commissioning of plastic spacers, grout annulus between encasing pipe and sewer pipes, waterproofing foam sealants and any other requirements specified in the design

j) placing detectable marker tape above pipe (entire length) as per SEQ or relevant code

k) laying and jointing or placing and assembling pipe components including support pads, saddle clamp pipe supports where specified

l) temporary support of other utility authority conduits, cables, pipes where/as required

m) cutting pipe components where necessary

n) constructing thrust blocks as per design requirements

o) finishing and curing concrete

p) performing butt welding, collar welding jointing where necessary

q) supply and placing Geotextile or equivalent where required as specified on design drawings

r) supply, placing and compacting backfill material (including side zone and overlay zones)

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s) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

t) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22552 Supply, install, test and commissioning of rising sewer [*valve type* | *size*], in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material, as required

g) prefabricating materials where required

h) cartage of valve components from the storage site

i) placing detectable valve markers / posts as per SEQ or relevant code

j) laying and jointing or placing and assembling of valve components including support pads, saddle clamp pipe supports where specified

k) temporary support of other utility authority conduits, cables, pipes where/as required

l) cutting pipe components where necessary

m) constructing thrust blocks as per design requirements

n) constructing valve pits, as required

o) installing surface boxes and surface fittings where specified

p) finishing and curing concrete

q) performing butt welding, collar welding jointing where necessary

r) supply and placing Geotextile or equivalent where required as specified on design drawings

s) supply, placing and compacting backfill material (including side zone and overlay zones)

t) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

u) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22553 Supply, install, test and commissioning of rising sewer chamber in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material, as required

g) prefabricating materials where required

h) cartage of all components from the storage site

i) laying and jointing or placing and assembling of access chamber components including epoxy sealing, trafficable lids, and so on as specified in [*reference design*]

j) temporary support of other utility authority conduits, cables, pipes where/as required

k) cutting pipe components where necessary

l) finishing and curing concrete

m) supply and placing Geotextile or equivalent where required as specified on design drawings

n) supply, placing and compacting backfill material as specified in [*reference design*]

o) installation of rising sewer vent / odour filter as specified in [*reference design*]

p) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22554 Supply install, test and commissioning of rising sewer vent in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations

d) utilising or disposing of excavated material

e) placing and compacting foundation bedding material, as required

f) prefabricating materials where required

g) cartage of all components from the storage site

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h) laying and jointing or placing and assembling of sewer vent/ odour control chamber components as specified in [*reference design*]

i) temporary support of other utility authority conduits, cables, pipes where/as required

j) cutting pipe components where necessary

k) finishing and curing concrete

l) supply, placing and compacting backfill material as specified in [reference design]

m) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

n) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22555 Supply, install, test and commissioning of [*product type*] gravity sewer, DN [*diameter*] mm in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] (includes all welding and or jointing requirements) (excludes access chambers)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material and haunch zone material

g) prefabricating materials where required

h) cartage of pipe components from the storage site

i) laying and jointing or placing and assembling pipe components

j) installing pipe envelopers as specified on design drawings. This shall include supply, installation and commissioning of plastic spacers, grouting annulus between encasing pipe and sewer pipes, waterproofing foam sealants and any other requirements specified in the design

k) temporary support of other utility authority conduits, cables, pipes where/as required

l) placing detectable marker tape above pipe (entire length) as per SEQ or relevant code

m) cutting pipe components where necessary

n) finishing and curing concrete

o) performing butt welding, collar welding jointing where necessary

p) supply and placing Geotextile or equivalent where required as specified on design drawings

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q) supply, placing and compacting backfill material (including side zone and overlay zones)

r) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

s) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22556 Supply and install thrust block in accordance with [*reference design*]. Constructed to [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] if not order as part of item 22551

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and install of all materials including all reinforcement, formwork and false work

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) temporary support of other utility authority conduits, cables, pipes where/as required

e) supply, place and compact backfill material

f) undertaking all work in accordance with relative utility authority requirements, and

g) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22557 Structural relining DN [*diameter*] mm sewer in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) prefabricating materials where required

d) cartage of all components from the storage site

e) laying and jointing or placing and assembling of structural relining components as specified in [*reference design*]

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) cutting pipe components where necessary

h) placing, Finishing and curing concrete, as required

i) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, and

j) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22558 Treatment of abandoned [*type*] DN [*diameter*] mm [*waste water* | *sewer*] main left insitu [*including AC* | *excluding AC*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the water / sewer main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the abandoned water / sewer main to be left insitu / grouted / plugged

e) all careful excavation operations to expose the abandoned section of water / sewer main to allow for flowable filling / grouting and/or plugging

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) all works associated with the cutting, dewatering and decontamination of the abandoned section of water/ sewer main and the removal of cut ends, if ordered. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned water / sewer mains left in place. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains, if ordered

i) backfill nominated abandoned water / sewer mains with flowable fill / grout as detailed in [*reference design*]

j) supply, place and compact excavations with [*material*]

k) disposal of excavated material

l) all work shall be carried out in accordance with the relevant provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22559 Treatment of abandoned sewer access chambers left insitu in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the sewer access chamber and associated main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned sewer access chambers to be removed and the extent of remaining section to be filled and modified

e) all careful excavation operations to expose the top section of abandoned sewer access chamber to be removed where required

f) temporary support of other utility authority conduits, cables, pipes where/as required

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g) removal and disposal of that section of abandoned concrete access chamber material. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) all works associate with cutting, dewater, decontamination, etc

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned mains left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) supply, place and compact with [*material*] backfill to depth of [*mm*] for remaining section of chamber left in place as specified in [*reference design*]

k) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

l) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) Reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22560 Removal and disposal of redundant OD [*diameter*] mm [*type* | *material*] sewer mains [*including AC* | *Sewer Main*] in accordance with [*reference design*] undertaken as per [*SEQ Code Standards* | *Water Supply Code of Australia* | *Utility Owner specific standard*] including pits and valves (excluding access chambers)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator that the sewer main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned sewer main to be removed

e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) remove identified sewer mains including any surface / underground fittings, concrete surrounds, surface boxes, location markers, thrust blocks, envelopers, valves, pits, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned mains left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

i) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommission sewer mains

j) utilise or dispose of excavated materials

k) transport of all materials selected for salvage to the nominated storage site. Dispose of all material not identified for salvage

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l) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

m) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

n) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

o) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22561 Removal and disposal of abandoned thrust blocks

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with the relevant utility authority and with the Transport and Main Roads Representative / Administrator that the thrust block is no longer required

d) verify with the Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the thrust block to be removed

e) all careful excavation operations to expose the abandoned thrust block to be removed (including shoring, if required)

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) removal and disposal of the thrust block material. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) utilise or dispose of excavated material

i) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

j) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

k) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

l) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22562 Demolition, removal and disposal of existing rising sewer vent / odour chamber in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

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c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the rising sewer vent / odour chamber and dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned rising sewer vent / odour chamber to be demolished, removed and disposed of

e) all careful excavation operations (including shoring) required to demolish, remove and dispose of abandoned rising sewer vent / access chamber

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) removal and disposal of abandoned rising sewer vent / odour chamber material. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act* (including AS material, if required)

h) transport of all materials selected for salvage to the nominated storage site. Dispose of all material not identified for salvage

i) all works associate with cutting, dewater, decontamination, etc

j) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned vent pipes left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

k) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

l) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

m) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

n) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22563 Demolition, removal and disposal of existing [*sewer access chambers* | *rising sewer chamber*] in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the sewer access chamber and associated main is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned sewer access chambers to be demolished, removed and disposed of

e) all careful excavation operations (including shoring) required to expose abandoned sewer access chamber to be removed where required

f) temporary support of other utility authority conduits, cables, pipes where/as required

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g) removal and disposal of abandoned access chamber material. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act* (including AS material, if required)

h) all works associate with cutting, dewater, decontamination, etc

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned mains left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

k) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

l) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

2.3.7 Gas Utility network

In addition to the design drawings, all gas relocation works (including material properties) shall be in accordance with the relevant Utility Authority specifications, standards and typical details. The contractor shall ensure all work method statements and inspection hold point documentation is built around the relevant Utility Authority's specifications to ensure that the design intent is met.

Contractor to confirm location of all gas asset prior to undertaking earthworks / auxiliary activities within the works area. Where assets are found to conflict with proposed design, contractor must notify the Administrator immediately advising on location and nature of the conflict.

Contractors to ensure that clearances to electrical infrastructure is maintained during construction in accordance with the relevant Utility Authority requirements to ensure that the proposed works do not impact on existing infrastructure.

> Often more than one standard, department and Utility will apply, engineers must reconcile and negotiate standards to ensure overall safety.

Item 22651 Supply [*product type*] gas pipeline, [*transmission* | *distribution*] DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*] addressing [*AS 4645* | *AS 2943* | *Utility Owner specific standard*] requirements

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and delivery of all materials.

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Item 22652 Supply, gas [*valve type* | *size*] for gas pipeline, [*transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 4645* | *AS 2885* | *AS 2943* | *AS 4853* | *Utility Owner specific standard*] requirements

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and delivery of all materials.

Item 22653 Supply, install, test and commissioning of other gas fittings / access chamber / or asset [*type* | *size*] for gas pipeline, [*transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 4645* | *AS 2885* | *AS 2943* | *AS 4853* | *Utility Owner specific standard*] requirements

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

e) utilising or disposing of excavated material

f) placing and compacting foundation bedding material

g) placing and compacting backfill material (side zone and overlay zones)

h) placing Geotextile or equivalent as specified on design drawings

i) prefabricating materials where required

j) cartage of materials from the storage site

k) placing detectable marker tape, hazard board, signage, and so on, as per relevant code

l) supplying laying and jointing or placing and assembling gas fitting / access chamber components, and so on as specified in [*reference design*]

m) temporary support of other utility authority conduits, cables, pipes where/as required

n) cutting pipe components as required

o) supply, place, finish and cure concrete

p) supply, place, finish blockwork

q) performing butt welding, collar welding jointing and all other welding as required for the works

r) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, pressure testing, concrete testing, and any other testing process as specified), and

s) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22654 **Install, test and commissioning of [*product type*] gas pipeline, [*transmission* | *distribution*] DN [*diameter*] mm [*pressure rating*] in accordance with [*reference design*]. Constructed to [*AS 4645* | *AS 2885* | *Utility Owner specific standard*] (includes all welding / jointing, marker boards, protection tape and posts) (excludes valves)**

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out localised excavations, including all necessary road pavement materials and bound material

c) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

d) utilising or disposing of excavated material

e) placing and compacting foundation bedding material and haunch zone material

f) prefabricating materials where required

g) cartage of pipe components from the storage site

h) installing pipe envelopers as specified on design drawings. This shall include supply, installation and commissioning of plastic spacers, grout annulus between encasing pipe and sewer pipes, waterproofing foam sealants, breather pipes and any other requirements specified in the design

i) placing detectable marker tape, hazard board, etc above pipe (entire length) as per relevant code

j) laying and jointing or placing and assembling pipe components including support pads, saddle clamp pipe supports, protection tape as required

k) temporary support of other utility authority conduits, cables, pipes where/as required

l) cutting pipe components as required

m) supply, place, finish and cure concrete, as required

n) performing butt welding, collar welding jointing and all other welding as required for the works

o) supply and placing Geotextile or equivalent where required as specified on design drawings

p) supply, placing and compacting backfill material (side zone and overlay zones)

q) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, pressure testing, concrete testing, and any other testing process as specified), and

r) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22655 Install, test and commissioning of gas [*valve type* | *size*] for gas pipeline, [*transmission* | *distribution*] in accordance with [*reference design*] addressing [*AS 4645* | *AS 2885* | *Utility Owner specific standard*] requirements

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out localised excavations, including all necessary road pavement materials and bound material

c) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

d) utilising or disposing of excavated material

e) supply, place and compact foundation bedding material and haunch zone material

f) prefabricating materials where required

g) cartage of valve components from the storage site

h) placing detectable marker tape, hazard board, signage, etc above pipe (entire length) as per relevant code

i) laying and jointing or placing and assembling pipe valve including support pads, saddle clamp pipe supports, protection tape, etc as required

j) temporary support of other utility authority conduits, cables, pipes where/as required

k) cutting pipe components as required

l) supply, place, finish and cure concrete, as required

m) performing butt welding, collar welding jointing and all other welding as required for the works

n) supply and placing Geotextile or equivalent where required as specified on design drawings

o) supply, placing and compacting backfill material (side zone and overlay zones)

p) undertaking all testing and commissioning requirements as per the relevant Utility Authority Code / Standard, (including soil compaction, pressure testing, concrete testing, and any other testing process as specified), and

q) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22656 Live Connection [*high* | *medium* | *low*] pressure [*product type*] DN [*diameter*] mm gas pipeline [*transmission* | *distribution*] (including all valves, fittings and welding)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out localised excavations, including all necessary road pavement materials and bound material

d) supply, assemble, install and remove all shoring equipment required for excavations exceeding 1.5 m

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e) temporary support of other utility authority conduits, cables, pipes where/as required

f) all Intervention planning and community notification requirements to maintain gas supply to Utility Authority customers

g) cutting pipe components where necessary

h) all welding and/or jointing as specified in [*reference design*]

i) temporary surface treatment where required, to facilitate live connection works

j) prefabricating fitting components where required

k) cartage of fitting components from the storage site

l) placing and assembling fitting components

m) placing, finishing and curing concrete (including reinforcement)

n) testing by an approved NATA approved authority as per the relevant Utility Authority Code including soil compaction, pressure testing and any other testing / commissioning process as required

o) utilise or dispose of excavated material

p) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

q) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

r) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

s) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22657 Treatment of abandoned [*type*] DN [*diameter*] mm for gas pipeline left insitu in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the gas pipeline is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the abandoned gas pipeline to be left in situ/ grouted/ plugged

e) all careful excavation operations to expose the abandoned section of gas pipeline to allow for flowable filling / grouting and/or plugging

f) temporary support of other utility authority conduits, cables, pipes where/as required

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g) all works associated with the cutting, dewatering and decontamination of the abandoned section of gas pipeline and the removal of cut ends, if ordered. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned gas pipelines left in place. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains, if ordered

i) backfill nominated abandoned gas pipeline with flowable fill / grout as detailed in [*reference design*]

j) supply, place and compact excavations with [*material*]

k) utilise or dispose of excavated materials

l) all work shall be carried out in accordance with the relevant provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22658 Treatment of abandoned other gas fitting / access chamber / or asset [*type* | *size*] for gas pipeline left in-situ in accordance with [*reference design*]

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator if the gas fitting/access chamber/or asset is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of the abandoned gas fitting / access chamber / or asset to be left insitu / grouted / plugged / backfilled

e) all careful excavation operations to expose the abandoned section of gas fitting / access chamber / or asset to allow for backfilling and/or plugging

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) all works associated with the cutting, dewatering and decontamination of the abandoned gas fitting / access chamber / or asset and the removal of cut or demolished components, if ordered. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned gas pipelines left in place. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains, if ordered

i) backfill nominated abandoned gas fitting / access chamber / or asset with [*material*] as detailed in [*reference design*]

j) supply, place and compact excavations with [*material*]

k) utilise or dispose of excavated materials

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l) all work shall be carried out in accordance with the relevant provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

m) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

Item 22659 Removal and disposal of redundant DN [*diameter*] mm [*type* | *material*] gas pipeline [*transmission* | *distribution*] in accordance with [*reference design*] including valves (excluding access chambers)

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator that the gas pipeline is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned gas pipeline to be removed

e) carrying out all necessary excavations

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) remove identified gas pipeline including any surface / underground fittings, concrete surrounds, surface boxes, location markers, envelopers, valves, pits, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned gas pipeline left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

i) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned gas pipeline

j) cutting pipe components as required

k) utilise or dispose of excavated materials

l) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

m) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

n) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

o) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

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Item 22660 Removal and disposal of other gas fitting / access chamber / or asset [*type* | *size*] for gas pipeline [*transmission* | *distribution*] in accordance with [*reference design*].

Work Operations incorporated in the above include the following as appropriate:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) verify with relevant Utility Authority the Transport and Main Roads Representative / Administrator that the gas fitting / access chamber / or asset is dead and abandoned

d) verify with the relevant Utility Authority and the Transport and Main Roads Representative / Administrator the extent of abandoned gas fitting / access chamber / or asset to be removed

e) carrying out all necessary excavations (including shoring as required)

f) temporary support of other utility authority conduits, cables, pipes where/as required

g) remove identified gas fitting / access chamber / or asset including any surface/underground fittings, concrete surrounds, surface boxes, location markers, envelopers, valves, pits, etc as relevant. This work is to be carried out in a lawful manner and in accordance with the current legislation for *Workplace Health and Safety Act* and *Environmental Protection Act*

h) cutting pipe components as required

i) concrete end plugs (N20/20 – unreinforced concrete) to all abandoned gas pipeline left in place, if ordered. Concrete ends to be 500 mm minimum thickness and completely seal ends of mains

j) all works and disposal of contaminated material associate with cutting, dewater and decontaminating of abandoned / decommissioned gas fitting / access chamber / or asset

k) utilise or dispose of excavated materials

l) supply, place and compact with [*material*] backfill to depth of [*mm*] as specified in [*reference design*]

m) supply, place and compact with [*material*] backfill to natural surface as specified in [*reference design*]

n) all work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the relevant Utility Authority's representative and the Transport and Main Roads Representative / Administrator, and

o) reinstate landscaping, turf, footpaths, pavements as specified in [*reference design*].

3 Temporary Support of Utility Assets

The Contractor shall take all necessary precautions to avoid damage to existing and new installations of utility assets whilst carrying out his own work on the Contract. No embankment material containing rock of an average dimension greater than 75 mm, is to be placed over underground utility assets, or in areas where new utility assets are to be laid.

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Where the Contractor's work operations necessitate the temporary support or protection of utility assets, the Contractor shall notify the Utility Authority concerned. All such supports and protection shall be carried out with the approval of the impacted Utility Authority.

The cost to the Contractor of temporarily supporting and/or protecting utility assets during work operations shall be deemed to be included in the schedule unit rates and lump sum amounts for the various items of work concerned. No claim for additional payment on this account will be considered.

Where utility assets require protection, the Contractor shall supply the necessary plant, material and labour to carry out the protection, as required by the relevant Utility Authority and will be fully responsible for all works associated with the Works. All works shall require approval from the Utility Authority and the Administrator.

4 Public Utility Authorities fees for representatives on Site

As part of the Principal Contractor’s works involving utility assets (utility assets being relocated / protected and adjacent assets impacted by relocation / protection or road works), a representative from the respective gas, electricity and telecommunications Utility Authority may be required on Site for supervision. These Authorities are permitted to charge fees for this service. Water authorities are excluded from being able to stop Transport and Main Roads works on site but may charge fees for a site representative only prior agreement has been included in the contract managing the works involving water assets.

5 Damage and Repair of PUP

The Contractor shall be responsible for any damage to any utility infrastructure (including any completed PUP relocation) caused by the execution of the work under the contract. The Contractor shall notify the Administrator forthwith of any such damage and shall make good any such damage at their cost.

The Contractor shall make arrangements directly with the relevant Utility Authority, for any such repair work and the Contractor shall have no claim against the Principal, for any payment, loss or delay occasioned by any such damage or repair work.

The Contractor shall be responsible for any damage caused to the work under the contract, by any fault that may develop in any utility asset during the contract period, where such fault is caused by a breach, act or omission of the Contractor.

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Technical Specification

Transport and Main Roads Specifications
MRTS01 Introduction to Technical Specifications

March 2021

Queensland Government

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Contents

1 Introduction 1
2 Definition of terms 1
2.1 Standard definitions 1
2.2 Definitions in other documents 4
2.3 Priority of definitions 4
3 Referenced documents 4
4 Standard test methods 5
5 Quality system requirements 5
5.1 General 5
5.2 Hold points, Witness Points and Milestones 6
5.3 Conformance requirements 6
6 Units of measurement 6
7 Materials and workmanship 7
8 Set out of individual installations 7
9 Ground slope 8
10 Utilisation and disposal of surplus material 8
11 Limits in the technical specifications 8
11.1 General 8
11.2 Maximum and/or minimum limits and/or shapes 8
11.3 Specified values/shapes and tolerances 9
11.4 Characteristic value 9
12 Calculation of the characteristic value 9
13 Methods of specifying skewed structures 11
14 The Administrator 12
15 Supplementary requirements 12
16 Commentaries 12

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1 Introduction

This Technical Specification serves as an introduction to Technical Specifications.

This Technical Specification contains definitions of terms and interpretation of clauses common to many Technical Specifications.

This Technical Specification shall be read in conjunction with other Technical Specifications.

In the Technical Specifications, reference to clause numbers shall be taken to mean reference to the clauses of that number within that Technical Specification, unless stated otherwise.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual. All specifications forming the Transport and Main Roads Specifications Manual detail the technical requirements for work related to departmental projects.

Others may use these documents for non-departmental projects at their own risk. In some cases, a particular Technical Specification may be based on the assumption that a standard departmental contract is in place (that is, references to “contract” means a reference to a specific standard contract). A consistency check should be undertaken if the contract is not a departmental standard.

These specifications do not specifically cover non-technical issues associated with undertaking departmental works, for example Workplace Health and Safety, or environmental. Such issues are generally covered by legislative or other requirements and are generally beyond the scope of these specifications.

The Standard Work Items outlined in Specification (Measurement) ‘MRSxx’ documents have changed from a four-digit number to a five-digit number to enhance the sustainability of this system. Existing contracts tendered using the four-digit Standard Work Items will continue to be managed under this numbering system until finalisation. Contracts prepared after 31 July 2017 will be prepared with five-digit Standard Work Items.

2 Definition of terms

2.1 Standard definitions

The standard definitions listed in Table 2.1 shall apply to the Technical Specifications.

Table 2.1 – Definition of terms

Term	Definition
base line	The survey line actually pegged on the ground, which may also be the control line or the centreline
cell	A single chamber of a drainage structure which provides an opening
compliance testing	Testing carried out to determine if the product complies with the relevant standards and requirements. Compliance testing may also be referred to as conformance testing
conformance	Conformity as defined in AS/NZS ISO 9000
conformance report	Summary statement submitted by the Contractor to the Administrator of the evidence pertaining to each lot which demonstrates that the specified requirements for that lot have been met
contract	Refers to the related contract between the department and other party

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Term	Definition
control testing	Testing used to monitor and control the construction process and material quality
culvert	A drainage structure which consists of one or more cells
height	The vertical distance of a point on a surface above or below the project survey datum. Height replaces the term “reduced level”
Hold Point	An identified point in a process past which the Contractor shall not proceed without a direction from the Administrator
localised excavation	A minor excavation which is not scheduled separately as a Work Item and whose dimensions are not specifically indicated in a standard and/or Drawing but which shall be carried out in order to correctly construct the work under the Contract
lot	A portion of material or a section of the Works which has been constructed and/or supplied under essentially uniform conditions and contains material of essentially uniform quality, or A single finished item of work which includes several materials and/or work types (eg a culvert in place)
Transport and Main Roads Specifications Manual	The manual containing the set of Specifications and Technical Specifications for road and bridge works published by Transport and Main Roads
mass concrete	Unreinforced concrete placed in a large mass which relies on its weight for stability
MDR	Abbreviation for moisture density relationship
Milestone	A point within a project where progress is verified by the completion of an activity or a point which marks the start of an activity
NATA	Abbreviation for the National Association of Testing Authorities Australia
natural ground surface	The ground surface existing prior to the commencement of any work under the Contract
nonconformance	Nonconformity as defined in AS/NZS ISO 9000
nonconformance report	A written report produced by the Contractor which indicates that a nonconformance has been identified
pavement marking	Any delineation device installed on the pavement including lines, symbols, chevrons and raised pavement markers
processing	Operations required to modify material for the purpose of altering its properties
proprietary product	A product obtained from a recognised manufacturer of that product which is recommended by the manufacturer as suitable for its intended use
random sampling	A system in which the selection of sampling locations, sampling intervals or test locations is made for a lot or sub-lot so that each location or interval in the lot or sub-lot has an equal chance of being selected. Random sampling shall be performed in accordance with Test Method Q050 – Selection of Sampling and Test Locations

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Term	Definition
random stratified sampling	A system in which selection of sampling locations, sampling intervals or test locations is made by dividing the lot or sub-lot into strata of equal size, followed by the random selection of a single location or interval for sampling or testing in each stratum. A different random number is used for each stratum. Random stratified sampling shall be performed in accordance with Test Method Q050 – Selection of Sampling and Test Locations.
relative compaction	Previously relative dry density, abbreviated to RDD, is the ratio, expressed as a percentage, of the insitu dry density of the material presented for compliance testing and the maximum dry density of a reference sample compacted in accordance with a specified procedure
road	The developed way devoted to public travel principally with motor vehicles
road furniture	Any roadside item or device including signs, guide posts, guardrails, barriers, fences and grids
road reserve	The whole width between abutting property boundaries of a section of land reserved for use for a road
specified	Given or described. When used without qualification it shall refer to information given or described in the Contract and/or information which can be derived from the Contract
Standard Drawing	A drawing published by the department as a Standard Drawing in the Manual of Standard Drawings Roads
subgrade	The trimmed or prepared portion of the formation on which the pavement is constructed
subgrade level	The level of the top surface of the prepared subgrade on which a pavement is constructed
sublot	A subdivision of a lot
supplementary technical specification	Any Technical Specification included in the Contract which is not a Technical Specification
systematic random stratified sampling	A system in which selection of sampling locations, sampling intervals or test locations is made by dividing the lot or sub-lot into strata of equal size, followed by the random selection of a single location or interval for sampling or testing in each stratum. The same random number is used for each stratum. Systematic random stratified sampling shall be performed in accordance with Test Method Q050 – Selection of Sampling and Test Locations
Technical Specification	Any Technical Specification published by the department as a Technical Specification forming part of the *Transport and Main Roads Specifications Manual*
Transport and Main Roads	The Department of Transport and Main Roads, Queensland, its successors or assigns
Witness Point	An identified point in a construction process at which an activity is observed
WPI	Abbreviation for Weighted Plasticity Index = Plasticity Index × % passing 0.425 mm test sieve

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2.2 Definitions in other documents

Further relevant definitions are contained in the following documents:

a) a particular Transport and Main Road's Supplementary Technical Specification

b) a particular Transport and Main Road's Technical Specification

c) a particular Transport and Main Road's Technical Publication (Manual, Supplement to Austroads Guide, Supplement to Australian Standards, Technical Note, Engineering Policy and Guideline)

d) Austroads Glossary of Terms, and

e) AS/NZS ISO 9000.

2.3 Priority of definitions

In the event of conflict in definition, priority shall be assigned in the order that the documents are listed below:

a) the relevant Transport and Main Road's Supplementary Technical Specification

b) the relevant particular Transport and Main Road's Technical Specification

c) this Technical Specification, MRTS01 *Introduction to Technical Specifications*

d) a particular Transport and Main Road's Technical Publication (Manual, Supplement to Austroads Guide, Supplement to Australian Standards, Technical Note, Engineering Policy and Guideline)

e) Austroads Glossary of Terms, and

f) AS/NZS ISO 9000.

3 Referenced documents

Throughout the Technical Specifications, Australian Standards are referenced by their allocated “AS” number only. Unless an edition date accompanies the particular reference, the latest edition available 14 days prior to the date of lodgement of tenders shall apply. Where a Referenced Standard has been superseded or deleted by Australian Standards, the current relevant Australian Standard shall apply.

For all other documents referred to in the Contract *(including the Materials Testing Manual, the Nuclear Gauge Testing Manual, Austroads documents, ASTM International Standards, other state road authority standards, technical notes and design guidelines / supplements)*, the latest edition available 14 days prior to the date of lodgement of tenders shall apply, unless an edition date accompanies the particular reference.

Table 3 lists documents referenced in this Technical Specification.

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Table 3 – Referenced documents

Reference	Title
-	*Austroads Glossary of Terms*
AS/NZS ISO 9000	*Quality management systems – Fundamentals and vocabulary*
MRTS04	*General Earthworks*
MRTS05	*Unbound Pavements*
MRTS06	*Reinforced Soil Structures*
MRTS07A	*Insitu Stabilised Subgrades using Quicklime or Hydrated Lime*
MRTS07B	*Insitu Stabilised Pavements using Cement or Cementitious Blends*
MRTS07C	*Insitu Stabilised Pavements using Foamed Bitumen*
MRTS08	*Plant-Mixed Heavily Bound (Cemented) Pavements*
MRTS09	*Plant-Mixed Pavement Layers Stabilised using Foamed Bitumen*
MRTS10	*Plant-Mixed Lightly Bound Pavements*
MRTS30	*Asphalt Pavements*
Q020	*Calculation of characteristic value of a lot*

4 Standard test methods

Testing of all work carried out under the Contract shall be undertaken in accordance with test methods in the departments *Materials Testing Manual* or where specified, from national standards. Where these methods are referenced in the *Materials Testing Manual* and in the Transport and Main Roads Specifications Manual they are prefixed as follows:

a) "Q" for methods published in the *Materials Testing Manual*

b) "AS" for methods published by Australian Standards, or

c) "AG:PT/T" for methods published by Austroads.

d) “ASTM” for method published by the ASTM International, formerly American Standards for Testing of Materials.

In some instances, however, test methods from other sources, such as, International Standards or other State Road Authorities, may be specified. Where this is the case, complete details of the test method references are given in the relevant Technical Specification.

5 Quality system requirements

5.1 General

The general quality system requirements for work covered by the Technical Specifications are set out in MRTS50 *Specific Quality System Requirements*.

Additional requirements, where applicable, are included in the relevant Technical Specification under a Clause titled “Quality System Requirements” (the “Quality clause”).

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5.2 Hold points, Witness Points and Milestones

Where a Hold Point, Witness Point or Milestone applies in a Technical Specification, the text is highlighted at the appropriate point and a summary of all such points is included in the Quality Clause of the relevant Technical Specification.

a) a Hold Point is indicated in the text as **Hold Point**

b) a Witness Point is identified in the text as **Witness Point** and

c) a Milestone is identified in the text as **Milestone**

The Hold Point to this Technical Specification is summarised in Table 5.2. There are no Milestone and Witness Points defined.

Table 5.2 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
8	1. Design appropriateness of design setout with regard to the actual site conditions		

5.3 Conformance requirements

Where applicable, a summary of the conformance requirements for a lot is included in the Quality Clause of the relevant Technical Specification.

Additionally, minimum testing requirements may be specified in the Technical Specification or in the Annexure to the relevant Technical Specification.

6 Units of measurement

Dimensions and measurements in the Technical Specifications are consistently described by the set of units of measurement listed in Table 6.

Table 6 – Units of Measurement

Measurement	Unit	Abbreviation
distance	metre	m
	micrometre	µm
	millimetre	mm
	centimetre	cm
	kilometre	km
area	square metre	m²
	hectare	ha
volume	cubic metre	m³
	kilolitre	kL
	litre	L
force	newton	N
	kilonewton	kN

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Measurement	Unit	Abbreviation
pressure	kilopascal	kPa
	megapascal	MPa
temperature	degrees Celsius	°C
unit weight	kilonewtons per cubic metre	kN/m³
velocity	metres per second	m/s
	kilometres per hour	km/h
mass	kilogram	kg
	tonne	t
mass per unit	grams per square metre	g/m²
	kilograms per square metre	kg/m²
density	tonnes per cubic metre	t/m³
time	seconds	s
	minutes	min
	hours	h
frequency	hertz	Hz
	kilohertz	kHz

7 Materials and workmanship

Where materials, material components, workmanship and procedures are not specifically described by the Contract, they shall be in accordance with the relevant Australian Standard. Where no Australian Standard is available, other specifications shall be used in the following order of priority:

a) the contract specification of the local authority where work is being undertaken

b) manufacturer's recommendations, and

c) accepted industry standards.

At a minimum materials and workmanship shall be the best of their respective kinds and fit for the purpose for which they are intended.

8 Set out of individual installations

The Contractor shall set out an installation as shown on the Drawings in sufficient detail to identify the location, length and levels of the proposed installation.

Once the initial set out is complete the Administrator will determine the design appropriateness of the set out with regard to the actual site conditions **Hold Point 1** The Administrator may direct amendments to the set-out details. Payment for such amendments will be made at appropriate rates in the Schedule of Rates or, where such rates are not deemed by the Administrator to be appropriate, as determined by the Administrator.

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Installations to be set out in accordance with the above requirements include:

a) drainage pipes, culverts and structures

b) landscaping, and

c) traffic control and lighting ducts, pits, poles and equipment.

9 Ground slope

Where used in the Technical Specifications to identify ground surface slope or batter angles, the following terms shall all be taken to mean a slope of 1 unit in the vertical direction and n units in the horizontal direction:

a) 1 on n

b) 1 in n

c) 1 : n, and

d) N to 1.

10 Utilisation and disposal of surplus material

Demolished material which complies in all respects with specified requirements may be used in the Works.

Demolished material which does not comply with specified requirements or which is not required for the construction of the Works shall be disposed of:

a) in accordance with the provisions specifically stated in any specification or Annexure thereto, or

b) by removal from the Site.

Surplus excavated material shall be disposed of in accordance with the provisions of Clause 11 of MRTS04 *General Earthworks*.

Where material is disposed of outside the Site, the Contractor shall comply with all relevant Commonwealth and State Government laws and regulations and Local Government By-Laws and shall obtain all necessary approvals and permits and shall comply with all lawful directives.

11 Limits in the technical specifications

11.1 General

Any limits specified in the Technical Specifications shall be interpreted as set out in Clause 11.

11.2 Maximum and/or minimum limits and/or shapes

Any specified maximum or minimum limit or shape is an absolute limit / shape and shall not be used as a target value. The relevant limit / shape shall not be exceeded as the result of any variation in the construction and/or measurement process.

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11.3 Specified values/shapes and tolerances

Any specified value or shape is to be regarded as a target value / shape and any specified tolerance shall be regarded as providing the absolute limit for any departure from the specified value/shape. The construction of the Works shall be controlled so that the relevant tolerance is not exceeded as the result of any variation in the construction and/or measurement process.

11.4 Characteristic value

Where a characteristic value is specified, a statistical procedure in accordance with Clause 12 shall be used to determine the value which represents the properties of a lot. The statistical procedure makes allowances for variations in the construction and measurement processes. The Works shall be constructed so that the characteristic value complies with the relevant requirements.

12 Calculation of the characteristic value

Where the compliance of a product is tested by the assignment of a characteristic value determined by the analysis of several individual tests or measurements using a statistical procedure, the following system shall be used:

a) compliance testing / measurements shall be undertaken as specified in the relevant specification

b) the characteristic value for the lot shall be determined using the individual test results or measurements and one of the following equations, as applicable:

for a minimum limit:

CharacteristicValue = Xav – ks

for a maximum limit:

CharacteristicValue = Xav + ks

where:

$$X_{av} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

$$s = \sqrt{\sum_{i=1}^{n} \frac{(X_i - X_{av})^2}{(n - 1)}}$$

where:

n = number of test results or measurements

X_i = the individual test result or measurement for i = 1, 2, 3, …, n, and

k = an acceptance constant dependent upon the number of tests or measurements.

c) the relevant value of k shall be selected from either Table 12(a) for the relevant Technical Specifications or Table 12(b) unless otherwise specified, and

d) the rounding of the characteristic value shall be as shown in Table 12(c).

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Table 12(a) – Acceptance constants (MRTS04, MRTS05, MRTS06, MRTS07A, MRTS07B, MRTS07C, MRTS08, MRTS09 & MRTS10)

Number of Tests or Measurements	Acceptance Constant (k)	Number of Tests or Measurements	Acceptance Constant (k)
≤10	0.828	23	0.965
11	0.847	24	0.972
12	0.863	25	0.978
13	0.877	30	1.002
14	0.890	35	1.020
15	0.901	40	1.036
16	0.910	45	1.049
17	0.919	50	1.059
18	0.928	60	1.077
19	0.937	70	1.091
20	0.946	80	1.103
21	0.952	90	1.112
22	0.959	100	1.120

Table 12(b) – Acceptance constants

Number of Tests or Measurements	Acceptance Constant (k)	Number of Tests or Measurements	Acceptance Constant (k)
2	0.403	19	0.937
3	0.535	20	0.946
4	0.617	21	0.952
5	0.675	22	0.959
6	0.719	23	0.965
7	0.755	24	0.972
8	0.783	25	0.978
9	0.808	30	1.002
10	0.828	35	1.020
11	0.847	40	1.036
12	0.863	45	1.049
13	0.877	50	1.059
14	0.890	60	1.077
15	0.901	70	1.091
16	0.910	80	1.103
17	0.919	90	1.112
18	0.928	100	1.120

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Table 12(c) – Rounding intervals

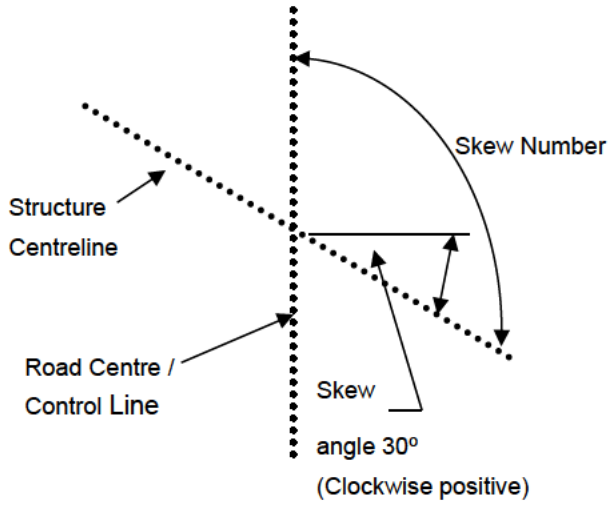
Property / Parameter	Rounding Value
dry density ratio	0.5%
Hilf density ratio	0.5%
relative compaction	0.5%
degree of saturation	1%
air voids	0.1%
relative compaction (asphalt)	0.1%
layer thickness	1 mm
wide strip tensile strength	0.1 kN/m
burst strength	0.1 kN
drop cone puncture resistance	1 mm
tensile strength (Ts) at 2% strain	? kN
X_{av}	to a number of significant figures which exceeds by one that normally reported for the property / parameter
s	to a number of significant figures which exceeds by one that normally reported for the property / parameter
k	0.001
characteristic value	to the same number of significant figures normally reported for the property / parameter

Where a characteristic value is included on NATA endorsed test reports, Test Method Q020 shall be used.

13 Methods of specifying skewed structures

The meaning of the "Skew Angle" and "Skew Number" which are used to specify the location of skewed culvert structures relative to the road centre line, are shown in Figure 13. "Skew Number" is required for ordering metal structures. The skew number is the number of degrees measured in a clockwise direction from the road centreline to the structure centreline.

Figure 13 – Skew number / Skew angle



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14 The Administrator

The Administrator shall be as stated in the Contract with the role as defined in the Contract.

15 Supplementary requirements

The requirements of MRTS01 *Introduction to Technical Specifications* are varied by the supplementary requirements given in Clause 1 of Annexure MRTS01.1.

16 Commentaries

Transport and Main Roads Specifications includes commentaries. The Commentaries are placed within a shaded area of the document. It does not form part of the Technical Specification or Specification (Measurement).

Where an inconsistency occurs between the Technical Specification and the Commentary, the Technical Specification prevails.

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Technical Specification

Transport and Main Roads Specifications
MRTS02 Provision for Traffic

March 2021

Queensland Government

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Contents

1 Introduction 1

1.1 Principal's documents for control of traffic during construction of roadworks 1

1.2 Departures from standards and innovation 2

1.3 Traffic control principles 3

2 Definition of terms 4

3 Referenced documents 5

4 Quality system requirements 6

4.1 Hold points, Witness Points and Milestones 6

4.2 Conformance reporting 7

5 Traffic management planning 7

5.1 TMP – General 7

5.2 Nominated traffic officer 7

5.3 Traffic management plan submission and approval 8

5.4 Scope of traffic management plan 8

5.5 Implementation of traffic management plan 10

5.6 Administration of the traffic management plan 10

5.6.1 Traffic management registration 10
5.6.2 Traffic controller accreditation 10
5.6.3 Out-of-hours representatives 11
5.6.4 Inspection and records 11
5.6.5 Traffic crashes and incidents 11
5.6.6 Complaints and requests for information 12

5.7 Traffic management provisions 12

5.7.1 General 12
5.7.2 Works restriction 12
5.7.3 Traffic lane restrictions 13
5.7.4 Traffic management for route alterations 14
5.7.5 Over dimension, over weight and dangerous goods vehicles 15
5.7.6 Access to private property 15
5.7.7 Vulnerable road user movements 15

5.8 Incident management 15

5.9 Contingency planning 15

6 Traffic guidance scheme (TGS) 16

6.1 General 16

6.2 Traffic guidance scheme submission and consideration 16

6.3 Scope of traffic guidance scheme 17

6.4 Implementation of traffic guidance schemes 17

6.5 Traffic guidance provisions 18

6.5.1 General traffic control devices 18
6.5.2 Additional optional traffic control devices 18
6.5.3 Traffic route alterations 19
6.5.4 Dust control 21
6.5.5 Night work 21
6.5.6 Stored plant and materials 21

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FOI 26-292 - Document 21

6.5.7 Preventing end of queue crashes ... 21
6.5.8 Delineation of trafficked corridors ... 22
6.5.9 Direction and street signs ... 22
6.5.10 Work site access ... 22
6.5.11 Temporary road safety barriers ... 22
6.5.12 Anti-gawking screens ... 24
6.5.13 Temporary road lighting ... 24
7 Traffic management inspection ... 25
7.1 General ... 25
7.2 Officer undertaking traffic management inspection ... 25
7.3 Scope of the traffic management inspection ... 26
7.4 Traffic management inspection schedule ... 26
7.5 Traffic management inspection reporting ... 27
8 Administration of traffic management ... 27
8.1 Traffic management audit and inspection ... 27
8.2 Safety performance of the TGS ... 27
8.3 Traffic non-conformances ... 27
9 Supplementary requirements ... 28
Appendix A – Speed management plan ... 29
A1 Objective ... 29
A2 Planning process ... 30
A3 Documentation ... 30
A3.1. Speed choices ... 30
A3.2. Speed monitoring ... 31
A3.2.1 Manual time travel surveys ... 31
A3.3 Risk assessment ... 32
A3.4 Engineering remedial actions ... 33
A3.5 Enforcement remedial actions ... 33
Appendix B – Enforcement request procedure ... 34
B1 Objective ... 34
B2 Enforcement request and determination procedure ... 34
B2.1 Request for enforcement (by Contractor through Principal) ... 34
B2.2 Enforcement decision (by Road Policing Unit, RPU) ... 34
B2.3 Implementation (by Road Policing Unit) ... 35
B2.4 Implementation (by Contractor) ... 35
B2.5 Monitoring and evaluation (by Contractor) ... 35
B3 Enforcement request form ... 36

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1 Introduction

This Technical Specification applies to the control of traffic during roadworks and describes the project specific requirements for control of all traffic through the work site.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

1.1 Principal's documents for control of traffic during construction of roadworks

This Technical Specification forms part of the suite of documents to be applied for provision for traffic during road construction and maintenance activities. The suite of documents includes:

- Transport and Main Roads Specification MRS02 *Provision for Traffic*, including Annexures.
- Transport and Main Roads Technical Specification MRTS02 *Provision for Traffic*, including Annexures (this document).
- Queensland *Manual of Uniform Traffic Control Devices* – Part 3, Traffic Control for Works on Roads (MUTCD Part 3) including amendments published on the Department of Transport and Main Roads website.
- *Queensland Guide to Temporary Traffic Management* (QGTTM) – Parts 1 through 10, including amendments published on the Department of Transport and Main Roads website.
- *Traffic Management for Construction or Maintenance Work – Code of Practice 2008* (Workplace Health and Safety Queensland and Department of Justice and Attorney General).
- *Guidline – Traffic Management at Works on Roads* (TMWOR) including amendments published on the Department of Transport and Main Roads website.
- *Traffic and Road Use Management Manual* (TRUM), Volume 1 – Guide to Traffic Management, Part 3: Traffic Studies and Analysis published on the Department of Transport and Main Roads website.
- Technical Notes: Traffic Engineering including amendments published on the Department of Transport and Main Roads website.

Where any conflicts occur between the requirements in these documents, the order of precedence shall be as listed above except:

- where document precedence is specified in the contract
- if not specified in the contract, shall be approved in writing by the Administrator, and
- where there are conflicting provisions in the MUTCD Part 3 and the QGTTM, seek advice from the department's Traffic Engineering Practice team at trafficengineering.support@tmr.qld.gov.au.

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1.2 Departures from standards and innovation

The requirements and recommendations set out in this Technical Specification and the associated Principal's documents for control of traffic during construction of roadworks (refer Clause 1.1), should not be inferred to preclude innovative or alternative traffic management solutions that provide improved value for money outcomes which meet the intent of this Technical Specification.

The primary principle in developing a Traffic Management Plan (TMP) and Traffic Guidance Scheme (TGS) is to ensure the safety of road workers and road users. Safety should at all times be maintained or improved.

The secondary principle of the TMP and TGS is to balance the:

a) efficient movement of traffic, and

b) construction and traffic management costs.

Innovative treatments that provide improved value for money outcomes are therefore encouraged. Such treatments may include:

- Changes to the work scheduling / programming to occur during periods of lower traffic demand. Planning for greater network impacts through reducing the Level of Service (LOS) for the road user typically enables works to be undertaken in a more time efficient manner.
- Innovative treatments for the deployment of devices.
- Alternative device layouts using new / improved devices.

Contractors undertaking works on roads are encouraged to propose / submit innovative or alternative traffic management solutions that provide improved value for money outcomes. These solutions may involve impacts outside the specified requirements but will be considered against the benefits that are provided and submitted as an Alternative Tender, as set out in the Conditions of Contract. Safety should at all times be maintained or improved. Any Alternative Tender shall be submitted in addition to a Conforming Tender.

Further guidance on innovations and preparing an Alternative Tender is provided in the Conditions of Tendering and the Conditions of Tendering Annexure.

It is also recognised that in some cases, conditions specific to the site and proposed traffic management layout may result in it not being possible to implement all the requirements as outlined in this Technical Specification and the associated departmental documents for control of traffic during construction of roadworks (refer Clause 1.1). In those cases where compliance is impractical, the Contractor should propose minor departures from the standards and / or alternative traffic management solutions in the Traffic Management Plan (TMP) (Clause 5).

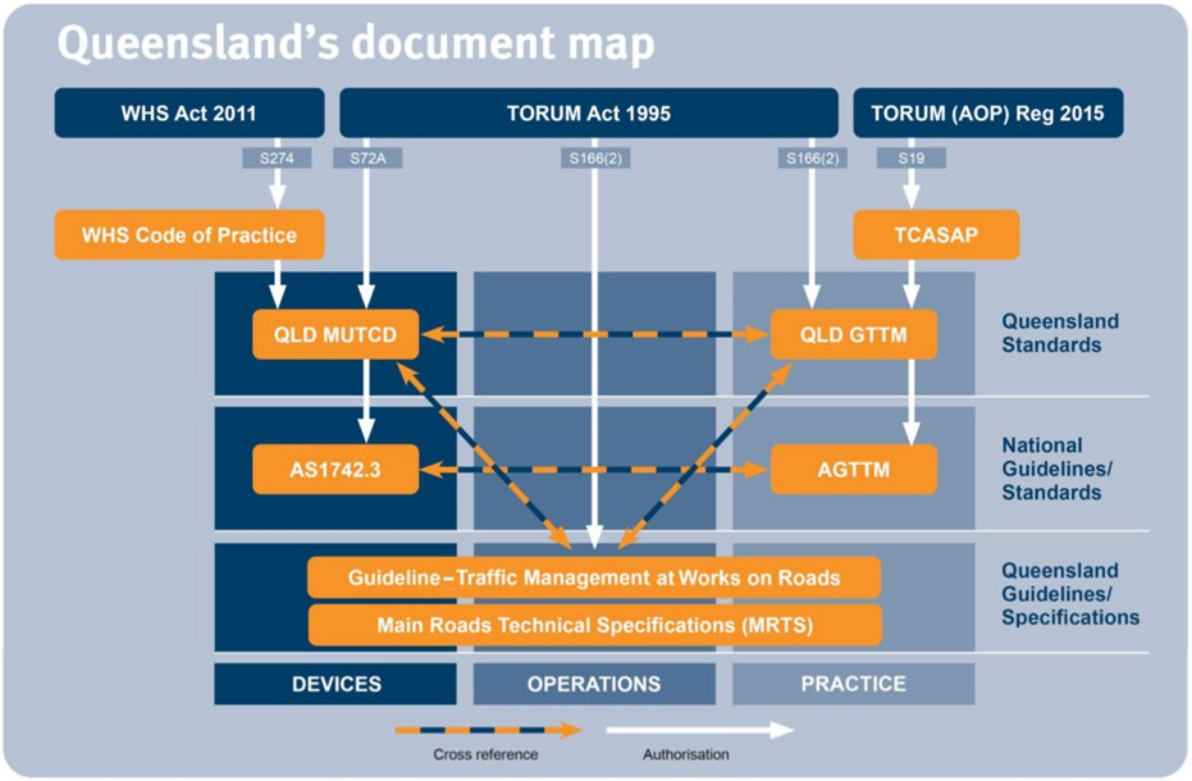
Where any innovation, alternative traffic management treatment or departure from standards is proposed, it shall be identified in the TMDs risk assessment, as part of that proposal, in accordance with MUTCD Part 3 Clause 1.9 and the QGTTM Part 2.

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1.3 Traffic control principles

The purpose of traffic control at roadworks is to clearly communicate to all road users, including vehicle operators, pedestrians and cyclists, the path and speed at which it is safe to travel through, past or around the roadworks site. The MUTCD Part 3 and QGTTM provide detailed guidance on the devices and most appropriate forms of traffic control for roadworks sites respectively, these documents should be applied as the optimal treatment at works on roads.

A summary of the documents relevant to Temporary Traffic Management (TTM) practice in Queensland, and their linkages, is provided following:



When applying the relevant TTM standards in Queensland, the following apply:

- The MUTCD Part 3 shall be read in conjunction with Australian Standard AS 1742.3 *Manual of uniform traffic control devices, Part 3: Traffic control for works on roads*, and
- The QGTTM shall be read in conjunction with *Austroads Guide to Temporary Traffic Management* (AGTTM).

The TGS and its relevance / relation to the roadworks site needs to be clear for the scheme to be accepted and credible to the road user, and effective in its implementation. Unless there is clear reason to comply with the TGS, drivers may disregard traffic control devices, most notably speed limit signs. It is in both the Contractor's and Principal's interest that speed limit choices in the TGS are realistic, self-enforced by road users, and enforceable.

As a result, there will be a focus on ensuring that the following requirements are met:

- Roadwork signage shall be in accordance with the TGS, MUTCD Part 3, QGTTM and installed and maintained to the required standards.

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- Reduced speed zones shall be kept to minimum lengths. This requires speed limit reinstatement signs to be in place as close to the end of the works requiring the limit as practicable.
- Reduced speed zones shall be kept to minimum durations. This requires speed signs to be changed or removed as soon as they are no longer appropriate.
- A speed zone for road worker safety shall only be in place if there are road workers present and while they are undertaking the works for which the speed limit is required.
- A reduced speed zone in place for road user safety (as a result of changes to the road environment) shall be justified and the danger shall be evident or made evident to the road user by the installation of appropriate warning signage. Portable VMS may be used in advance of the work area to advise changed road conditions.
- A reduced speed zone in place to protect works (for example, as outlined in the early trafficking requirements in MRTS11 *Sprayed Bituminous Treatments (Excluding Emulsion)*) shall be justified and the reason shall be evident or made evident to the road user, and
- Speed zones should be implemented as close to the time of commencement of works as practicable, and no longer than one hour prior to the commencement of works requiring the speed zone, and should be removed as soon as practicable, and within one hour following the completion of the works requiring the speed zone.

The Contractor retains ultimate responsibility for traffic control and management and is responsible for ensuring that the traffic guidance system is adequately designed, installed correctly and regularly reviewed on site.

Re-inspection costs will apply for breaches of these situations as identified at Clause 8.3.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Anti-gawking screen	An opaque screen attached to a Temporary Road Safety Barrier (TRSB) to shield the construction work from the view of passing motorists.
Community Control Plan	A document that outlines how information about the project will be communicated to the community.
Dynamic deflection	The largest transverse deflection of a TRSB system recorded during an actual crash or during a full-scale impact test.
End Treatment	The collective term for devices and features at the leading and trailing ends of TRSB systems, which are selected on the basis of traffic speed and composition, the type of TRSB system and the particular site constraints.
May	A permissive condition that indicates that usage of the device is conditional, or optional.

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Term	Definition
Nominated Traffic Officer	A person responsible in accordance with Clause 5.2 for preparation and implementation of the TMP, TGS and managing onsite monitoring of TTM performance (for example, speed management, traffic delays, condition of devices).
Principal	The State of Queensland acting through the Department of Transport and Main Roads.
RPEQ	Registered Professional Engineer of Queensland
Shall	A mandatory condition. Where certain requirements in the design or application of the device are described with the 'shall' stipulation, it is mandatory that, when an installation is made, these requirements be met.
Should	Indicates a recommendation. Where the word 'should' is used, it is considered to be recommended use, but not mandatory. Any recommendation that is not applied must be based on sound traffic engineering judgement and documented.
Speed Management Plan	A document that outlines the proposed speed limits during and outside of work hours, the measures to be taken to monitor speeds and remedial actions to ensure compliance with the speed limit.
Substantial (change in traffic)	These are changes introduced by a Traffic Guidance Scheme which result in: • reduction in the available road space by one lane or more including bicycle lanes • realignment of carriageway by more than one lane width, and • geometric change to an intersection operation.
Traffic Controller	A person authorised in accordance with Clause 5.6.2 to control traffic at roadworks.
Traffic Guidance Scheme (TGS)	An arrangement of temporary signs and devices to warn traffic and guide it through or past a work area or temporary hazard.
Traffic Management Plan (TMP)	Prepared by the Contractor in accordance with the requirements of the Contract. It outlines how the works are integrated into the operation of the road network, identifies and considers all foreseeable risks, and assesses the impact on all road users, and identifies requirements for TTM monitoring.
TRSB	Temporary Road Safety Barrier

3 Referenced documents

Table 3 lists acronyms for documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
–	*Limitation of Actions Act 1974*
–	*Transport Operations (Road Use Management) Act 1995*
–	*Transport Operations (Road Use Management – Accreditation and Other Provisions) Regulation 2015*
AGTTM	*Austroads Guide to Temporary Traffic Management*
AS 1742.3	*Manual of uniform traffic control devices, Part 3: Traffic control for works on roads*

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Reference	Title
AS 3845	*Road safety barrier systems*
AS/NZS 1158	*Lighting for roads and public spaces*
AS/NZS ISO 31000	*Risk Management – Principles and Guidelines*
Austroads guide	*Guide to Traffic Management Part 3 – Traffic Studies and Analysis*
Austroads AP-R403-12	Austroads Report – *Implementing National Best Practice for Traffic Control at Worksites – Risk Management, Auditing and Field Operations*
MRTS01	*Introduction to Technical Specifications*
MRTS11	*Sprayed Bituminous Treatments (Excluding Emulsion)*
MRTS14	*Road Furniture*
MRTS45	*Road Surface Delineation*
MRTS50	*Specific Quality System Requirements*
MUTCD	Queensland *Manual of Uniform Traffic Control Devices*, Transport and Main Roads as harmonised with AS 1742.3
QGTTM	*Queensland Guide to Temporary Traffic Management*, Transport and Main Roads as harmonised with the AGTTM
RPDM	*Road Planning and Design Manual*
TC2320_2	*Sign layout prior to deployment of speed cameras at roadworks sites*
TIPDS	*Transport Infrastructure Project Delivery System*
TMWOR	*Guidelines – Traffic Management at Works on Roads, Transport and Main Roads*
TRUM	*Traffic and Road Use Management Manual*, Transport and Main Roads

4 Quality system requirements

4.1 Hold points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1. There are no Witness Points defined.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.3	1. Approval of Traffic Management Plan		
6.2	2. Approval of Traffic Guidance Schemes*		
7.5			Submission of Traffic Management Inspection Report

*Unless specified in Clause 4 in Annexure MRTS02.1, approval of TGS shall be a Hold Point for approval of proposed speed limits only.

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4.2 Conformance reporting

The Contractor shall establish and keep updated records to show the Contractor's conformance to the requirements of this Technical Specification and other relevant reference documents. These records shall be submitted to the Administrator on a monthly basis, or otherwise as directed.

5 Traffic management planning

5.1 TMP – General

The TMP outlines how the works are integrated into the operation of the road network. The outcome of the TMP is to describe how all road users will be accommodated throughout the duration of the works and the impacts on both road users and the construction process. Indicative staging of long-term traffic management changes align to the proposed construction methodology and form the basis on which the TGS is subsequently developed.

5.2 Nominated traffic officer

The Nominated Traffic Officer shall be accountable to the Contractor and responsible for the preparation, implementation, and ongoing monitoring of the TMP and all TGS and other requirements contained within the TMP. The Contractor shall submit to the Administrator the name of its Nominated Traffic Officer.

The Nominated Traffic Officer shall have the requisite level of training / experience outlined in Table 5.2.

When dealing with innovations, alternatives and departures from the MUTCD Part 3, or QGTTM, the Nominated Traffic Officer will either be an RPEQ or have access to an appropriately experienced RPEQ with Transport and Main Roads approved Traffic Management Design training. See MUTCD Part 3 Clause 1.5 and 1.9.

Table 5.2 – Nominated traffic officer training / experience requirements

Level of Complexity	Nominated Traffic Officer – Level of Training / Experience
Complex traffic management schemes which have significant impacts on delays or traffic rerouting	Successful completion of Transport and Main Roads approved Traffic Management Design Training course delivered by a registered training provider. Additional qualifications and / or experience as nominated in Clause 1 of Annexure MRTS02.1
Innovations, alternatives and departures from standards resulting in treatments other than specified in the MUTCD Part 3 or QGTTM	An appropriately experienced RPEQ with successful completion of Transport and Main Roads approved Traffic Management Design Training course delivered by a registered training provider
TGS is selected from a suite of generic TGSs	Successful completion of Transport and Main Roads approved Traffic Management Implement course delivered by a registered training provider
TGS are developed using the principles from the MUTCD Part 3 and QGTTM to develop site specific diagrams	Successful completion of Transport and Main Roads approved Traffic Management Design Training course delivered by a registered training provider

Notes:

- Statements of successful completion must be obtained through training delivered by a registered training organisation which meets the requirements of Traffic Management for Construction or Maintenance Work Code of Practice 2008.

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5.3 Traffic management plan submission and approval

A TMP shall be submitted by the Contractor to the Administrator, for a direction from the Principal as to its suitability, at least 21 days before commencement of its implementation, or as nominated in Clause 2 in Annexure MRTS02.1.

Where the Work under the Contract consists of Separable Portions or other clearly identifiable sections, the TMP may be separated into identifiable sections.

The TMP shall comply with any project specific requirements stated in Clause 2 of Annexure MRTS02.1

No traffic rearrangements shall be carried out until after the Administrator has advised the Contractor that the submitted, and amended as directed, TMP is approved and suitable for use. **Hold Point 1**

5.4 Scope of traffic management plan

The TMP shall:

a) Include all TMP elements as detailed in Clause 3 of the QGTTM Part 2, including but not limited to:

   i. traffic demand

   ii. traffic routing

   iii. traffic control (including proposed speed limits while workers are present and not present and their justification)

   iv. provision for all road users including users of paths and adjacent transport infrastructure

   v. special vehicle requirements, and

   vi. site conditions including property accesses and roadside facilities (e.g. Bus stops, parking bays).

b) Describe traffic arrangements which provide for any necessary sequencing of the work under the Contract while minimising disruption and confusion to road users, local traffic, public transport, emergency vehicles, pedestrians and cyclists.

c) Where required, describe how the construction work area shall be physically and visually isolated from road users.

d) Provide details of how local access to communities and adjacent private properties and businesses will be maintained.

e) Provide details of arrangements to be made for detouring traffic.

f) Identify arrangements for managing the movement of oversize vehicles through the work site (height and width clearance constraints shall be provided by the Principal).

g) Provide details of all road closures and / or traffic lane restrictions required to undertake the work under the Contract.

h) Provide details for timely notification and engagement of the community (business owners, road users and other stakeholders) in advance of alterations to existing traffic conditions. The extent of notification required will depend on the scope, impact and duration of the works and will be guided by the requirements of the Community Control Plan (CCP). This process shall incorporate the Principal's requirements with respect to public notifications.

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The notification advice should include:

- the physical changes to the road
- expected delays and traffic impacts, and
- alternative route and transport mode options.

Transport and Main Roads is currently reviewing and refreshing its systems and processes relating to event and incident management, traveller information, and road occupancy permitting. A key driver of this work is to provide a better service to our customers.

With respect to roadworks and traveller information, one area currently under investigation is the ability for detailed information about roadworks and changes to road conditions to be more efficiently shared with the department, for publication on Transport and Main Roads traveller information services and for sharing with third party stakeholders. This will allow users of traffic management applications to automatically share roadworks information, removing the need to manually communicate details, and providing richer information for our customers to allow journey planning and achieve better road safety outcomes for road users and road workers alike.

It is anticipated that Transport and Main Roads will require 'real-time' notification advice to mitigate the risk of end of queue crashes that occur when vehicle speeds are significantly reduced, or when vehicles are stationary as a result of lane closures, traffic operating under single lane reversible flow (shuttle flow) or congestion is occurring due to roadwork operations or a traffic crash or incident.

This advice will encompass:

- the worksite location and direction of travel of the traffic flow that is affected
- what is affecting the traffic flow – a lane closure on a multi-lane road, traffic operating under single lane reversible flow on two-lane way roads (controlled by traffic controllers or portable traffic signals), reduced speed limits due to roadwork operations or a traffic crash / incident
- the time and date at which the traffic control measure (lane closure, traffic controllers, portable traffic signals, reduced speed limit, traffic crash or incident) was implemented and removed
- the lane that has been closed (if a lane closure has been installed)
- the principal contractor and nominated traffic officer names and telephone numbers
- the traffic control company name and telephone number, and
- whether workers are present.

A data specification for communicating roadworks information for applications has been published and is available on www.qldtraffic.qld.gov.au.

i) Include a Speed Management Plan detailing the measures to be taken to monitor traffic speeds and to implement remedial actions should traffic speeds exceed the speed limits posted for the works. The Speed Management Plan should be prepared in accordance with the guidance in Appendix A.

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j) Include the following administrative items:

- provision for participation of a senior member of the Contractor's site personnel on any traffic coordination committee convened by the Principal
- the names and contact details of the nominated out-of-hours representatives as specified in Clause 5.6.3
- the name of the Nominated Traffic Officer and evidence of the Nominated Traffic Officer's experience in compliance with the requirements of Table 5.2 (including RPEQ where required)
- details of the Contractor's organisational structure for traffic management issues including a list of the duties and responsibilities of each position nominated in that structure, and
- include a schedule of TGS giving a general description of the relevant traffic arrangements and the TGS submission date for each arrangement. Each TGS shall be prepared and submitted as specified in Clause 6.

k) Provide the following information where independent inspection of the traffic management is required as specified in Clause 7:

- name of the officer undertaking the inspection
- the schedule of inspections, and
- description of the methodology for undertaking the inspections

5.5 Implementation of traffic management plan

The Contractor shall:

a) implement the TMP in accordance with the schedule included in the TMP

b) provide details of the TMP, or any changes to that TMP, to any organisations or parties nominated by the Administrator

c) monitor the continued effectiveness of the TMP during the Contract and revise and update the TMP where necessary, and

d) monitor the continued effectiveness of the speed limits posted as part of the works and revise and update the speed controlling measures in accordance with the Speed Management Plan.

5.6 Administration of the traffic management plan

5.6.1 Traffic management registration

When traffic control is required, only organisations registered with the department's Traffic Management Registration Scheme shall be used. A listing of registered traffic management organisations can be obtained from the departmental website at http://www.tmr.qld.gov.au

5.6.2 Traffic controller accreditation

A Traffic Controller shall hold an appointment as an accredited person under Section 21 of the *Transport Operations (Road Use Management) Act 1995* to perform the functions of a traffic controller as prescribed by the *Transport Operations (Road Use Management – Accreditation and Other Provisions) Regulation 2015*. The Traffic Controller shall carry their Transport and Main Roads issued Traffic Controller Accreditation Scheme accreditation identity card at all times while working as a traffic controller.

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Traffic control shall be undertaken in accordance with the Traffic Controller Accreditation Scheme: Approved Procedure (available at http://www.tmr.qld.gov.au).

5.6.3 Out-of-hours representatives

The Contractor shall nominate a minimum of two representatives to address traffic management issues, one of whom shall be available at all times outside of the Contractor's normal working hours. These two representatives may include the Nominated Traffic Officer. The Contractor shall notify the Administrator of the name, address and telephone number of the nominated persons. Such persons, when requested by the Administrator, shall coordinate and expedite immediate repairs to and maintenance of such part of the work under the Contract as may be considered necessary by the Administrator and shall carry out such work to the satisfaction of the Administrator.

If a nominated person leaves the employ of the Contractor during the period of the Contract, the Contractor shall immediately nominate another person and provide the full details of that person.

5.6.4 Inspection and records

The Contractor shall inspect all traffic control devices and traffic control arrangements in accordance with QGTTM Part 6 Clause 7.

As an alternative to the record keeping arrangements outlined in the MUTCD Part 3, photographic and / or video evidence of the TGS is permitted. Photographic and / or video evidence shall include date and time stamps and GPS location and be of sufficient resolution to accurately identify and locate traffic control devices. GPS coordinates shall be in World Geodetic System 1984 (WGS84) format or Geocentric Datum of Australia 1994 (GDA94) format, with latitude and longitude in decimal degrees. Time and date stamping shall be in Australian Eastern Standard Time (Coordinated Universal Time [UTC] + 10 hours).

Records shall be retained by the Contractor in accordance with the *Limitation of Actions Act 1974*, for actions associated with personal injury (plus as long as required for any claims to be resolved). Records shall be provided to the Administrator at the end of each month, and at other times upon request by the Administrator. Where requested by the Administrator, records shall be provided in a timely manner.

When required, the Contractor, and in particular the Nominated Traffic Officer, shall provide evidence in Court in the event that a speeding infringement notice is challenged, or in the event of a traffic incident within the site, or outside the site but contributed to by activities of the site.

5.6.5 Traffic crashes and incidents

In the event of a traffic crash / incident within the site, the Contractor shall record the date and take time and date stamped photographs of the signs / devices present in the vicinity of the crash. In the event of a traffic crash / incident that requires notification to Police and relevant Emergency Services, the Contractor shall make the appropriate notifications. All crashes / incidents shall be recorded in the incident log. A copy of the incident log shall be forwarded to the Administrator within 24 hours of the incident, and at other times upon request by the Administrator.

The Contractor shall assist with the mitigation of the impacts of incidents so far as is reasonably practicable.

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5.6.6 Complaints and requests for information

The Contractor shall keep a register of all complaints received and actions taken to address each complaint. The complaints register shall be forwarded to the Administrator on a weekly basis. The Contractor shall similarly keep a register of requests for information from the public. This public information request register shall also be forwarded to the Administrator on a weekly basis.

5.7 Traffic management provisions

5.7.1 General

The provision of traffic management at works sites should at all times address the need to maintain safe and effective traffic flow that minimises traffic delays and the risk of off-site incidents and driver frustration.

Further guidance is available in TMWOR, with regards to methods for the assessment of impacts on traffic (available at http://www.tmr.qld.gov.au).

5.7.2 Works restriction

Work shall conform to the following principles unless approved otherwise:

Work on shoulder areas – in any section, is limited to one side of the road, or of a divided road's carriageway.

Vertical clearance – not less than 4.6 metres vertical clearance shall be provided from the trafficked surface, including any side-tracks or detours, to any obstacle.

The Contractor shall make the necessary arrangements and obtain the necessary approvals from the appropriate Electricity and / or Communications Authority in the case of overhead cables.

Length of 40 km/h zone – in sections of the project where the speed restriction is 40 km/h, the maximum length of roadway with a 40 km/hr speed limit, excluding tapers and acceleration zone shall be in accordance with QGTTM Part 3 Clause 5.5.1.

Hazardous lift events – during the erection of bridge girders, deck units and other bridge components and / or while lifting and fixing street light poles and sign gantries no traffic shall be allowed under or within the distance the lifted item could fall. Traffic shall be temporarily stopped or diverted while such work is carried out.

Specific restrictions on work which impacts on traffic – work which impacts on traffic is not permitted on:

- Thursday before Easter
- Anzac Day
- during the period from the day prior to Christmas Day until New Year's Day, both inclusive, and
- during any other event deemed by the Administrator as set out in Clause 3.1 of Annexure MRTS02.1 to be a major commercial, sporting or cultural event, where the Administrator considers that such closure would cause an unacceptable level of disruption to the traffic operations associated with such events.

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Prohibition Notice – the Principal is subject to a Prohibition Notice which restricts personnel from crossing multilane divided roads with posted speed limit of 100 km/h or greater. The Contractor is to conform to the requirements of this Prohibition Notice and at all times refrain from crossing these roads without the use of lane closures or speed reductions.

5.7.3 Traffic lane restrictions

Lane restrictions shall conform to the following principles unless approved otherwise.

Minimum lane requirements – the minimum number of lanes to be maintained on a midblock section of road will be determined from:

- the requirements of Clause 3.2 of Annexure MRTS02.1 which sets out the minimum requirements for various time periods and for various locations in the work site
- the requirements of Table 2.4 QGTTM Part 3, or
- where specified in Clause 3.2 of Annexure MRTS02.1 the required lane availability shall be determined through a traffic operational Level of Service assessment in accordance with the requirements of TMWOR Chapter 2 Section 3.

Where the number of traffic lanes is not listed in Clause 3.2 of Annexure MRTS02.1, recent historical traffic information shall be used to provide data for the assessments under b) and c) of Clause 3.2 of Annexure MRTS02.1.

The 24 hour traffic count information at the site is to conform to the following requirements:

- be less than 12 months old
- not be collected during school holidays, and
- be undertaken on a day of the week which is expected to have the greatest traffic volumes.

The source of the traffic count information shall be documented, and, in addition to confirmation of adherence to the requirements listed above, shall be provided to the Administrator upon request.

The use and interpretation of any traffic count information is entirely at the Contractor's own risk.

The minimum lane requirements to be maintained at an intersection shall be determined as per method (A), (B) or (C) of Clause 3.3 of Annexure MTRS02.1.

Single lane reversible flow (Shuttle flow) – where single lane reversible flow (to serve both directions) is allowed, the Contractor shall maintain traffic flow under the control of traffic controllers or portable traffic signals in such a way that no road user is delayed in excess of the maximum delay specified in Clause 3.4 of Annexure MRTS02.1. In all cases, the length of one-lane, two-way operation shall be limited to one kilometre. See also QGTTM Part 3 Table 5.4.

Stopping traffic in both directions – the Contractor may stop traffic in both directions simultaneously only for purposes of construction of specific work and during the specific period stated in Clause 3.5 of Annexure MRTS02.1. The maximum delay to any road user shall be as stated in Clause 3.5 of Annexure MRTS02.1.

Specific periods where lane closures are not permitted – work under the Contract involving lane closures, stop / slow arrangements or construction traffic entering or leaving any through traffic lanes shall not be carried out during any periods stated in Clause 3.6 of Annexure MRTS02.1 and unless otherwise stated, such restrictions shall apply 24 hours per day.

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Measuring traffic delays – where stated in Clause 3.7 of Annexure MRTS02.1, the Contractor shall undertake surveys prior to, and following, any changes to the TTM provisions to monitor the impact of the activities on the road user.

Traffic surveys shall be undertaken as stated in Clause 3.7 of Annexure MRTS02.1 and according to the Part 3 Supplement of Queensland *Manual of Uniform Traffic Control Devices* (available at http://www.tmr.qld.gov.au). Typical periods during which delays shall be recorded include during full road closures and during all road closures which require detours off site. Baseline traffic conditions prior to the commencement of works shall be measured for comparison.

5.7.4 Traffic management for route alterations

5.7.4.1 General requirements for traffic route alterations

A traffic route alteration refers to the act of closing one section of road and redirecting traffic onto another road. The traffic route alteration refers to the re-direction task only and once traffic is flowing safely on the new road, the traffic route alteration is deemed to be finished. Traffic route alterations include re-directing traffic to and from:

a) the road under construction

a) a detour on an existing road, and

b) a side-track.

When specified in Clause 3.8 of Annexure MRTS02.1, traffic may be altered from its existing route via one of these means.

5.7.4.2 Specific traffic management requirements for detours

When specified in Clause 3.8 of Annexure MRTS02.1, traffic may be detoured away from the Works via existing roads. Detours that involve the diversion of traffic off the work site are not permitted except for the express purpose of implementing a full carriageway closure to allow specific construction activities.

Any proposed detour shall be fully documented in the TMP and the relevant TGS. The Contractor shall provide details within the TMP to demonstrate that detours proposed for the purpose of implementing a full carriageway closure have sufficient capacity and are capable of supporting the traffic volumes expected during the use of the detour. The TMP shall show:

a) maximum extra length added to motorist trips

b) maximum extra delay for motorists

c) maximum number of hours for which a detour is to be implemented, and

d) any parking or other restrictions required to accommodate the detour.

The Contractor shall liaise with and make all necessary arrangements with the relevant Local Government(s) and / or other authorities concerned. These arrangements shall include making provision for such matters as the issuing of public notices in respect of the detour and ensuring the classification and condition of the roads concerned are adequate for the volume and composition of traffic to be detoured.

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5.7.5 Over dimension, over weight and dangerous goods vehicles

The Contractor shall not reduce pre-existing provisions for the movement of heavy vehicles including over dimension, over weight and dangerous goods vehicles that have approval from the Administrator and / or other relevant Authorities.

5.7.6 Access to private property

Existing accesses to private properties affected by the work shall be maintained in useable condition during the construction, or alternative access arrangements acceptable to the property owners / tenants shall be made. The Contractor shall permit and provide for the free movement of traffic in and out of the properties at all times except as otherwise agreed to by the property owners / tenants.

The Contractor shall, at no expense to the Principal, make good any damage to accesses to private properties which results from the Contractor's operations during the construction of the work under the Contract.

5.7.7 Vulnerable road user movements

Where it is necessary to provide for pedestrian and / or cyclist access along or across portions of the work under the Contract, the Contractor shall provide such temporary pathways as necessary in accordance with the requirements of the QGTTM Part 3.

The pathways shall be clearly delineated, signed and fenced to prevent unintended access to the remainder of the work under the Contract. Signs shall be provided adjacent to the pathway to clearly indicate that access to the remainder of the work under the Contract is prohibited.

Adequate illumination shall be provided during all periods of darkness.

Where a large volume of pedestrian traffic has to cross the work site, consideration shall be given to directing pedestrians to suitably constructed and protected crossings.

Special provision for pedestrians may be required where the direction of traffic flow is opposite to that normally expected.

5.8 Incident management

For sites of longer than three days duration, an incident management plan is to be prepared by the Contractor and submitted to the Administrator, detailing the measures to be implemented in the event of a traffic incident occurring within the worksite or on any detour route.

The Administrator or Police may direct the Contractor as per Clause 5.6.5 to implement detours for incident management, without preparation of an incident management plan or without acting in accordance with any existing plan.

5.9 Contingency planning

On occasions a traffic route alteration can lead to excessive unforeseen delays and other impacts not predicted within the TMP.

The Contractor shall include in the TMP, a contingency to address this possibility which can be implemented immediately should traffic operation delays or safety issues exceed those identified within the accepted plan. This contingency plan may include restoration of the route in existence prior to implementation of the traffic route alteration until such time that alternative arrangements can be developed.

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6 Traffic guidance scheme (TGS)

6.1 General

A TGS shows all traffic control devices and their layouts on a plan and shall be consistent with the approved TMP.

Where any change to existing traffic arrangements is proposed or where construction conflicts with normal traffic movements, the Contractor shall prepare a TGS which clearly details the revised traffic arrangements at all locations affected by the change or conflict. A separate TGS is required for each stage of the works where changes are made to the traffic control devices.

Traffic shall be controlled at all times, during construction, in accordance with the provisions of the MUTCD Part 3, QGTTM and the TMP.

The requirements and recommendations set out in the MUTCD Part 3, QGTTM and this Technical Specification and its Annexure do not preclude innovative or alternative traffic management solutions, as outlined in Clause 1.2.

6.2 Traffic guidance scheme submission and consideration

All TGS shall be prepared by suitably qualified and experienced persons and submitted by the Contractor to the Administrator for the Principal's consideration. Aspects of the TGS require approval in the following circumstances: **Hold Point 2**

- **Proposed speed limits:** TGS implemented for three days duration or longer (works need not be continuous over this period) shall be submitted for approval or rejection only for proposed speed limits, by the Principal. The Principal's review will consider the appropriateness of the posted speed limits when workers are present and when they are not present.
- **Improving compliance with speed limits:** as outlined in Clause 1.3, the Principal wishes to improve compliance with posted speed limits at roadworks. Together with improved speed limit choices it is intended to improve opportunities for enforcement of roadwork speed limits. Appendices A (Speed Management Plan) and B (Speed Enforcement at Roadwork Sites), outline remedial actions in response to non-compliance with the posted speed limit and the procedure with which departmental staff and contractors can request that Police undertake speed enforcement within roadwork sites, and
- **Specific circumstances:** where specified in Clause 4 of Annexure MRTS02.1.

The Principal may provide comments on other matters in the TGS.

TGS that require approval shall be clearly marked "For Approval" and be submitted at least 14 days prior to the date of the proposed traffic rearrangement, or as nominated in Clause 4 of Annexure MRTS02.1. Failure to comply with this requirement may result in the Principal deferring the date for traffic rearrangement. Such deferment shall not be a cause for an extension of time under the Contract.

TGS that do not require approval as outlined above shall be clearly marked "For Information" and be submitted to the Administrator at least three days prior to implementation.

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Transport and Main Roads has made a policy decision to progressively remove itself from TGS approval. As a result "NO" should generally be chosen when completing Clause 4 of Annexure MTRS02.1. "YES" can be nominated during the transition in those Regions where it is evident that industry capability is lacking.

6.3 Scope of traffic guidance scheme

TGS shall be prepared in accordance with the requirements of the MUTCD Part 3 and QGTTM shall align with the site specific TMP.

The TGS shall show traffic control device layouts (including TRSB, temporary pavement marking and temporary islands), be fully dimensioned and shall generally agree with the construction sequence and other requirements shown elsewhere in the Contract.

The TGS shall also state the period for which the traffic control devices are to be in place (time and date) and the person who is responsible for installing, maintaining and removing them. Work site access arrangements shall form part of the TGS.

The TGS shall also identify those traffic control devices which are only to be in place during periods of actual work on site. Signs such as symbolic workers signs and speed limits, introduced due to reduced clearances to workers, should be covered or removed during periods when workers are no longer on site (e.g. at night). The Principal requires that speed limits are applied strictly in accordance with the QGTTM Part 3 Clause 5.5.1 unless accompanied by a supporting risk assessment and RPEQ approval or signoff.

Where the TGS includes changes to regulatory signs or devices, the Contractor shall include roadwork signing records in accordance with the QGTTM Part 6 and the MUTCD Part 1 Appendix B certified by the Nominated Traffic Officer.

6.4 Implementation of traffic guidance schemes

Should the Contractor wish to depart from the speed signage arrangements in the TGS that have been submitted to Police for enforcement (in accordance with Appendix B), an amended TGS shall be submitted to the Administrator seven days prior to implementation of any new arrangements, and if approved shall be supplied to the Police.

On a daily basis, the Contractor shall ensure that all applicable traffic redirection and / or warning measures and safety requirements are implemented prior to proceeding with any relevant work under the Contract.

The NTO shall monitor the effectiveness of the TGS and revise it in response to incidents and / or unexpected traffic disruptions.

Details of a TGS shall be provided on request to any other party nominated by the Administrator.

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6.5 Traffic guidance provisions

6.5.1 General traffic control devices

Traffic control devices and their use shall conform to the requirements of the MUTCD Part 3, QGTTM and such other additional Standards as may be issued by Transport and Main Roads.

All traffic control devices shall be securely fixed in the correct position and maintained in an effective and clean condition suitable for day and night operations, and any reasonably expected weather conditions whilst employed on the work under the Contract. Devices which are damaged or worn, or which do not conform to the above requirements, shall not be used.

6.5.1.1 Portable Traffic Control Devices (PTCD)

PTCD shall be used in accordance with the QGTTM Part 7 and TMOR Chapter 5 Section 2. The principal may mandate the use of PTCD in specific situations stated in Clause 5.1 of Annexure MRTS02.1

6.5.2 Additional optional traffic control devices

6.5.2.1 Variable Message Signs (VMS)

VMS devices may be used to supplement other traffic control devices, particularly in communicating complex arrangements to drivers. Their need should be determined through a risk assessment either to supplement other traffic control devices or as an alternative traffic control device when site conditions constrain a preferred TGS layout.

Where they are used, the Contractor shall coordinate operation of temporary VMS with the operations of the traffic control room or traffic management centre as appropriate. The contractor shall comply with the requirements for VMS installations stated in Clause 5.2 of Annexure MRTS02.1.

Prior to the operation of the VMS at the site, the contractor shall ensure that any previous messages on the VMS have been deleted and only messages, symbols and time schedules that have been approved for the site are programmed into the VMS.

6.5.2.2 Use of police

Police presence should be limited to those occasions where:

a) a risk assessment indicates that their presence mitigates the need for other more costly measures, or

b) the situation is stated in Clause 5.3 of Annexure MRTS02.1.

Where police officers are to be employed to assist in the control of traffic around or through the work site, the Contractor shall be responsible for making all necessary arrangements with the local Police Station or relevant branch of the Police Service and for making all payments.

6.5.2.3 Speed enforcement

In addition to speed enforcement undertaken through Principal submission of speed limits for enforcement, the Contractor may implement additional speed enforcement at roadworks sites to ensure that traffic speeds are in compliance with the posted speed limits. This may result in savings associated with the TMP by being able to implement lower cost solutions by not having to cater for higher vehicle speeds.

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Contractors wishing to implement site specific speed enforcement would do so at their own cost and would need to make the necessary arrangements with the Police.

6.5.2.4 Truck mounted attenuators (TMA)

The use of TMA's should be limited to the following situations:

a) in accordance with the requirements of the QGTTM and the TMWOR Chapter 4, or

b) where a risk assessment indicates that their presence mitigates the need for other more costly measures, or

c) the situation is stated in Clause 5.4 of Annexure MRTS02.1.

6.5.3 Traffic route alterations

6.5.3.1 Specific requirements for construction under traffic

When construction under traffic is permitted as per Clause 3.8 of Annexure MRTS02.1, the Contractor shall arrange its construction program and sequencing so traffic flow is maintained through the Works in accordance with the requirements of this document and the QGTTM, as supplemented or amended by any requirements in Clause 5.5 of Annexure MRTS02.1.

6.5.3.2 Specific requirements for detours

In implementing the detour, the Contractor shall:

a) inspect the route for adequacy for the entire length of the detour

b) implement any parking or other restrictions required to allow the suitable flow of detoured traffic

c) provide suitable directional signage and other infrastructure to guide motorists, and

d) restore or arrange restoration as necessary following cessation of the detour period to the approval of the relevant Authorities.

6.5.3.3 Specific requirements for side-tracks

Where re-directing traffic onto a side-track is permitted by Clause 3.8 of Annexure MRTS02.1, construction of the side-track shall comply with the requirements set out in this document and any additional requirements stated in Clause 5.6 of Annexure MRTS02.1. All aspects of the side-track design shall be signed off by an appropriately experienced RPEQ.

Design and construction – design and construction of side-tracks shall comply with the QGTTM Part 3. Materials for construction of side-tracks shall comply with the provisions of the relevant Technical Specification.

Location and route – the location and route of side-tracks shall be in accordance with the details provided in Clause 5.6 of Annexure MRTS02.1 and / or as shown on the drawings.

Surface and clearing – the ground surface of the areas on which a side-track is to be constructed shall be cleared, grubbed and stripped of vegetation and any other undesirable matter. Such operations shall extend for not less than the full width of the surface formation of the side-track. Any tree or other object within three metres of the edge of the side-track shall be removed, shielded or delineated.

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Alignment – side-tracks shall be aligned, formed, graded, drained and maintained so as to provide for safe, comfortable passage of vehicles at the indicated speed limit. In general, not more than four percent surface cross-fall shall be provided.

Surface – the requirements for paving and / or sealing of a side-track shall be as stated in Clause 5.6 of Annexure MRTS02.1 or the QGTTM Part 3. Where paving and / or sealing of a side-track is required, the Contractor shall prepare the side-track formation and carry out the paving and / or sealing operations in accordance with the requirements of the relevant Technical Specification and such other requirements as may be stated elsewhere in the Contract. Materials for construction of side-tracks shall comply with the provisions of the relevant Technical Specification.

Geometric requirements – the minimum geometric standards of a side-track shall be as specified in Clause 5.6 of Annexure MRTS02.1.

Where a side-track is used as a part of an overnight road occupancy (e.g. crossovers on motorways between divided carriageways) only, the side-track may be designed for a lower posted speed. The Contractor shall ensure that the length of road, which the reduced speed is applied to, is as short as possible according to the QGTTM Part 3.

Width – the width of a side-track shall be as specified in Clause 5.6 of Annexure MRTS02.1. If the normal width of the road is less than six metres, suitable passing facilities, not less than 30 metres in length and providing an available width inclusive of the normal width of the road of not less than six metres, shall be located at minimum intervals of 800 metres along the side-track and at locations where sight distance is less than 100 metres.

Waterway crossings – unless the construction of special waterway crossings has been provided for elsewhere in the Contract, the form and design of waterway crossings along the route of a side-track shall be determined through an appropriate risk assessment provided by the Contractor and approved by the Principal.

The risk assessment shall consider the consequences of flooding, the time of year, and the traffic impact of road closures. When the waterway crossing design is based upon a rainfall Average Recurrence Interval that is lower than the current crossing, the Contractor shall advise this in their Offer.

The waterway crossing shall be constructed for the full width of the side-track. The edges of waterway crossings shall be signed and delineated effectively both day and night, in accordance with the requirements of the MUTCD, QGTTM and MRTS14 *Road Furniture*.

Traffic control – side-tracks shall be signed and delineated to ensure the clarity of the route.

Lighting – side-tracks shall be lit at the points of divergence from the existing roadway to comply with Clause 5.5 or at any other points where the driving task may be more difficult to comply with.

Reuse of side-tracks – where a side-track is to be reused, all temporary pavement markings shall be updated and / or removed as necessary to comply with the Contract.

Maintenance – side-tracks shall be maintained to the standard to which they were built and to always ensure safety of users. They shall be maintained such that:

a) pavement markings or delineation is clearly visible at all times, and

b) lane closures on the side-tracks only occur when maintenance is undertaken or traffic control devices are being moved.

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FOI 26-292 - Document 21

Decommissioning – after a side-track has been used for the last time during construction, it shall be completely removed and rehabilitated. All temporary line marking used on any permanent road surface, including tie-ins on the approach / departure to the works, that becomes obsolete shall be obliterated from the permanent road surface, and the site shall be restored to a condition equivalent to that existing before the side-track was constructed.

Any removed materials shall be disposed of in accordance with Clause 11 of MRTS01 *Introduction to Technical Specifications*.

6.5.3.4 Implementation of traffic route alterations

Pilot vehicles may be required to implement a traffic route alteration during the process of transferring vehicles from or to an altered route.

6.5.4 Dust control

The Contractor shall take adequate precautions to effectively minimise the generation of dust, which may affect the safety and general comfort of the travelling public, the Contractor's employees and / or occupants of adjacent buildings, during the construction of the work under the Contract.

In this respect, the Contractor shall carry out regular applications of water or other palliative measures along the sections of the work traversed by the travelling public, as required, to minimise dust.

6.5.5 Night work

Only machinery fitted with reversing or other alarms, which adjusts the alarm sound output to no more than 5dB above the surrounding noise level and an alarm sound output range of 85dB – 115dB, will be used to work from midnight to 6 am.

6.5.6 Stored plant and materials

Where plant or materials are stored on the site, the Contractor shall comply with the minimum clear zone requirements of the *Road Planning and Design Manual* (RPDM). Any plant or materials stored overnight within nine metres of the edge of any trafficked lane shall be delineated in accordance with the QGTTM Part 3, unless located behind a safety barrier.

6.5.7 Preventing end of queue crashes

End of queue risk control measures, in accordance with the QGTTM Part 3 Clause 4.8 and the TMWOR Chapter 1, shall be used in situations where the speed limit is 80 km/h or higher or where sight-distance is restricted, to prevent rear end collisions where vehicles are stopped or slowed by the work under the Contract. While decisions regarding the use of these measures will generally be made by the Contractor, Transport and Main Roads has nominated mandatory control measures in Clause 5.7 of Annexure MRTS02.1.

Guidance about supplementary devices to reduce speed and prevent end of queue crashes is provided in both the MUTCD Part 3 Clause 4.23, QGTTM Part 3 and the TMWOR Chapter 1 Section 1.

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6.5.8 Delineation of trafficked corridors

6.5.8.1 General

Where described in Clause 5.8 of Annexure MRTS02.1, direction hazard markers, temporary raised reflective pavement markers, line marking, reflective mesh fencing and / or other such delineation devices shall be used in addition to the requirements of the MUTCD Part 3 and QGTTM to delineate trafficked corridors.

6.5.8.2 Materials

Materials used for temporary pavement markings shall be subject to the approval of the Administrator. Only materials which can be removed without damaging the pavement surface shall be used for temporary marking of the final pavement surface.

Delineation shall consist of bollards, traffic cones, hollow plastic ballasted barrier elements or mesh fencing using a heavy, highly visible plastic safety mesh.

When used as delineators, plastic water-ballasted TRSB shall comply with the requirements of QGTTM Part 3 Section 5.3.1. Stand-alone non-interconnected lightweight modules, which do not meet the requirements for a TRSB, shall not be used as temporary delineators.

Drums and cylinders which can roll if dislodged by impact or wind shall not be used as temporary delineators.

Star pickets shall not be used within 1 m of the edge of traffic lanes for speeds of 80 km/h or more. Where used, star pickets shall be fitted with end caps.

6.5.8.3 Construction

Under no circumstances shall temporary painted or thermoplastic line marking materials or temporary raised pavement markers be used on the surface of a final pavement layer.

Temporary pavement marking and temporary raised pavement markers shall be installed in accordance with the requirements of MRTS45 *Road Surface Delineation*.

Temporary delineation devices shall not damage the surface of the Works.

6.5.9 Direction and street signs

Where access to streets and side roads has been altered during the construction of the Works, the Contractor shall supply and erect all such temporary signs necessary to assist the travelling public to find their way to such streets and roads.

6.5.10 Work site access

Vehicular access points to and from the work site shall be in accordance with the RPDM. Acceleration and deceleration lanes and tapers shall comply with the traffic volume, speed and sight distance warrants specified in that document. Cross section widths for acceleration and deceleration lanes should be a minimum of 3.2 m.

6.5.11 Temporary road safety barriers

6.5.11.1 General

Temporary Road Safety Barriers (TRSB) shall be used to contain and redirect errant vehicles so as to reduce the likelihood of them entering the work site. They may also be used to separate opposing traffic.

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6.5.11.2 Provision

Provision shall be made for TRSB at the following locations:

- at those locations identified in Clause 5.9 of Annexure MRTS02.1
- at locations that meet worker safety requirements of the MUTCD Part 3 and QGTTM Part 3, and
- at locations where a risk assessment determines that TRSB are the most appropriate method of separation between traffic and the work site or other hazards.

Where TRSB are shown on the drawings, the type, location of barriers and dynamic deflection zone shall be as shown on the drawings.

Opposing flows of traffic may be separated with TRSB with sufficient offset provided to reduce the likelihood that TRSB deflect into opposing traffic flow in the event of impact.

When TRSB are used to protect the work site, the requirements to maintain a clearance zone behind the TRSB as specified in the MUTCD Part 3 and QGTTM Part 3 shall apply. The maximum dynamic deflection is specified by the manufacturer.

6.5.11.3 Barrier types

Only those TRSB which are included in the Transport and Main Roads – Road Safety Barrier Systems and Devices (Assessed as accepted for use on State-controlled roads in Queensland) shall be used. Where TRSB are manufactured according to Transport and Main Roads Standard Drawings referenced within this document, they shall be manufactured in accordance with MRTS14 *Road Furniture*.

Steel Beam Guardrail, in accordance with Standard Drawings 1474 and 1475, may be used instead of TRSB in some locations subject to the approval of the Administrator. End treatments shall be in accordance with Standard Drawings 1470, 1474 and 1475, or with an approved proprietary end treatment listed in the Transport and Main Roads – Road Safety Barrier Systems and Devices (Assessed as accepted for use on State-controlled roads in Queensland).

Steel Beam Guardrail shall not be used for temporary erection where posts have to be installed through pavements which remain part of the permanent works.

6.5.11.4 End treatments

Provision shall be made to treat the approach and / or departure ends of both permanent and TRSB that are exposed to on-coming traffic, including barriers that are flared to terminate outside the clear zone.

Only those end treatments listed in the Transport and Main Roads – Road Safety Barrier Systems, and Devices (Assessed as accepted for use on State-controlled roads in Queensland) shall be used.

6.5.11.5 Design of barrier system

The performance of a TRSB system is dependent not only on the design of the barrier segment, but also in the correct design of the entire TRSB system including the minimum length of TRSB and the location and form of end treatments.

Any TRSB placement shall be designed in accordance with the requirements stated in:

- AS 3845 *Road safety barrier systems*

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- MRTS14 *Road Furniture*
- MUTCD Part 3
- QGTTM Part 3 Clause 5.3.1, and
- *Road Planning and Design Manual* Volume 3, Part 6.

Care shall be taken at intersections to prevent visibility problems for motorists negotiating the intersection.

When a need for TRSB is identified, the barrier type shall be determined on the basis of:

a) the type, shape, deflection performance and test characteristics of the TRSB

b) the speed of traffic travelling through the work site, and

c) the clearance between the traffic and the work area.

6.5.11.6 Installation

All TRSB and end treatments shall be installed in accordance with the department's Standard Drawings and / or the manufacturer's specifications.

Water filled plastic barriers shall be filled with water to the level specified in the manufacturer's specifications.

TRSB shall have recesses at their base to allow drainage at ground surface level under the barriers.

6.5.11.7 Maintenance

The Contractor shall maintain TRSB on their correct alignment for the period that they are installed on the work site.

6.5.12 Anti-gawking screens

Anti-gawking screens are used to minimise visibility of the construction activities to the travelling public.

When the requirement for anti-gawking screens is identified in Clause 5.10 of Annexure MRTS02.1, they shall be installed where:

- so stated in Clause 5.10 of Annexure MRTS02.1, and
- where activities are being undertaken within 3.5 metres of the lane edge line and such activities are likely to cause traffic delays or may be a visual distraction to drivers.

Anti-gawking screens shall be provided as per QGTTM Part 3 Clause 5.3.3 and TMWOR Chapter 1.

6.5.13 Temporary road lighting

Temporary road lighting shall comply with the requirements of the QGTTM Part 3.

Temporary road lighting shall be provided as stated in Clause 5.11 of Annexure MRTS02.1.

Existing lighting shall not be removed until temporary lighting, as required by the QGTTM or Clause 5.11 of Annexure MRTS02.1, is installed.

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FOI 26-292 - Document 21

Temporary road lighting is typically required at conflict points and potential hazards to highlight the greater level of risk. These conflict points or hazards may include:

a) significant changes in carriageway width

b) changes from single to divided carriageway

c) converging and diverging traffic streams

d) crests and humps

e) curves below 100 m radius, and

f) road sections with high night time crash rates.

Where temporary lighting is used it shall include two spans of lead-in lighting in advance of the conflict point or hazard.

The Contractor shall install, operate and maintain the temporary road lighting installations for the full period during which the relevant road is required and / or until the permanent road lighting is installed and becomes operational.

Temporary road lighting shall be arranged in such a manner as to avoid creating levels of glare arising from shallow angles of incidence towards the drivers of vehicles using the adjacent traffic lanes. At no time shall temporary road lighting be directed towards oncoming traffic.

7 Traffic management inspection

7.1 General

Traffic Management Inspection is an independent review to establish conformance with the approved TMP and TGS, and with the performance requirements of this Technical Specification.

Traffic Management Inspection will occur in the following circumstances:

- for motorways, any TGS that is in place for two weeks or longer
- for all projects over $10 million in construction value, and
- for all other projects as specified in Clause 6.1 of Annexure MRTS02.1.

7.2 Officer undertaking traffic management inspection

The officer undertaking the inspection of the TMP and TGS shall be accountable to the Contractor and is responsible for the independent inspection of the TMP and TGS and other requirements contained within the TMP. This officer may be an employee of the Contractor but shall be independent of the project. They shall also be independent of the process of designing and implementing the TMP and TGS. Where the contractor is the party designing and implementing the TMP and TGS, documentation shall be provided to demonstrate the officer undertaking the inspection is sufficiently independent of the team undertaking the traffic management works.

The officer undertaking the inspection shall have the requisite level of training / experience outlined in Table 7.2.

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Table 7.2 – Requirements for officer undertaking traffic management inspection

Level of Complexity	Officer undertaking Traffic management inspection – level of training / experience
TMP and TGS are developed using the principles from the MUTCD Part 3 and QGTTM to develop site specific diagrams.	Successful completion of Transport and Main Roads approved Traffic Management Design training course delivered by a registered training organisation.
TMP and TGS entail complex traffic management schemes which have significant impacts on delays or traffic rerouting.	Successful completion of Transport and Main Roads approved Traffic Management Design training course delivered by a registered training organisation, and Additional qualifications and / or experience as nominated in Clause 6.2 of Annexure MRTS02.1
TMP and TGS entails innovations, alternatives and departures from standards resulting in treatments other than specified in the MUTCD Part 3 and QGTTM.	An appropriately experienced RPEQ with successful completion of Transport and Main Roads approved Traffic Management Design Training course delivered by a registered training organisation.

7.3 Scope of the traffic management inspection

The inspection of the TMP and TGS shall determine at a minimum the following:

- The conformance of the TMP and the TGS to the requirements of:
  - this MRTS02 *Provision for Traffic* and Annexures
  - MUTCD Part 3
  - QGTTM, and
  - Technical Notes.
- The conformance of the installed TGS with the documented TMP and TGS
- The performance of the TMP and TGS against the traffic operational performance criteria outlined in the approved TMP and any requirements in Clause 3.2 and 3.3 of Annexure MRTS02.1, and
- The performance of the measures taken to ensure that compliance to posted speed limits is achieved.

7.4 Traffic management inspection schedule

A Traffic Management Inspection schedule shall be outlined in the TMP and shall provide the dates or milestones at which each inspection shall be undertaken. The inspection of the site covered by a TMP and TGS(s) shall at a minimum be in accordance with the following requirements:

1. prior to submission of the TMP for approval
2. within two weeks of the first implementation of a TGS at the site
3. within two weeks of every subsequent TGS that results in a substantial change in the traffic patterns / location of lanes / change in risk profile etc.
4. at three monthly intervals where the requirements of condition (3) have not occurred, and
5. at other times as per the requirements outlined in Clause 6.3 of Annexure MRTS02.1.

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7.5 Traffic management inspection reporting

The officer undertaking the Traffic Management Inspection shall provide a report to the Contractor for its action. The Contractor shall forward to the Administrator, within one week of the receipt of the report, the reports and findings, together with documentation of any actions taken in regard to the findings. **Milestone**

8 Administration of traffic management

8.1 Traffic management audit and inspection

The Administrator will undertake regular performance / compliance audits of the Contractor's traffic control measures and provide feedback monthly in line with the Principal's Contract Performance Report in the *Transport Infrastructure Project Delivery System* (TIPDS) (available at https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/TIPDS).

The Principal may undertake additional surveillance and inspections at any time. Non-conformances identified will be communicated to contractors through the Administrator. Contractors shall be required to undertake the necessary modifications to the TGS to address the identified issues.

8.2 Safety performance of the TGS

If, despite a TGS being in conformance with the MUTCD Part 3, the QGTTM and this Technical Specification and the implemented scheme being in conformance with the TGS, the scheme is unsafe in some way, the Contractor shall undertake the necessary Traffic Management Designer approved modifications to the TGS to address the identified issues and submit the amended TGS to the Administrator.

8.3 Traffic non-conformances

The Principal requires that traffic is managed strictly in accordance with the submitted TMP and approved TGS. Costs for re-inspection will apply for non-conformances relating to inappropriate use of speed limits and other TGS non-conformances. Additional non-conformances may also be identified through audits against MRTS50 *Specific Quality System Requirements*.

The reinspection costs that shall apply are outlined in Clause 7 of Annexure MRTS02.1.

In the case of non-conformance, the Administrator will request the Contractor raise a non-conformance report. Examples of typical non-conformances are shown in Table 8.3.

Table 8.3 – Examples of non-conformances that attract re-inspection costs

Speed	Traffic Guidance Scheme (TGS)	Quality – MRTS50
Failure to install and maintain speed limit signs as detailed in a TGS.	Failure to maintain any other traffic control device detailed in a TGS.	Failure to maintain and update the TMP.
Reduced speed limits introduced more than one hour prior to the commencement of the works. Speed limit signs may be installed but should be covered until immediately prior to the need for their use applies.	Failure to maintain minimum travelled path dimensions.	Failure of the TGS to comply with the principles outlined in Clause 1.3.

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Speed	Traffic Guidance Scheme (TGS)	Quality – MRTS50
Failure to cover / remove signs and traffic control devices associated with reduced speed limits within one hour of completion of the shift or the work requiring the reduced limit.	Failure to cover / remove unused signs and traffic control devices within two hours of completion of any revised traffic arrangement.	Traffic delay periods exceeding any maximum period nominated in the Contract.
Speed limits and associated control measures not implemented in accordance with the Speed Management Plan.	Failure to use other than designated construction workplace entries or exits for the works.	Failure to provide the required information / notification to the community or local businesses of changes to traffic movement.
	Failure to maintain an obstruction free travelled path.	Failure to assist with mitigating the impacts of traffic incidents as much as is reasonably practicable.
	Undertaking traffic rearrangements without an approved TGS except where required for incident management purposes (refer to Clause 5.8).	Any other issue raised by the Administrator deemed to be a non-conformance.

All non-conformances shall be remedied by the Contractor within two hours of receipt of notice of the non-conformance. Failure to remedy any non-conformance within the two-hour period shall entitle the Principal to carry out any remedial work deemed necessary pursuant to the Contract. All costs related to this work shall be charged to the Contractor, in addition to the costs for re-inspection as set out in Clause 7 of Annexure MRTS02.1.

9 Supplementary requirements

The requirements of MRTS02 *Provision for Traffic* are varied by the supplementary requirements given in Clause 8 of Annexure MRTS02.1.

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FOI 26-292 - Document 21

Appendix A – Speed management plan

A1 Objective

The objective of the Speed Management Plan is to achieve compliance by road users with the roadwork speed limits. It documents all measures to be taken by the Contractor to achieve this outcome. Monitoring the effectiveness of temporary traffic control measures is a core principle of the *Manual of Uniform Traffic Control Devices* (MUTCD) Part 3 and the QGTTM and is required on all sites.

Where a posted temporary speed limit is in place for worker safety, and it is found that substantial non-compliance occurs, the contractors' obligations under workplace health and safety regulations will not be met.

The requirements following are intended for application to worksites ≥ 2 weeks duration. It is recognised that at these sites the heightened level of exposure of work personnel to traffic warrants a higher level of speed monitoring to help meet workplace health and safety requirements.

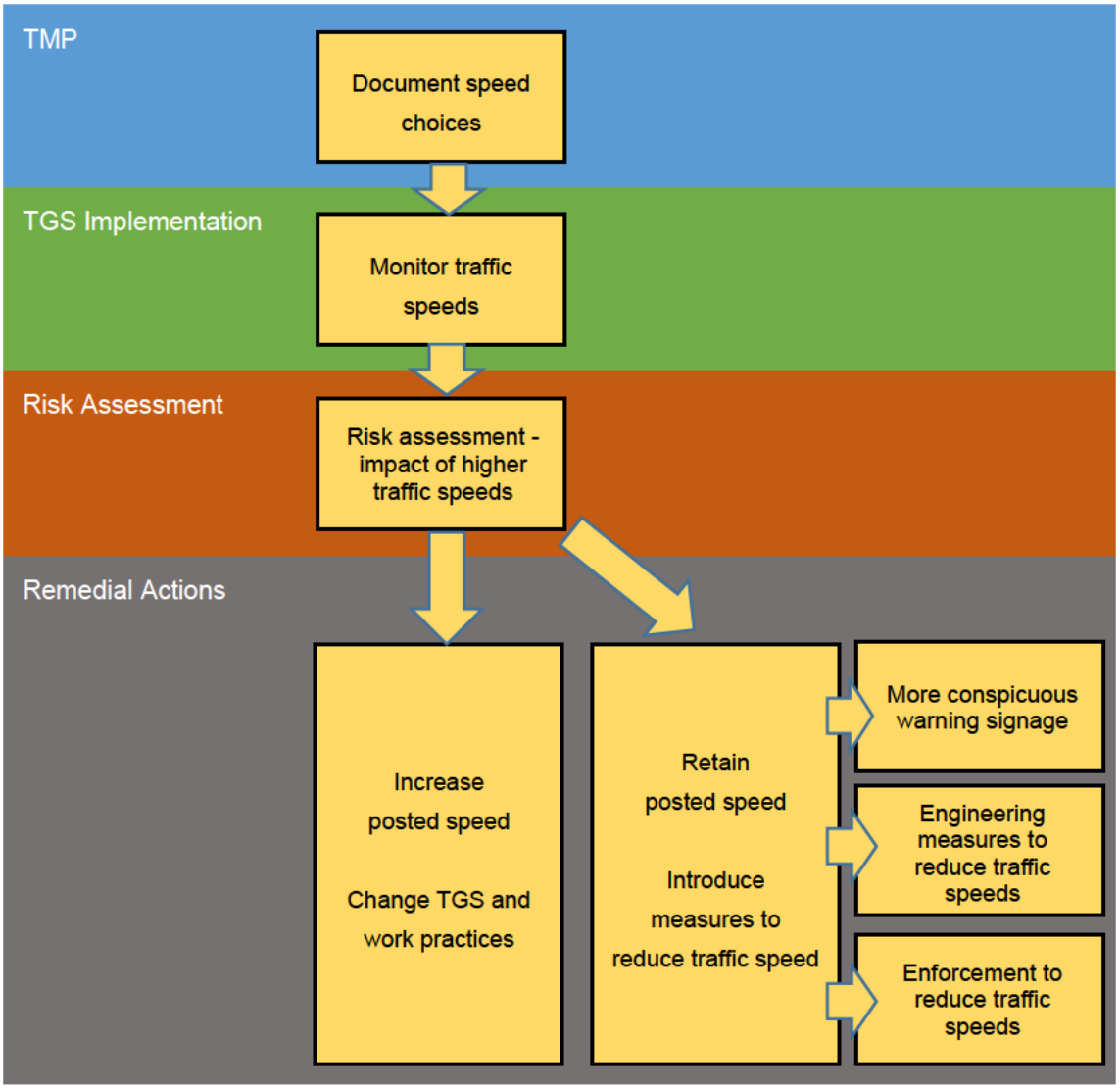
Where used at worksites of shorter duration (< 2 weeks) alternative methods of undertaking speed surveys are available to acknowledge the reduced exposure to risk.

For sites with very low traffic volumes, it may not be appropriate to meet the requirements of Table A3 following. Where low traffic volumes are present it is important that those preparing and implementing SMPs balance the exposure to overspeed vehicles against the time required to obtain a sufficient sample group. Any variation to the minimum sample sizes in Table A1 shall be subject to a risk assessment.

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A2 Planning process

The following flow chart documents the key elements to the speed management planning process.



A3 Documentation

The Speed Management Plan should include information detailed in the following Clauses.

A3.1. Speed choices

- Permanent speed limits at the site and on the sections of road adjoining the site.
- Constraints and considerations impacting on the choice of speed limits to be applied throughout the works.
- The speed limits adopted for the project.
- Conditions under which temporary speed limits are required for worker and traffic safety, and
- Measures included within the TMP and TGS to restrict traffic speeds to the posted speed limits.

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A3.2. Speed monitoring

Speed surveys for sites in place ≥ 2 weeks shall be undertaken in accordance with one of the following:

1. *Austroads Guide to Traffic Management*, Part 3 *Traffic Studies and Analysis*
2. MUTCD Part 4 – *Speed Controls*, or
3. Speed indicator devices as per TMWOR Chapter 1.

Speed surveys for sites in place < 2 weeks may be undertaken in accordance with one of the following:

1. speed indicator devices as per TMWOR Chapter 1
2. manual travel time surveys, see Clause A3.2.1 of this Appendix, or
3. other industry accepted method, subject to a risk assessment by the traffic management designer and acceptance by the administrator.

Documentation should address the following:

- Speed monitoring arrangements:
  - contractual requirements, and
  - risk assessed additional requirements.
- Collection frequency, and
- Reporting arrangements.

A3.2.1 Manual time travel surveys

Manual travel time surveys involve recording the time it takes a vehicle to go from one datum to another and may be undertaken by a traffic management implementer, a site worker under the direct supervision of a traffic management implementor, or a traffic controller. Time travel surveys should comply with the following steps:

1. A start and end datum are to be established within the site by placing an additional delineating device at each point.

   The added delineating device is to be different to the general devices used in the vicinity for identification i.e. where 450 mm cones are the typical device, an additional 700 mm cone may be placed to identify the datums.

   These points are to be sufficiently distanced from the traffic control point, is not to be within the safety buffer, and is not to be in a location where changes in speed due to manoeuvring are likely to occur.
2. The distance between these points is to be measured in metres.
3. A competent site worker is to be suitably positioned to allow observation of both points. This location is to be offset from the travelled path and must have a suitable escape path.
4. Site worker is to record the time required for each vehicle to travel between the datums using a stopwatch or device with similar capability. The following also apply:
   a) Stopwatch, or similar, must be capable of recording times to 1/10th of a second.

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b) Ideally there is to be at least four seconds headway between each vehicle to ensure free flow speeds are observed. Where platooning is frequently observed, which often occurs under PTCD or STOP / SLOW control, this requirement may be reduced to two seconds.

c) Minimum sample sizes, as per the Table A3.2.1 following, are to be observed as far as reasonably practicable.

Table A3.2.1 – Minimum sample sizes (MUTCD Part 4 Appendix A)

Permanent posted speed (km/h)	40	50	60	70	80	90	100	110
Minimum sample size	55	65	85	95	110	130	155	200

5. Samples including their respective times are to be tabulated and the 85th percentile speed calculated. Example manual calculation below:

   a) Count number of samples (N).

   $N = 25\ (assumed\ for\ example)$

   b) Multiply N by 0.85 to get the 85th percentile sample (n), round down to nearest whole number:

   $n = 0.85 * N = 0.85 * 25 = 21.25 \approx 21$

   c) Arrange samples from largest to smallest based on travel time and select nth sample from step (b).

Sample	Time (s)	Sample	Time (s)	Sample	Time (s)	Sample	Time (s)	Sample	Time (s)
1	5.4	6	5	11	4.6	16	4.5	21	4.3
2	5.3	7	4.8	12	4.6	17	4.4	22	4.3
3	5.2	8	4.8	13	4.5	18	4.4	23	4.1
4	5.1	9	4.7	14	4.5	19	4.4	24	4
5	5.1	10	4.6	15	4.5	20	4.4	25	4

   d) Convert time to speed (v) in km/h:

   $$v = \frac{3.6 \times distance}{time} = \frac{3.6 * 80m\ (assumed\ distance\ for\ example)}{4.3\ sec} = 66.9km/h$$

   e) Check 85th percentile speed against the posted roadwork speed limit as per Clause A3.3 following.

Speeds surveys are typically appropriate for any area on site where a speed reduction occurs, as such surveys on approach to the sites and within the site are usually considered appropriate.

A3.3 Risk assessment

Where speed monitoring demonstrates that speed compliance is not achieved (the 85th percentile speed is greater than 10 km/h above the posted roadwork speed limit), a decision is required to either:

- introduce additional measures to achieve compliance with the speed limit, or
- raise the speed limit.

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In the event that a decision is made to raise the speed limit, a risk assessment shall be undertaken to determine measures to mitigate the subsequent increase in risk. This risk assessment must be substantially completed prior to implementation of the TGS and the selected speed choices to ensure a timely response in the case that traffic speeds are found to exceed the posted limits.

A3.4 Engineering remedial actions

An engineering remedial action plan should be prepared as part of the TMP to ensure that appropriate measures can be implemented at short notice should monitoring reveal non-compliance with posted speed limits. These remedial actions should be implemented before Police enforcement is considered.

The engineering remedial actions that should form part of the package of available options include:

- Alter work practices and increase speed limits:
  - modifications to all or part of the construction and worksite design should be considered to allow posted speeds to be maintained at a speed limit aligning with the observed speed of traffic
  - these modifications may restrict the use of the lowest speed limit reductions to only specified high risk activities which are more obvious to drivers as to the reason for the limit, and
  - where speed limit reductions are only required for specific short-term events, consider the use of temporary warning signs with advisory limits or other measures to better communicate the risk to drivers.
- Make warning signage more conspicuous, more prominent.
- Implement additional engineering measures to reduce traffic speeds:
  - QGTTM Part 3 and TMWOR Chapter 1 outline a number of additional measures that can be implemented to assist in reducing the speed of traffic at roadworks, and
  - alternative innovative treatments that encourage drivers to reduce speeds to comply with the posted speed limits are also encouraged.

A3.5 Enforcement remedial actions

In the event that the preceding engineering remedial actions are ineffective, Police enforcement can be requested in accordance with the procedure in Appendix B.

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Appendix B – Enforcement request procedure

B1 Objective

This Appendix documents the information that is required by police to determine whether enforcement can be undertaken and to make a decision about the appropriate enforcement strategy. The strategy will seek to improve compliance to speed limits and other regulatory signage or signals within the roadwork area.

The safety of road users and road workers within roadworks relies predominately upon driver speed compliance.

As in most situations where regulatory controls are introduced, the effectiveness of the regulation requires a combination of self-regulation and the perceived risk of a penalty associated with contravention of the regulation.

Consistent deterrence strategies, which typically comprise of a visible police or camera presence, can bring about lasting changes in road user behaviour and, as a consequence, changes in road user's attitudes which reinforce the behavioural change.

Non-compliance with temporary speed limits or signage can result from a range of factors, including:

- poor signage and roadwork management
- speed limits that do not appear intuitive to drivers and are not supported by the surrounding road environment (surface conditions, proximity of workers and so on)
- speed limits that are introduced to protect workers that are not removed after workers finish the works or move away from the road edge, and
- drivers infrequently encountering enforcement activity, despite signage indicating that roadworks speed limits are enforced.

B2 Enforcement request and determination procedure

B2.1 Request for enforcement (by Contractor through Principal)

1. Complete the Enforcement Request Form.
2. Submit completed Enforcement Request Form to the Principal for approval, and
3. Contractor submits the approved Enforcement Request Form to the relevant Police Road Policing Unit (RPU) for decision.

B2.2 Enforcement decision (by Road Policing Unit, RPU)

Enforcement strategies include:

- Non-Camera Enforcement (police presence, patrols and use of hand-held enforcement devices such as LIDAR), and
- Camera Enforcement (mobile speed camera, temporary unattended speed camera placements, fixed speed camera, point to point speed camera or combined red light with speed camera).

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Decision process:

1. Upon receipt of the approved Enforcement Request Form from the Contractor, the relevant RPU will review the proposal which may require a site inspection to determine whether enforcement can be undertaken safely and to develop an enforcement plan. In cases where enforcement requires a camera-based enforcement strategy, these matters will be referred to the Operations Manager, Traffic Camera Office. It is important to note that while police may agree a site is suitable for enforcement, attendance at the site will be influenced by other policing priorities, and
2. The RPU informs the Contractor of the enforcement decision.

B2.3 Implementation (by Road Policing Unit)

The RPU will liaise with the Contractor regarding site access and proposed dates and times of enforcement.

B2.4 Implementation (by Contractor)

1. The Contractor shall arrange to install the signs in the layout TC2320_2 (SIGN LAYOUT PRIOR TO DEPLOYMENT OF SPEED CAMERAS AT ROADWORK SITES) in advance of the site and advise the RPU that the sign(s) have been installed prior to enforcement commencing.
2. The Contractor shall ensure signage is maintained in accordance with the approved Traffic Guidance Scheme and appropriate records kept, in accordance with this Technical Specification. Copies of records shall be sent to the Principal on a daily basis for the duration of the period that the site is being enforced, and
3. The Contractor must ensure that the RPU is kept up to date with all traffic staging within the site, and the project completion date.

B2.5 Monitoring and evaluation (by Contractor)

1. The Contractor shall, for the duration of the works, monitor the site where enforcement activity has been implemented to ensure it is operating safely and effectively, and
2. This monitoring may be incorporated into the daily routine checks of roadwork signs required under the QGTTM Part 6, Part 10 and through speed surveys. Accurate records of the monitoring undertaken, analysis of results and any changes made to the TMP and / or TGS must be kept. These records should be documented, secured and kept for a duration that meets evidentiary requirements (should they be required to support or defend any future court action).

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FOI 26-292 - Document 21

B3 Enforcement request form

The information provided in this form will be used by police to establish whether enforcement can be undertaken safely and to assist with the development of an enforcement plan. As a result, Transport and Main Roads specific project descriptions (such as road number and chainage) should be avoided.			
PROJECT NAME / DESCRIPTION		**PROJECT LOCATION:**	
DISTRICT:		**REGION:**	
WORK COMMENCED:		**DURATION:**	
GPS COORDINATES:			
Longitude			
Latitude			
CONTACT OFFICER:			
Name:	**Role:**		**Date:**
Issues of concern in support of this request for enforcement (please attach supporting risk assessment, if one has been completed):			
PRINCIPAL REVIEW:			
Roadwork Speed limit appropriate: Y/N		**Enforcement supported: Y/N**	
Name:	**Signature:**	**Date:**	

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FOI 26-292 - Document 21

Site Characteristics	Comments
Speed Limit Permanent speed limit (on approach to worksite) Roadwork speed limit (zone to be enforced)	
'Stability' of work site (number of and proposed timing of significant movements, switches or realignment of works)	
Daily Traffic Volume and Composition	
Copy of Traffic Management Plan (TMP) and Traffic Guidance Scheme (TGS) (the TGS shall include details of approved roadwork speed limit locations and will be used by Queensland Police Service to identify suitable sites for enforcement activity, and determine the enforcement strategy)	
Lateral Clearances (to workers operating without temporary barrier protection)	
Crash history (prior to and / or during roadworks, if relevant)	
Speed survey data and identification of the day(s) of the week and times of night or day when speed compliance issues are occurring	

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Technical Specification

Transport and Main Roads Specifications
MRTS03 Drainage, Retaining Structures and Protective Treatments

January 2019

Queensland Government

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FOI 26-292 - Document 21

Contents

1 Introduction 1

2 Definition of terms 1

3 References 2

4 Standard test methods 4

5 Quality system requirements 4

5.1 Hold Points, Witness Points and Milestones 4

5.2 Construction procedures 6

5.3 Compliance testing 6

5.4 Testing frequency 6

6 General material and construction requirements 7

6.1 Concrete and reinforcing steel 7

6.2 Cement mortar 7

6.3 Cement grout 7

6.4 Grates, cover and frames 7

6.5 Excavation and backfilling 8

6.6 Proprietary products 8

7 Geometric tolerances for culverts 8

7.1 General 8

7.2 Horizontal tolerances 8

7.3 Vertical tolerances 8

8 Removal or demolition of culverts and culvert end structures 9

8.1 General 9

8.2 Description 9

9 Removal / demolition of kerbs and channels and concrete slabs 9

9.1 General 9

9.2 Description 9

10 Removal / demolition of gullies and access chambers 9

10.1 General 9

10.2 Description 10

11 Supply of precast and preformed culvert and drainage trough components 10

11.1 General 10

11.2 Material requirements 10

12 Installation of precast and preformed culvert components 11

12.1 General 11

12.2 Material requirements 11

12.3 Construction 12

12.3.1 General 12

12.3.2 Bedding of culvert components 12

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

12.3.3 Assembling culvert components ... 12
12.3.4 Laying and jointing culvert components ... 13
12.3.5 Special requirements for concrete pipe culvert components ... 13
12.3.6 Special requirements for concrete box culvert components ... 14
12.3.7 Special requirements for corrugated steel culvert components ... 14
12.3.8 Special requirements for corrugated pipe, pipe-arch and arch culverts ... 14
12.3.9 Cutting culvert components ... 14
12.3.10 Backfilling of culverts ... 15

13 Installation of precast and preformed drainage trough components ... 15

13.1 General ... 15

13.2 Material requirements ... 15

13.3 Construction ... 15

13.3.1 General ... 15
13.3.2 Bedding of drainage trough components ... 15
13.3.3 Assembling drainage trough components ... 15
13.3.4 Laying and jointing drainage trough components ... 15
13.3.5 Cutting drainage trough components ... 16
13.3.6 Installing holding down anchors ... 16

14 Installation of precast pipe culvert components using jacking methods ... 16

14.1 General ... 16

14.2 Material requirements ... 16

14.3 Construction ... 16

15 Supply and installation of precast and preformed culvert and drainage trough components ... 17

15.1 General ... 17

15.2 Materials ... 17

15.3 Construction ... 17

16 Concrete end plugs for existing culverts ... 17

16.1 General ... 17

16.2 Construction ... 17

17 Insitu concrete culvert components ... 17

17.1 General ... 17

17.2 Material requirements ... 17

17.3 Construction ... 17

17.3.1 General ... 17
17.3.2 Special requirements for slab deck culverts ... 18
17.3.3 Special requirement for corrugated steel arch culverts ... 18

18 End structures to culverts ... 18

18.1 General ... 18

18.2 Material requirements ... 18

18.3 Construction ... 18

19 Precast concrete end structures to culverts ... 19

19.1 General ... 19

19.2 Material requirements ... 19

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

19.3 Construction 19
20 Cast-in-place concrete kerb, channel, and kerb and channel 19
20.1 General 19
20.2 Material 20
20.3 Construction 20
20.4 Tolerances 20
20.5 Water test 20
21 Precast concrete kerb, channel, and kerb and channel blocks 21
21.1 General 21
21.2 Material 21
21.3 Construction 21
21.4 Tolerances 21
21.5 Water test 21
22 Shoulder dykes 21
22.1 General 21
22.2 Material requirements 22
22.3 Construction 22
22.3.1 General 22
22.3.2 Concrete shoulder dykes 22
22.4 Asphalt shoulder dykes 22
22.4.1 Precast concrete block shoulder dykes 22
22.5 Tolerances 22
23 Concrete gullies 23
23.1 General 23
23.2 Material requirements 23
23.3 Construction 23
23.4 Tolerances 24
23.4.1 Horizontal tolerances 24
23.4.2 Vertical tolerances 24
24 Insitu concrete access chambers 24
24.1 General 24
24.2 Materials requirements 24
24.3 Construction 24
24.4 Tolerances 25
24.4.1 Horizontal tolerances 25
24.4.2 Vertical tolerances 25
25 Precast concrete access chambers 25
25.1 General 25
25.2 Material requirements 25
25.3 Construction 26
25.4 Tolerances 27

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

26 Precast concrete side inlet gullies 27
26.1 General 27
26.2 Material requirements 27
26.3 Construction 27
26.3.1 General 27
26.3.2 Precast shafts 28
26.4 Tolerances 28
26.5 Water test 28
27 Subsoil drains 28
27.1 General 28
27.2 Materials requirements 28
27.2.1 Drainage pipes 28
27.2.2 Strip filter drains 29
27.2.3 Geotextiles 29
27.2.4 Trench backfill 29
27.2.5 Concrete 29
27.2.6 Marker posts 30
27.3 Storage of materials 30
27.4 Construction 30
28 Sheet or strip filter drains 31
28.1 General 31
28.2 Material requirements 31
28.3 Storage and handling of materials 32
28.4 Construction 32
29 Vertical drains 33
29.1 General 33
29.2 Material requirements 33
29.3 Construction 33
29.3.1 General 33
29.3.2 Special requirements for wick drains 33
29.3.3 Special requirements for sand drains 34
29.4 Tolerances 34
30 Stone columns 34
30.1 General 34
30.2 Construction procedure 34
30.3 Granular working platform 35
30.3.1 Materials 35
30.3.2 Construction 35
30.4 Stone columns 35
30.4.1 Materials 35
30.4.2 Construction 36
30.4.3 Tolerances 36
30.5 Construction of embankment 36
30.5.1 Materials 36
30.5.2 Construction 37

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

31 Concrete paved inverts in corrugated culverts 37
31.1 General 37
31.2 Material requirements 37
31.3 Construction 37
32 Linings in drains and channels 38
32.1 General 38
32.2 Material requirements 38
32.3 Construction 38
33 Berm drains 38
33.1 General 38
33.2 Materials 38
33.3 Construction 38
34 Concrete margins and batters 39
34.1 General 39
34.2 Material requirements 39
34.3 Construction 39
35 Concrete rail track crossings and machinery crossings 39
35.1 General 39
35.2 Material requirements 39
35.3 Construction 39
35.4 Tolerances 40
36 Hand-placed concrete paving 40
36.1 General 40
36.2 Material requirements 40
36.3 Construction 40
36.4 Colouring and finishing 41
36.5 Vertical tolerances 41
37 Sprayed concrete paving 41
37.1 General 41
37.2 Material requirements 41
37.3 Construction 41
37.4 Vertical tolerance 42
38 Block paving 42
38.1 General 42
38.2 Material requirements 42
38.3 Construction 43
38.3.1 Block laying 43
38.3.2 Compaction 43
38.3.3 Joint filling 43
38.4 Vertical tolerance 44

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

39 Rock masonry 44
39.1 General 44
39.2 Material requirements 44
39.3 Construction 44
40 Grouted rock pitching 45
40.1 General 45
40.2 Material requirements 45
40.3 Construction 45
41 Rock protection 45
41.1 General 45
41.2 Material requirements 45
41.3 Construction 46
42 Steel-wire gabion protection 46
42.1 General 46
42.2 Material requirements 46
42.3 Basic gabion requirements 46
42.4 Construction 47
42.4.1 Assembling, positioning and joining gabions 47
42.4.2 Forming shapes 47
42.4.3 Rock filling 47
42.4.4 Closing gabions 47
43 Steel-wire mattress protection 47
43.1 General 47
43.2 Material requirements 47
43.2.1 General 47
43.2.2 Proprietary mattresses 48
43.2.3 Non-proprietary mattresses 48
43.3 Rock 48
43.4 Anchor pickets 48
43.5 Construction 48
43.5.1 General 48
43.5.2 Installing anchors 49
43.5.3 Assembling, positioning and joining mattresses 49
43.5.4 Forming shapes 49
43.5.5 Tensioning of mattresses 50
43.5.6 Rock filling 50
43.5.7 Closing mattresses 50
44 Fabric-encased concrete batter protection 50
44.1 General 50
44.2 Materials 50
44.2.1 Fabric 50
44.2.2 Concrete 51
44.3 Construction 51
44.3.1 General 51
44.3.2 Placement of mats 51

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

44.3.3 Grouting 51
45 Bridge abutment protection Type 1 – rock spillthrough 51
45.1 General 51
45.2 Material requirements 51
45.3 Construction 52
46 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough 52
46.1 General 52
46.2 Material requirements 52
46.3 Construction 52
46.4 Tolerances 53
47 Bridge abutment protection Type 4 – rockwork over earth spillthrough 53
47.1 General 53
47.2 Material requirements 54
47.3 Construction 54
48 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough 54
48.1 General 54
48.2 Material requirements 54
48.3 Construction 55
48.4 Tolerances 56
49 Bridge abutment protection Type 7 – Rock-filled gabion protection 56
49.1 General 56
49.2 Material requirements 56
49.3 Construction requirements 56
50 Shotcreting 57
50.1 General 57
50.2 Material requirements 57
50.2.1 Shotcrete 57
50.2.2 Steel reinforcing 57
50.2.3 Fixing pins 58
50.3 Construction 58
50.4 Tolerances 59
51 Concrete retaining walls 59
51.1 General 59
51.2 Material requirements 59
51.3 Construction 59
51.4 Tolerances 60
52 Concrete masonry retaining walls 60
52.1 General 60
52.2 Material requirements 60
52.3 Construction 60

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

52.4 Tolerances 61
53 Crib walls 61
53.1 General 61
53.2 Material requirements 61
53.3 Construction 61
53.4 Tolerances 62
54 Boulder retaining walls 62
54.1 Boulder retaining walls 62
54.1.1 General 62
54.2 Material requirements 62
54.2.1 Rock fill 62
54.2.2 Drainage blanket 63
54.2.3 Packing stones in boulder walls 63
54.2.4 Foundation 63
54.3 Construction 63
54.3.1 Foundation construction requirements 63
54.3.2 Boulder wall placement 64
54.3.3 Backfill compaction 64
54.3.4 Concrete slurry fill 64
54.3.5 Seepage drains 64
54.3.6 Surface runoff behind the wall 65
54.4 Tolerances 65
55 Soil nailing 65
55.1 General 65
55.2 Methodology and construction procedure 65
55.3 Material requirements 65
55.3.1 Soil nails 65
55.3.2 Spacers 66
55.3.3 Cement grout 66
55.4 Construction 66
55.4.1 General 66
55.4.2 Drilling 66
55.4.3 Installation of soil nails 66
55.4.4 Grouting of soil nails 66
55.5 Acceptance testing of soil nails 67
56 Passive rock dowels 67
56.1 General 67
56.2 Methodology and construction procedure 67
56.3 Materials 68
56.3.1 Passive rock dowels 68
56.3.2 Spacers 68
56.3.3 Cement grout 68
56.4 Construction 68
56.4.1 General 68
56.4.2 Drilling 68
56.4.3 Installation of rock dowels 69
56.4.4 Grouting 69
56.5 Acceptance testing of passive rock dowels 69

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

57 Active rock bolts 70
57.1 General 70
57.2 Methodology and construction procedure 70
57.3 Materials 70
57.3.1 Active rock bolts 70
57.3.2 Spacers 70
57.3.3 Cement grout 71
57.4 Construction 71
57.4.1 General 71
57.4.2 Drilling 71
57.4.3 Installation of rock bolts 71
57.4.4 Grouting 71
57.5 Stressing active rock bolts 71
57.6 Load testing active rock bolt 72
58 Supplementary requirements 72
59 Surveying requirements 72
60 Existing underground assets 72

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1 Introduction

This Technical Specification applies to the provision of drainage structures, retaining structures, and protective treatments in roadworks.

The requirements for reinforced soil retaining structures are specified in MRTS06 *Reinforced Soil Structures*.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

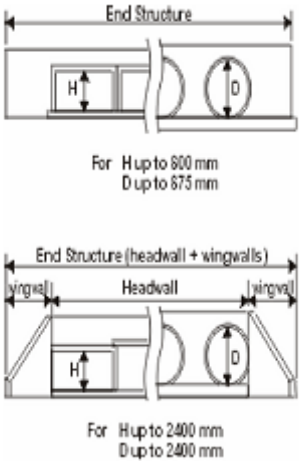
The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Gabion	A steel-wire mesh cage which is filled with rock particles and used to construct a retaining structure.
Mattress	A steel-wire mesh cage which is filled with rock particles and used to line a drainage channel.
Spillthrough	That portion of an embankment constructed adjacent to and under a bridge abutment.

End structures for culverts are defined by the terms detailed in Figure 2.

Figure 2 – Culvert end structure terms



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3 References

Tables 3(a) and 3(b), below, list documents referenced in this Technical Specification.

Table 3(a) – Referenced documents

Reference	Title
AS 1379	*Specification and supply of concrete*
AS 1762	*Helical lock-seam corrugated steel pipes – Design and Documentation*
AS 1830	*Grey cast iron*
AS 2338	*Preferred dimensions of wrought metal products*
AS 2423	*Coated steel-wire fencing products for terrestrial, aquatic and general use*
AS 2439.1	*Perforated plastics drainage and effluent pipe and fittings – Perforated drainage pipe and associated fittings*
AS 3678	*Structural steel – hot-rolled plates, floor plates and slabs*
AS 3679.1	*Structural steel – hot-rolled bars and sections*
AS 3600	*Concrete structures*
AS 3700	*Masonry structures*
AS 3750.9	*Paints for steel structures – Organic zinc – rich primer*
AS 3996	*Access covers and grates*
AS 5100	*Bridge design – scope and general principles*
AS/NZS 1254:2010	*PVC-U pipes and fittings for stormwater and surface water applications*
AS/NZS 2041.4:2010	*Buried corrugated metal structures – Helically formed sinusoidal pipes*
AS/NZS 2041:1998	*Buried corrugated metal structures*
AS/NZS 4455.1	*Masonry units, pavers, flags and segmental retaining wall units – Masonry units*
AS/NZS 4671	*Steel reinforcing materials*
AS/NZS 4680	*Hot-dipped galvanised (zinc) coatings on fabricated ferrous articles*
MRTS01	*Introduction to Technical Specifications*
MRTS04	*General Earthworks*
MRTS05	*Unbound Pavements*
MRTS06	*Reinforced Soil Structures*
MRTS24	*Manufacture of Precast Concrete Culverts*
MRTS25	*Manufacture of Precast Concrete Pipes*
MRTS26	*Manufacture of Fibre Reinforced Concrete Drainage Pipes*
MRTS27	*Geotextiles (Separation and Filtration)*
MRTS30	*Asphalt Pavements*
MRTS50	*Specific Quality System Requirements*
MRTS70	*Concrete*

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Reference	Title
MRTS71	*Reinforcing Steel*
MRTS72	*Manufacture of Precast Concrete Elements*
MRTS77	*Bridge Deck*
MRTS78	*Fabrication of Structural Steelwork*
-	*TMR Surveying Standards*

Table 3(b) – Referenced departmental Standard Drawings

Standard Drawing Number	Title
1033	*Kerb and channel — Kerbs, channels and ramped vehicular crossing*
1116	*Subsoil drains - Outlets and cleanouts*
1174	*R C Box Culverts – Installation of Precast Units and Construction Headwalls – Height = 375 to 600*
1303	*R C Box Culverts & Slab Link Box Culverts - Construction of Headwalls and Wingwalls – Height > 600*
1304	*Pipe Culverts – Wingwalls, Headwall and Apron for Pipe Diameter 750 to 2400 – Drawing 1 of 2 to 2 of 2*
1305	*Pipe Culverts - Headwall and Apron for Pipe Diameter 375 to 675*
1307	*Access Chamber - Details 1050 to 2100 Dia.*
1308	*Access Chamber - Roof Slabs 1050 to 2100 Dia.*
1313	*Concrete Gully - Precast Lintel Details*
1316	*R C Box Culverts & Slab Link Box Culverts - Installation of Precast Units – Height > 600*
1317	*R C Box Culverts & Slab Link Box Culverts - Construction of Bases with Nibs and Aprons (all sizes)*
1318	*R C Box Culverts & Slab Link Box Culverts - Construction of Bases with Recesses and Aprons (all sizes)*
1320	*R C Box Culverts & Slab Link Box Culverts - Crown Unit Holding Down Anchors*
1321	*Concrete Gully - Precast Concrete Side Inlet Gully with Precast Shaft*
1322	*Concrete Gully - Precast Concrete Side Inlet Gully with Cast In Situ Pit*
1443	*Concrete Gully - Roadway Type Precast Inlet Units on Grade*
1444	*Concrete Gully - Roadway Type Precast Inlet Units in Sag*
2232	*Abutment Protection – Type 1 - Rock Spillthrough - Up to 1700 Clearance*
2233	*Abutment Protection – Type 1 - Rock Spillthrough – Greater Than 1700 Clearance*
2234	*Abutment Protection – Type 2 - Reinforced Concrete Over Spillthrough - Up to 1700 Clearance*
2235	*Abutment Protection – Type 2 - Reinforced Concrete Over Spillthrough - Greater Than 1700 Clearance*

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Standard Drawing Number	Title
2236	*Abutment Protection – Type 4 - Rockwork Over Spillthrough - Up to 1700 Clearance*
2237	*Abutment Protection – Type 4 - Rockwork Over Spillthrough - Greater Than 1700 Clearance*
2238	*Abutment Protection - Rock Masonry*
2241	*Abutment Protection – Type 7 - Rock Filled Gabion Protection – Height up to 6 Metres*

4 Standard test methods

The Standard test methods listed in Table 4 shall be used in this Technical Specification.

Table 4 – Standard Test Methods

Property to be tested	Method No.
Particle size distribution	AS 1141.11.1
Density index	AS 1289.5.5.1 AS 1289.5.6.1
Los Angeles value	AS 1141.23
Particle density on a dry basis	AS 1141.6.1
Apparent particle density	AS 1141.6.1
Point load strength index	AS 4133.4.1
Total weighted loss	AS 1141.24
Water absorption	AS 1141.6.1
California Bearing Ratio (CBR)	Q113C
Compressive strength	AS 1012.8.3 AS 1012.9
Tensile strength – warp and weft	ASTM D5034 and D5035
Porosity	ASTM D737

Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

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Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
12.2	1. Bandage cover materials for culvert joints		
12.3.1	2. Approval of Culvert Construction Procedure		
12.3.5	3. Acceptance of CCTV Defect Inspection Report		
12.3.10	4. Backfilling of culverts		
20.5		1. Water flow test in concrete channels	
21.5		2. Water flow test in precast block channels	
23.3	5. Grate placement		
24.3	6. Concrete top slab placement		
25.3	7. Concrete top slab placement		
26.5		3. Water flow test in precast concrete side inlet gullies	
27.4		4. Flushing of sub-soil drains	
29.3.1			Sequence for construction of vertical drains (14 days)
30.2	8. Construction of stone columns		Submission of construction for stone columns (28 days)
44.3.2	9. Grouting of fabric-encased batter protection		
48.2	10. Use of alternative interlocking blocks		Submission of technical details of interlocking blocks (14 days)
49.3	11. Submission of method statement		
51.3	12. Backfilling on concrete retaining wall footing		
55.2	13. Installation of soil nails		Submission of construction procedure for soil nails (14 days)
55.4.4.2	14. Grouting of soil nails		
55.5	15. Acceptance of soil nails		
56.2	16. Installation of passive rock dowels		Submission of construction procedure for passive rock dowels (14 days)

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Clause	Hold Point	Witness Point	Milestone
56.4.4.2	17. Grouting of passive rock dowels		
56.5	18. Acceptance of passive rock dowels		
57.2	19. Installation of active rock bolts		Submission of construction procedure for active rock bolts (14 days)
57.4.4.2	20. Grouting of active bolts		
57.6	21. Acceptance of active rock bolts		

5.2 Construction procedures

The Contractor shall prepare documented procedures for all construction processes in accordance with Clause 5 of MRTS50 *Specific Quality System Requirements*.

Those construction procedures which are required to be submitted by the Contractor to the Administrator in accordance with Clause 5 of MRTS50 *Specific Quality System Requirements* include those listed in Table 5.2.

Table 5.2 – Construction procedures

Clause	Procedure
12.3.1	Culvert construction
30.2	Stone columns
55.4.3	Installation of soil nails
56.4.3	Installation of rock dowels
57.4.3	Installation of rock bolts

5.3 Compliance testing

Compliance testing shall be carried out for each lot.

The Contractor shall undertake sufficient tests to ensure that the works comply with the Technical Specifications and requirements of the Contract.

The testing program shall be such that the testing frequencies and number of tests are not less than those required by Clause 5.4.

5.4 Testing frequency

The minimum test frequencies and minimum numbers of tests as stated in Clause 1 of Annexure MRTS03.1 shall apply to the construction of work covered by this Technical Specification.

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6 General material and construction requirements

6.1 Concrete and reinforcing steel

Concrete and reinforcing steel shall be in accordance with the requirements of MRTS70 *Concrete* and MRTS71 *Reinforcing Steel* respectively, and with the following requirements:

a) The minimum characteristic strength of concrete shall be as specified within the drawings.

b) Construction joints shall be provided only as specified within the drawings and no construction joint specified within the drawings shall be omitted.

c) Weepholes shall be provided at the locations specified within the drawings and to the details specified. A 300 mm x 300 mm x 150 mm thick 'no-fines' concrete block wrapped with a non-woven geotextile complying with MRTS27 *Geotextiles (Separation and Filtration)* shall be provided and placed or constructed at each weephole.

d) Where concrete is constructed on ground surfaces or on a foundation bedding, a polythene sheet separator of thickness not less than 100 µm shall be installed between the ground/bedding and the concrete. The separator shall extend not less than 300 mm beyond the concrete. Puncturing or tearing the separator shall be avoided. Should puncturing or tearing occur, the damage shall be repaired prior to concreting. Joints in the separator shall be provided by overlapping the sheets a minimum of 300 mm or by overlapping and taping.

e) Rock plums may be employed in unreinforced concrete. Individual plums shall not exceed 150 mm dimension. Plums shall not constitute more than 30% of the volume of concrete, and

f) Concrete shall be cured for the period of time specified for the application and the concrete mix used or, where such time is not specified, for a minimum of seven days.

6.2 Cement mortar

Unless otherwise specified, cement mortar shall consist of one part of Type GP cement to three parts of clean sharp sand, with only sufficient water added to form a moist dry-pack material. Materials shall comply with MRTS70 *Concrete*.

6.3 Cement grout

Cement grout shall consist of neat cement or neat cement with a plasticised expanding grout admixture (e.g., a methyl-cellulose-based compound used at a rate of 0.2% by weight of cement). Mixing of the admixture with cement shall be in accordance with the manufacturer's recommendations. Cement shall be either Type GP or Type HE in accordance with MRTS70 *Concrete*.

The water-cement ratio of the grout shall not be greater than 0.4.

Where required, the compressive strength of the grout shall be determined using samples cast in 50 mm cube moulds in accordance with AS 1012.8.3 and tested in accordance with AS 1012.9.

6.4 Grates, cover and frames

Grates, cover and frames for gullies and access chambers shall:

a) meet Class D requirements when tested in accordance with AS 3996, and

b) have a positive mechanical retainer system to stop accidental closure of the grate or cover when in the open position in accordance with the requirements of AS 3996.

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Grates located on a road carriageway or bicycle path shall meet bicycle safety requirements in accordance with AS 3996.

6.5 Excavation and backfilling

Excavation and backfilling operations required to be undertaken to construct the work described by this Technical Specification shall be carried out in accordance with the provisions of MRTS04 *General Earthworks*.

6.6 Proprietary products

Where proprietary products are specified within this Technical Specification, the Contractor shall guarantee and, if requested, submit evidence that the product used shall be satisfactory, structurally adequate, durable and safe for the intended purpose, and also complies with the law and applicable Australian Standards.

In particular, any structural (or load bearing) component/product shall be designed to accommodate all temporary and permanent loadings, and the component/product shall be constructed in accordance with that design, certified by a practising Structural Engineer.

A full set of auditable design calculations shall be made available for perusal if requested by the Administrator.

Precast concrete proprietary products shall be cast in accordance with MRTS72 *Manufacture of Precast Concrete Elements* by a registered precaster.

7 Geometric tolerances for culverts

7.1 General

The horizontal and vertical alignments of culverts shall not exhibit noticeable irregularities.

Culverts shall have a positive drainage slope along the whole of their length and, where relevant, shall join neatly to existing structures.

7.2 Horizontal tolerances

The horizontal alignment of culverts shall not vary from the location specified in the drawings by more than ± 100 mm.

7.3 Vertical tolerances

The invert heights of culverts shall not vary from those specified by more than ± 10 mm, provided always that nowhere shall the grades of culverts depart from those specified by more than 1% (absolute).

Notwithstanding these tolerances, the minimum thickness of cover over culverts shall nowhere be less than as shown on the drawings. If cover is not shown or if it is not clear, it shall be nowhere less than the following:

a) 100 mm for concrete box culverts, and cast-in-place concrete slab deck culverts and concrete unitary box culverts if deck wearing surfaces are not specified

b) 300 mm for concrete pipe culverts, and

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c) 600 mm or diameter or span

6

whichever is the greater for corrugated steel culverts.

8 Removal or demolition of culverts and culvert end structures

8.1 General

Clause 8 applies to the work to be carried out where culverts and culverts end structures are to be removed or demolished under the Contract.

8.2 Description

Culverts and culvert end structures shall be removed or demolished where specified in the drawings. If existing culvert components are to be removed and re-used, they shall be removed and stacked in a manner which avoids damaging the components. Removed components which are not to be salvaged, nor reused, shall be removed from the Site and disposed.

The culvert components listed in Clause 2.1 of Annexure MRTS03.1 are required to be salvaged intact by the Contractor and delivered and stored at the storage site nominated in Clause 2.2 of Annexure MRTS03.1.

Excavations carried out and the void left by the removed culvert or end structure shall be backfilled to reinstate the area to a safe and free draining state.

9 Removal / demolition of kerbs and channels and concrete slabs

9.1 General

Clause 9 applies to the work to be carried out where kerbs and channels and concrete slabs are to be removed or demolished under the Contract.

9.2 Description

Existing kerbs, channels, kerbs and channels, kerb crossings and concrete slabs shall be removed or demolished where specified in the drawings.

No damage shall result to adjacent work.

Where part only of existing kerbs, channels, kerbs and channels, kerb crossings and slabs are to be removed or demolished and new kerbs, channels, kerbs and channels, kerb crossings and slabs are to be joined to the remaining part, removal or demolition operations shall terminate at a joint. Alternatively, the existing kerb, channel, kerb and channel, kerb crossing or slab shall be sawn to provide a clean joint.

Any resulting excavations shall be backfilled and the surface finished level with the surrounding area.

10 Removal / demolition of gullies and access chambers

10.1 General

Clause 10 applies to the work to be carried out where gullies and access chambers are to be removed or demolished under the Contract.

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10.2 Description

Gullies and access chambers shall be removed or demolished where specified in the drawings.

Gullies and access chambers shall be removed or demolished in a manner which avoids damaging any adjacent work.

Resulting excavations and voids shall be backfilled and the surface finished level with the surrounding area.

11 Supply of precast and preformed culvert and drainage trough components

11.1 General

Clause 11 applies to the work to be carried out where precast and preformed culvert and drainage trough components are required to be supplied under the Contract.

Precast and preformed culvert components shall comprise precast pipes, preformed pipes, unitary box units, U-shaped units, lid, base and spanning slabs, plates, couplers, rubber rings, arch channels, bolts, nuts, washers, plugs, dowels and all other fittings necessary for the installation of the components to be provided.

11.2 Material requirements

Precast and preformed culvert components shall conform to the following requirements:

a) Concrete pipe culvert components shall comply with the requirements specified in MRTS25 *Manufacture of Precast Concrete Pipes* or with MRTS26 *Manufacture of Fibre Reinforced Concrete Drainage Pipes:*

   i. All pipes supplied to MRTS25 of diameter 800 mm or less shall have joints which are spigot and socket with rubber sealing rings. Joints for other sizes shall be as specified on the drawings.

   ii. All pipes supplied to MRTS26 shall have flexible elastomeric double ‘V’ ring joints.

b) Concrete box culvert components and spanning slabs shall comply with MRTS24 *Manufacture of Precast Concrete Culverts.*

c) Helical lock-seam corrugated steel pipe culvert components shall:

   i. comply with the requirements specified in AS/NZS 2041.4

   ii. comply with the requirements of AS 1762, except that Tables A1, A2, A3 and A4 shall be deleted and AS 1762 Appendix C shall be replaced by Table 11.2, and

   iii. have an allowance for corrosion of 1 mm.

Table 11.2 – Live load pressure for AS 5100 highway loads

Depth (m)	Wheel Load Pressure (kPa)	Depth (m)	Wheel Load Pressure (kPa)
0.40	246	2.80	19
0.60	129	3.00	18
0.80	78	3.20	17
1.00	52	3.40	17

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Depth (m)	Wheel Load Pressure (kPa)	Depth (m)	Wheel Load Pressure (kPa)
1.20	39	3.60	16
1.40	30	3.80	16
1.60	24	4.00	15
1.80	23	4.20	15
2.00	22	4.40	14
2.20	21	4.60	14
2.40	20	4.80	13
2.60	19	5.00	13

d) Nestable corrugated steel pipe culvert components and multiple plate corrugated steel pipe or pipe-arch or arch culvert components shall:

   i. comply with the requirements specified in AS/NZS 2041, except that Appendix E shall be deleted and AS/NZS 2041 Appendix G shall be replaced by Table 11.2, and

   ii. have an allowance for corrosion of 1 mm.

e) Helical lock-seam corrugated aluminium pipe culvert components shall comply with the requirements stated in Clause 3.1 of Annexure MRTS03.1 or, where not so stated, shall be subject to prior approval by the Administrator.

The culvert component size, class and/or wall thickness shall be as specified in the drawings.

The design height of fill above box culverts shall be as specified in the drawings or in Clause 3.2 of Annexure MRTS03.1.

12 Installation of precast and preformed culvert components

12.1 General

Clause 12 applies to the work to be carried out where precast and preformed culvert components are required to be installed under the Contract.

12.2 Material requirements

Bandage covers shall be a suitable proprietary product consisting of:

a) a synthetic woven or non-woven fabric factory impregnated with a rubberised bitumen or a neutral petrolatum based compound, or

b) plastic or natural rubber bands.

Woven or non-woven fabrics shall have the following properties:

a) grab tensile strength not less than 300 N (50 mm wide strip)

b) thickness not less than 1.25 mm, and

c) mass not less than 1.4 kg/m².

Plastic and natural rubber bands shall have properties appropriate to the sealing requirements and shall be to the approval of the manufacturer of the culvert components concerned.

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Samples of the materials to be used as bandage covers shall be made available for inspection by the Administrator prior to commencement of installation. **Hold Point 1**

Concrete in end blocks shall comply with Clause 6.1, except that the maximum aggregate size shall not exceed 9.5 mm.

Concrete infill material shall consist of one part of Type GP cement to 10 parts aggregate (loose volume). The maximum aggregate size shall be 9.5 mm.

Lean Mix concrete shall have one part of Type GP cement to 10 parts aggregate, loose volume.

Holding down anchors shall comply with the details shown on the Standard Drawings.

12.3 Construction

12.3.1 General

Prior to construction, the construction loads which shall be placed on the culvert by the proposed construction procedure and equipment shall be checked. If the culvert is to be installed prior to the age at which the nominal concrete strength is achieved, the check shall account for the actual strength of the concrete at the time of construction. If necessary, a culvert with a higher class of concrete shall be substituted. Construction of culverts shall not commence until the check of the construction procedure has been carried out. For concrete pipe culverts, refer to Clause 12.3.5 for additional requirements for constructions loads. **Hold Point 2**

Precast and / or preformed culvert components shall be installed in the locations and in accordance with the details shown in the drawings.

The drainage structure shall be set out in accordance with the details shown in the drawings. The provisions of Clause 9 of MRTS01 *Introduction to Technical Specifications* apply to the set out procedure.

Excavations shall be carried out in accordance with Clause 13 of MRTS04 *General Earthworks*.

Concrete shall comply with the requirements specified in Clause 6.1. Where corrugated steel culvert components are installed, the invert heights specified are the levels of the tops of the corrugations.

All drainage structures shall be marked with indelible ink on the inside face with the name of the Manufacturer and month and year of manufacture.

12.3.2 Bedding of culvert components

Foundation bedding and haunch zone materials shall be placed in accordance with Clause 19 of MRTS04 *General Earthworks*.

The foundation bedding shall provide continuous, even support to the culvert components.

12.3.3 Assembling culvert components

Culvert components shall be assembled in accordance with the manufacturer's drawings and recommendations as relevant.

Where corrugated steel pipe culvert components are employed, circumferential joints shall be staggered and longitudinal joints shall be horizontally opposed.

Where multiple plate corrugated steel arch culvert components are employed, the arch channels shall be filled with cement mortar after the arch has been assembled. The top surface of the mortar filling shall be sloped such that water shall not pond in the arch channel or against the arch.

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12.3.4 Laying and jointing culvert components

Where possible, laying of culvert components shall commence at the outlet end of the culvert and progress to the inlet end.

Components shall be selected and arranged to give best fit.

The ends of components shall be free of any foreign matter at the time of jointing.

In butt and flush joints, the culvert components shall abut one another and a bandage cover shall be installed on the outer surfaces to seal the joints.

Unless a specific type of bandage cover is specified in the drawings, the bandage cover shall consist of:

a) one layer of non-woven fabric

b) three layers of woven fabric, or

c) a plastic or natural rubber band.

Fabric covers shall have a width sufficient to overlap adjacent components by not less than 45 mm, and shall not be applied until the ambient temperature exceeds 15°C. Fabric covers shall not be wrinkled and shall adhere to the outer surfaces of the adjacent components. The ends of the fabric in the covers shall be secured in accordance with the manufacturer's recommendations.

Plastic or natural rubber covers shall be installed in accordance with the manufacturer's recommendations.

Bandage covers are not required for legs of adjacent culverts in multiple installations where the joint is infilled with concrete.

12.3.5 Special requirements for concrete pipe culvert components

Construction and installation loading shall comply with the requirements specified in MRTS25 *Manufacture of Precast Concrete Pipes* or MRTS26 *Manufacture of Fibre Reinforced Concrete Drainage Pipes* and associated annexures as appropriate.

Where spigot and socket joints are used, the thickness of bedding material under each socket shall not be less than 50 mm.

Pipes shall be placed with their external grooved ends or spigot ends facing the culvert outlet.

Where the word 'TOP' is marked on pipes or where lifting holes are provided, the pipes shall be laid with the word / hole uppermost. Lifting holes shall be plugged or otherwise closed off in accordance with the manufacturer's instructions after the pipe is installed.

Spigot and socket joints shall be made using the appropriate rubber rings.

At the completion of the pipe installation, including placement and compaction of fill to the final specified fill height, the contractor shall undertake a CCTV defect inspection with WNCAN report to demonstrate that the completed pipe installation is acceptable to the department and that the pipes are correctly installed and are free of Defect Types 2,3,5, 6 and 7 as defined in MRTS25 *Manufacture of Precast Concrete Pipes* for Steel Reinforced Concrete Pipes and free of cracks and joint damage for Fibre Reinforced Concrete Drainage Pipes. Acceptance of this report by the Administrator shall be a **Hold Point 3**

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12.3.6 Special requirements for concrete box culvert components

Box culvert components shall generally be installed in accordance with the details shown on Standard Drawing 1316.

U-shaped units supplied with precast lid/base slabs shall be installed as follows:

a) units laid in the 'legs up' position shall be placed directly on a foundation bedding. The lid slabs shall be seated onto the tops of the legs using continuous cement mortar pads, and

b) units laid in the 'legs down' position on base slabs shall be seated onto the slabs using continuous cement mortar pads. The base slabs shall be placed directly on a foundation bedding.

U-shaped units laid in the 'legs down' position on cast-in-place concrete bases shall be seated on to the bases using continuous cement mortar pads. Where specified, holding down anchors shall also be installed to retain the units in position in accordance with the details shown on Standard Drawing 1320.

Corrodible lifting lugs shall be cut off close to the unit. The exposed ends of the embedded portions of the lug shall be given two coats of a surface tolerant epoxy.

Where spanning slabs are installed, locating dowels shall be installed in the tops of the units and the spanning slabs shall be seated on continuous cement mortar pads on adjacent unit — all as shown on the Standard Drawing. All surplus mortar shall be removed from the installation before the mortar hardens.

In multiple cell culverts, the gaps between lines of installed cells shall be a minimum of 40 mm wide and filled as follows:

a) Concrete end blocks extending not less than 250 mm along the gap shall be constructed to full height at each end of the culvert. Headwall anchor bars shall be installed in the end blocks as specified in the Standard Drawings, and

b) After the end blocks have hardened, the remaining gaps between the cells shall be dry packed with concrete infill material.

Where spanning slabs are installed, the space between slabs shall be filled with lean mix concrete. No other backfilling material shall be placed over the culvert for 24 hours after the placement of the lean mix concrete.

12.3.7 Special requirements for corrugated steel culvert components

Thrust beams and ring beams shall be constructed in accordance with the manufacturer's drawings and recommendations as relevant.

12.3.8 Special requirements for corrugated pipe, pipe-arch and arch culverts

The deformation limits specified in MRTS04 *General Earthworks* shall be strictly adhered to during installation and backfilling operations.

12.3.9 Cutting culvert components

Cutting operations shall provide neat end surfaces.

The cut surfaces of reinforced concrete culvert components shall be given two coats of a surface tolerant epoxy.

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The cut surfaces of steel culvert components shall be given two coats of zinc-rich organic priming paint as specified in AS 3750.9. The coats shall have a combined thickness at least equivalent to the thickness of the galvanised coating. Each coat shall overlap the adjacent uncut surfaces by not less than 25 mm.

12.3.10 Backfilling of culverts

Backfilling of culverts shall be carried out in accordance with clauses 15 and 20 of MRTS04 *General Earthworks*.

Backfilling of culverts shall not commence until all the conformance and As Constructed Survey requirements have been met and notice of such works provided to the Administrator. **Hold Point 4**

13 Installation of precast and preformed drainage trough components

13.1 General

Clause 13 applies to the installation of precast and preformed drainage trough components.

13.2 Material requirements

Bandage covers shall be a synthetic woven or non-woven fabric as specified in Clause 12.2.

13.3 Construction

13.3.1 General

Precast and/or preformed culvert components shall be installed in the locations and in accordance with the details specified in the drawings.

Excavations shall be carried out in accordance with Clause 13 of MRTS04 *General Earthworks*.

Where corrugated steel drainage trough components are installed, the invert heights specified are the levels of the tops of the corrugations.

All drainage structures shall be marked with indelible ink on the inside face with the name of the Manufacturer and month and year of manufacture.

13.3.2 Bedding of drainage trough components

Foundation bedding materials shall be placed in accordance with Clause 19 of MRTS04 *General Earthworks*.

The foundation bedding shall provide continuous, even support to the drainage trough components.

13.3.3 Assembling drainage trough components

Drainage trough components shall be assembled in accordance with the manufacturer's drawings and recommendations.

13.3.4 Laying and jointing drainage trough components

Drainage trough components shall be laid with the tops flush with the finished batter.

Laying of drainage trough components shall commence at the outlet end of the trough and progress to the inlet end. Where necessary, components shall be selected and arranged to give satisfactory fit.

The ends of components shall be free of any foreign matter at the time of jointing. When butt and flush joints are specified, the drainage trough components shall abut one another.

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Bandage covers shall be applied to the outer surfaces of butt and flush joints. Bandage covers shall consist of:

a) one layer of non-woven fabric, or

b) three layers of woven fabric.

Fabric covers shall have a width sufficient to overlap adjacent components by not less than 45 mm and shall not be applied until the ambient temperature exceeds 15°C. Fabric covers shall not be wrinkled and shall adhere to the outer surfaces of the adjacent components. The ends of the fabric in the covers shall be secured in accordance with the manufacturer's recommendations.

13.3.5 Cutting drainage trough components

Cutting operations shall provide neat end surfaces.

The cut surfaces of concrete drainage trough components shall be given two coats of a surface tolerant epoxy.

The cut surfaces of corrugated steel drainage trough components shall be given two coats of zinc-rich organic priming paint as specified in AS 3750.9. The coats shall have a combined thickness at least equivalent to the galvanised coating thickness. Each coat shall overlap adjacent uncut surfaces by not less than 25 mm.

13.3.6 Installing holding down anchors

Holding down anchors shall be installed in accordance with the requirements specified in the Standard Drawings and the manufacturer's recommendations as relevant.

14 Installation of precast pipe culvert components using jacking methods

14.1 General

Clause 14 applies to the installation of precast pipe culvert components using jacking methods.

14.2 Material requirements

Concrete pipes installed using jacking methods shall be Class 4 with suitable joints designed by the manufacturer.

Cement mortar shall comply with Clause 6.2.

14.3 Construction

Pipe jacking shall be carried out in the locations specified by, and in accordance with, the drawings.

Pipe jacking shall be carried out only by experienced personnel.

Jacking operations shall comply with the pipe manufacturer's recommendations.

Jacking operations shall proceed with care so as to cause no damage to the pipes.

The location of any existing underground services shall be established prior to commencement of jacking operations and all reasonable care shall be taken not to damage such services or any adjacent work.

Pipe joints shall be sealed with cement mortar after installation of the pipes.

All drainage structures shall be marked with indelible ink on the inside face, with the name of the Manufacturer and month and year of manufacture.

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15 Supply and installation of precast and preformed culvert and drainage trough components

15.1 General

Clause 15 applies to the work to be carried out where precast and preformed culvert and drainage trough components are required to be supplied and installed under the Contract.

15.2 Materials

Materials shall conform to the relevant requirements of Clauses 11.2, 12.2, 13.2 and 14.2 as appropriate.

Where one type of pipe is detailed on the drawings and the Contractor proposes to use an alternative, the Contractor shall ensure that all details are amended to be compatible and that as-constructed drawings are prepared and submitted to the Administrator.

15.3 Construction

Construction shall conform to the relevant requirements of Clauses 12.3, 13.3 and 14.3, as appropriate.

16 Concrete end plugs for existing culverts

16.1 General

Clause 16 applies to the provision of concrete end plugs for existing culverts.

16.2 Construction

Concrete end plugs shall be used to seal off existing culverts that are to be taken out of service, but not removed or demolished.

Concrete end plugs for culverts shall be constructed in the locations and in accordance with the details shown on the drawings.

Concrete shall comply with Clause 6.1.

The thickness of the plugs shall be not less than 500 mm. The plugs shall completely seal the ends of the culverts.

17 Insitu concrete culvert components

17.1 General

Clause 17 applies to construction of situ concrete culvert components.

17.2 Material requirements

Concrete shall comply with Clause 6.1.

Galvanised arch channels with integral arches shall be approved proprietary products.

17.3 Construction

17.3.1 General

Cast-in-place culvert components shall be constructed in the locations specified by, and in accordance with, the drawings. If not specifically detailed in the drawings, box culvert bases shall be constructed in accordance with the details shown on Standard Drawings 1317 and 1318.

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Where insitu material on or against which culvert bases or footings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Cast-in-place concrete bases, footings, infill floors, abutments, piers and unitary box culverts may be constructed without a foundation bedding unless specified otherwise in the drawings.

Concrete work shall comply with Clause 6.1.

Construction of bases, footings, infill floors, abutments and piers, and unitary box culverts shall include the construction of nibs and integral cut-off walls.

17.3.2 Special requirements for slab deck culverts

Construction of bases and footings shall include the provision and installation of embedded dowel bars for abutments and piers. Construction of abutments and piers shall include the provision and installation of embedded dowel bars for slab decks and kerbs. Slab decks and kerbs shall be constructed monolithically.

17.3.3 Special requirement for corrugated steel arch culverts

Construction of abutments and piers shall include the supply and installation of galvanised arch channels (with integral anchorages).

18 End structures to culverts

18.1 General

Clause 18 applies to end structures to culverts.

18.2 Material requirements

Concrete shall comply with Clause 6.1.

Steel Reinforcement shall comply with MRTS71 *Reinforcing Steel*.

Material for rock masonry shall comply with Clause 39.

Materials for concrete masonry shall comply with Clause 51.

Materials for grouted rock pitching shall comply with Clause 40.

Materials for steel-wire mattresses shall comply with Clause 43.

18.3 Construction

Cast, formed-in-place endwalls and wingwalls, aprons, and kerbs to culverts shall be provided in the locations specified in the drawings. Unless otherwise specified in the drawings, cast-in-place concrete end structures to culverts shall comply with the details shown on Standard Drawings 1174, 1303, 1304, 1305, 1317, 1318 and 1319 as applicable.

Where insitu material on or against which structures are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete shall be constructed to comply with Clause 6.1.

The construction of rock masonry shall comply with Clause 39.

The construction of concrete masonry shall comply with Clause 51.

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The construction of grouted rock pitching shall comply with Clause 40.

The construction of steel-wire mattresses shall comply with Clause 43.

Endwalls, wingwalls and concrete aprons may be constructed without a foundation bedding.

Endwalls and wingwalls shall be formed monolithically.

Construction of endwalls and wingwalls shall include the construction of integral cutoff walls where relevant.

Construction of aprons shall include the construction of integral cut-off walls, the construction of integral energy dissipaters if specified and the installation of dowel bars.

Rock masonry endwalls and wingwalls shall be capped with a cement mortar coping not less than 25 mm thick. The coping shall be trowelled to provide smooth, even surfaces with neat edges.

19 Precast concrete end structures to culverts

19.1 General

Clause 19 applies to the provision of precast concrete end structures for culverts.

19.2 Material requirements

Precast concrete end structures shall be proprietary products manufactured in accordance with Clause 6.6.

Cement mortar shall comply with Clause 6.2.

19.3 Construction

Precast concrete end structures to culverts shall be installed in the locations and in accordance with the drawings.

Where insitu material on or against which end structures are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

End structures shall be laid on a foundation bedding which provides continuous even support to the structures.

The joints between end structures and culverts shall be filled with cement mortar. The joint areas shall be thoroughly cleaned and wetted just prior to filling. All joints shall be finished smooth and uniform with the surfaces of the end structures.

Any holes and recesses provided in end structures to assist installation shall be neatly plugged or filled with cement mortar.

Mortared joints and filled holes and recesses shall be cured for a period of not less than 48 hours. Backfilling operations against end structures shall not be carried out during the curing period.

20 Cast-in-place concrete kerb, channel, and kerb and channel

20.1 General

Clause 20 applies to the provision of cast-in-place concrete kerb, channel and kerb and channel. The Clause does not apply to kerbs cast integrally with structures.

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20.2 Material

Concrete shall comply with Clause 6.1.

Compressible packing shall be bitumen impregnated fibre board or other suitable packing.

20.3 Construction

Cast-in-place concrete kerb, channel, and kerb and channel, including kerb crossings, shall be provided in the locations specified in the drawings and in accordance with Standard Drawing 1033.

Where insitu material on or against which kerbs or channels are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*. The ground surface shall be moistened just prior to placing concrete.

Manually-placed concrete shall be in accordance with Clause 6.1. Exposed surfaces shall have a steel-trowelled finish.

Where kerb, channel and/or kerb and channel is constructed by an extrusion process, concrete shall comply with the prescription ordering requirements specified in AS 1379, with a maximum aggregate size not exceeding 20 mm and a minimum of 320 kg of cement per cubic metre of concrete. The extrusion machine shall be fitted with a tamper and an automatic control which allows adjustment of the position of the forming mould while the machine is in operation.

The horizontal and vertical alignments of kerb, channel and/or kerb and channel shall be controlled by means of a sensor working to a control line. The finished kerb, channel and/or kerb and channel shall be well compacted and shall have exposed surfaces free from voids and honeycombing.

Expansion joints shall be installed at regular intervals not exceeding 20 m. The joints shall be constructed by installing 6 mm maximum thickness compressible packing in the full cross-section of the kerb, channel and/or kerb and channel. Where relevant, joints shall be located to line up with expansion joints in adjacent structures.

Contraction joints between expansion joints shall be installed at regular intervals not exceeding 5 m. The joints shall be constructed by forming grooves 40 mm deep and not more than 6 mm wide in all exposed surfaces of the kerb, channel and/or kerb and channel. All grooves shall be normal to the top surface and square to the alignments of the kerb, channel and/or kerb and channel.

Concrete shall be cured for a period not less than seven days before any other roadworks operations are carried out adjacent to the kerb, channel or kerb and channel.

20.4 Tolerances

The horizontal and vertical alignments of kerb, channel and/or kerb and channel shall not vary from those specified by more than ± 10 mm.

Notwithstanding the above tolerances, the alignments of the kerb, channel and/or kerb and channel shall have smooth lines. The overall dimensions of the kerb, channel and/or kerb and channel shall nowhere be less than that specified in the drawings.

20.5 Water test

Where the longitudinal grade of channels is less than 1%, a test shall be carried out by discharging water into the channel to check uniformity of flow along the channel. After the flow has ceased, water shall not pond to a depth of more than 5 mm in any section of the channel. The test shall be carried out as soon as possible after the concrete in the channel has hardened. **Witness Point 1**

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FOI 26-292 - Document 21

21 Precast concrete kerb, channel, and kerb and channel blocks

21.1 General

Clause 21 applies to the provision of precast concrete kerb, channel and kerb and channel blocks.

21.2 Material

Precast concrete kerb blocks and channel blocks shall be proprietary products manufactured in accordance with Clause 6.6.

Blocks installed on a horizontal alignment of radius 12 m or less shall be precast to the required radius or shall be straight blocks of dimensions which ensure the jointing requirements specified herein are complied with. Where blocks are precast to a radius, each shall be clearly marked to indicate its radius.

Epoxy adhesion agent shall be a suitable proprietary product.

Cement mortar shall comply with Clause 6.2.

21.3 Construction

Precast concrete kerb, channel and kerb and channel blocks shall be installed in the locations specified by, and in accordance with, the drawings.

Where insitu material on or against which precast blocks are to be installed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Where kerb, channel and kerb and channel blocks are to be fixed to the surface of asphalt or concrete, epoxy adhesion agent shall be employed. The epoxy adhesion agent shall be spread evenly over the whole of the contact surfaces.

Kerb, channel and kerb and channel blocks shall be laid on bedding of minimum thickness 50 mm.

Kerb, channel and kerb and channel blocks shall have watertight cement mortar joints. Cement mortar shall be used within one hour of mixing and shall not be re-tempered.

The joints shall be finished to give smooth surfaces uniform with the surfaces of the blocks. The thickness of joints shall not be less than 7 mm or greater than 13 mm. Exposed surfaces of blocks shall be cleaned of cement mortar coating as soon as possible after the joint mortar has hardened. No roadworks operations shall be carried out adjacent to the kerb, channel and kerb and channel blocks until 48 hours after its construction.

21.4 Tolerances

The tolerances for the finished work shall be as specified in Clause 20.4.

21.5 Water test

A water test as specified in Clause 20.5 shall be carried out on completed channel and kerb and channel blocks. **Witness Point 2**

22 Shoulder dykes

22.1 General

Clause 22 applies to the provision of shoulder dykes.

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22.2 Material requirements

Compressible packing shall be bitumen impregnated fibre board or other equivalent packing.

Concrete shall comply with Clause 6.1.

Cement mortar shall comply with Clause 6.2.

Asphalt shall comply with MRTS30 *Asphalt Pavements*.

22.3 Construction

22.3.1 General

Shoulder dykes shall be constructed in the locations specified by, and in accordance with, the drawings.

22.3.2 Concrete shoulder dykes

Concrete shall comply with Clause 6.1.

The surface on which shoulder dykes are to be constructed shall be moistened just prior to placing concrete. Exposed surfaces shall have a steel-trowelled finish.

Where shoulder dykes are constructed by an extrusion process, the extrusion machine shall be fitted with a tamper and an automatic control which allows adjustment of position of the forming mould while the machine is in operation. The horizontal and vertical alignments of shoulder dykes shall be controlled by means of a sensor working to a control line. The finished shoulder dykes shall be well compacted and shall have exposed surfaces free from voids and honeycombing.

Expansion joints shall be installed at regular intervals not exceeding 20 m. The joints shall be constructed by installing 6 mm maximum thickness compressible packing in the full cross-section of the shoulder dykes.

Contraction joints between expansion joints shall be installed at regular intervals not exceeding 5 m. The joints shall be constructed by forming grooves 40 mm deep and not more than 6 mm wide in all exposed surfaces of the shoulder dykes. All grooves shall be normal to the top surface and square to the alignments of the shoulder dykes.

Concrete shall be cured for a period appropriate to the concrete mix and its application, but not less than seven days before any other roadwork operations are carried out adjacent to the shoulder dykes.

22.4 Asphalt shoulder dykes

Asphalt shoulder dykes shall comply with MRTS30 *Asphalt Pavements*.

22.4.1 Precast concrete block shoulder dykes

Precast concrete block shoulder dykes shall be in accordance with Clause 22.

22.5 Tolerances

The horizontal and vertical alignments of shoulder dykes shall not vary from those specified by more than ± 10 mm. Notwithstanding the above tolerances, the alignments of shoulder dykes shall have smooth lines. The overall dimensions of shoulder dykes shall nowhere be less than those specified.

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23 Concrete gullies

23.1 General

Clause 23 applies to the provision of concrete gullies.

23.2 Material requirements

Concrete shall comply with Clause 6.1.

Cement mortar shall comply with Clause 6.2.

Precast concrete back-units for gullies shall be proprietary products manufactured in accordance with Clause 6.6.

Grates, covers and frames shall be reinforced concrete, mild steel or cast iron as specified in the drawings and/or Standard Drawings and shall comply with Clause 6.4.

Mild steel components shall comply with MRTS78 *Fabrication of Structural Steelwork*. Mild steel components shall be hot-dipped galvanised in accordance with AS/NZS 4680.

Cast iron components shall be fabricated from cast iron, grade T200 and shall comply with AS 1830.

23.3 Construction

Concrete gullies shall be provided in the locations specified by, and in accordance with, the drawings.

Where insitu material on or against which gullies are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete shall be in accordance with Clause 6.1.

Where the sides of excavations are in solid ground, the gully pits may be constructed without the use of backforms and concrete may be placed against the insitu material.

Where shafts are constructed without the use of backforms, the specified wall thickness shall be increased by not less than 25 mm to provide additional cover to reinforcement.

The joints between gullies and culverts shall be made watertight using cement mortar. The mortar shall be used within one hour of mixing and shall not be re-tempered. The joints shall be finished to provide smooth surfaces, uniform with the inner surfaces of the gullies.

Where backforms are used, they shall be removed and backfilling shall be undertaken in accordance with MRTS04 *General Earthworks*.

Concrete back-units and frames shall be joined to gullies using cement mortar. Exposed concrete surfaces shall be cleaned free of any cement mortar.

Grates and frames shall be installed as specified in the drawings and/or Standard Drawings.

Grates on gullies shall not be installed until all the surveying requirements have been met as specified in Clause 59 and notice of such works provided to the Administrator. **Hold Point 5**

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23.4 Tolerances

23.4.1 Horizontal tolerances

The locations of gullies shall not vary from those specified in the drawings by more than ± 100 mm in the direction of the construction centre line and ± 50 mm in the direction at right angles to the construction centre line.

23.4.2 Vertical tolerances

The invert heights of gullies shall not vary from those specified by the drawings by more than ± 50 mm, provided always that the gullies join neatly to existing drainage structures, do not pond water unnecessarily and are at heights compatible with other adjacent structures. The heights of the tops of back-units, grates and frames shall not vary from those described in the drawings by more than ± 10 mm.

24 Insitu concrete access chambers

24.1 General

Clause 24 applies to the provision of access chambers.

24.2 Materials requirements

Concrete shall comply with Clause 6.1.

Cement mortar shall comply with Clause 6.2.

Step irons shall be heavily galvanised mild steel bars. Mild steel bars shall comply with AS/NZS 4671 and the step irons shall be galvanised in accordance with the requirements specified in AS/NZS 4680. The average coating mass shall be not less than 600 g/m².

Covers and frames shall be manufactured from cast iron, grade T200 and shall comply with AS 1830 and Clause 6.4 of this Technical Specification.

Precast components shall be in accordance with Standard Drawings 1307 and 1308.

Precast surrounds shall be proprietary products manufactured in accordance with Clause 6.6.

Epoxy mortar shall be a proprietary product.

24.3 Construction

Cast-in-place concrete access chambers shall be provided in the locations specified in, and in accordance with, the drawings.

Where insitu material on or against which access chambers are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete shall be in accordance with Clause 6.1.

Where the sides of excavations are in solid ground, the access chamber shafts may be constructed without the use of backforms. Where concrete is placed without the use of backforms, the specified wall thicknesses shall be increased by not less than 25 mm to provide additional cover to reinforcement.

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The joints between access chambers and pipes shall be made watertight using cement mortar. The mortar shall be used within one hour of mixing and shall not be re-tempered. The joints shall be finished to provide smooth surfaces, uniform with the inner surfaces of the access chambers.

Concrete benching shall be shaped to the shapes specified by the drawings and/or Standard Drawings and shall have smooth, even surfaces and neat edges. Step irons shall be installed horizontal, vertically in line, and shall project uniformly from shafts.

Where step irons are not cast-in-place, they shall be epoxy mortared into drilled holes. The joints between the step irons and the shafts shall be completely filled so that the step irons are held rigid and the joints are watertight.

Concrete top slabs shall be joined to the shafts using cement mortar or epoxy mortar.

The opening in the top slab shall be closed with temporary covers, after which excavations shall be backfilled. Backfilling shall be undertaken in accordance with MRTS04 *General Earthworks*.

Frames shall be joined to the top slabs using cement mortar or epoxy mortar. Close-fitting units shall employ epoxy mortared joints only.

Cast insitu concrete surrounds shall be constructed on the top slabs to encase the frames. Alternatively, precast concrete surrounds may be installed using epoxy mortared joints.

Covers shall be installed in the frames.

For access chambers in roadworks, temporary covers shall remain in position and installation of the frames and surrounds shall be deferred until pavement construction has reached a stage where the frames and surrounds can be positioned accurately.

Concrete top slabs on insitu concrete access chambers shall not be placed until all the surveying requirements have been met as specified in Clause 59 and notice of such works provided to the Administrator. **Hold Point 6**

24.4 Tolerances

24.4.1 Horizontal tolerances

The locations of access chambers shall not vary from those specified in the drawings by more than ± 100 mm.

24.4.2 Vertical tolerances

The invert heights of access chambers shall not vary from those specified in the drawings by more than ± 50 mm, provided that the access chambers join neatly to existing drainage structures and are at heights compatible with other adjacent structures.

The heights of the tops of frames, surrounds and covers shall not vary from those specified in the drawings by more than ± 10 mm.

25 Precast concrete access chambers

25.1 General

Clause 25 applies to the provision of precast concrete access chambers.

25.2 Material requirements

Concrete shall comply with Clause 6.1.

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Cement mortar shall comply with Clause 6.2.

Precast concrete access chambers shall be proprietary products manufactured in accordance with Clause 6.6.

Step irons shall be as specified in Clause 24.2.

Covers and frames shall be as specified in Clause 24.2.

Epoxy mortar shall be a suitable proprietary product.

25.3 Construction

Precast concrete access chambers shall be installed in the locations and in accordance with the drawings.

Where insitu material on or against which access chambers are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Foundation bedding material shall be placed to provide continuous even support for the access chamber.

Concrete shall be in accordance with Clause 6.1.

Bases shall be of thickness not less than 150 mm and shall extend not less than 150 mm radially beyond the outside of the precast access chamber shafts.

The lowest precast concrete shaft section of the access chamber shall be bedded in the concrete base before the concrete in the base sets.

Openings for culverts shall be cored out of the shaft sections during manufacture or carefully broken out to avoid shaft fractures.

Minimum gaps of 25 mm shall be provided all around between connecting culverts and shaft sections.

Culverts shall be joined to shafts to form watertight joints using cement mortar. Cement mortar shall be used within one hour of mixing and shall not be re-tempered. The joints shall be finished to give smooth surfaces which are uniform with the surfaces of the shafts.

Concrete benching shall be shaped as specified in the drawings and/or Standard Drawings and shall have smooth, even surfaces and neat edges.

Precast concrete shaft sections shall be sealed with an epoxy compound in accordance with the manufacturer's instructions to produce watertight joints. The joints shall be pointed from the inside.

Step irons shall be horizontal, vertically in line and project uniformly from shafts. All holes shall be completely filled with cement mortar or epoxy mortar and all joints neatly pointed so that the step irons are rigid and the joints watertight.

Precast concrete top slabs shall be joined to the shafts using cement mortar or epoxy mortar.

After shafts have been completed and top slabs placed in position and closed with temporary covers, excavations shall be backfilled. Backfilling shall be undertaken in accordance with MRTS04 *General Earthworks*.

Precast concrete adjustment rings shall be joined to top slabs using cement mortar.

Frames shall be joined to adjustment rings using cement mortar or epoxy mortar. Concrete surrounds

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shall be constructed on the adjustment rings to encase the frames. Covers shall be installed in the frames.

Temporary covers may be placed on the top slabs and fixing of the adjustment rings, frames and surrounds deferred until pavement construction has reached a stage when the adjustment rings, frames and surrounds can be finished accurately.

Concrete top slabs on precast concrete access chambers shall not be placed until all the surveying requirements have been met as specified in Clause 59 and notice of such works provided to the Administrator. **Hold Point 7**

25.4 Tolerances

The horizontal and vertical tolerances shall be as specified in Clause 24.4.

26 Precast concrete side inlet gullies

26.1 General

Clause 26 applies to the provision of precast concrete side inlet gullies.

26.2 Material requirements

Concrete shall comply with Clause 6.1.

Cement mortar shall comply with Clause 6.2.

Precast concrete side inlet gullies shall be proprietary products manufactured in accordance with Clause 6.6.

Precast concrete side inlet gullies shall be in accordance with Standard Drawings 1313, 1321, 1322, 1443 and 1444 as applicable.

Epoxy mortar shall be a suitable proprietary product.

Dowel pins shall be mild steel of minimum thickness 25 mm and hot-dipped galvanised as per AS/NZS 4680.

Grates and frames shall be in accordance with Standard Drawings 1321 and 1322.

26.3 Construction

26.3.1 General

Side inlet gullies shall be provided in the locations specified in the drawings and in accordance with the details shown on Standard Drawings 1321 and 1322.

Where insitu material on or against which gullies are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Foundation bedding material shall be placed to provide continuous even support for the precast gully component.

Concrete shall comply with Clause 6.1.

Concrete benching shall be provided to gullies to the shapes specified in the Standard Drawings and shall have smooth, even surfaces and neat edges.

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Culverts shall be joined to shafts/pits to form watertight joints using cement mortar. Cement mortar shall be used within one hour of mixing and shall not be re-tempered. The joints shall be finished to given smooth surfaces which are uniform with the surfaces of the shafts.

A precast concrete gully chamber and converter slab (if required) shall be joined to the shafts/pits using cement mortar or epoxy mortar.

After shafts or pits have been completed and a chamber placed in position and closed with temporary covers, excavations shall be backfilled. Backfilling shall be undertaken in accordance MRTS04 *General Earthworks*.

26.3.2 Precast shafts

The lowest precast concrete shaft section of gullies shall be bedded in the concrete base before the concrete in the base sets.

Openings for culverts shall be cored out of the shaft sections during manufacture or carefully broken out to avoid shaft fractures. Minimum gaps of 25 mm shall be provided all around between connecting culverts and shaft sections.

Joints in precast concrete shaft sections shall be sealed from the inside with an epoxy compound in accordance with the manufacturer's instructions to produce watertight joints.

26.4 Tolerances

The horizontal and vertical alignment of the side inlet gully shall not vary from those specified in the drawings by more than ± 10 mm.

Notwithstanding the above tolerances, the alignments of the side inlet gully shall have smooth lines.

The overall dimensions of any component shall be nowhere less than that specified on the applicable drawings or Standard Drawings.

26.5 Water test

A water test on a side inlet gully shall be carried out where the longitudinal grade is less than 1%.

Water shall be discharged into the side inlet gully to check uniformity of flow. After the flow has ceased, water shall not pond to a depth of more than 5 mm in any section of the channel.

The test shall be carried out as soon as possible after the concrete in the channel has cured.
Witness Point 3

27 Subsoil drains

27.1 General

Clause 27 applies to the provision of subsoil drains.

27.2 Materials requirements

27.2.1 Drainage pipes

Drainage pipes (perforated and unperforated) and associated fittings and jointing procedures shall comply with the following requirements:

a) fibre reinforced concrete pipes – MRTS26 *Manufacture of Fibre Reinforced Concrete Drainage Pipes*

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b) corrugated steel pipes – AS/NZS 2041

c) PVC pipes – AS/NZS 1254, and

d) perforated plastic pipes – AS 2439.1.

27.2.2 Strip filter drains

Notwithstanding requirements to the contrary in this Clause 27.2, strip filter drains shall be a suitable proprietary product, comprising a plastic core of nominal thickness not less than 40 mm, encased by a non-woven geotextile which complies with the provisions of MRTS27 *Geotextiles (Separation and Filtration)*.

The strip filter drain shall permit the passage of high water flows along the drain, and shall have a crush strength not less than 200 kPa.

Textile sleeves shall be either seamless knitted proprietary products or be formed from woven geotextiles. The geotextile material in formed sleeves shall comply with the provisions of MRTS27 *Geotextiles (Separation and Filtration).*

27.2.3 Geotextiles

Geotextiles shall be suitable proprietary products and shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

27.2.4 Trench backfill

Trench backfill material shall be crushed or granular material which conforms to the grading requirements stated in this clause.

For Type B subsoil drains, backfill material shall consist of a single-sized aggregate of 20 mm or 10 mm particle size, with a maximum of 5% passing the 0.150 mm test sieve.

For Type D subsoil drains, backfill material shall consist of coarse sand with 100% of material passing the 4.75 mm test sieve and not greater than 10% passing the 0.300 mm test sieve.

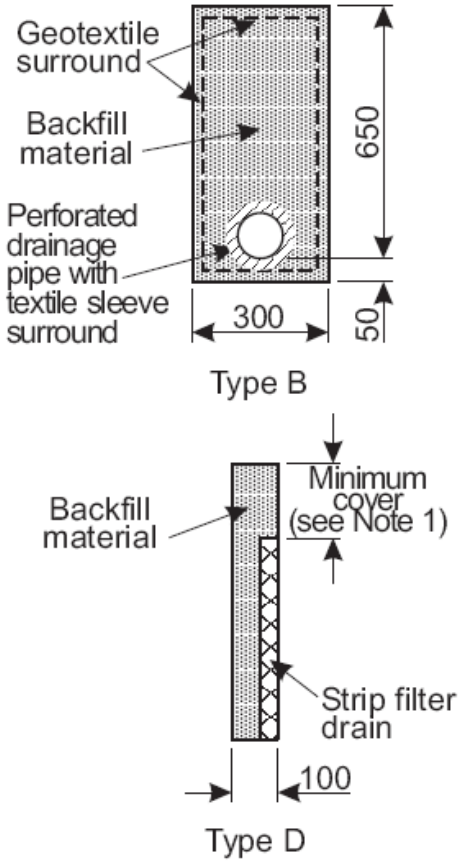
Alternatively, backfill to Type B subsoil drains may consist of no-fines concrete (nominal aggregate size 20 mm) which complies with Clause 26 of MRTS70 *Concrete*.

27.2.5 Concrete

Concrete shall comply with Clause 6.1.

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Figure 27.2.5 – Subsoil drain types



Notes:
1. Minimum cover for various compactors unless approved otherwise:
   Hand-held units: 100
   Units < 15 tonnes: 200
   Units > 15 tonnes: 300
2. All dimensions are in millimetres.

27.2.6 Marker posts

Marker posts shall be tubular steel and comply with the Standard Drawing 1356.

27.3 Storage of materials

Storage and handling of textile sleeves and strip filter drains shall be in accordance with the manufacturer's recommendations. The drains shall not be exposed to heat or direct sunlight to the extent that their physical and/or mechanical properties are diminished.

Materials shall not be stored directly on the ground. Storage arrangements shall protect the materials from damage and soiling.

27.4 Construction

Subsoil drains shall be constructed in the locations and in accordance with the drawings.

Dimensions shall be in accordance with the requirements specified in Clause 27.2.5.

Subsoil drains shall be installed to the grades specified in the drawings. Where the grades are not specified, the bottom of trenches shall be trimmed to provide not less than 0.5% longitudinal fall

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towards outlets for pipe-type drains, and not less than 1% longitudinal fall towards outlets for strip filter-type drains.

Clean-outs shall be located at the heads of all subsoil drains and at subsequent spacings not exceeding 60 m for pipe-type drains and 50 m for strip filter-type drains. Clean-outs shall be constructed in accordance with the details shown on Standard Drawing 1116.

Installation of filter fabric shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

Where an outlet, inlet, or clean-out pipe passes through the filter fabric, a separate piece of fabric of sufficient size shall be wrapped around the pipe and flared against the main fabric to provide an effective seal.

Subsoil drains shall be joined in accordance with the manufacturer's recommendations. Clean-out pipes shall be joined to the subsoil drains using oblique tee connections. Perforated fibre reinforced concrete and corrugated steel pipes shall be laid with the perforations so aligned as to provide the most efficient water entry.

Trench backfill material used where a textile sleeved drain or a strip filter drain is employed shall be damp when placed in the trench. The material shall be carefully placed in layers not exceeding 200 mm loose thickness and shall be tamped. Trench backfill material used where a geotextile trench surround is employed shall be compacted to achieve effective mechanical interlock between particles.

Where subsoil drains are constructed within the subgrade, they shall extend to the underside of the lowest pavement layer unless specified otherwise in the drawings.

Where subsoil drains are constructed outside the subgrade edge point, the trench backfill material shall be placed to within 150 mm of the ground or finished surface and the remaining 150 mm filled with impervious material compacted as for embankment material in accordance with MRTS04 *General Earthworks*.

Concrete outlets, concrete surrounds, galvanised chicken wire cones, pest-proof flaps, cast iron or PVC caps, grouted rock pitching, and marker posts shall be constructed and/or installed in accordance with Standard Drawing 1116.

Concrete shall comply with Clause 6.1.

Grouted rock pitching shall comply with Clause 40.

Marker posts shall be installed as specified in the drawings.

After the drains are constructed, they shall be flushed out. Flushing shall continue until the outlet water is clean and flows consistently. **Witness Point 4**

No construction equipment shall be permitted to stand or travel directly on completed subsoil drains.

28 Sheet or strip filter drains

28.1 General

Clause 28 applies to the provision of sheet and strip filter drains.

28.2 Material requirements

Sheet filter drains shall be a suitable proprietary product, comprising a plastic core of nominal thickness not less than 18 mm, encased by a non-woven geotextile which complies with MRTS27 *Geotextiles (Separation and Filtration)*.

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Strip filter drains shall be a suitable proprietary product, comprising a plastic core of nominal thickness not less than 40 mm, designed to allow the drainage of water along the drain and encased by a non-woven geotextile which complies with MRTS27 *Geotextiles (Separation and Filtration)*.

The plastic core shall permit the passage of high water flows, and shall have a crush strength not less than 200 kPa.

Drainage pipes and fittings and associated joining materials/procedures shall comply with the requirements specified in the following references:

a) fibre reinforced concrete pipes – MRTS26 *Manufacture of Fibre Reinforced Concrete Drainage Pipes*

b) corrugated steel pipes – AS/NZS 2041

c) PVC pipes – AS/NZS 1254, and

d) perforated plastic pipes – AS 2439.1.

Concrete shall be grade N20/20 in accordance with Clause 6.1.

Marker posts shall be tubular steel and comply with the Standard Drawings.

28.3 Storage and handling of materials

Storage and handling of filter drain materials shall be in accordance with the manufacturer's recommendations. Materials shall not be exposed to heat or direct sunlight to the extent that their physical and/or mechanical properties are diminished.

Materials shall not be stored directly on the ground. The storage arrangements shall protect the materials from damage or soiling.

28.4 Construction

Sheet and/or strip filter drains shall be constructed in the locations and in accordance with the drawings.

Prefabricated sheet and/or strip filter drains and associated pipework shall be installed to the shapes and other requirements specified in the drawings, and fixed in position in accordance with the manufacturer's recommendations.

Sheet and/or strip filter drains shall be installed just ahead of other construction work which follows.

Any tearing or puncturing of the drain material shall be repaired.

Where sheet filter drains are used against structures employing weepholes, the core of the drain shall have cutouts of a size and spacing recommended by the manufacturer. The geotextile shall be left intact over these core cutouts.

Collector pipes shall be constructed to the shapes specified in the drawings and jointed in accordance with the manufacturer's recommendations.

Concrete ends to drainage outlets shall be in accordance with Clause 6.1.

Filling around collection pipes shall be general backfill material in accordance with Clause 20 of MRTS04 *General Earthworks*. Fill material shall be compacted to a relative compaction not less than 97%.

Marker posts shall be installed in accordance with the drawings.

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Concrete outlets, concrete surrounds, galvanised chicken-wire cones and pest-proof flaps shall be provided in accordance with Standard Drawing 1116.

29 Vertical drains

29.1 General

Clause 29 applies to the provision of vertical wick filter and sand drains.

29.2 Material requirements

Vertical wick filter drains shall be in accordance with the drawings. Where plastic cores are specified, they shall be 100 mm wide and comprise a regular pattern, encased by a non-woven geotextile complying with MRTS27 *Geotextiles (Separation and Filtration)*. The drains shall have a discharge capacity (flow per unit hydraulic gradient) not less than 150 m^3/year.

Sand drains shall be natural sand, manufactured sand or a mixture thereof and shall conform to the grading requirements shown in Table 29.2.

Table 29.2 – Sand drains – Grading

Test sieve size (mm)	Percent passing by mass
9.5	100
4.75	90–100
2.36	70–100
1.18	50–100
0.6	20–70
0.3	0–40
0.15	0–20
0.075	0–5

29.3 Construction

29.3.1 General

Vertical drains shall be constructed in the locations and in accordance with the drawings.

The proposed sequence for construction of the vertical drains shall be submitted to the Administrator for a direction as to its suitability at least 14 days before commencement of the work. **Milestone**

Vertical drains shall be straight, shall provide continuous drainage over the installed lengths, and shall be constructed in a manner which does not disturb the surrounding ground surface.

29.3.2 Special requirements for wick drains

To minimise disturbance of the subsoil, the cross-sectional area of the mandrel shall be as close to that of the drain as possible. As a guide, it is typical for the maximum cross-sectional area to be 65 cm^2. The mandrel shall also be sufficiently stiff to prevent wobble or deflection during installation.

The mandrel shall incorporate an anchor plate or similar arrangement at the bottom, the dimensions of which shall conform as closely as possible to the dimensions of the mandrel so as to minimise soil disturbance.

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Installation techniques requiring driving shall not be used. Jetting techniques shall require the prior written approval of the Administrator. In no circumstances shall alternate raising or lowering of the mandrel during advancement be used. Raising of the mandrel shall be carried out only after completion of installation of a drain.

The rate of mandrel advance shall be controlled to avoid significant bending or deflection from the vertical. Penetration shall be uninterrupted and typical rates are approximately 0.15 m/sec to 0.60 m/sec. Drains shall be anchored and finished in accordance with the manufacturer's recommendations.

Splices in drains shall be made in a manner recommended by the manufacturer. Nevertheless, the jacket and core shall be overlapped a minimum of 150 mm at any splice.

Each installed drain shall not have more than one splice.

Wick drains shall be installed to the toe levels specified in the drawings. 300 mm of wick drain shall be embedded in the drainage blanket, with not less than 50 mm of material surrounding the wick drain.

29.3.3 Special requirements for sand drains

Sand drains may be constructed using displacement or replacement processes and shall be continuous for their full length.

Compaction of sand by vibration, tamping or other methods shall not be carried out.

After construction, the level of sand in the drains shall be monitored. Should the sand drop, the drains shall be topped up with additional sand.

29.4 Tolerances

The locations of drains shall not vary from those specified in the drawings by more than 200 mm.

The departure from verticality of any drain shall not exceed 1 horizontal to 50 vertical. A suitable means of assessing the verticality of the drain installation equipment shall be provided so that verticality may be checked at any time.

The diameter of constructed sand drains shall not vary from those specified by more than + 50 mm or - 20 mm.

30 Stone columns

30.1 General

Clause 30 applies to the provision of stone columns.

30.2 Construction procedure

The construction procedure shall comply with the details shown in the drawings.

The Contractor shall submit to the Administrator the procedure for constructing stone columns no less than 28 days before construction of the stone columns is to commence **Milestone**

The procedure shall include:

a) details of all materials to be used, including embankment fill in the area immediately above the stone columns, and

b) details of the method of construction of the stone columns and the equipment to be used.

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Construction of stone columns shall not commence until the Administrator has deemed the construction procedure suitable to use **Hold Point 8**

30.3 Granular working platform

30.3.1 Materials

30.3.1.1 Granular material

The material for construction of granular working platforms shall be selected fill comprising stone aggregate consisting of sound crushed rock, crushed gravel or uncrushed gravel which is free from dust, clay, vegetable matter and other deleterious materials. It shall be at least a Type 4.5 unbound pavement material as defined in MRTS05 *Unbound Pavements*, with a maximum stone size of 50 mm. Additional properties may apply if stated in the drawings.

30.3.1.2 Geotextile

The geotextile fabric shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

30.3.1.3 Reinforcement geosynthetic material

Any reinforcement geosynthetic material shall comply with the drawings.

30.3.2 Construction

Where required by the drawings, a granular working platform shall be constructed prior to commencement of construction of the stone columns.

The surface of the entire area on which the granular platform is to be constructed shall be cleared and all objects shall be removed and disposed of.

The geotextile fabric shall be placed over the prepared area in accordance with the provisions of MRTS27 *Geotextiles (Separation and Filtration)*.

Where required by the drawings, a reinforcement geosynthetic material shall also be placed along with the geotextile fabric.

The moisture content of the granular material shall be not less than 85% of optimum moisture content (Standard compaction) and not more than 110% of optimum moisture content (Standard compaction) prior to delivery to the working platform area.

The granular material shall be dumped onto the geotextile in a manner which prevents damage to the geotextile fabric.

The granular material shall be compacted sufficiently to enable movement of construction equipment on its surface. The material shall be trimmed to the depth and profile specified in the drawings.

30.4 Stone columns

30.4.1 Materials

Stone columns shall be constructed from stone or crushed rock which has particle size distribution (Test Method AS 1141.11.1) in accordance with the grading requirements defined in Table 30.4.1.

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Table 30.4.1 – Grading requirements

Test sieve size (mm)	Percent passing by mass
75	100
37.5	65–80
19	5–10
9.5	0–5

The stone or rock particles shall have a minimum particle density on a dry basis of 2.70 (Test Method AS 1141.6.1) and a maximum Los Angeles value of 35 (Test Method AS 1141.23).

30.4.2 Construction

During construction of the stone columns, the movement of construction equipment over the working platform shall be controlled in a manner which prevents undue distortion or damage to the geotextile fabric.

Columns shall be installed to the levels below existing ground level specified in the drawings.

All stone columns shall be vertical, straight and fully continuous over the full installed length. Columns shall conform to the diameter specified in the drawings.

Compaction to achieve a sound dense column of uniform diameter shall be achieved in a controlled manner. The material in the columns shall be compacted in a controlled manner to achieve a minimum density index of 70% when tested in accordance with Test Methods AS 1289.5.5.1 and AS 1289.5.6.1.

Adequate surface drainage shall be provided to ensure that the Site remains de-watered and safe for construction personnel and equipment. Adjoining areas shall not be contaminated by material displaced during the construction of the stone columns.

Immediately following completion of the stone columns, the surface shall be trimmed, cleaned and repaired as necessary without soil contamination of the stone columns. All mud, contaminated fill or aggregate, or other foreign material which has resulted from the process of construction of the stone columns, or associated activities, shall be removed. The surface shall be trimmed generally in accordance with the profile specified in the drawings. Undulations in the surface of the working platform shall be trimmed.

30.4.3 Tolerances

The position of the centreline of any individual column shall be within 200 mm of the set out position based on the adopted grid pattern specified in the drawings.

30.5 Construction of embankment

30.5.1 Materials

30.5.1.1 Embankment material

The material to be placed in the base layer for construction of the embankment immediately above the stone columns shall comply with Clause 15 of MRTS04 *General Earthworks* and any additional requirements specified in the drawings.

30.5.1.2 Geotextile

The geotextile fabric shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

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30.5.2 Construction

Where specified in the drawings, a geotextile fabric shall be placed over the entire area on which the embankment fill is to be constructed in accordance with the provisions of MRTS27 *Geotextiles (Separation and Filtration)*.

The embankment fill material shall be placed over the working platform in layers not exceeding 150 mm uncompacted depth. Greater depths of fill may be used in the upper layers once stability of the fill has been established. Embankment fill shall be placed and compacted in accordance with Clause 15 of MRTS04 *General Earthworks* and any additional requirements specified in the drawings.

31 Concrete paved inverts in corrugated culverts

31.1 General

Clause 31 applies to the provision of concrete paved inverts in corrugated culverts.

31.2 Material requirements

Concrete shall comply with the requirements of Clause 6.1. Concrete shall be Class 32MPa/9.5.

Epoxy-based bonding agent shall be an approved proprietary product.

31.3 Construction

Concrete paved inverts shall be constructed in the locations and in accordance with the drawings.

The invert of corrugated steel and aluminium pipe culverts shall be lined with concrete with the following requirements:

a) the minimum depth of concrete above the corrugations shall be 50 mm, and

b) the minimum height of lining above invert shall be D/6 – where ‘D’ = Diameter of culvert.

The construction of paved inverts shall be delayed until all backfilling operations around and adjacent to the culverts concerned have been completed. Where practicable, the construction of paved inverts shall be delayed to the latest possible time within the construction period.

The surfaces on which paved inverts are to be constructed shall be dry and free of foreign matter.

Immediately prior to paving, the surfaces shall be coated with an epoxy-based bonding agent for the full width of the paved area, plus an additional 100 mm width each side.

Steel reinforcement shall be fastened to the culvert components in accordance with the culvert component manufacturer’s drawings and recommendations.

Concrete work shall be in accordance with the requirements specified in Clause 6.1. The concrete shall be thoroughly worked into the corrugations, screeded off and trowelled to provide a uniform surface free of depressions.

The edges of the concrete paving shall be sloped such that water shall not pond against the steel culvert.

The surface of the trowelled concrete shall be scored longitudinally to a depth of 10 mm at 500 mm centres.

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32 Linings in drains and channels

32.1 General

Clause 32 applies to the provision of linings in drains and channels.

32.2 Material requirements

Concrete shall comply with Clause 6.1.

Compressible packing shall be bitumen impregnated fibre board or other equivalent packing.

Materials for grouted rock pitching shall comply with Clause 40.

Materials for steel-wire mattresses shall comply with Clause 43.

32.3 Construction

Concrete linings in drains and channels shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which linings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete linings may be constructed without foundation bedding.

Concrete shall comply with Clause 6.1.

The surface of concrete linings shall be finished with a wood float and cured.

Expansion joints shall be constructed at regular intervals not exceeding 20 m by installing 6 mm maximum thickness compressible packing for the full cross-section of the berm drain.

Grouted rock pitching shall comply with Clause 40.

Steel-wire mattresses shall comply with Clause 43.

33 Berm drains

33.1 General

Clause 33 applies to the provision of berm drains.

33.2 Materials

Concrete shall comply with Clause 6.1 and shall be N25/20.

33.3 Construction

Berm drains shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which linings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Berm drains shall be a nominal 100 mm deep when constructed.

Unreinforced concrete linings shall comply with Clause 32. Concrete lining shall be 100 mm thick.

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34 Concrete margins and batters

34.1 General

Clause 34 applies to the provision of concrete margins and batters.

34.2 Material requirements

Concrete shall comply with Clause 6.1.

Steel sleeves shall comply with the drawings.

34.3 Construction

Concrete margins and batters shall be constructed in the locations and in accordance with the drawings.

Where the insitu material on or against which margins, batters and aprons are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete margins and batters may be constructed without foundation bedding.

Concrete shall comply with Clause 6.1.

Construction of concrete margins and batters shall include the construction of integral cut-off walls, the installation of steel sleeves, and the provision of weepholes.

35 Concrete rail track crossings and machinery crossings

35.1 General

Clause 35 applies to the provision of concrete rail track and machinery crossings.

35.2 Material requirements

Concrete shall comply with Clause 6.1.

Compressible packing shall be bitumen-impregnated fibre board or similar.

Joint sealing compound shall be bituminous putty or similar.

35.3 Construction

Concrete rail track and machinery crossings shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which slabs are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with the requirements of MRTS04 *General Earthworks*.

Crossings shall be laid on foundation bedding.

Concrete work shall comply with Clause 6.1.

Saw-cut grooves shall be provided at the locations shown on the drawings.

Compressible packing shall be placed in accordance with the details shown on the drawings.

Construction joints and saw-cut grooves shall be sealed with joint sealing compound in accordance with the details shown on the drawings and the manufacturer's recommendations.

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35.4 Tolerances

The horizontal dimensions measured at right angles from the construction centreline to edges of crossings shall not vary from those shown on the drawings by more than ± 25 mm.

Except where the provision of a smooth connection to existing structures dictates otherwise, the heights of the finished surfaces of crossings shall not vary from those shown on the drawings by more than ± 10 mm. In addition:

a) the gap under a straight-edge 3.0 m long placed anywhere on the finished surfaces of the crossing shall not exceed 5 mm due allowance being made for the design shape, and

b) the crossfalls of the finished surfaces shall not depart from those shown on the drawings by more than 0.5% absolute.

36 Hand-placed concrete paving

36.1 General

Clause 36 applies to the provision of hand-placed concrete paving.

36.2 Material requirements

Concrete shall comply with Clause 6.1.

Concrete to be pattern finished shall have coarse aggregate of size not greater than 20 mm.

Colouring agent shall be a colour curing compound from a suitable manufacturer.

Compressible packing shall be bitumen impregnated fibre board or other suitable packing.

36.3 Construction

Hand-placed concrete paving shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which paving is to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete paving shall not be constructed before ducting, pits, stormwater drainage, underground services and any bases for traffic signals, traffic signs, and street light poles within the area to be concreted have been installed.

Concrete shall comply with Clause 6.1.

Expansion joints shall be installed at regular intervals not exceeding 20 m longitudinally and transversely by installing 6 mm maximum thickness compressible packing in the full cross-section of the concrete paving. The joints shall be located to line up with expansion joints in adjacent structures where present.

Contraction joints shall be installed at regular intervals not exceeding 5 m longitudinally and also 5 m transversely between expansion joints by forming grooves 40 mm deep and not more than 6 mm wide in all exposed surfaces of the concrete paving. All grooves shall be normal to the top surface.

Concrete shall be cured for a period not less than seven days before any other operations are carried out adjacent to the work.

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36.4 Colouring and finishing

Where specified, concrete paving shall be coloured. The surfaces of the concrete paving shall be uniform in colour.

Where specified, the surfaces of concrete paving shall be pattern finished. Areas not to be pattern finished shall be lightly broomed to produce uniform non-slip surfaces.

36.5 Vertical tolerances

The finished surfaces shall join neatly to edges of adjacent work.

Elsewhere the heights of the finished surface of concrete paving shall not vary from those specified in the drawings by more than ± 10 mm and, in addition, the gap under a straight-edge 3.0 m long placed anywhere on the finished surface of the concrete paving shall not exceed 5 mm due allowance being made for the design shape.

37 Sprayed concrete paving

37.1 General

Clause 37 applies to the provision of sprayed concrete paving.

37.2 Material requirements

Concrete shall comply with Clause 6.1 and shall be Class N25/10.

Compressible packing shall be bitumen impregnated fibre board or other suitable packing.

37.3 Construction

Sprayed concrete paving shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which paving is to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Concrete paving shall not be constructed before ducting, pits, stormwater drainage, underground services and bases for traffic signals, traffic signs, and street light poles within the area to be concreted have been installed.

Concrete shall be in accordance with Clause 6.1.

Concrete paving shall be sprayed directly onto shaped and trimmed surfaces. The shaped and trimmed surfaces shall be dampened with water just prior to spraying the concrete paving.

The top surface shall be screeded and finished in accordance with Clause 20 of MRTS70 *Concrete*.

Expansion joints shall be installed at regular intervals not exceeding 20 m longitudinally and transversely by installing 6 mm maximum thickness compressible packing in the full cross-section of the concrete paving. The joints shall be located to line up with expansion joints in adjacent structures where present.

Contraction joints shall be installed at regular intervals not exceeding 5 m longitudinally and also 5 m transversely between expansion joints by forming grooves 40 mm deep and not more than 6 mm wide in all exposed surfaces of the concrete paving. All grooves shall be normal to the top surface.

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Concrete shall be cured for a period appropriate to the concrete mix and its application before any other operations are carried out adjacent to the work.

37.4 Vertical tolerance

The finished surfaces shall join neatly to edges of adjacent work.

Elsewhere, the heights of the finished surfaces of concrete paving shall not vary from those specified by more than ± 10 mm and, in addition, the gap under a straight-edge 3.0 m long placed anywhere on the finished surface of the concrete paving shall not exceed 5 mm due allowance being made for the design shape.

38 Block paving

38.1 General

Clause 38 applies to the provision of block paving.

38.2 Material requirements

Paving blocks shall be as shown in the drawings. Colour, shape and strength shall be as specified in the drawings. Blocks shall be sound and free from cracks or other defects which would interfere with proper placing or impair the strength or permanence of construction or their appearance.

Bedding material shall be natural sand, free from soluble salts or other contaminants which would have a detrimental effect on the performance or appearance of the paving blocks. The material shall conform to the grading requirements shown in Table 38.2.

Concrete shall comply with Clause 6.1, except that the maximum aggregate size shall be 10 mm. Cement mortar shall comply with Clause 6.2.

Colouring agent shall be a colour curing compound.

Joint filling sand shall be a clean, sharp sand which is free of deleterious soluble salts or other contaminants likely to cause efflorescence or staining. The grading of the sand shall be such that 100% shall pass a 1.18 mm test sieve.

Table 38.2 – Block paving – bedding material grading

Test sieve size (mm)	Percent passing by mass
9.5	100
4.75	95–100
2.36	80–100
1.18	50–85
0.6	25–60
0.3	10–30
0.15	5–15
0.075	0–10

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38.3 Construction

38.3.1 Block laying

Block paving shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which paving is to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Block paving shall not be constructed before ducting, pits, stormwater drainage, underground services and any bases for traffic signals, traffic signs, and street light poles within the area to be paved have been installed.

Bedding material shall be spread loosely in a uniform layer and screeded to the shapes and heights which shall provide a depth of bedding not less than 25 mm or not more than 40 mm after the blocks have been laid and compacted.

Screeded sand shall be protected against pre-compaction. Any screeded sand which is pre-compacted prior to laying paving blocks shall be removed and replaced to shape.

Paving blocks shall be laid to the bond patterns specified in the drawings. All edge blocks shall abut an edge restraint. All full blocks in each row shall be laid first. Where practicable, closure blocks shall be cut and fitted subsequently in the gaps between blocks and edge restraints. Where this is not practicable, gaps shall be filled with concrete or cement mortar.

Where there is insufficient depth to pave over structures, concrete infills shall be placed over such structures in lieu of paving blocks. Moulds shall be used to form the required patterns in the surfaces of the infills.

Where coloured paving blocks are used, concrete infill and cement mortar shall be coloured to match the blocks.

Any pedestrian or barrow traffic which is required to move over the block paving prior to compaction of the paving shall use overlaying boards. No other traffic shall be allowed on the paving prior to its compaction.

38.3.2 Compaction

Compaction of paving blocks shall be carried out using vibrating plate compactors. The plate area of any compactor shall cover a minimum of 12 paving blocks. The frequency of vibration and the amplitude of the vibrating plate compactors shall be appropriate to the blocks being compacted.

Block paving shall be vibrated until no further lowering of the surface is evident.

Compaction shall proceed as closely as possible following placing of blocks. Compaction shall not be attempted within 1 m of the advancing edge during the placing of blocks.

Compaction shall continue until adjoining blocks are flush and to the required level.

Any blocks that are damaged shall be removed and replaced.

38.3.3 Joint filling

As soon as practicable after compaction and prior to termination of work on that day or use by traffic, sand for joint filling shall be spread over the block paving and broomed to fill the joints.

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The surfaces of the block paving shall receive at least one further coverage (pass) of a vibrating plate compactor to achieve compaction of the joint filling sand.

Excess sand shall be removed from the surfaces by brooming.

38.4 Vertical tolerance

The finished surfaces shall join neatly to edge restraints.

Elsewhere the heights of the finished surfaces of block paving shall not vary from those specified in the drawings by more than ± 10 mm and, in addition, the gap under a straight-edge 3.0 m long placed anywhere on the finished surface of the block paving shall not exceed 5 mm due allowance being made for the design shape.

39 Rock masonry

39.1 General

Clause 39 applies to the provision of rock masonry. Rock masonry may also be referred to as 'rubble masonry'.

39.2 Material requirements

Rock for rock masonry shall be clean, hard, durable and free from seams or other imperfections. No weathered rock shall be used. Stones shall not be rounded on more than two sides or ends. No stones less than 0.003 m^3 in volume shall be used except in the case of spalls for wedges. Stones greater than 0.3 m^3 in volume shall not be incorporated in walls. The tightly-packed rock behind the piles, as shown in the Standard Drawing 2238, shall be 50 to 150 mm diameter.

Geotextile shall be the grade specified in the drawings and in accordance with MRTS27 *Geotextiles (Separation and Filtration)*.

Cement mortar for bedding shall consist of one part by volume of Type GP cement to three parts by volume of clean fine sand with only sufficient water added to achieve a plastic-like texture. Hydrated lime may be incorporated into the cement mortar to the extent of one part hydrated lime to 10 parts of Type GP cement (loose volume). Hydrated lime shall be an addition to, and not a replacement for, the cement. The mortar shall be able to retain its shape and not flow like a liquid. Materials shall comply with MRTS70 *Concrete*.

39.3 Construction

Rock masonry shall be constructed in the locations and in accordance with the drawings.

Rock masonry may be constructed without a foundation bedding. Rock shall be placed in cement mortar beds in horizontal layers. All rock shall be cleaned and thoroughly wetted before placing. Rocks shall be laid on mortar in horizontal beds with all exposed faces finished fair. All voids shall be filled with cement mortar and/or smaller size rock.

Cement mortar shall be used within one hour of mixing and shall not be re-tempered.

The exposed rock surface shall be cleaned free of any coating of cement mortar.

As an alternative to rock masonry walls, unreinforced concrete or plum concrete walls of N20/20 may be substituted. In this case, concrete shall comply with Clause 6.1.

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40 Grouted rock pitching

40.1 General

Clause 40 applies to the provision of grouted rock pitching.

40.2 Material requirements

Rock (other than smaller-size rock required for wedging) shall be of size not less than 150 mm and not greater than 250 mm (minimum dimension). The rock shall be sound rock which does not disintegrate in water and which has been selected to match the existing rock pitching where appropriate.

Cement mortar for bedding shall consist of one part by volume of Type GP cement to three parts by volume of clean fine sand with only sufficient water added to achieve a plastic-like texture. Hydrated lime may be incorporated into the cement mortar to the extent of one part hydrated lime to 10 parts of Type GP cement (loose volume). Hydrated lime shall be an addition to, and not a replacement for, the cement. The mortar shall be able to retain its shape and not flow like a liquid. Materials shall comply with MRS70.

Sand bedding shall comply with Clause 19 of MRTS04 *General Earthworks*.

40.3 Construction

Grouted rock pitching shall be constructed in the locations and in accordance with the drawings.

Where insitu material on or against which the grouted rock pitching is to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

The first row of rocks shall be placed on a sand bedding of minimum thickness 50 mm.

Rocks shall be placed so as to form irregular joints. All rocks shall be interlocked and wedged with smaller-size rock, as necessary, so that no single rock may be easily dislodged and no large voids remain between rocks. All rock pitched faces shall be stable prior to grouting with mortar.

Where rock pitching is constructed for batter protection, the toe rocks shall be of size not less than 250 mm.

The voids between rocks at the exposed surface shall be filled with cement mortar. The mortar shall be used within one hour of mixing and shall not be re-tempered.

Exposed surfaces shall have a relatively smooth, even, neat appearance. Where rock pitching is to be trafficable, care shall be taken to provide a smooth running surface.

Rock surfaces shall be cleaned free of any coating of cement mortar exposing the faces of the rocks.

41 Rock protection

41.1 General

Clause 41 applies to the provision of rock protection.

41.2 Material requirements

Rock employed for protection shall be as specified in the drawings or if not shown, rock used shall be of size not less than 150 mm and not greater than 500 mm. Rock shall be well graded with not less than 50% larger than a size twice the minimum size specified.

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Rock shall be clean, hard, dense and durable igneous or Metamorphic rocks. In addition, it shall be resistant to weathering, free from overburden, spoil, shale and organic matter. Rock that is laminated, fractured, porous, with discontinuities or otherwise physically weak, shall not be used. Sedimentary rocks shall not be used.

The breadth or thickness of a single stone shall be not less than one-third its length.

41.3 Construction

Rock protection shall be constructed in the locations and in accordance with the drawings.

Rock protection shall have a uniform appearance overall, and shall not have noticeable overall irregularities in horizontal and vertical alignments.

Rock protection shall be placed in a manner which ensures that the larger rocks are uniformly distributed throughout the protection work, and that the smaller rocks effectively fill the spaces between the large rocks without leaving any large voids. The layers of placed rock shall be of even thickness and of even grading.

The placing operations shall minimise the chances of rock running loose and damaging adjacent areas. Rock deposited in areas outside the rock protection zone shall be recovered.

Where rock protection of embankments is specified, placement of the protection shall occur progressively along with the construction of the embankment such that at no time shall the constructed level of the rock protection be more than 1 m vertical height below the constructed level of the embankment.

42 Steel-wire gabion protection

42.1 General

Clause 42 applies to the provision of steel-wire gabion protection.

42.2 Material requirements

Steel-wire gabions shall be manufactured from heavily galvanised, hexagonally woven, steel-wire mesh having a wire diameter not less than 2.7 mm and a mesh opening of 80 mm across the flats of the hexagon. Selvedge wire shall have a diameter not less than 3.4 mm and binding wire shall have a diameter not less than 2.2 mm. All wire shall comply with AS 2338 and AS 2423. Galvanising shall be in accordance with the requirements specified in AS/NZS 4680. Where specified, the wire shall have a black PVC or other durable plastic coating of nominal thickness 0.55 mm, minimum thickness 0.4 mm.

Rock shall be sound igneous or metamorphic rock that shall not disintegrate in water or when exposed to the weather. Rock used for filling shall be of size not less than 120 mm and not greater than 200 mm. The rock shall be uniformly graded, and not less than 80% by number shall be of size greater than 150 mm. Rocks shall, where possible, be cubical, but in no case shall their least dimensions be less than half their greatest dimension.

42.3 Basic gabion requirements

Gabions shall have an appropriate mesh size to retain the rock filling. Gabion panels and diaphragms shall be selvedged. The selvedge wire shall be woven integrally with the mesh or fastened to the mesh either by binding the edges of the mesh about the selvedge wire or by stainless steel clips, all in accordance with the manufacturer's recommendations.

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Sufficient binding wire shall be available for binding and tying operations.

42.4 Construction

Steel-wire gabion protection shall be constructed in the locations and in accordance with the drawings.

The areas on which gabions are to be positioned shall be trimmed to the shapes specified within a tolerance of ± 50 mm. Trimmed surfaces shall be free of roots, stumps, brush, rocks and like protrusions.

Gabion protection shall be constructed to the shapes and other requirements specified herein.

42.4.1 Assembling, positioning and joining gabions

Gabions shall be assembled in accordance with the manufacturer's recommendations. Assembled gabions shall be positioned empty in the locations required for the finished work.

The first row of gabions shall be securely positioned and filled before gabions in other rows are positioned. Other gabions may then be positioned, joined and filled as the work requires. Joining shall be affected by binding or clipping the gabions together in accordance with the manufacturer's recommendations.

42.4.2 Forming shapes

Where necessary, the mesh panels shall be cut, folded and tied together to form mitre joints, angles, curves, slopes and other non-rectangular shapes. Surplus mesh shall be completely cut out or be folded back on and neatly tied to an adjacent gabion face. Cut or folded edges shall be selvedged. Adjacent cut or folded edges shall be bound or clipped together in accordance with the manufacturer's recommendations.

42.4.3 Rock filling

The gabion shall have a dense, evenly distributed filling with minimum voids, and shall not be significantly distorted in shape. Where necessary, the outer and inner panels of gabions shall be tied together during the placing operation to minimise distortion, especially when diaphragms are not employed. Care shall be taken to avoid damaging the gabion mesh and any geotextile placed under the gabions.

42.4.4 Closing gabions

Gabions shall be closed as soon as practicable after filling. All lids shall be securely bound to edges and diaphragms in accordance with the manufacturer's recommendations.

43 Steel-wire mattress protection

43.1 General

Clause 43 applies to the provision of steel-wire mattress protection.

43.2 Material requirements

43.2.1 General

Wire mattresses shall be either proprietary products or non-proprietary products constructed as shown in the drawings.

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43.2.2 Proprietary mattresses

Proprietary mattresses shall be manufactured from heavily galvanised, hexagonally woven, steel-wire mesh having a wire diameter not less than 2 mm and a mesh opening of 60 mm across the flats of the hexagon. Selvedge wire shall have a diameter not less than 2.4 mm and binding wire shall have a diameter not less than 2.0 mm. All wire shall comply with AS 2338 and AS 2423. Galvanising shall be in accordance with AS/NZS 4680. Where specified, the wire shall have a black PVC or other durable plastic coating of nominal thickness 0.55 mm, minimum thickness 0.4 mm.

All panels in proprietary products shall be selvedged. The selvedge wire may be woven integrally with the mesh or fastened to the mesh either by binding the edges of the mesh about the selvedge wire or by using stainless steel clips, all in accordance with the manufacturer's recommendations.

Sufficient binding wire shall be available for binding and tying operations.

Anchor plates shall be fabricated from grade 250 commercial quality steel and galvanised. All plates shall comply with AS 3678 and AS 3679.1. All sharp edges and curves shall be ground smooth prior to galvanising. Galvanising shall be in accordance with AS/NZS 4680. Galvanising shall be carried out after cutting and drilling of the plates.

Anchor bolts securing anchor plates to concrete shall be supplied in accordance with the details specified. Anchor pickets shall be star pickets 1.8 m long.

Mattresses shall have an appropriate mesh size to retain the rock filling.

43.2.3 Non-proprietary mattresses

Non-proprietary products shall be constructed from 1.8 m minimum width rolls of chain wire mesh. Diaphragms are not required in this form of mattress.

43.3 Rock

Rock shall be sound igneous or metamorphic rock that shall not disintegrate in water or when exposed to the weather. Rock used for filling shall be of size not less than 75 mm and not greater than 150 mm. The rock shall be uniformly graded, and not less than 80% by number shall be of a size greater than 100 mm. Rock shall, where possible, be cubical, but in no case shall their least dimension be less than half their greatest dimension.

43.4 Anchor pickets

Anchor pickets shall be 12 mm minimum in diameter and 1.8 m minimum in length. Material grade shall be R250N, hot dip galvanised in accordance with MRTS71 *Reinforcing Steel* and AS/NZS 4680.

43.5 Construction

43.5.1 General

Steel-wire mattress protection shall be constructed in the locations and in accordance with the drawings.

The areas on which mattresses are to be positioned shall be trimmed to the shapes specified within a tolerance of + 50 mm to -50 mm, except where the provision of such tolerances shall not permit the tops of mattresses to join neatly to the inverts of adjacent culverts. Trimmed surfaces shall be free of roots, stumps, brush, rocks and like protrusions. Mattress protection shall be constructed to the shapes and to other requirements specified herein.

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43.5.2 Installing anchors

43.5.2.1 Anchor plates

Where specified, anchor plates and bolts shall be installed to secure mattresses to structures.

43.5.2.2 Anchor pickets

Where specified, anchor pickets shall be employed to secure mattress protection. Such pickets shall be installed prior to placing mattresses, and shall be positioned along the line of the upstream edge of mattresses placed on stream beds, and along the line of the top edge of mattresses placed on sloped areas. Nominal spacing of pickets shall be 1 m.

Where geotextiles are employed under mattresses, neatly cut openings shall be made in the geotextile at the appropriate locations to permit insertion of pickets.

The tops of the installed pickets shall finish level with the tops of the mattresses. Pickets which cannot be driven full depth shall be cut off level with the tops of the mattresses.

43.5.3 Assembling, positioning and joining mattresses

43.5.3.1 Proprietary wire mattresses

Proprietary wire mattresses shall be assembled in accordance with the manufacturer's drawings and recommendations.

Assembled mattresses shall be positioned empty in the locations required for the finished work.

The first row of mattresses shall be securely positioned and filled before mattresses in other rows are placed, joined and filled.

The corners and all diaphragm points along the side of the first row of assembled mattresses shall be tied to the anchor plates and anchor pickets prior to placing rock filling. Mattresses in other rows may be positioned, joined and filled as the work requires. The joining of mattresses shall be in accordance with the manufacturer's recommendations.

43.5.3.2 Non-proprietary wire mattresses

Lengths of chain wire mesh shall be laid out flat on the ground surface and stretched sufficiently to remove any kinks and bends. Each length shall be sufficient to provide for the top, bottom and two ends.

The chain wire mesh shall be positioned length transverse to the direction of flow, leaving a top section of the mesh to be turned over to complete the mattress.

The bottom and ends of each length of chain wire mesh shall be bound to adjacent lengths through each individual mesh in turn.

The outermost lengths of mesh shall be cut and shaped such that part of the bottom may be folded up to form end panels of height equal to the thickness of the mattress.

Wire ties, not less than 1.6 mm diameter and having sufficient length to secure the top of the mattress, shall be provided at 500 mm intervals in each direction along the bottom of the mattress.

43.5.4 Forming shapes

Where necessary, mattresses shall be neatly cut, folded and tied together to form mitre joints, angles, curves, slopes and other shapes not possible to obtain using rectangular units. Surplus mesh shall be

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completely cut out or folded back on and neatly tied to an adjacent mattress face. Cut or folded edges of adjacent mattresses shall be securely bound or clipped together.

43.5.5 Tensioning of mattresses

Unfilled, positioned mattresses shall be tensioned using a wire strainer or by winching. The stretching apparatus shall be firmly attached to the free end of the assembled mattress. The tensioning process shall in no way distort the mattress shape. Adjacent mattresses shall be securely bound together along the top, bottom and sides while under tension.

43.5.6 Rock filling

Rock filling shall be placed while mattresses are under tension. Rock filling of mattresses shall be carried out entirely by mechanical methods. The method of placing rock in mattresses shall produce a dense, evenly distributed filling with minimum voids and minimum distortion of the mattress shape. Care shall be taken to avoid damaging the mattresses and any geotextile under the mattresses. Tension on the mattresses shall be released only when the mattresses have sufficient rock filling to prevent the mesh from slackening after release.

43.5.7 Closing mattresses

Mattresses shall be closed and lids and top sections tied down as soon as practicable after filling.

Tying of proprietary mattresses shall be in accordance with the manufacturer's recommendations. Tying of non-proprietary mattresses shall be carried out in a suitable manner. The top section of each mattress shall be turned over the rock filling and securely bound to the bottom. Each top section shall be bound to adjacent top sections through each mesh in turn. The free end and sides of the outermost top sections shall similarly be bound to the top and side edges of the end panels.

44 Fabric-encased concrete batter protection

44.1 General

Clause 44 applies to the provision of fabric-encased concrete batter protection.

44.2 Materials

44.2.1 Fabric

Fabric material shall consist of multiple panels of double-layer open selvage fabric jointed in a mat configuration. The two layers shall be heavily ultraviolet stabilised continuous filament nylon tyre cord, of which at least 50% by weight shall be textured.

Fabric shall be filter point mattress and shall meet the minimum requirements for tensile strength and porosity stated in Table 44.2.1.

Table 44.2.1 – Properties of fabric for encased batter protection

Property	Value
Tensile strength – warp and weft	900 N per 25 mm (D5034-09 and D5035-06(2008)e1)
Porosity	3 m³/min (D737-04(2008)e1)
Colour	Pigment added green or brown as approved by the Administrator

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44.2.2 Concrete

Concrete shall comply with MRTS70 *Concrete*. Concrete shall consist of a mixture of fine aggregate, cement and water proportioned to provide a pumpable slurry.

The minimum 28 day compressive strength of concrete shall be 25 MPa.

44.3 Construction

44.3.1 General

Fabric-encased concrete batter protection shall be constructed in the locations and in accordance with the details shown on the drawings.

44.3.2 Placement of mats

Fabric mats shall be positioned as shown on the drawings on batter slopes and in excavations for cut-off walls.

Grouting shall not commence until fabric units have been positioned correctly. **Hold Point 9**

44.3.3 Grouting

Grout shall be introduced into the space between the layers of fabric in such a manner as to provide a uniform average thickness of mat. Sufficient inspections or tests shall be carried out to ensure the requirements of the Technical Specification are being achieved.

The average thickness of the concrete mat shall be not less than that stated in Clause 4 of Annexure MRTS03.1.

The Contractor shall demonstrate that the specified average thickness has been achieved by calculating the volume of grout used and the area of the mat.

45 Bridge abutment protection Type 1 – rock spillthrough

45.1 General

Clause 45 applies to the provision of rock spillthrough protection at bridge abutments.

45.2 Material requirements

Rock employed for protection shall be as specified in the drawings or, if not so shown, rock used shall be of size not less than 150 mm and not greater than 500 mm. Rock shall be well graded with not less than 50% larger than a size twice the minimum size specified.

Rock shall be clean, hard, dense and durable. In addition, it shall be resistant to weathering, free from overburden, spoil, shale and organic matter. Rock that is laminated, fractured, porous, or otherwise physically weak, shall not be used.

The breadth or thickness of a single stone shall be not less than one-third its length.

Rock for the hand-packed face shall be of a size and shape necessary to provide the finish specified in Clause 45.3.

Cement mortar shall consist of one part by volume of Type GP cement to three parts by volume of clean fine sand with only sufficient water added to achieve a plastic-like texture. Hydrated lime may be incorporated into the cement mortar to the extent of one part hydrated lime to 10 parts of Type GP

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cement (loose volume). Hydrated lime shall be an addition to, and not a replacement for, the cement. The mortar shall be able to retain its shape and not flow like a liquid.

45.3 Construction

Rock spillthrough protection shall be constructed in the locations and in accordance with the drawings or, where not specifically detailed, in accordance with the details shown on Standard Drawings 2232 and 2233.

The toe wall shall be constructed to the width and depth shown on the drawings in rock masonry in accordance with Clause 39 except that the rock shall comply with the requirements of Clause 45.2.

Rock spillthrough material shall be placed in a manner which ensures that the larger rocks are uniformly distributed throughout the spillthrough zone, and that the smaller rocks effectively fill the spaces between the large rocks without leaving any large voids. The layers of placed rock shall be of even thickness and of even grading.

The placing operations shall minimise the chances of rock running loose and damaging adjacent areas. Rock deposited in areas outside the rock spillthrough zone shall be recovered.

In addition, the face of rock spillthrough shall be hand-packed with selected smaller rock and grouted with cement mortar to give a relatively smooth and even appearance. Excess mortar shall be removed from the rock faces before it hardens.

46 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough

46.1 General

Clause 46 applies to the provision of reinforced concrete protection at bridge abutment earth spillthrough embankments.

46.2 Material requirements

Concrete shall be N25/20 and shall comply with Clause 6.1.

Welded steel-wire reinforcing fabric shall be as shown in the drawings or, where not shown, shall be F52. It shall be hot-dipped galvanised in accordance with AS/NZS 4680.

Compressible packing shall be 10 mm thick bitumen impregnated fibre board or other suitable packing.

46.3 Construction

Reinforced concrete protection shall be constructed in the locations and in accordance with the drawings or, where not specifically detailed, in accordance with the details shown on Standard Drawings 2234 and 2235.

Embankment faces shall be slightly overfilled during embankment construction and trimmed to the correct profile just before placing the reinforced concrete protection. Cut faces shall be trimmed neatly to the lines specified in the drawings. The trimmed face shall be lightly compacted.

The embankment face shall be true to line such that the deviation of the ground surface from a 3 m straight-edge held in any direction does not exceed 25 mm.

Faces of curved embankments shall be either a smooth curve or formed in a series of straights of approximately equal size. Curved faces of embankment shall conform to the above 25 mm maximum

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deviation when a 3 m straight-edge is placed up the sloping face, and in the horizontal direction shall form a smooth curve.

Where the embankment faces are to be filled to achieve the above specified surface, the fill material shall be either no-fines concrete as specified in Clause 26 of MRTS70 *Concrete* or dry stabilised sand in accordance with Clause 19 of MRTS04 *General Earthworks*. The stabilised sand shall be dampened sufficiently so that it remains in place. Where no-fines concrete is used, extreme care shall be taken to achieve the specified surface profile.

The toe wall shall be constructed to the width and depth specified in the drawings and shall be reinforced with welded steel-wire reinforcing fabric.

The embankment face shall be boxed if necessary. If no boxing is used, screed boards or level pins shall be installed to ensure an accurate surface profile and to maintain the depth on concrete specified in the drawings. Level pins shall be hot-dipped galvanised 12 mm diameter steel reinforcing bar of sufficient length to be accurately located by driving into the embankment face.

Welded steel-wire reinforcing fabric shall be placed with a minimum cover of 75 mm from the embankment face.

Concrete shall be placed and compacted over the embankment face in accordance with MRTS70 *Concrete*.

The surface of the concrete shall be finished with a wooden float to give a uniform appearance. The surface shall be joint trowelled to give a blockwork appearance with joints at approximately 1.5 m centres.

Where a slab is more than 12 m wide on the plane face (not including curved faces at the edges), vertical expansion joints shall be formed at 6 m to 9 m centres. Reinforcement shall not be continuous through these joints.

Where the face of a curved embankment is formed in a series of straights, contraction joints shall be formed at the junction between adjacent straight segments of concrete slab.

Expansion joints shall be formed full depth using compressible packing.

Contraction joints shall be constructed by forming grooves 40 mm deep and not more than 6 mm wide in the surface of the slab.

46.4 Tolerances

The tolerances of the finished surface shall be such that the gap beneath a straight-edge 3.0 m long placed anywhere on the finished surface shall not exceed 25 mm due allowance being made for the design shape, where relevant.

47 Bridge abutment protection Type 4 – rockwork over earth spillthrough

47.1 General

Clause 47 applies to the provision of rockwork protection at bridge abutment earth spillthrough embankments.

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47.2 Material requirements

Rock shall be sound igneous or metamorphic rock that shall not disintegrate in water or when exposed to the weather. Rock shall be free from overburden, spoil, shale and organic matter. Rock that is laminated, fractured, porous, or otherwise physically weak, shall not be used.

Rock shall be of a size not less than 200 mm and the least dimension of any rock shall be not less than half its greatest dimension.

Cement mortar shall consist of one part by volume of Type GP cement to three parts by volume of clean fine sand with only sufficient water added to achieve a plastic-like texture. Hydrated lime may be incorporated into the cement mortar to the extent of one part hydrated lime to 10 parts of Type GP cement (loose volume). Hydrated lime shall be an addition to, and not a replacement for, the cement. The mortar shall be able to retain its shape and not flow like a liquid. Materials shall comply with MRTS70 *Concrete*.

47.3 Construction

Rockwork protection shall be constructed in the locations and in accordance with the drawings or, where not specifically detailed, in accordance with the details shown on Standard Drawings 2236 and 2237.

The toe wall shall be constructed to the width and depth specified in the drawings in rock masonry in accordance with Clause 39, except that the rock shall comply with Clause 47.2.

Rock material shall be placed in a manner which ensures that the larger rocks are uniformly distributed throughout the rockwork layer, and that the smaller rocks effectively fill the spaces between the large rocks without leaving any large voids. The layers of placed rock shall be of even thickness and of even grading.

The placing operations shall minimise the chances of rock running loose and damaging adjacent areas. Rock deposited in areas outside the rock spillthrough zone shall be recovered.

In addition, the face of rock spillthrough shall be hand-packed with selected smaller rock and grouted with cement mortar to give a relatively smooth and even appearance. Excess mortar shall be removed from the rock faces before it hardens.

48 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough

48.1 General

Clause 48 applies to the provision of interlocking blockwork protection at bridge abutment earth spillthrough embankments.

48.2 Material requirements

Blocks shall be interlocking blocks manufactured from concrete with nominal dimensions of either:

a) 610 mm length, 150 mm breadth and 115 mm thickness, or

b) 440 mm x 500 mm module, 100 mm thick.

The concrete strength shall be a minimum of N25 at 28 days. The minimum mass of the interlocking block shall be 170 kg/m².

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Approved products are listed in Clause 5 of Annexure MRTS03.1. Full technical details of proposed alternative products may be submitted to the Administrator for approval at least 14 days prior to commencement of installation **Milestone**

Construction shall not commence until the Administrator has approved the type of interlocking block. **Hold Point 10**

Interlocking blocks shall be as specified in the drawings.

Stabilised sand comply with MRTS04 *General Earthworks*.

Geotextile fabric shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

Slotted UPVC drainage pipe shall comply with AS 2439.1.

48.3 Construction

Interlocking blockwork protection shall be constructed in the locations and in accordance with the drawings.

Embankment faces shall be slightly overfilled during embankment construction and trimmed to the correct profile just before laying the interlocking blockwork protection. Cut faces shall be trimmed neatly to the lines specified in the drawings. The trimmed face shall be lightly compacted.

The embankment face shall be true to line such that the deviation of the ground surface from a three metre straight-edge held in any direction does not exceed 25 mm.

Faces of curved embankments shall be either a smooth curve or formed in a series of straights of approximately equal size. Curved faces of embankment shall conform to the above 25 mm deviation when a three metre straight-edge is placed up the sloping face, and in the horizontal direction shall form a smooth curve.

Where the embankment faces are to be filled to achieve the above specified surface, the fill material shall be either no-fines concrete as specified in Clause 26 of MRTS70 *Concrete* or dry stabilised sand in accordance with Clause 19 of MRTS04 *General Earthworks*. The stabilised sand shall be dampened sufficiently so that it remains in place. Where no-fines concrete is used, extreme care shall be taken to achieve the specified surface profile.

A stabilised sand layer with a minimum thickness of 50 mm shall be placed over the entire surface area to be covered with interlocking blocks and shall comply with MRTS04 *General Earthworks*.

The concrete toe wall and edge strip shall be constructed to the dimensions specified in the drawings. Concrete shall be N32/20 and concrete shall comply with Clause 6.1.

Where the face of a curved embankment is formed in a series of straights, the straight segments shall be separated by concrete mid walls. Concrete end walls shall be constructed to confine the interlocking blockwork. Mid-walls and end walls shall be provided as specified in the drawings.

A slotted UPVC drainage pipe shall be installed as specified in the drawings.

After the slope surface and the concrete base have been constructed, a geotextile filter mat shall be spread over the prepared slope in accordance with the manufacturer's recommendations.

The interlocking blocks shall be placed on the filter mat such that the 610 mm dimension of the block is horizontal. Where necessary, the blocks shall be cut to fit the profiles of the mid-walls, end walls and capping concrete.

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A concrete capping shall be installed above the top row of interlocking blocks.

48.4 Tolerances

The tolerances of the finished surface shall be such that the gap beneath a straight-edge 3.0 m long placed anywhere on the finished surface shall not exceed 25 mm due allowance being made for the design shape, where relevant.

49 Bridge abutment protection Type 7 – Rock-filled gabion protection

49.1 General

Clause 49 applies to the provision of rock-filled gabion protection for bridge abutment spillthrough embankment fill. Unless specified otherwise in drawings, rock filled gabion protection for height up to 6 metres shall be in accordance with Standard Drawing 2241.

49.2 Material requirements

Concrete for mass concrete toe shall be N25/20 and shall comply with Clause 6.1.

Concrete for concrete capping shall be S32/20 and shall comply with Clause 6.1. Welded steel-wire reinforcing fabric shall be SL82 and shall be hot-dipped galvanised in accordance with AS/NZS 4680.

Type B subsoil drainage shall comply with Clause 27. Perforated drainage pipe shall be 100 mm in diameter.

Rock armour protection shall comply with Clause 41.

Rock fill gabion toe, boxes and basket shall comply with Clause 42.

Mattress toe protection shall comply with Clause 43.

Cement stabilised sand shall comply with MRTS04 *General Earthworks*.

Geotextile filter material shall be Filtration Class 3, Strength Class D and shall comply with MRTS27 *Geotextiles (Separation and Filtration)*.

Compressible filler shall comply with MRTS77 *Bridge Deck*.

Medium impact polythene sheet separator (builders film) shall be 200 µm thick.

49.3 Construction requirements

Rock-filled gabion protection (Type 7) shall be constructed at the locations shown and in accordance with the drawings.

Embankment faces shall be slightly overfilled during embankment construction and trimmed to the correct profile before placing the rock-filled gabion protection. The trimmed face shall be levelled and lightly compacted.

Rock-filled gabion protection shall be constructed to the shapes and dimensions shown in the drawings. Gabion boxes of each row of the protection shall be staggered as practical as possible. Each gabion box in the protection shall be adequately laced with adjoining boxes to avoid separation in accordance with Gabion supplier's gabion installation manual.

Gabion toe shall be constructed to the dimensions shown in the drawings. If mass concrete toe is specified in the drawings, where toe is permanently underwater, the contractor shall develop a method statement for construction of mass concrete toe and cement stabilised sand layer and submit to

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Administrator for acceptance at least 14 days before commencement of the protection. **Hold Point 11** Dewatering and cofferdam may be required. Cement-stabilised sand shall be constructed to form a foundation layer for construction of the mattress toe protection to the details shown in the drawings.

Mattress toe protection shall be constructed to the extent and dimensions shown in the drawings and shall comply with Clause 43. The mattress shall extend below the gabion for sufficient anchorage as shown in the drawings.

Type B subsoil drainage shall be constructed to the details shown in the drawings to avoid excessive hydrostatic pressure developed behind the toe. Appropriate grading shall be maintained for subsoil drains and appropriate outlets shall be provided.

Rock armour protection shall be constructed to the extent shown in the drawings. Geotextile layer shall be extended below the rock armour protection where shown in the drawings. Rock armour protection shall be constructed to form a transition from the Gabion or mattress protection to the road embankment or existing ground. This is to prevent undermining of the abutment protection during flood events.

Concrete capping for bearing inspection shall be constructed on the top most gabion box to the details shown in the drawings. Medium impact polythene sheet separator shall be laid on the rock fill of the gabion box prior to concreting and in accordance with the Manufacturer's recommendations. The top rock layers in these boxes shall be packed to the approximate required level to lay the polythene separator.

Compressible filler shall be installed between abutment and the gabion protection to the details shown in the drawings and in accordance with the Manufacturer's recommendations.

50 Shotcreting

50.1 General

Clause 50 applies to the provision of shotcreting.

50.2 Material requirements

50.2.1 Shotcrete

Shotcreting concrete shall be in accordance with MRTS70 *Concrete*. Aggregate size and slump shall be chosen to suit the requirements of the shotcreting pump. Concrete grade shall be in accordance with the drawings. Minimum concrete grade shall be S32.

> Grade of concrete to be specified on the drawings as per the required design life and the exposure classification of the application. Slope protections are generally 50-year design life, therefore S32 concrete is required.
>
> Design life of wall-facing of soil nail retaining walls require 100-year and minimum exposure classification of B2 with minimum concrete grade of S40.

50.2.2 Steel reinforcing

Steel reinforcement shall be in accordance with drawings. Welded steel-wire reinforcing fabric shall be minimum SL82 in accordance with MRTS71 *Reinforcing Steel* and shall be hot-dipped galvanised in accordance with AS/NZS 4680.

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FOI 26-292 - Document 21

50.2.3 Fixing pins

Fixing pins shall be 1.0 m long N12 steel reinforcing bars conforming to the requirements of MRTS71 *Reinforcing Steel* and shall be hot-dipped galvanised in accordance with AS/NZS 4680. Bending operations, where required, shall be carried out prior to hot-dipped galvanising.

50.3 Construction

Shotcrete protection shall be constructed in the locations and in accordance with the details specified in the drawings.

Shotcrete shall be provided by an experienced operating crew. Equipment for shotcreting shall be such as to ensure thorough mixing, delivery, discharge, placing and finishing of shotcrete.

Shotcrete shall be of uniform construction and appearance.

For newly-constructed embankments, faces shall be slightly overfilled during embankment construction and trimmed to the correct profile just before placing the shotcrete protection. The trimmed face shall be lightly compacted. Cut faces shall be trimmed neatly to the lines specified in the drawings.

Faces of curved embankments shall be either a smooth curve or formed in a series of straights of approximately equal size.

Cut-off walls shall be provided on all free edges of the shotcreted slab and shall be constructed with the slab. Cutoff walls shall be 300 mm thick and shall be reinforced with welded steel-wire reinforcing fabric. The base cut-off wall shall be 1000 mm deep and the top and side cut-off walls shall each be 600 mm deep.

Thickness of the shotcrete shall be as specified in the drawings. Minimum shotcrete thickness for slope protections or similar applications in exposure classification B1 shall be 120 mm and 160 mm for shotcreting for wall-facing slab of soil nail walls in exposure classification B2. Thickness shall be increased to meet cover requirements for higher exposure classifications.

> Slope protections of minimum 50-year design life require cover to reinforcement in accordance with AS 3600. For applications in exposure classification B1, cover against the soil to be 60 mm and other areas 40 mm. This needs 120 mm minimum shotcrete thickness. Similarly, shotcreting facing slabs for soil nail retaining walls or similar applications require 100-year design life and minimum exposure classification of B2. Therefore, cover to reinforcement to be in accordance with AS 5100 and cover against the soil side to be 85 mm and on other areas 55 mm. This require minimum thickness of 160 mm.

Contraction joints shall be installed in the direction of the dip of the batter only at a maximum spacing of 4 m or as otherwise specified in the drawings. Contraction joints shall extend for the full depth of the slab and the reinforcing fabric shall be discontinued at the joints.

Weep holes shall be provided as specified in the drawings.

The finished concrete surface shall be of neat appearance with lines generally conforming to the surface levels – i.e., flat surfaces on straight batters and curved surfaces where batters are curved. The top surface shall be screeded and finished in accordance with Clause 20 of MRTS70 *Concrete*. All surfaces shall be finished with a wood float and broom finish.

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All rebound, overspray, dumped and cut-out concrete material shall be cleared and removed from the Site.

Curing of shotcrete shall comply with MRTS70 *Concrete*. However, membrane curing shall not be used to surfaces that shall be covered by an additional layer of shotcrete.

50.4 Tolerances

The tolerances of the finished surface shall be such that the gap beneath a straight-edge 3.0 m long placed anywhere on the finished surface shall not exceed 25 mm due allowance being made for the design shape where relevant.

51 Concrete retaining walls

51.1 General

Clause 51 applies to the provision of concrete retaining walls.

51.2 Material requirements

Concrete shall be as shown on the drawings or, where not so shown, it shall be N32/20 in accordance with Clause 6.1.

Steel reinforcing shall comply with MRTS71 *Reinforcing Steel*.

Inserts shall be in accordance with the details specified.

Compressible packing shall be bitumen impregnated fibre board or other suitable packing.

Joint sealing compound shall be bituminous putty or other suitable joint sealing compound.

51.3 Construction

Concrete retaining walls shall be constructed in the locations and in accordance with the drawings.

Where insitu material on which footings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Footings shall be constructed without foundation bedding.

Concrete shall comply with Clause 6.1, except as specified otherwise in this clause.

Construction of the walls shall include the provision of inserts where these are specified in the drawings.

Expansion joints shall be installed in the locations specified in the drawings using compressible packing. Contraction joints shall be installed in the locations specified in the drawings.

Expansion and contraction joints shall be sealed with joint sealing compound in accordance with the drawings and the manufacturer's recommendations.

Cast-in-place concrete walls shall be cured for a period of not less than 28 days prior to the construction of backfilling against the walls.

Backfilling on the concrete retaining wall footing shall not be placed until all the surveying requirements have been met as specified in Clause 59 and notice of such works provided to the Administrator. **Hold Point 12**

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51.4 Tolerances

The horizontal alignment of cast-in-place concrete walls shall not depart from that specified in the drawings by more than ± 10 mm.

The heights of the tops of the walls shall not depart from those specified in the drawings by more than ± 20 mm, except where the provision of such tolerances shall not permit the top to join neatly to adjacent structures.

52 Concrete masonry retaining walls

52.1 General

Clause 52 applies to the provision of concrete retaining walls.

52.2 Material requirements

Masonry units shall comply with the general requirements specified in AS/NZS 4455.1. The units shall have the following properties:

a) strength classification – Grade 15, and

b) total water absorption – not greater than 210 kg/m³.

Steel reinforcing shall comply with MRTS71 *Reinforcing Steel*.

Concrete shall be N25/20 and in accordance with Clause 6.1.

Concrete infill shall be N25/20 and shall have a maximum slump within the range 100 mm to 150 mm immediately prior to placing.

Cement mortar for bedding shall consist of one part by volume of Type GP cement to three parts by volume of clean fine sand with only sufficient water added to achieve a plastic-like texture. Hydrated lime may be incorporated into the cement mortar to the extent of one part hydrated lime to 10 parts of Type GP cement (loose volume). Hydrated lime shall be an addition to, and not a replacement for, the cement. Materials shall comply with MRTS70 *Concrete*.

Inserts shall be in accordance with the drawings.

Compressible packing shall be bitumen impregnated fibre board or other suitable packing.

Joint sealing compound shall be bituminous putty or other suitable joint sealing compound.

52.3 Construction

Concrete masonry retaining walls shall be constructed in the locations and in accordance with the drawings.

Where insitu material on which footings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Footings may be constructed without foundation bedding.

Concrete in footings shall comply with Clause 6.1. Concrete footings shall be cured for a period not less than two days before any masonry units are placed on them.

Concrete masonry unit retaining walls shall be constructed to the details specified in AS 3700.

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All masonry units shall be laid in stretcher bond using cement mortar and 10 mm joints. Cement mortar for joints shall be used within one hour of mixing and shall not be re-tempered.

Construction of the walls shall include the provision of inserts where these are specified in the drawings.

Expansion joints shall be installed in the locations specified in the drawings using compressible packing. Contraction joints shall be installed in the locations specified in the drawings.

Expansion and contraction joints shall be sealed with joint sealing compound in accordance with the drawings and the manufacturer's recommendations.

The cores of placed masonry units shall be completely filled with a concrete infill, placed and compacted in accordance with Clause 6.1. Prior to commencement of filling, the cores shall be cleaned of any surplus mortar.

Steel reinforcing shall be placed in accordance with the drawings and the recommendations of the manufacturer of the masonry units.

Masonry unit retaining walls shall be capped with a cement mortar capping not less than 25 mm thick. Tops of cappings shall be trowelled to provide smooth, even surfaces with neat edges. Alternatively, the walls may be capped with capping blocks mortared in position.

Exposed wall faces and capping blocks shall be cleaned free of cement mortar and infill concrete.

Concrete masonry unit walls shall be cured for a period of not less than 28 days prior to the construction of backfilling against the walls.

52.4 Tolerances

The horizontal alignment of cast-in-place concrete walls shall not depart from that specified in the drawings by more than ± 10 mm.

The heights of the tops of the walls shall not depart from those specified in the drawings by more than ± 20 mm, except where the provision of such tolerances shall not permit the top to join neatly to adjacent structures.

The thickness of mortar joints shall not vary from that specified by more than ± 3 mm.

53 Crib walls

53.1 General

Clause 53 applies to the provision of crib walls.

53.2 Material requirements

Crib units shall be proprietary products manufactured in accordance with Clause 6.6.

Backfilling material shall be free draining granular material conforming to Clause 19 of MRTS04 *General Earthworks*.

53.3 Construction

Crib walls shall be constructed in the locations and in accordance with the details shown on the drawings.

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Where insitu material on which footings are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with MRTS04 *General Earthworks*.

Footings may be constructed without foundation bedding.

Concrete in footings shall comply with Clause 6.1. Concrete footings shall be cured for not less than two days before any crib units are placed on them.

Crib units shall be installed in accordance with the manufacturer's recommendations.

Following the installation of crib units in each course of the wall, backfilling material shall be placed in and behind the crib units, as specified in the manufacturer's recommendations, and thoroughly compacted using appropriate mechanical tampers.

53.4 Tolerances

The horizontal alignment of crib walls shall not depart from that specified by more than ± 20 mm.

The heights of the tops of the walls shall not depart from those specified by more than ± 20 mm, except where the provision of such tolerances shall not permit the tops to join to adjacent structures neatly.

54 Boulder retaining walls

54.1 Boulder retaining walls

54.1.1 General

Clause 54 applies to the provision of boulder retaining walls.

54.2 Material requirements

54.2.1 Rock fill

a) Rock fill must be sound igneous, metamorphic or approved sedimentary rock (as per MRTS04 *General Earthworks*) that must meet the minimum requirements of Table 54.2.1 below.

Table 54.2.1 – Properties of rock fill

Property	Test Method	Limit
Apparent particle density	AS 1141.6.1	2.60 t/m³ minimum
Point load strength index Is(50)	AS 4133.4.1	1.0 MPa minimum
Los Angeles value	AS 1141.23	25% maximum
Total weighted loss (five cycles)	AS 1141.24	5% maximum
Water absorption	AS 1141.6.1	2.0% maximum

b) Rock must be fresh or slightly weathered and not rounded.

c) For the selected source of rock fill – i.e., quarry, the contractor must develop a methodology outlining the quality assurance procedures that would be adopted to manage the production of rock fill meeting the stipulated requirements described in this Technical Specification.

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d) The shape and size of rock must comply with the following:

   i. nearly cubic rock where possible

   ii. rock with a ratio of maximum to minimum dimension of not greater than three

   iii. at least two split faces

   iv. the minimum dimension of a boulder shall be 0.5 m, and

   v. multiple blocks at any given cross section is not permitted.

54.2.2 Drainage blanket

a) A drainage blanket of minimum width 300 mm must be placed behind the boulder wall to act as permanent drainage to the adjacent fill material. Material in the drainage blanket must be sound, durable, fresh, angular and semi-rounded or rounded stone. The rock size shall comply with the size limitations in Table 54.2.2 below.

Table 54.2.2 – Grading requirements for drainage blanket

Stone size (mm)	Percent finer
150	100
75	90-100
50	30-60
26.5	0-5
19	0-2

b) The geosynthetic separator to be used at the drainage blanket/backfill interface must conform to Technical Specification MRTS27 *Geotextiles (Separation and Filtration).*

54.2.3 Packing stones in boulder walls

Packing stones or rock wedges may be needed to bed boulder wall rocks tightly or to level rocks for subsequent courses. This material must meet the Technical Specification for Drainage Blanket (see Table 54.2.2 above).

54.2.4 Foundation

Select granular fill must be used to replace unsuitable material under the boulder wall footing if intersected below footing level. The select granular fill shall comply with the following:

a) maximum size: 100 mm

b) soaked CBR: 15%.

54.3 Construction

54.3.1 Foundation construction requirements

The foundation of the boulder walls must be inspected by the Contractor's RPEQ Geotechnical Engineer to ensure that the allowable bearing capacity of the exposed foundation meets the design requirements. Where the exposed foundations have an allowable bearing capacity less than the design allowable bearing capacity, the weak material must be excavated and replaced with select granular materials (see 'Foundation' in Clause 54.2.4) to the extent necessary to provide the required foundation at the base of the boulder wall.

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54.3.2 Boulder wall placement

Rock fill must be placed so that they interlock with each other. This must be achieved by the following measures:

a) The first row of boulder (rock fill) must be placed on a binding layer of 150 mm minimum thickness of 20 MPa/20 concrete or better. The rock fill within the depth of embedment must be set in concrete.

b) All boulders must be placed with the minimum dimension vertical; multiple blocks along the width and elevation is not permitted.

c) Vertical joints between adjacent boulders, in the longitudinal direction of the wall, must be staggered between successive courses by a distance not less than 300 mm.

d) Vertical joints between adjacent boulders, in the cross-section of the wall, must be staggered between successive courses by a distance not less than 300 mm.

e) Placement of the boulders must be progressive along the wall length so as to minimise voids. Packing Stone (see Section 54.2.3) may be used to correct uneven surfaces and to prevent rocking.

f) The extent of contact at any interface between boulders of the adjacent courses in a cross-section must be not less than 75% of the width of the particular interface in the cross-section.

g) Adjacent boulders must touch:

   i. The face of the wall must have a uniform appearance for the full visible height by suitable selection from a stockpile. Boulders of similar exposed end dimensions must be placed as uniformly as practicable along the length and height of the wall.

   ii. Placement of boulders must be subject to daily inspections by the Contractor's RPEQ Geotechnical Engineer.

54.3.3 Backfill compaction

Compaction of backfill adjacent to the boulder wall/drainage blanket must conform to the requirements of Table 15.2 in Technical Specification MRTS04 *General Earthworks*, with the exception that the compaction of the backfill shall be carried out with no relaxation of compaction requirements adjacent to the wall. Light compaction equipment as per MRTS03 *Drainage, Retaining Structures and Protective Treatments* shall be used for compaction of back fill. The wall must be designed to accommodate this compaction-induced thrust.

54.3.4 Concrete slurry fill

The voids between the boulders must be filled with slurry concrete (slump greater than 100 mm) to the level of the adjacent ground where shown on the drawings.

54.3.5 Seepage drains

a) Seepage drains using slotted PVC (minimum 100 mm diameter) must be placed at not more than 10 m centres to link the drainage blanket through the boulder wall to an outlet at the face of the wall.

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b) Backfill around the PVC drain must be screened gravel of 20 mm nominal size and must completely surround the pipe with a geotextile (as per MRTS03 *Drainage, Retaining Structures and Protective Treatments*) forming the interface with the backfill.

c) The boulder course above the pipe must span over the pipe between adjacent boulders.

54.3.6 Surface runoff behind the wall

Positive measures must be taken to discharge the surface runoff and must not be allowed to infiltrate into the backfill.

54.4 Tolerances

a) The horizontal tolerance for the front face of the wall must be constructed to within +/- 150 mm from the sloping face defined on the drawings.

b) The thickness of the wall at any cross-section should not be less than that shown on the drawings.

c) It is the responsibility of the contractor to set out the wall alignment and shape. The contractor must provide the equipment or tools for the control of the lines and levels (templates, string lines, etc.) and this equipment must remain on site.

55 Soil nailing

55.1 General

Clause 55 applies to the provision of soil nailing.

55.2 Methodology and construction procedure

The performance provisions of Clause 55 shall be the minimum requirements which apply to the installation of soil nails. The Contractor's installation methodology may differ from the prescriptive provisions of Clause 55, provided that such methodology can be shown to have been proven by previous field use by the subcontract installer.

At least 14 days prior to commencing any work which involves the installation of soil nails, the Contractor shall submit to the Administrator a construction procedure which details the method of drilling, installation, grouting and testing of the soil nails. **Milestone**

No work which involves the installation of soil nails shall be commenced until the Administrator has deemed the construction procedure suitable to use. **Hold Point 13**

55.3 Material requirements

55.3.1 Soil nails

Soil nails shall be manufactured from Grade D500N deformed reinforcing bar conforming to MRTS71 *Reinforcing Steel*. The length of soil nails shall be as specified in the drawings.

All permanent soil nails shall be hot dip galvanised to AS/NZS 4680 and shall be encapsulated by a completely waterproof corrugated plastic sheath. The sheath shall be made from PVC or HDPE tube, with a minimum uniform thickness of at least 2 mm. The size of the sheath shall be such as to ensure a 10 mm minimum grout annulus surrounding the reinforcing bar. A sacrificial grout tube reaching to the bottom end of the sheath shall be provided. Where possible, corrugated plastic sheath shall be unjointed for the full length of soil nail. Where necessary, sheath joints shall be achieved by lapping of at least 50 mm together with liberal use of solvent glues appropriate for the sheathing material.

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After galvanising, soil nails shall be passivated by dipping in a 2% solution of sodium dichromate to prevent any adverse reactions between the zinc coating and the cement grout.

55.3.2 Spacers

Spacers shall be provided to ensure that the nail and the sheathing are centrally located within the hole and provided with a minimum of 30 mm of grout cover. Spacers shall also be provided to ensure that all sheaths if specified in the design are centrally located within the hole and provided with a minimum of 10 mm grout cover. Spacers shall be provided at both ends (within 300 mm from the ends) of nail and at 750 mm intervals (maximum) along the nail between the end spacers. The spacers shall be fabricated from materials which have no deleterious effect on the soil nail system. Spacers shall be manufactured to permit the free flow of grout.

55.3.3 Cement grout

Cement grout shall comply with Clause 6.3. In addition it shall have a minimum characteristic strength of 32 MPa.

55.4 Construction

55.4.1 General

Soil nails shall be installed in the locations and in accordance with the details specified in the drawings.

55.4.2 Drilling

The minimum diameter of hole for soil nails shall be 125 mm. The directions and the depths of the hole shall be as specified in the drawings.

Plant employing water as the drill flushing medium shall not be used as this can result in saturation of the soil surrounding the nail and the subsequent instability of the finished retaining structure.

55.4.3 Installation of soil nails

A sacrificial grout tube shall be attached to the bottom end of the soil nail. The soil nail shall be carefully positioned into the hole with a minimum of disturbance to the surrounding soil material.

55.4.4 Grouting of soil nails

55.4.4.1 Equipment

Grouting equipment shall include:

a) a purpose-designed grout mixer of the continuous high speed type operating in the range of 1500 to 2000 rpm and producing grout free from lumps

b) a holding tank fitted with an agitator

c) a grout pump with a sustained outlet pressure of at least 400 kPa and fitted with a bypass back to the agitator tank, and

d) a grout delivery line fitted with a gauge reading accurately to 1000 kPa.

55.4.4.2 Operations

Grouting of the soil nails shall be performed in the presence of the Administrator. **Hold Point 14**

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Grout shall be pumped into the hole through the grout tubes until grout is forced out of the top of the hole. The level of grout inside and outside the sheath shall be kept approximately equal to avoid damage to the sheath. The amount of grout pumped into the hole shall be recorded to determine if the hole is blocked or if there are voids in the grout. Each soil nail shall be completely and continuously surrounded by a grout annulus.

55.5 Acceptance testing of soil nails

Testing of the soil nails shall be carried out and test result included in the quality records. Acceptance of test results for soil nails shall be subject to the approval of the Designer. **Hold Point 15**

The number of nails to be tested is as stated in Table 55.5.

Table 55.5 – Number of soil nails to be tested

No. of soil nails	Minimum number of pull-out tests
< 50	3
51–100	6
> 100	6%

The test procedure shall be:

a) The grout shall have a minimum strength of 20 MPa and be at least four days of age.

b) The test load shall be 1.5 times the working load which shall be as specified in the drawings.

c) The test load shall be measured with an accuracy of ± 1 kN.

d) The test frame used to mount the testing jack shall have supports such that it does not load the retained face at any localised point.

e) Dial gauges used to record deflection of the soil nail shall be accurate to at least 0.01 mm.

f) The soil nail shall be loaded to 20% of the test load, which point shall be recorded as the datum for deflection measurements.

g) The remaining test load shall be applied in three equal increments and deflection measurements shall be recorded at each stage. The full test load shall be maintained for one hour.

h) Three complete cycles of the test load shall be applied sequentially, and

i) The test shall be considered successful if the deflection of the soil nail after three cycles does not exceed 0.1% of its length.

56 Passive rock dowels

56.1 General

Clause 56 applies to the provision of passive rock dowels.

56.2 Methodology and construction procedure

The performance provisions of Clause 56 shall be the minimum requirements which apply to the installation of passive rock dowels. The Contractor's installation methodology may differ from the prescriptive provisions of Clause 55 provided that such methodology can be shown to have been proven by previous field use by the subcontract installer.

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At least 14 days prior to commencing any work which involves the installation of passive rock dowels, the Contractor shall submit to the Administrator a construction procedure which details the method of drilling, installation, grouting and testing of the rock dowels. **Milestone**

No work which involves the installation of passive rock dowels shall be commenced until the Administrator has deemed the construction procedure suitable to use. **Hold Point 16**

56.3 Materials

56.3.1 Passive rock dowels

Passive rock dowels shall be fabricated from Grade 500N deformed steel reinforcing bar conforming to MRTS71 *Reinforcing Steel* and shall be hot-dipped galvanised in accordance with AS/NZS 4680. The length of passive rock dowels shall be as specified in the drawings.

After galvanising, dowels shall be passivated by dipping in a 0.2% solution of sodium dichromate to prevent any adverse reactions between the zinc coating and the cement grout.

The dowels shall be encapsulated by a completely waterproof corrugated PVC or HDPE sheath of 2 mm minimum thickness. The size of the sheath shall be such as to ensure a 10 mm minimum grout annulus surrounding the reinforcing bar. A sacrificial grout tube reaching to the bottom end of the sheath shall be provided. All welds in the sheath and end caps and between the sheath and grout tube shall be water tested to prove their integrity.

A sacrificial grout tube shall also be securely attached externally to the bottom end of the sheath.

56.3.2 Spacers

Spacers shall be provided to ensure that the dowel and the sheathing are centrally located within the hole and provided with a minimum of 30 mm of grout cover. Spacers shall also be provided to ensure that all sheaths if specified in the design are centrally located within the hole and provided with a minimum of 10 mm grout cover. Spacers shall be provided at both ends (within 300 mm from the ends) of nail and at 750 mm intervals (maximum) along the nail between the end spacers.

The spacers shall be fabricated from materials which have no deleterious effect on the soil nail system. Spacers shall be manufactured to permit the free flow of grout.

56.3.3 Cement grout

Cement grout shall conform to Clause 6.3. In addition, it shall have a minimum characteristic strength of 40 MPa.

56.4 Construction

56.4.1 General

Rock dowels shall be installed in the locations and in accordance with the drawings.

56.4.2 Drilling

Holes for rock dowels shall be drilled to a minimum of 125 mm diameter in the directions and to the depths specified in the drawings.

The plant used to drill the holes into the rock face shall employ percussion drilling techniques and use air as the drill flushing medium. Water shall not be used as this can result in excess water pressures building up within the rock mass and cause instability of the rock slope.

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56.4.3 Installation of rock dowels

The rock dowel shall be carefully positioned into the hole without damaging the encapsulating sheath or the grout tubes.

56.4.4 Grouting

56.4.4.1 Equipment

Grouting equipment shall include:

a) a purpose-designed grout mixer of the continuous high speed type operating in the range of 1500 to 2000 rpm and producing grout free from lumps

b) a holding tank fitted with an agitator

c) a grout pump with a sustained outlet pressure of at least 400 kPa and fitted with a bypass back to the agitator tank, and

d) a grout delivery line fitted with a gauge reading accurately to 1000 kPa.

56.4.4.2 Operations

Grouting of the rock dowels shall be performed in the presence of the Administrator. **Hold Point 17**

Grout shall be pumped into the hole through the grout tubes until grout is forced out of the top of the hole. The level of grout inside and outside the sheath shall be kept approximately equal to avoid damage to the sheath. The amount of grout pumped into the hole shall be recorded to determine if the hole is blocked or if there are voids in the grout. As the rock is likely to contain defects or voids, grout losses shall be expected. Each rock bolt shall be completely and continuously surrounded by a grout annulus.

56.5 Acceptance testing of passive rock dowels

Testing of the rock dowels shall be carried out and test results included in the quality records. Acceptance of test results for soil nails shall be subject to the approval of the Designer. **Hold Point 18**

The number of dowels to be tested shall be as stated in Table 56.5.

Table 56.5 – Number of rock dowels to be tested

No. of rock dowels	Minimum number of pull-out tests
< 50	3
51–100	6
> 100	6%

The test procedure shall be:

a) The grout shall have a minimum strength of 25 MPa and be at least five days of age.

b) The test load shall be 1.5 times the working load which shall be as specified in the drawings.

c) The test load shall be measured with an accuracy of ± 1 kN.

d) The test frame used to mount the testing jack shall have supports such that it does not load the retained face at any localised point.

e) Dial gauges used to record deflection of the soil nail shall be accurate to at least 0.01 mm.

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f) The rock dowel shall be loaded to 20% of the test load, which point shall be recorded as the datum for deflection measurements.

g) The remaining test load shall be applied in three equal increments and deflection measurements shall be recorded at each stage. The full test load shall be maintained for one hour.

h) Three complete cycles of the test load shall be applied sequentially, and

i) The test shall be considered successful if the deflection of the rock dowel after three cycles does not exceed 0.1% of its length.

57 Active rock bolts

57.1 General

Clause 57 applies to the provision of active rock bolting.

57.2 Methodology and construction procedure

The performance provisions of Clause 56 shall be the minimum requirements which apply to the installation of active rock bolts. The Contractor's installation methodology may differ from the prescriptive provisions of Clause 55 provided that such methodology can be shown to have been proven by previous field use by the subcontract installer.

At least 14 days prior to commencing any work which involves the installation of active rock bolts, the Contractor shall submit to the Administrator a construction procedure which details the method of drilling, installation, grouting, stressing and testing of the rock bolts. **Milestone**

No work which involves the installation of active rock bolts shall be commenced until the Administrator has deemed the construction procedure suitable to use. **Hold Point 19**

57.3 Materials

57.3.1 Active rock bolts

Active rock bolts shall be manufactured from 26 mm diameter, 575 kN ultimate capacity steel stress bar. The length of active rock bolts shall be as specified in the drawings.

Each bar shall be encapsulated in PVC or HDPE corrugated sheath having an internal diameter of 65 mm, an external diameter of 85 mm and a minimum thickness of 2 mm. A sacrificial grout tube reaching to the bottom end of the sheath shall be provided. All welds in the sheath and end caps and between the sheath and grout tube shall be water tested to prove their integrity.

A sacrificial grout tube shall also be securely attached externally to the bottom end of the sheath.

57.3.2 Spacers

Spacers shall be provided to ensure that the rock bolt and the sheathing are centrally located within the hole and provided with a minimum of 30 mm of grout cover. Spacers shall also be provided to ensure that all sheaths if specified in the design are centrally located within the hole and provided with a minimum of 10 mm grout cover. Spacers shall be provided at both ends (within 300 mm from the ends) of bolt and at 750 mm intervals (maximum) along the bolt between the end spacers.

The spacers shall be fabricated from materials which have no deleterious effect on the rock bolt system. Spacers shall be manufactured to permit the free flow of grout.

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57.3.3 Cement grout

Cement grout shall comply with Clause 6.3. In addition, it shall have a minimum characteristic strength of 40 MPa.

57.4 Construction

57.4.1 General

Rock bolts shall be installed in the locations and in accordance with the drawings.

57.4.2 Drilling

Holes for rock bolts shall be drilled to a minimum of 125 mm diameter in the directions and to the depths specified in the drawings.

The plant used to drill the holes into the rock face shall employ percussion drilling techniques and use air as the drill flushing medium. Water shall not be used as this can result in excess water pressures building up within the rock mass and cause instability of the rock slope.

57.4.3 Installation of rock bolts

The rock bolt shall be carefully positioned into the hole without damaging the encapsulating sheath or the grout tubes.

57.4.4 Grouting

57.4.4.1 Equipment

Grouting equipment shall include:

a) a purpose-designed grout mixer of the continuous high speed type operating in the range of 1500 to 2000 rpm and producing grout free from lumps

b) a holding tank fitted with an agitator

c) a grout pump with a sustained outlet pressure of at least 400 kPa and fitted with a bypass back to the agitator tank, and

d) a grout delivery line fitted with a gauge reading accurately to 1000 kPa.

57.4.4.2 Operations

Grouting of the rock bolts shall be performed in the presence of the Administrator. **Hold Point 20**

Grout shall be pumped into the hole through the grout tubes until grout is forced out of the top of the hole. The level of grout inside and outside the sheath shall be kept approximately equal to avoid damage to the sheath. The amount of grout pumped into the hole shall be recorded to determine if the hole is blocked or if there are voids in the rock mass. As the rock is likely to contain defects or voids, grout losses shall be expected. Each rock bolt shall be completely and continuously surrounded by a grout annulus.

57.5 Stressing active rock bolts

Before stressing the rock bolt, the grout shall have a minimum strength of 25 MPa and be at least five days of age.

The rock bolt shall be jacked to the Design Lock-Off Load specified in the drawings in five separate stages. The load to which the rock bolt shall be jacked in the five stages are 20%, 40%, 60%, 80%

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and 100% of the Design Lock-Off Load. The load shall be held constant for five \ minutes at each loading stage and the deflection of the bolt head recorded at the start and completion of the specified loading period for each stage.

After the completion of loading at each stage, except for the last stage, the bolt load shall be relaxed to 20% of the Design Lock-Off Load before proceeding to the next stage of loading. The deflection of the bolt head shall be recorded each time the anchor load is relaxed to 20% of the Design Lock-Off Load. After completion of the loading stage to 100% of the Design Lock-Off Load, the bolt shall be engaged to the anchorage assembly to transfer the load in the bolt directly to the bolt head and bearing plate.

57.6 Load testing active rock bolt

The commencement of testing of active rock bolts shall be a Hold Point. **Hold Point 21**

All active rock bolts shall be tested.

The test procedure shall be:

a) The load in the rock bolt shall be determined by carrying out a lift-off test. The lift-off test shall be undertaken using a jack and suitable accessories by lifting the bolt head a distance of 1 mm above the bearing plate. This step is considered satisfactory if the load measured is greater than or equal to 96% of the Design Lock-Off Load.

b) If the load measured in subparagraph (a) is less than 96% of Design Lock-Off Load, then using a jack, the rock bolt shall be re-stressed to Design Lock-Off Load, plus an adjustment for lock-off losses. The lift-off test described in subparagraph (a) shall then be repeated. If the rock bolt load is still less than 96% of Design Lock-Off Load, a structural assessment shall be carried out to determine the future course of action for that rock bolt, and

c) A second lift-off test shall be carried out three days after the first. The maximum load loss since the first lift-off test shall not exceed 12% of the Design Lock-Off Load.

The measured loads and displacements for all tests shall be recorded, plotted and compared with theoretical elastic deflections. A plot of these results for each rock bolt tested shall be delivered to the Administrator within three working days following the completion of the tests on that rock bolt.

After successful testing of the rock bolt, the void, if any, above the bonded length of the rock bolt to the underside of the anchor head shall be completely filled with grout.

58 Supplementary requirements

The supplementary requirements given in Clause 6 of Annexure MRTS03.1 shall apply.

59 Surveying requirements

All surveying requirements associated with the installation of new or relocated underground assets that include culverts, stormwater pipes, gullies and access chambers and retaining wall footings are to be fulfilled as prescribed in Clauses 6.1, 6.2, 6.3, 6.4 and 6.7 of the *TMR Surveying Standards*, Part 2.

60 Existing underground assets

In the event where any existing underground assets that may be fully or partly exposed during construction works, additional surveying information is required to be undertaken as prescribed in Clause 1.7, 6.7.7 and 6.7.8 of the *TMR Surveying Standards*, Part 2.

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FOI 26-292 - Document 21

Contents

1 Introduction 1
1.1 General 1
1.2 Scope 1
2 Definition of terms 1
3 Referenced documents 7
4 Standard test methods 10
4.1 Supplementary requirements for Test Methods AS 1289.5.4.1, 5.7.1 and 5.8.1 12
4.2 Supplementary requirements for Test Method AS 1289.6.1.1 12
4.3 Supplementary requirements for Test Method Q115 12
5 Quality system requirements 13
5.1 Hold Points, Witness Points and Milestones 13
5.2 Construction procedures 14
5.3 Protection of earthworks 15
5.4 Compliance testing 16
5.4.1 General 16
5.4.2 Sampling 16
5.4.3 Sampling and test locations 16
5.4.4 Compaction 16
5.5 Conformance requirements 17
5.5.1 Geometrics 17
5.5.2 Compaction 17
5.6 Testing frequency and Lot sizes 17
6 Geometrics 17
6.1 General 17
6.2 Horizontal tolerances 18
6.3 Vertical tolerances 18
6.3.1 Primary tolerances 18
6.3.2 Additional tolerances 18
7 Clearing and grubbing 19
7.1 General 19
7.2 Construction 19
7.2.1 Areas to be cleared and grubbed 19
7.2.2 Limitation on clearing operations 19
7.2.3 Trees required by the Administrator 19
7.2.4 Material suitable for organic mulch 19
7.2.5 Fauna habitat logs 20
7.2.6 Sugar cane and banana plants 20
7.2.7 Disposal of cleared and grubbed materials 20
7.2.8 Additional requirements 21
8 Stripping of Topsoil 21
8.1 General 21
8.2 Topsoil stripping dimensions 21
8.3 Material considered suitable for use as Topsoil 21

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

8.4 Construction 21
8.4.1 Stripping to stockpile 21
8.4.2 Surplus material 22
8.4.3 Stripping limitations 22
8.4.4 Stockpiling of Topsoil 22
8.4.5 Finishing 23
9 Unsuitable Material 23
9.1 General 23
9.2 Identification of Unsuitable Material 23
9.3 Unsuitable Material from inappropriate construction activities 24
9.4 Construction requirements 24
10 Acid Sulfate Soils 24
10.1 General 24
10.2 Initial assessment of Acid Sulfate Soils on the Site 25
10.3 Management of Acid Sulfate Soils 25
10.4 Testing and reporting of Acid Sulfate Soils 25
10.5 Assessment of potential Acid Sulfate Soils 26
10.6 Soil treatment 26
10.7 Water treatment 26
11 Use of or disposal of surplus and Unsuitable Material 27
11.1 General 27
11.2 Disposal in areas on the Site 27
11.3 Spoil to offsite areas 27
12 Ground surface treatment 27
12.1 General 27
12.2 Construction 28
12.2.1 Ground surface treatment, standard 28
12.2.2 Ground surface treatment, special 28
12.2.3 Ground surface treatment – Insitu treatment of Acid Sulfate Soils 28
12.2.4 Removal of Unsuitable Material 29
13 Excavation 29
13.1 General 29
13.2 Blinding concrete 29
13.3 Construction 29
13.3.1 All excavations 29
13.3.2 Special requirements for cuttings 29
13.3.3 Special requirements for Confined Excavations 30
13.3.4 Special requirements for structure foundations 31
13.3.5 Excavation to clear waterways 32
13.3.6 Additional requirements for culverts 32
13.3.7 Special requirements for drains 32
13.3.8 Dewatering of excavations 33
14 Embankments 33
14.1 General 33

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

14.2 Materials 33
14.2.1 Introduction 33
14.2.2 Earth Fill Material 33
14.2.3 Rock Fill 35
14.2.4 Verge material 36
14.2.5 Water retaining embankments 36
14.2.6 Geotextile 36
14.2.7 Geosynthetic reinforcement 36
14.2.8 Special Embankment materials 36
14.3 Construction 36
14.3.1 General 36
14.3.2 Geotextile at changes in material type 40
14.3.3 Stepping the ground surface on which embankments are to be constructed 40
14.3.4 Special requirements for diversion blocks 42
14.3.5 Special requirements for catch banks 42
14.3.6 Special requirements for Acid Sulfate Soil materials 42
15 Compaction 43
15.1 General 43
15.2 Method of compaction and testing 43
15.3 Compacted layer method of construction 43
15.4 Mechanical interlock method of construction 46
16 Finishing batters 47
16.1 General requirements 47
17 Borrow operations 48
17.1 General 48
17.2 Borrowing operations on the Site 48
17.3 Borrowing operations off the Site 48
18 Subgrade 48
18.1 General 48
18.2 Materials 49
18.2.1 Fill Material 49
18.2.2 Unbound granular material 49
18.2.3 Unbound granular Drainage Layer material 49
18.2.4 High-permeability drainage material 50
18.2.5 Stabilised Subgrade material 51
18.2.6 Geotextile filter fabric 54
18.2.7 Geosynthetic reinforcement 54
18.3 Construction 54
18.3.1 General 54
18.3.2 Proof rolling 54
18.3.3 Subgrade treatment 54
18.3.4 Earthworks transition from cut to fill 59
18.4 Existing Subgrade testing 60
19 Backfill 61
19.1 General 61
19.2 Materials 61
19.2.1 General 61
19.2.2 Earth Backfill Material 61

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

19.2.3 Select Backfill Material ... 61
19.2.4 Free Draining Granular Material ... 62
19.2.5 Sand (including recycled crushed glass) ... 62
19.2.6 Coarse Sand (including recycled crushed glass) ... 63
19.2.7 Bedding Material and drainage aggregate (including recycled crushed glass) ... 63
19.2.8 Filter material ... 64
19.2.9 Cement Stabilised Unbound Granular Material ... 65
19.2.10 Stabilised Sand ... 65
19.2.11 Dry Stabilised Sand ... 65
19.2.12 Lean Mix Concrete ... 65
19.2.13 Backfill and Bedding Material for steel culverts ... 65
19.2.14 Rock Fill material ... 66
19.3 Construction ... 66
19.3.1 Backfilling general ... 66
19.3.2 Backfill beneath structure foundations ... 66
19.3.3 Backfilling to in-place units ... 66
19.3.4 Backfill zones to concrete pipe culverts ... 67
19.3.5 Backfill to soil retaining structures ... 67
19.3.6 Special requirements for corrugated pipe, pipe-arch and arch-culverts ... 68
20 Turnouts, entrances and stopping places ... 68
21 Widening of existing formation to Subgrade Level ... 68
21.1 Construction ... 68
21.1.1 General ... 68
21.1.2 Subgrade heights ... 69
22 Supplementary requirements ... 69
Appendix A – Testing frequencies ... 70
Appendix B – Existing Subgrade testing and design verification ... 84
B.1 Introduction ... 84
B.2 Existing Subgrade design verification construction procedure ... 84
B.3 Existing Subgrade Lots ... 85
B.4 Existing Subgrade Sampling requirements ... 85
B.4.1 General ... 85
B.4.2 Sampling process ... 86
B.5 Existing Subgrade testing requirements ... 86
B5.1 General ... 86
B5.2 CBR test conditions ... 87
B.6 Reporting and pavement design requirements ... 87
B.6.1 General ... 87
B.6.2 Construct Only Contracts ... 87
B.6.3 Contracts which include pavement design ... 87
B.7 Determination of Lot CBR, swell and expansive nature classification ... 88

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

1 Introduction

1.1 General

This Technical Specification applies to the construction of earthworks in roadworks and bridgeworks.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

Specific earthwork requirements covered elsewhere are:

- reinforced soils structures which are specifically covered by MRTS06 *Reinforced Soils Structures*
- cast-in-place piles which are specifically covered by MRTS63 *Cast-In-Place Piles*, and
- footings for poles which are specifically covered by MRTS92 *Traffic Signal and Road Lighting Footings*.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

1.2 Scope

'Earthworks' refers to all operations involved in loosening, removing, depositing, shaping and compacting soil or rock, and is also used to describe the structure resulting from these operations. The aim of the earthworks is to facilitate construction of other components such as pavements and structures, and to provide a long-term, stable platform of sufficient strength to enable these components to function for their intended life. Earthworks are undertaken using materials won from the Site or (if suitable or sufficient materials are not available within the Site), using suitable materials from offsite.

The earthworks formation comprises a series of earth or rock structures, which must be constructed by the controlled excavation and placement of materials, and the use of associated structural treatments. Better-quality materials are typically used in the upper portion of the earthworks.

The execution of earthworks involves safety and environmental risks and attention is drawn to the requirements of the relevant Technical Specifications.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Acid Sulfate Soils	Materials which contain iron sulfides in concentrations which have the potential to produce acidic conditions in the earthworks if left untreated. Acid Sulfate Soils shall include all materials which are actual Acid Sulfate Soils or potential Acid Sulfate Soils as indicated by the testing regime described in Clause 10.

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Term	Definition
Backfill	Material placed in Confined Excavations for culverts, structures, conduits, pits and so on, or, in some instances, to fill excavations of Unsuitable Material. Backfill includes Bedding Material and materials placed in the foundation bedding, haunch, side and overlay zones during culvert Backfill.
Bedding Material	Material suitable for use in the Foundation Bedding Zone of culverts and for bedding of pipes, conduits, pits, and so on.
Borrow Area	An area: a) on the Site outside the excavation lines, or b) an area off the Site which can be developed by the Contractor as a source of Borrow Material.
Borrow Material	Material, sourced from Borrow Areas, which is used to supplement a shortage of material sourced from excavations.
Cement Stabilised Unbound Granular Material	Unbound granular material stabilised with cement.
Cohesive / Cohesion-less Soil	This definition applies for compaction purposes only. This definition does not apply for general geotechnical descriptions, where cohesive material is considered as > 35% passing the 75 µm sieve. Cohesive soil is a material which has a well-defined moisture density relationship when tested accordance with AS 1289.5.1.1 *Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density / moisture content relation of a soil using standard compactive effort*. This soil is typically over 12% fines (passing the 75 µm sieve, by weight), but may still apply to above 5% fines in some cases. Whilst Cohesive Soils are typically clayey in nature, for the purpose of this definition only, these may also include well-graded granular materials such as crushed rock. Cohesion-less (non-cohesive) Soils typically have less than 5% fines, are non-plastic and do not exhibit a well-defined moisture density relationship.
Confined Excavation	An excavation for a culvert, pipe or conduit trench or an excavation for a structure which requires the use of an excavator or similar machine fitted with a bucket. An excavation shall not be classed as a Confined Excavation where the excavation is of sufficient size to allow the operation of a crawler tractor of Class 150C or larger, as determined in Table 3.3.2 of MRS04, the Specification (Measurement) to this Technical Specification.
Core Zone	The central zone of an Embankment.
Cutting	Earthworks constructed by excavation to the lines shown on the drawings.
Diversion channels	Open channels that divert or redirect a given water flow from its natural flow path.
Drainage Layer	A layer of permeable material placed within the Subgrade in wet cuttings.
Earth Backfill Material	Earth Fill Material Class A or B predominantly less than 25 mm Stone size used as Backfill.
Earth Fill Material	Fill material for an Embankment that can be placed using the compacted layer method.

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Term	Definition
Embankment	Earthworks constructed by placement of Fill Material to the shapes and dimensions shown on the drawings.
Existing Subgrade Material	Existing insitu material that will form part of the Subgrade, other than that moved from another location and/or compacted as part of the Works. May include material placed and compacted as part of previous Works (such as existing Fill Material), completed under a separate Contract or material that is naturally occurring. Typically, this is unprocessed material, but may include processed materials from previous Works (such as existing pavement layer).
Fill Material	Material making up an Embankment to Subgrade Level, used to Backfill Subgrade treatments or to replace Unsuitable Material. Includes both Earth Fill and Rock Fill. Fill Material used in Embankments may be interchangeably described as 'Embankment Fill' in this Technical Specification.
Foundation Bedding Zone	The layer of material forming the bedding for culverts as shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts*.
Foundation Surface	The level of an excavation for a structure at which the material with the required bearing capacity exists.
Free-Draining Granular Material	Coarse graded Backfill material used behind retaining walls.
Haunch Zone	The layer of material immediately above the Foundation Bedding Zone for installation of pipe culverts as shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts*.
Lean Mix Concrete	Low strength concrete used for Backfill of over-excavation for structures and as otherwise directed.
Lot	• An area of work that is essentially homogeneous in relation to material properties, moisture condition during compaction, rolling response and compaction technique, or • A single finished item of work which includes several materials and/or work types (for example, a culvert in place).
Lot CBR	The California Bearing Ratio (CBR) assigned to a Lot of Existing Subgrade Material in accordance with this Technical Specification.
Lot expansive nature classification	The expansive nature classification assigned to a Lot of Existing Subgrade Material in accordance with this Technical Specification and the *Pavement Design Supplement to Austroads' Guide to Pavement Technology Part 2: Pavement Structural Design (Pavement Design Supplement)*.
Lot swell	The swell (%) assigned to a Lot of Existing Subgrade Material based on swell test values obtained in conjunction with the soaked CBR test in accordance with this Technical Specification.
Monosulfidic Black Oozes	Monosulfidic Black Oozes are highly reactive organic-rich gels with extremely high Moisture Content. They are commonly enriched in ultra-fine-grained reactive iron sulfides.
Natural Ground Surface	The ground surface which exists prior to any Works being carried out under the Contract.

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Term	Definition
Near-grade Embankments	Any part of an Embankment with less than 300 mm of new Fill Material between the Prepared Ground Surface and Subgrade Level.
Outer Zone	The Outer Zone of an Embankment.
Overlay Zone	The layer of material placed above pipe culverts as shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts*.
Planting Media	Material used as a planting medium for landscaping as defined 'Topsoil' in MRTS16 *Landscape and Revegetation Works*. In this Technical Specification, Topsoil is the top layer of existing soil on the Site which supports vegetation.
Prepared Ground Surface	The ground surface after clearing and grubbing and Topsoil stripping operations have been completed.
Relative Compaction	The ratio, expressed as a percentage, of the insitu density (wet or dry) of the material presented for compliance testing and the maximum density (dry or converted wet density) of a reference sample compacted in accordance with a specified procedure.
Road Excavation	All excavation except for Confined Excavation and excavation for open channels and drains.
Rock Fill	Fill Material consisting predominantly of stones and rock. Stability is achieved by mechanical interlock.
Sand	Natural or manufactured material with more than 85% passing 2.36 mm test sieve. No oversize shall be greater than 6 mm. Less than 5% and 10% passing 0.075 mm test sieve for natural Sand and manufactured Sand respectively.
Select Backfill Material	Backfill comprising gravel and/or loam materials with specified properties used for backfilling to trenches and structures.
Side Zone	The layer of material placed adjacent to the centre of pipe culverts as shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts*.
Spoil	Material surplus to the Contract requirements which shall be disposed of on or off the Site.
Stabilised Sand	Backfill material comprising Sand stabilised with cement.
Stone	Material including natural rock, natural gravel, processed crushed rock and construction rubble which does not break down significantly under compaction.
Structure Zone	As per Transport and Main Roads' *Geotechnical Design Standard – minimum requirements (Geotechnical Design Standard),* is not less than 25 m within the approach to any structure (for example, bridges, culverts, slabs used to support rigid inclusions, as well as embankments supported on rigid inclusions).
Subgrade	The portion of the formation on which the pavement is constructed and which provides support to the pavement. All material within 1.5 m below Subgrade Level.
Subgrade Depth	1.5 m below Subgrade Level.
Subgrade Level	The level of the top surface of the Subgrade on which a pavement is constructed. Refer Figures 2(a) to 2(f) for the definition of Subgrade Level.

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Term	Definition
Topsoil	The top layer of existing soil on the Site which supports vegetation. The definition of Topsoil is different in MRTS16 *Landscape and Revegetation Works*. Refer definition of Planting Media in this Technical Specification.
Treated Subgrade	The Subgrade in cuttings which has been either modified or replaced to improve its properties.
Upper Zone	The top zone of an Embankment, excluding pavement and verge.
Unsuitable Material	All materials as defined in Clause 9.2.

Figures 2(a)–(f) illustrate cross-sections of an embankment and the applicable terminology.

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Figure 2(a) – Embankment terminology – zoned

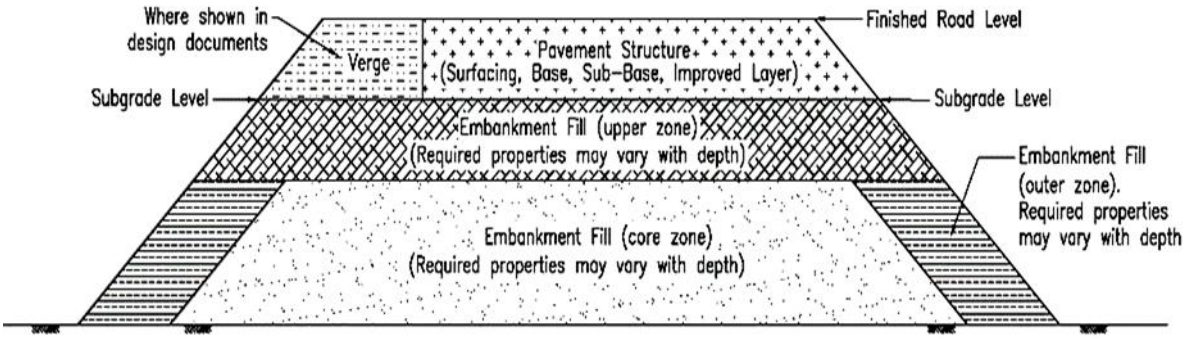


Figure 2(b) – Embankment terminology – homogeneous

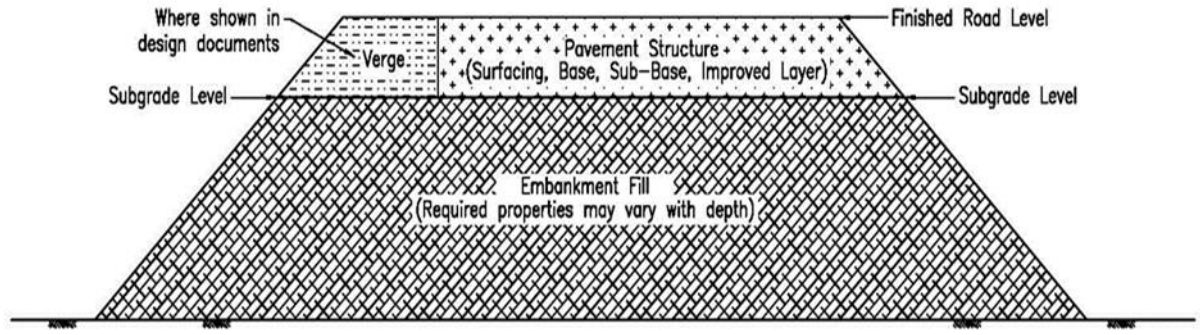


Figure 2(c) – Cutting terminology

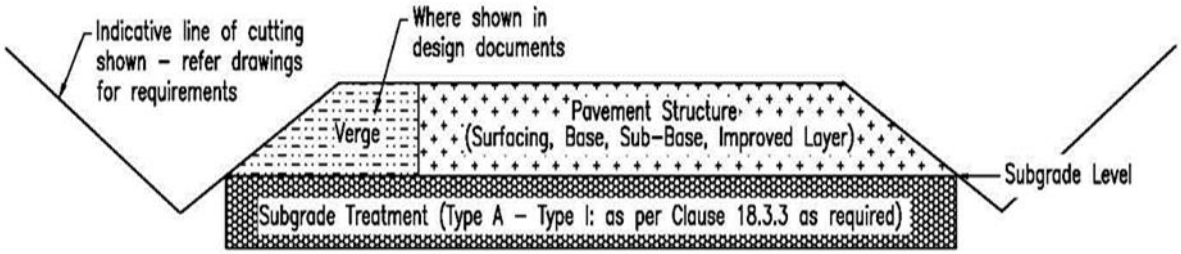
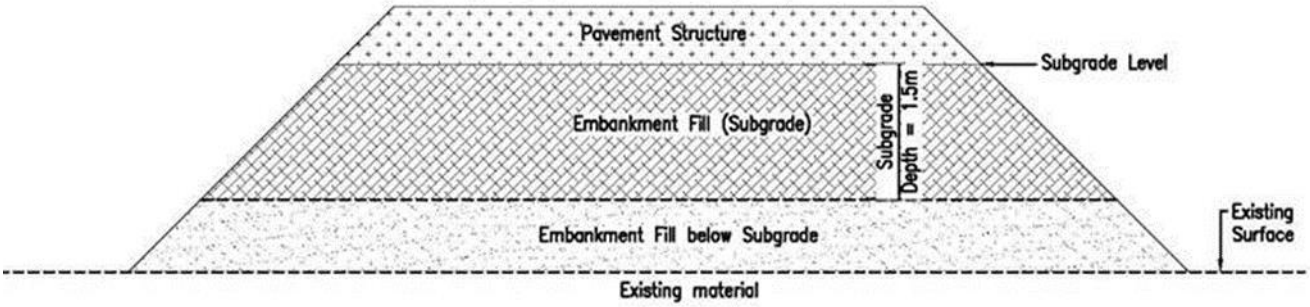


Figure 2(d) – Subgrade Depth in an Embankment > 1.5 m high



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Figure 2(e) – Subgrade Depth in an Embankment < 1.5 m high

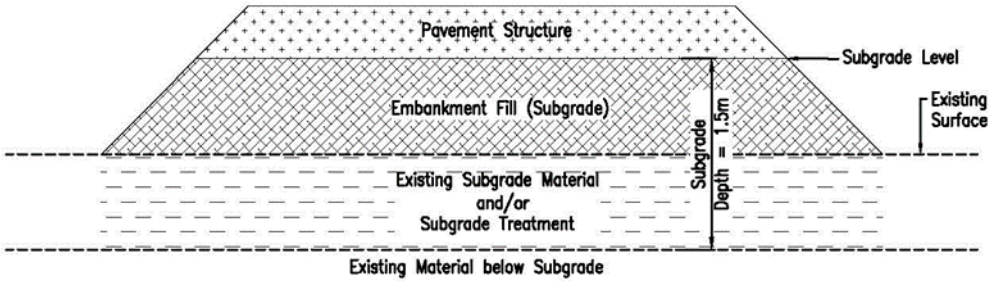
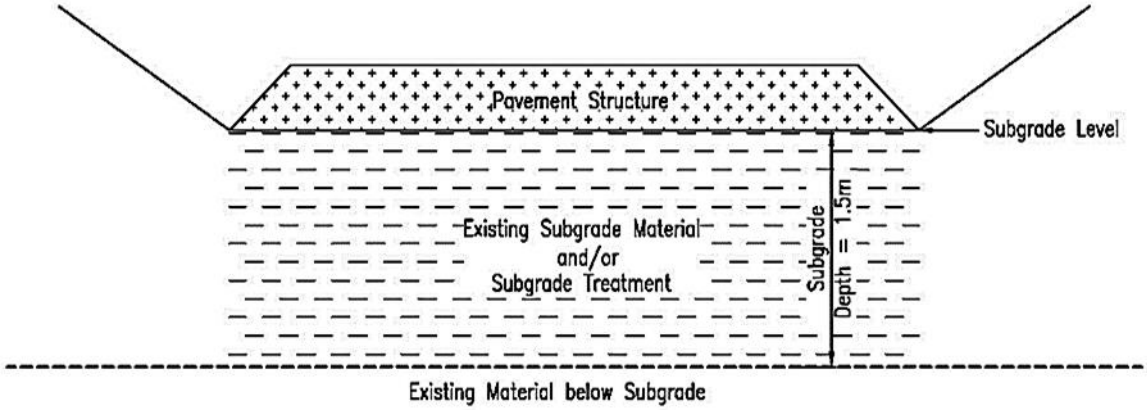


Figure 2(f) – Subgrade Depth in cuttings or at grade



3 Referenced documents

Table 3 list documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 1141.6.1	*Methods for sampling and testing aggregates, Method 6.1: Particle density and water absorption of coarse aggregate – Weighing-in-water method*
AS 1141.11.1	*Methods for sampling and testing aggregates, Method 11.1: Particle size distribution – Sieving method*
AS 1141.22	*Methods for sampling and testing aggregates, Method 22: Wet / dry strength variation*
AS 1289.1.2.1	*Methods of testing soils for engineering purposes, Method 1.2.1: Sampling and preparation of soils – Disturbed samples – Standard method*
AS 1289.1.4.2	*Methods of testing soils for engineering purposes, Method 1.4.2: Sampling and preparation of soils – Selection of sampling or test sites – Stratified random number method*
AS 1289.2.1.1	*Methods of testing soils for engineering purposes, Method 2.1.1: Soil moisture content tests – Determination of the moisture content of a soil – Oven drying method (standard method)*
AS 1289.2.1.2	*Methods of testing soils for engineering purposes, Method 2.1.2: Soil moisture content tests – Determination of the moisture content of a soil – Sand bath method (subsidiary method)*

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Reference	Title
AS 1289.2.1.4	*Methods of testing soils for engineering purposes, Method 2.1.4: Soil moisture content tests – Determination of the moisture content of a soil – Microwave-oven drying method (subsidiary method)*
AS 1289.2.1.5	*Methods of testing soils for engineering purposes, Method 2.1.5: Soil moisture content tests – Determination of the moisture content of a soil – Infrared lights method (subsidiary method)*
AS 1289.2.1.6	*Methods of testing soils for engineering purposes, Method 2.1.6: Soil moisture content tests – Determination of the moisture content of a soil – Hotplate drying method*
AS 1289.3.1.1	*Methods of testing soils for engineering purposes, Method 3.1.1: Soil classification tests – Determination of the liquid limit of a soil – Four point Casagrande method*
AS 1289.3.3.1	*Methods of testing soils for engineering purposes, Method 3.3.1: Soil classification tests – Calculation of the plasticity index of a soil*
AS 1289.3.3.2	*Methods of testing soils for engineering purposes, Method 3.3.2: Soil classification tests – Calculation of the cone plasticity index of a soil*
AS 1289.3.4.1	*Methods of testing soils for engineering purposes, Method 3.4.1: Soil classification tests – Determination of the linear shrinkage of a soil – Standard method*
AS 1289.3.6.1	*Methods of testing soils for engineering purposes, Method 3.6.1: Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving*
AS 1289.3.8.1	*Methods of testing soils for engineering purposes, Method 3.8.1: Soil classification tests – Dispersion – Determination of Emerson class number of a soil*
AS 1289.4.2.1	*Methods of testing soils for engineering purposes, Method 4.2.1: Soil chemical tests – Determination of the sulfate content of a natural soil and the sulfate content of the groundwater – Normal method*
AS 1289.4.3.1	*Methods of testing soils for engineering purposes, Method 4.3.1: Soil chemical tests – Determination of the pH value of a soil – Electrometric method*
AS 1289.5.1.1	*Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density / moisture content relation of a soil using standard compactive effort*
AS 1289.5.4.1	*Methods of testing soils for engineering purposes – Method 5.4.1: Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio*
AS 1289.5.4.2	*Methods of testing soils for engineering purposes, Method 5.4.2: Soil compaction and density tests – Compaction control test – Assignment of maximum dry density and optimum moisture content values*
AS 1289.5.5.1	*Methods of testing soils for engineering purposes, Method 5.5.1: Soil compaction and density tests – Determination of the minimum and maximum dry density of a cohesionless material – Standard method*
AS 1289.5.6.1	*Methods of testing soils for engineering purposes, Method 5.6.1: Soil compaction and density tests – Compaction control test – Density index method for a cohesionless material*
AS 1289.5.7.1	*Methods of testing soils for engineering purposes – Soil compaction and density tests – Compaction control test – Hilf density ratio and Hilf moisture variation (rapid method)*

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FOI 26-292 - Document 21

Reference	Title
AS 1289.5.8.1	*Methods of testing soils for engineering purposes, Method 5.8.1: Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture – Density gauge – Direct transmission mode*
AS 1289.6.1.1	*Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen*
AS 3672	*Plastics – Unsaturated-polyester resins (UP-R);*
AS 3972	*General purpose and blended cement*
AS 4133.4.1	*Methods of testing rocks for engineering purposes – Rock strength tests – Determination of point load strength index*
AS 5101.3.2	*Methods for preparation and testing of stabilized materials, Method 3.2: Lime or cement content of stabilized pavement materials (EDTA method)*
AS/NZS 3725	*Design for installation of buried concrete pipes*
ASTM C295	*Standard guide for petrographic examination of aggregates for concrete*
Acid Sulfate Soils Guidelines	*Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines*, Department of Science, Information Technology, Innovation and the Arts, Queensland Government
Sampling and analysis procedure	*Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland*, Queensland Acid Sulfate Soils Investigation Team and the Department of Natural Resources and Mines
Geotechnical Design Standard	*Geotechnical Design Standard – Minimum Requirements*, Transport and Main Roads
Geotechnical terms and symbols	*Geotechnical terms and symbols*, Transport and Main Roads
MTM	*Materials Testing Manual,* Transport and Main Roads
MRTS01	*Introduction to Technical Specifications*
MRTS03	*Drainage, Retaining Structures and Protective Treatments*
MRTS05	*Unbound Pavements*
MRTS06	*Reinforced Soils Structures*
MRTS07A	*Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime*
MRTS07B	*Insitu Stabilised Pavements Using Cement or Cementitious Blends*
MRTS10	*Plant-Mixed Lightly Bound Pavements*
MRTS16	*Landscape and Revegetation Works*
MRTS27	*Geotextiles (Separation and Filtration)*
MRTS36	*Recycled Glass Aggregate*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*
MRTS52	*Erosion and Sediment Control*
MRTS55	*Use of Explosives in Roadworks*
MRTS56	*Construction Surveying*

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Reference	Title
MRTS58	*Subgrade Reinforcement using Pavement Geosynthetics*
MRTS63	*Cast-In-Place Piles*
MRTS70	*Concrete*
MRTS92	*Traffic Signal and Road Lighting Footings*
MRTS100	*High Strength Geosynthetic Reinforcement in Road Embankments*
Pavement Design Supplement	*Pavement Design Supplement to Austroads' Guide to Pavement Technology Part 2: Pavement Structural Design,* Transport and Main Roads
QRS	Quarry Registration System as defined in MRTS50 *Specific Quality System Requirements*
Standard Drawing 1149	*Traffic Signals / Road Lighting / ITS – Installation of Underground Electrical and Communications Conduit*
Standard Drawing 1178	*Diversion of Water – Diversion of Water from Roadway and Table Drains*
Standard Drawing 1359	*Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts*
Standard Drawing 2232	*Abutment Protection – Type 1 – Rock Spillthrough – Up to 1700 Clearance*
Standard Drawing 2233	*Abutment Protection – Type 1 – Rock Spillthrough – Greater than 1700 Clearance*
Standard Drawing 2234	*Abutment Protection – Type 2 – Reinforced Concrete Over Spillthrough – Up to 1700 Clearance*
Standard Drawing 2235	*Abutment Protection – Type 2 – Reinforced Concrete Over Spillthrough – Greater than 1700 Clearance*
Standard Drawing 2236	*Abutment Protection – Type 4 – Rockwork Over Spillthrough – Up to 1700 Clearance*
Standard Drawing 2237	*Abutment Protection – Type 4 – Rockwork Over Spillthrough – Greater than 1700 Clearance*
Standard Drawing 2238	*Abutment Protection – Rock Masonry*
TN187	*Controlled Low-Strength Material for Pipe Installation*

4 Standard test methods

Testing of all Works shall be undertaken in accordance with Clause 4 of MRTS01 *Introduction to Technical Specifications*.

Unless stated elsewhere herein, the standard test methods listed in Table 4 shall be used in this Technical Specification.

Table 4 – Test methods

Property to be Tested	Method No.
Acid Sulfate Soil Testing Field pH Tests (pHF and pHFOX) SPOCAS testing / Chromium Suite Monosulfidic Black Oozes (MBO)	*Acid Sulfate Soils Laboratory Methods Guidelines in Queensland*

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Property to be Tested	Method No.
Allowable working time	Q136A
California Bearing Ratio	AS 1289.6.1.1
Characteristic value	Q020
Chloride Content	Q130A, Q130B, other published or validated classical chemistry technique or instrumentation technique[1]
Compaction (Dry Density ratio or Hilf density ratio) and Moisture (moisture ratio, moisture variation or Hilf moisture variation)	AS 1289.5.4.1 or AS 1289.5.7.1
Density Index	AS 1289.5.5.1 and AS 1289.5.6.1
Dry Density – Moisture Relation	AS 1289.5.1.1, AS 1289.5.4.2
Density – Moisture Relation (rapid)	AS 1289.5.7.1
Degradation factor	Q208B
Electrical Conductivity / Resistivity	Q122A, Q122B
Emerson Class Number	AS 1289.3.8.1
Ferrous Oxide FeO content	Determination of ferrous iron by acid digestion
Insitu California Bearing Ratio (Dynamic Cone Penetrometer)	Q114B
Lime Content	AS 5101.3.2
Lime Demand	Q133
Linear Shrinkage	AS 1289.3.4.1
Liquid Limit	AS 1289.3.1.1 or AS 1289.3.9.1[2]
Moisture Content	AS 1289.2.1.1, AS 1289.2.1.2, AS 1289.2.1.4, AS 1289.2.1.5, AS 1289.2.1.6 and AS 1289.5.8.1
Organic Content	Q120B
Particle Size Distribution	AS 1289.3.6.1, AS 1141.11.1
Particle Size Distribution and Shape – Rock	Q230
Petrographic Analysis	ASTM C295
pH	AS 1289.4.3.1
Plasticity Index	AS 1289.3.3.1 or AS 1289.3.3.2
Point Load Index Test	AS 4133.4.1
Pretreatment of Road Construction Materials	Q101E
Proof Rolling	Q723
Relative Compaction	Q140A
Sampling	Q060 or AS 1289.1.2.1
Selection of Sampling and Testing Location	AS 1289.1.4.2 or Q050
Sulfate content	AS 1289.4.2.1, other published or validated classical chemistry technique or instrumentation technique[1]

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FOI 26-292 - Document 21

Property to be Tested	Method No.
Unconfined Compressive Strength (UCS) of Stabilised Materials	Q115
Water Absorption	AS 1141.6.1
Weighted Plasticity Index (WPI)	Q252
Wet Strength	AS 1141.22
Wet / Dry Strength Variation	AS 1141.22

Notes:

1. Instrumentation techniques may include Ion Chromatography / Inductively Coupled Plasma / Discrete Analyser and so on. NATA-endorsed test results are evidence of a validated technique.
2. Where Liquid Limit cannot be determined using AS 1289.3.1.1

4.1 Supplementary requirements for Test Methods AS 1289.5.4.1, 5.7.1 and 5.8.1

For compaction testing using Test Methods AS 1289.5.4.1 *Methods of testing soils for engineering purposes – Method 5.4.1: Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio* or AS 1289.5.7.1 *Methods of testing soils for engineering purposes – Soil compaction and density tests – Compaction control test – Hilf density ratio and Hilf moisture variation (rapid method),* the depth tested shall be the full depth of the compacted layer, except for Test Method AS 1289.5.8.1 *Methods of testing soils for engineering purposes, Method 5.8.1: Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture – Density gauge – Direct transmission mode* where the test depth shall be the greatest depth at which the source rod remains within the compacted layer.

4.2 Supplementary requirements for Test Method AS 1289.6.1.1

All laboratory California Bearing Ratio (CBR) and swell test conditions shall be as follows, unless otherwise specified in Clause 9.1 of the Annexure MRTS04.1 to this Technical Specification:

a) soaking period of four days

b) target laboratory density ratio of 95.0%

c) target laboratory moisture ratio of 100%

d) standard compactive effort

e) surcharge mass during soaking of 4500 g

f) surcharge mass during penetration of 4500 g

g) minimum curing times in AS 1289.6.1.1 *Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen* Table 1 shall apply, and

h) swell, Dry Density after soaking and Moisture Content of the remaining depth of specimen after penetration to be reported.

4.3 Supplementary requirements for Test Method Q115

Unconfined Compressive Strength (UCS) testing shall be undertaken at the Optimum Moisture Content and Maximum Dry Density determined using standard compaction.

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FOI 26-292 - Document 21

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2	1. Submission of construction procedures		
7.2.2	2. Trees and so on to be left undisturbed marked by Contractor		
7.2.3	3. Trees required by Administrator marked by Contractor		
9.4	4. Treatment of Unsuitable Material		
10.4	5. Testing for acid sulfate potential		
13.3.2.1	6. Subgrade in cuttings treatment type		
13.3.4.1	7. Acceptance of foundation by Administrator	1. Inspection of Foundation Surface	
14.2.1	8. Submission of Fill Material stockpile / source testing		
15.3		2. Testing of each layer	
15.4		3. Rolling using mechanical interlock method of compaction	
18.2.4.1			Submit *Quarry Registration Certificate*
18.2.5.4	9. Contractor to submit a mix design		
18.3.1	10. Subgrade testing prior to placement of pavement		
18.3.2		4. Visible vertical movement of Subgrade	
19.1	11. Submission of Backfill materials testing		

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Clause	Hold Point	Witness Point	Milestone
19.3.1		5. Backfill material compliance	
19.3.3	12. Backfill not placed before pipes, etc completed and inspected		
Appendix B B.2	13. Existing Subgrade design verification construction procedure		
Appendix B B.4		6. Existing Subgrade sampling	
Appendix B B.5		7. Testing of Existing Subgrade Material	
Appendix B B.6.1	14. Reporting of existing Subgrade test results		

5.2 Construction procedures

Those construction procedures which are required to be prepared by the Contractor in accordance with the quality system requirements of the Contract are listed in Table 5.2. The Contractor shall submit the construction procedures to the Administrator at least seven days prior to commencing the Works. **Hold Point 1**

Table 5.2 – Construction procedures

Clause	Procedure
5.2	Earthworks construction procedure
10.3	Acid Sulfate Soil management plan
11.2	Spoil disposal plan
Appendix B B.2	Subgrade design verification construction procedure

The earthwork construction procedure shall include, but not be limited to:

a) details of the proposed sources of earthworks materials including but not limited to general fill, Rock Fill, aggregates and sands, in addition to any proposed material suppliers (such as quarries) to be used

b) details regarding borrow Site establishment, operation and finalisation

c) details of proposed methodology for excavations and construction of cuttings and any proposed protective batter treatments

d) details of the quality system requirements of MRTS55 *Use of Explosives in Roadworks*, if explosives are proposed for the removal of rock materials

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e) details of the proposed Embankment construction methodology; details shall include:

   i. Embankment configuration (homogeneous or zoned)

   ii. materials to be used and their proposed location within the Embankment

   iii. any proposed re-use of poor-quality materials after amelioration, and

   iv. proposed measures to be taken to ensure compaction is achieved on batters, shoulders and verges

f) details of any proposed stockpile locations, temporary or permanent

g) details of all plant and equipment associated with the work detailed in this Technical Specification

h) a Mass Haul Diagram where total quantities of cut to fill from Site are 250,000m³ or greater

i) proposed measures for protection of Works during construction

j) details of how services, utilities, buildings and drainage components shall be located and protected from damage,

k) proposed testing frequencies, where greater than the minimum testing frequencies as given in Appendix A

l) all proposed workplace health and safety measures to be adopted during earthworks construction, and

m) all proposed environmental protection measures to be adopted during earthworks construction.

5.3 Protection of earthworks

It shall be the responsibility of the Contractor to provide protection of earthworks by (including, but not limited to, the following).

a) Installing and maintaining effective erosion and sedimentation control measures.

b) Maintaining drainage of all working areas at all times to ensure run-off of water without scour, except where ponding is off the formation and forms part of a planned erosion and sedimentation control system. Do not allow water to pond in the working areas, resulting in wetting up of the existing pavement or formation or foundation material.

c) When rain is likely or when work is not proposed to continue in a working area on the following day, take precautions to minimise ingress of water into earthworks material. Seal off ripped material remaining in cuttings and material placed on Embankments with a smooth drum roller.

d) Should earthworks material become over-wet (above the specified Moisture Content for compaction), the Contractor is responsible for replacing and/or drying out the material, and for any consequent costs.

e) Do not allow the earthworks material to dry out to the point where excessive shrinkage occurs in the Embankment, and/or the surface is pulverised by traffic generating excessive dust.

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5.4 Compliance testing

5.4.1 General

Compliance testing of earthworks shall be undertaken on a Lot basis in accordance with MRTS01 *Introduction to Technical Specifications*.

For each material type / source / Lot, the Contractor is responsible for performing sufficient tests to ensure that the Works comply in all regards with the requirements of this Technical Specification. As a minimum, the Contractor's testing program shall not be less than that specified in Clause 5.6.

The Contractor shall ensure that sufficient, clearly-documented construction compliance records are provided to the Administrator to ensure that traceability of earthworks materials is provided from their source (for example, quarry face) to the constructed earthworks.

> The Administrator should implement an audit and surveillance plan for the management of quality and conformance of Lots.
>
> Audit and surveillance activities may be undertaken based on the Contractor's historical performance, the project's risk profile, or where there are any concerns regarding Lot compliance.

5.4.2 Sampling

5.4.2.1 General

For the purpose of undertaking compliance testing, all materials used on the Works shall be sampled in accordance with Test Method AS 1289.1.2.1 *Methods of testing soils for engineering purposes, Method 1.2.1: Sampling and preparation of soils – Disturbed samples – Standard method* or Test Method Q060.

5.4.2.2 Sampling Fill Material

The Contractor shall sample Fill Material by the following methods:

1. sampling from the source, where material is not stockpiled, or
2. sampling from the source stockpile, and
3. sampling after field compaction has been completed.

Any fill materials sampled before compaction that break down under environmental and service conditions due to weathering (such as shales, claystones, siltstones and other soft laminated or jointed rocks) shall be pre-conditioned by artificial weathering in accordance with Test Method Q101E.

5.4.3 Sampling and test locations

Locations for compliance sampling or testing shall be selected by random stratified sampling as specified in Test Method AS 1289.1.4.2 *Methods of testing soils for engineering purposes, Method 1.4.2: Sampling and preparation of soils – Selection of sampling or test sites – Stratified random number method* or Test Method Q050.

5.4.4 Compaction

The compaction shall be determined by Test Method AS 1289.5.4.1 or Test Method AS 1289.5.7.1.

For stabilised materials, Relative Compaction shall be determined by Test Method Q140A.

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FOI 26-292 - Document 21

The Density Index of non-cohesive materials shall be determined using Test Method AS 1289.5.5.1 *Methods of testing soils for engineering purposes, Method 5.5.1: Soil compaction and density tests – Determination of the minimum and maximum dry density of a cohesionless material – Standard method* and Test Method AS 1289.5.6.1 *Methods of testing soils for engineering purposes, Method 5.6.1: Soil compaction and density tests – Compaction control test – Density index method for a cohesionless material*.

5.5 Conformance requirements

5.5.1 Geometrics

The geometric tolerances shall be as per Clause 6.

5.5.2 Compaction

The compaction standard for each Lot shall be represented by the minimum or maximum characteristic value of the compaction results. The characteristic value shall be calculated in accordance with Test Method Q020 using the individual compaction results reported for each Lot.

Where a Lot is assessed for compaction conformance using characteristic values, Moisture Content conformance shall also be assessed using characteristic values.

5.6 Testing frequency and Lot sizes

The maximum Lot sizes shall be as stated in Table A.2 of Appendix A.

The minimum testing frequencies shall be as stated in Tables A.1 and A.2 of Appendix A.

Source or stockpile compliance testing requirements shall be as specified in Table A.1 of Appendix A.

Construction compliance testing requirements shall be as specified in Table A.2 of Appendix A.

6 Geometrics

6.1 General

Earthworks shall be constructed so as not to depart from the widths, lengths, heights and shapes specified by more than the tolerances stated in this Clause 6.

The widths, lengths, and heights for the surfaces of a layer other than the final layer shall be calculated from interpolation and extrapolation of the design lines shown on the Standard Drawings.

If the location of batter toe points specified are found not to lie on the existing ground surface, derived batter points shall be established by interpolating or extrapolating batters to ground surface.

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6.2 Horizontal tolerances

The horizontal location of any point on a surface or interface between material types shall not differ from the corresponding point shown on the Standard Drawings, or determined in accordance with Clause 6.1, by more than ± 50 mm except for the following situations:

a) for edges not adjacent to a structure, the tolerance shall be – 50 mm + 250 mm (where the + tolerance is in the direction which increases the width of the earthworks)

b) the width of an Embankment at Subgrade Level shall not be less than that specified, and

c) where alignment of the pavement with an existing road structure is necessary, the new Works shall be joined to the existing work in a smooth manner as shown on the drawings or, if not so shown, in a manner approved by the Administrator.

6.3 Vertical tolerances

6.3.1 Primary tolerances

The heights of earthworks measured anywhere on a layer surface shall not vary from those shown on the drawings, or calculated in accordance with Clause 6.1, by more than the tolerance stated in Table 6.3.1 unless specified otherwise.

Average tolerances shall apply to the results for a completed Lot.

Table 6.3.1 – Primary vertical tolerances

Location	Tolerance (mm)
Subgrade Level (individual results)	± 25
Subgrade Level (average)	± 10
Top of Embankment, other than Subgrade Level	± 50
Top of insitu material below Subgrade (in cuttings other than rock)	± 25
Top of insitu material below Subgrade in cuttings that cannot be trimmed with a grader (refer to Clause 18.3.3.1).	+ 25 / - 75
Top of Rock Fill	
Top of high permeability Drainage Layer	
Top of insitu material below Subgrade (in rock cuttings)	
Top of verge	± 15 (provided the verge is free draining)
Inverts of drains	± 40
Top of benches and berms	± 35
Other interfaces between earthworks materials	± 50

6.3.2 Additional tolerances

The gap beneath a three metre-long straight-edge placed anywhere on the surface at Subgrade Level shall not exceed 25 mm, due allowance being made for design shape where relevant.

All Embankments, Subgrade, benches, berms and drains shall not pond water and be free draining. Batters shall be finished in accordance with Clause 16.

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7 Clearing and grubbing

7.1 General

Clause 7 applies to clearing and grubbing and bridge Site preparation where shown on the Standard Drawings or specified elsewhere in the Contract.

7.2 Construction

7.2.1 Areas to be cleared and grubbed

Clearing and grubbing operations shall be limited to those areas required to construct the Works and/or meet specified visibility requirements. As a minimum, the following clearing and grubbing shall be carried out:

a) where earthworks are to be constructed, the minimum width required to construct the Works, plus an additional width of not more than the distance stated in Clause 1.1 of Annexure MRTS04.1 to this Technical Specification or 3 m where not so stated, or the property boundaries, whichever is the lesser

b) where a bridge is to be constructed, the part of the area beneath the bridge required to construct the bridge plus a margin of not more than the distance stated in Clause 1.1 of Annexure MRTS04.1 to this Technical Specification or 2 m beyond the plan limits of the bridge where not so stated, or the property boundaries, whichever is the lesser

c) any areas specified for visibility, and

d) other areas specified in Clause 1.2 of Annexure MRTS04.1 to this Technical Specification.

7.2.2 Limitation on clearing operations

Any trees, shrubs and overhanging branches to be left undisturbed shall be clearly marked by the Contractor. This marking shall be carried out prior to clearing operations reaching the areas concerned. **Hold Point 2**

Clearing operations within streams and waterways shall not include removal of stumps and roots below ground surface. Beyond the areas to be cleared, only those trees, shrubs and overhanging branches which are shown on the drawings shall be removed or pruned, as necessary. Such removal or pruning shall only be carried out after consultation with the Administrator.

The Contractor shall take precautions to ensure that there is no unnecessary damage to stream beds or banks or any vegetation growing on them.

7.2.3 Trees required by the Administrator

Any trees required by the Administrator for use as marketable timber shall be as nominated in Clause 1.3 of Annexure MRTS04.1 to this Technical Specification. Such trees shall be clearly marked by the Contractor prior to clearing operations reaching the areas concerned. **Hold Point 3**

Marked trees shall be felled and handled in a manner which avoids damaging the trunks. The trunks of these trees shall be trimmed of branches and the trunks stacked in neat manageable stockpiles at locations approved by the Administrator at spacings of not more than 500 m.

7.2.4 Material suitable for organic mulch

Where Site-manufactured mulch is required in accordance with MRTS16 *Landscape and Revegetation Works* or MRTS52 *Erosion and Sediment Control*, processing of such material shall also

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FOI 26-292 - Document 21

be carried out in accordance with the Material and Construction requirements of MRTS16 *Landscape and Revegetation Works*.

> Payment Note: Payment for the processing and stockpiling of the Site-manufactured mulch material can be nominated in the Schedule of rates of Standard Work Item 50655P as per Specification (Measurement) MRS16 *Landscape and Revegetation Works*.

Payment for the spreading of mulch can be nominated in the schedule of rates of Standard Work Item 50951 as per Specification (Measurement) MRS16 *Landscape and Revegetation Works* and Standard Work Item 20613P as per Specification (Measurement) MRS52 *Erosion and Sediment Control*.

7.2.5 Fauna habitat logs

Hollow timber which is identified as being suitable for fauna habitat logs shall be relocated to areas clear of construction activities as follows:

a) behind batters

b) behind proposed safety barriers but not within any hazard-free zone, and

c) areas at least 9 m clear of carriageways.

Fauna habitat log density shall not exceed 20 m length per 100 m² area. Logs shall not be placed in waterways or in any area where they are likely to be struck by errant vehicles.

7.2.6 Sugar cane and banana plants

Banana plant root systems shall be completely removed and disposed of.

Sugar cane shall be either completely removed and disposed of or treated as follows:

1. Harvest the cane (if not already done prior to the Works). If outside the normal harvest period, turn off blower fans, harvest all material, including trash, then dispose of in a way approved by the Administrator. If done during the cane season, harvest the cane as normal, then rill the trash and burn as per normal farming practice.
2. Rotary hoe the top 300 mm of the ground twice. Perpendicular runs are preferred; however, if both passes need to be in the same direction, each run shall be overlapped.
3. The resulting mixture of top soil, soil and shredded cane stools can then be used in the ground surface treatment and/or Embankment where it is greater than or equal to 1.5 m below Subgrade Level or in the shoulder wedge between the theoretical 1 on 1 batter and actual 1 on X batter (where X > 2).

Any regrowth of sugar cane and/or banana plants occurring during the Contract, including the Defects Liability Period, shall be removed.

7.2.7 Disposal of cleared and grubbed materials

Cleared and grubbed material other than that mulched under Clause 7.2.4 shall be disposed of in any areas stated in Clause 5 of Annexure MRTS04.1 to this Technical Specification. If no such disposal instructions are stated, the cleared and grubbed material shall be removed from the Site and disposed of in accordance with all relevant statutory requirements, including the requirements in MRTS51 *Environmental Management*.

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Any burning of cleared and grubbed materials shall be carried out strictly in accordance with the requirements of the Contract.

7.2.8 Additional requirements

Within the limits of the clearing and grubbing, but clear of earthworks operations, any existing local irregularities of the natural surface shall be trimmed so as not to cause a hazard to errant vehicles. The surface shall be lightly compacted if necessary, to provide a surface consistent with that existing prior to the Works.

Any requirements listed in Clause 1.4 of Annexure MRTS04.1 to this Technical Specification shall apply to clearing and grubbing operations in addition to all other requirements of Clause 7.

8 Stripping of Topsoil

8.1 General

Clause 8 applies to stripping of existing Topsoil where shown on the drawings.

8.2 Topsoil stripping dimensions

Where Site Topsoil is required to be supplied in accordance with MRTS16 *Landscape and Revegetation Works*, Topsoil shall be stripped from the Site at a nominal depth of 75 mm (± 25 mm), or from areas and depths as specified in Clause 2 of Annexure MRTS04.1 to this Technical Specification.

All Topsoil needs to be stripped, with areas of Topsoil deeper than the nominal depth highlighted to the Administrator.

8.3 Material considered suitable for use as Topsoil

Soil stripped from the Site which is considered suitable for use as manufactured Site Topsoil shall be tested and ameliorated in accordance with MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for the testing of Topsoil, supply of amelioration agents, incorporation of amelioration agent to Topsoil and installation of Topsoil can be nominated in the Schedule of Rates of Standard Work Items 50602P, 50606P, 50701P and 50705P, 50651P and 50803 as per Specification (Measurement) MRS16 *Landscape and Revegetation Works*.

8.4 Construction

8.4.1 Stripping to stockpile

Material considered suitable for use as Topsoil in accordance with Clause 8.3 shall be stripped from the Site in a separate operation to any other clearing and/or stripping operation.

Stripped material shall be stockpiled in the locations shown on the drawings, as stated in Clause 2.2 of Annexure MRTS04.1 to this Technical Specification. Material shall not be stockpiled within the drip lines of existing plants to be retained.

Consider testing and ameliorating the Topsoil prior to stripping, for efficient and effective incorporation of amendments prior to stockpiling.

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Refer to *Soil Management Plan – Planning* in the environmental documents for preliminary Topsoil test data and recommendations

8.4.2 Surplus material

Surplus material and material considered to be not suitable for use as Topsoil in accordance with Clause 8.3 shall be assessed for use as fill or deemed to be Unsuitable Material and disposed of in accordance with Clause 11.

8.4.3 Stripping limitations

Material shall not be removed from within drip lines of existing plants to be retained except where this would otherwise result in Unsuitable Material being left beneath embankments. The root systems of existing plants to be retained shall be preserved wherever practical.

8.4.4 Stockpiling of Topsoil

Wherever practical, Topsoil shall be transferred directly to placement as Planting Media. Where stockpiling of Topsoil is required, it shall be carried out in a manner which ensures that the properties of the Topsoil are not permitted to degrade such that it becomes unsuitable as Topsoil.

To assist preservation of Topsoil, the Contractor shall include the following provisions in the management of Topsoil stockpiles:

a) limiting the height of stockpiles to three metres

b) limiting the width of the base of stockpiles to 10 m

c) adopting batter slopes, protective covers and drainage which reduce potential for erosion and/or segregation

d) limiting the period of stockpiling to a minimum practical time

e) where stockpiling for greater that 12 months, the stockpile shall be revegetated with grass to provide erosion and preserve the physical and chemical properties of the Topsoil, and

f) carrying out herbicide spraying or other treatment of the stockpile at intervals required to prevent weed growth and ensure the stockpile faces are weed-free prior to use.

Manufactured of stripped Topsoil into manufactured Site Topsoil shall be in accordance with MRTS16 *Landscape and Revegetation Works*.

Smaller linear projects, particularly in rural contexts, may consider grading the Topsoil to the outer edge of the Site to form a long linear Topsoil stockpile, which can double as a catch bank during construction and maintain seed bank in the Topsoil.

Consider testing and ameliorating the Topsoil prior to stripping, for efficient and effective incorporation of amendments prior to stockpiling.

Payment Note: Payment for the testing of Topsoil, supply of amelioration agents, incorporation of amelioration agent to Topsoil and installation of Topsoil can be nominated in the Schedule of Rates of Standard Work Items 50602P, 50606P, 50701P and 50705P, 50651P and 50803 as per Specification (Measurement) MRS16 *Landscape and Revegetation Works*.

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8.4.5 Finishing

All stripped areas, other than areas beneath road embankments or above road cuttings, shall be left in a neat, free-draining condition with side slopes not steeper than one in four unless otherwise specified.

They shall be treated to conform with the landscape, revegetation and environmental requirements of the Contract.

Prior to any further Works over the stripped area, an As Constructed survey of the stripped area shall be undertaken as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

9 Unsuitable Material

9.1 General

Clause 9 applies to the identification, excavation and disposal of Unsuitable Material where encountered on the Site and the backfilling of the resulting excavation.

9.2 Identification of Unsuitable Material

Unsuitable Material shall include:

a) material from swamps, marshes and bogs

b) logs, stumps and perishable materials

c) material susceptible to spontaneous combustion

d) excavated material that has a Weighted Plasticity Index (WPI) greater than 4200 and/or a Plasticity Index (PI) greater than 50 (as stated in Clause 14.2)

e) dry or wet material to a depth of 300 mm or the depth of Subgrade treatment, whichever is greater, which, in the opinion of the Administrator, cannot be reasonably worked or conditioned to achieve specified requirements

f) all material removed, where the material below the depth defined in Clause 9.2(e) is, in the opinion of the Administrator, unsuitable for compacting subsequent layers

g) material forming the foundation for a structure which has an allowable bearing pressure less than that nominated on the drawings

h) material forming the foundation for an Embankment which has an allowable bearing pressure or CBR less than that stated in Clause 3 of Annexure MRTS04.1 to this Technical Specification or, where not so stated, a CBR less than three, based on Dynamic Cone Penetrometer using Test Method Q114B

i) material containing biosecurity matter, including noxious weeds and other matter which may adversely affect the local environment, except where these are treated in an appropriate manner – for management of contaminated land, refer MRTS51 *Environmental Management*

j) Acid Sulfate Soils from within the Site which cannot be treated or managed in accordance with Clause 10

k) stripped Topsoil which is deemed not suitable as Planting Media and is not suitable for use elsewhere in the Works

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l) building rubble, including concrete, asphalt and other materials except where broken down or otherwise treated and proved to be suitable for use, or

m) abandoned Public Utility Plant and any associated material.

9.3 Unsuitable Material from inappropriate construction activities

If suitable material was to become unsuitable because of inappropriate construction activities or failure to protect Works adequately, all costs associated with reworking or replacing such Unsuitable Material shall be borne by the Contractor.

Examples of inappropriate construction activities include, but are not limited to:

- poor surface drainage
- restricted or inoperative subsurface drains
- contamination
- excessive-sized construction plant where the imposed load exceeds the material strength
- poorly maintained construction plant allowing leakage of oils and water onto the formation, and
- leaving the surface unsealed allowing moisture ingress during wet weather.

9.4 Construction requirements

It shall be the sole responsibility of the Contractor to prove that material is Unsuitable Material as defined in Clause 9.2.

Where Unsuitable Material or potentially Unsuitable Material is encountered on the Site, the Contractor shall, before proceeding to remove or cover such material, notify the Administrator and provide any test results required to justify such a claim. **Hold Point 4**

Within 24 hours of the above notification, the Administrator will advise the Contractor of the required treatment, if any, and the extent of such treatment.

Methods of excavation of Unsuitable Material shall be in accordance with the requirements of Clause 13. Excavated material shall be used or disposed of in accordance with Clause 11.

In general, backfilling of excavations of Unsuitable Material shall be carried out in accordance with the provisions of Clause 13.3.

10 Acid Sulfate Soils

10.1 General

Clause 10 applies to the identification, testing and treatment of Acid Sulfate Soils where encountered on the Site and in imported materials. For the purposes of this clause, the term 'Sampling and Analysis Procedure' shall mean the current revision of the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland* published by the Queensland Acid Sulfate Soils Investigation Team and the Department of Natural Resources and Mines.

Acid Sulfate Soils are predominantly found in sediments of marine origin in coastal areas where the ground surface elevation is less than five metres above sea level. Any tidal swamp or wetland which was once tidal, and some inland marshes subject to saline seepage, have the potential for the development of Acid Sulfate Soils.

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10.2 Initial assessment of Acid Sulfate Soils on the Site

If Acid Sulfate Soil has been identified on the Site, its presence shall be indicated in Clause 4.1 of Annexure MRTS04.1 to this Technical Specification and its location shall be stated in Clause 4.2 of Annexure MRTS04.1 to this Technical Specification.

Where Acid Sulfate Soil is likely to occur by reference to elevation, geology, geomorphology or as shown on *Sulfate Soil Risk Maps* compiled by the Department of Natural Resources and Mines, this shall be indicated in Clause 4.3 of Annexure MRTS04.1 to this Technical Specification and the likely locations shall be stated in Clause 4.4 of Annexure MRTS04.1 to this Technical Specification.

10.3 Management of Acid Sulfate Soils

Assessment of excavated materials, exposed Subgrade and borrow sources shall be undertaken by testing as specified in Clause 10.4. Where additional Site-specific requirements are stated in Clause 4.5 of Annexure MRTS04.1 to this Technical Specification, the additional requirements shall also be met.

Where potentially Acid Sulfate Soils are discovered, detailed methods for the identification, assessment and treatment of Acid Sulfate Soils shall be set out in an *Acid Sulfate Soil Management Plan* as part of the *Environmental Management Plan*. The *Acid Sulfate Soil Management Plan* shall comply with the *Sampling and Analysis Procedure*.

10.4 Testing and reporting of Acid Sulfate Soils

Testing for acid sulfate potential and reporting of test results shall be carried out on all excavated material and exposed cuttings on the Site which could reasonably be expected to have a possible acid sulfate potential.

The testing frequency and reporting shall be as detailed below.

a) Visual testing undertaken by trained personnel shall be continuous throughout the earthworks phase of the Contract and shall be applied to all such areas on which work is performed including Borrow Areas.

b) Field pH testing for both actual and potential Acid Sulfate Soils shall be carried out (on the same soil sample) on all Borrow Material to be imported to the Works and all material excavated or exposed in the Works in areas specified as having acid sulfate potential. A minimum of one test per soil type shall be carried out.

   The results shall be documented and reported to the Administrator prior to such materials being used on the Site. **Hold Point 5**

c) Where materials test positive to actual or potential acid sulfate contamination in the field, the Administrator shall be notified immediately. Such soils shall not be used on the Site until the results of subsequent quantitative laboratory testing negates the results of the field testing.

   Recommended quantitative laboratory methods are the Suspension Peroxide Oxidation Combined Acidity and Sulfate method and Total Oxidisable Sulfur method, as specified in the Sampling and Analysis Procedure and *Suspension Peroxide Oxidation – Combined Acidity and Sulfate (SPOCAS) Method*.

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10.5 Assessment of potential Acid Sulfate Soils

Visual assessment (as per *Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines* (Acid Sulfate Soil Guidelines)), followed by a soil pH test kit, can be used to indicate the presence of actual Acid Sulfate Soils. If the soil's field pH (pHF) is less than four, oxidisation of pyrite has probably occurred in the past, indicating that actual Acid Sulfate Soil is present. The pHF test shall only be used as an indicator.

All samples collected for laboratory analysis shall be placed in sealed sample containers which exclude air and the containers shall be placed in an insulated container packed with dry ice or in a refrigerator.

The samples shall be transported to the laboratory within 24 hours of collection to reduce the possibility of biologically-catalysed oxidation. Specific soil sampling methods shall be outlined in the Contractor's Acid Sulfate Soil Management Plan.

10.6 Soil treatment

Acid Sulfate Soils encountered below the base of excavations which will not be subjected to a change in water and oxygen regime do not require treatment; however, the high water content of such materials can be an issue for load bearing and subsidence.

Exposure of potential Acid Sulfate Soil (above the water table) exceeding 24 hours requires treatment. During hot weather, a covering may also be required. Actual Acid Sulfate Soil and Monosulfidic Black Oozes (MBO) are not allowed to be exposed without treatment.

Acid Sulfate Soils encountered as part of excavated materials and left exposed in cuttings or otherwise subjected to a change in water and oxygen regime will require treatment by the methods detailed below.

The treatment of positively identified actual or potential Acid Sulfate Soils shall be to neutralise their actual and potential acidity as specified in the Sampling and Analysis Procedure before use or transport off the Site. Methods of treatment shall be outlined in the Contractor's Acid Sulfate Soil Management Plan.

Acid Sulfate Soils from within the nominated excavation lines shall generally be treated with lime during placement in Embankment as provided for in Clause 14.3.6. Acid Sulfate Soils which cannot practically be neutralised for use on Site, or which are classed as Unsuitable Material, shall be removed from the Site and treated in accordance with the Acid Sulfate Management Plan.

Acid Sulfate Soils outside the nominated excavation and drainage lines shall be treated by insitu stabilisation with lime in accordance with Clause 12.2.3.

10.7 Water treatment

Runoff from stockpiles of Acid Sulfate Soil and exposed groundwater potentially contaminated by Acid Sulfate Soils shall be contained and managed within the boundary of the Site or treated to acceptable levels before discharge to watercourses. Analysis shall be carried out for at least chloride, sulfate, aluminium, calcium and iron content, pH and Electrical Conductivity. Water shall not be discharged unless it meets the standard specified in Clause 4.6 of Annexure MRTS04.1 to this Technical Specification.

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FOI 26-292 - Document 21

Treatment shall generally consist of introduction of a lime slurry to the contaminated water prior to discharge. Details of management and treatment methods and release parameters shall be included in the Contractor's Acid Sulfate Soil Management Plan.

11 Use of or disposal of surplus and Unsuitable Material

11.1 General

Clause 11 applies to the methods for use of and/or disposal of surplus material and Unsuitable Material. Material suitable for an alternative use shall be used for that purpose, if possible. Disposal of material shall be either to onsite Spoil areas or to Spoil off the Site.

11.2 Disposal in areas on the Site

Disposal in areas on the Site shall be permitted only at the locations specified in Clause 6 of Annexure MRTS04.1 to this Technical Specification. Where no such areas are specified in Clause 5 of Annexure MRTS04.1 to this Technical Specification, all surplus material and/or Unsuitable Material shall be removed from the Site in accordance with Clause 11.3.

Placement of surplus material and/or Unsuitable Material in areas on the Site shall be conditional on it being placed in neat and uniform lines which will remain stable and free-draining in the long term and compacted by traversing with construction machinery. The finished surface of the material shall be treated by topsoiling and grassing or other equivalent method so that it is not subject to erosion.

The following materials shall not be placed in disposal areas on the Site:

a) material susceptible to spontaneous combustion

b) untreated Acid Sulfate Soils

c) materials containing rubbish, construction materials, organic materials other than would be acceptable as Planting Media and other deleterious, odorous or unsightly materials, and

d) contaminated materials and materials containing biosecurity matter including noxious weeds or other matter which may affect the local environment or are considered environmentally hazardous.

11.3 Spoil to offsite areas

Except as provided for in Clauses 11.1 and 11.2, materials excess to project requirements and Unsuitable Material shall be disposed of off the Site.

Such material shall be removed from the Site and disposed of in accordance with all relevant statutory requirements. The Contractor must obtain a Deed of Indemnity from the given landowner, stipulating that the Principal, Superintendent and any associated Officers, Contractors and Sub-Contractors for the Project will not be held liable for the physical, chemical and/or biological condition of the material accepted on the property.

12 Ground surface treatment

12.1 General

Clause 12 applies to ground surface treatment where shown on the drawings or specified elsewhere in the Contract. The requirements of Clause 12 shall apply following clearing and grubbing operations and the stripping of Topsoil where appropriate.

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FOI 26-292 - Document 21

12.2 Construction

12.2.1 Ground surface treatment, standard

12.2.1.1 Areas to be treated

The requirements specified in Clause 12.2.1 are those to be carried out on the ground surface in all areas beneath any part of a road Embankment or road pavement, and any additional areas specified in Clause 6.1 of Annexure MRTS04.1 to this Technical Specification, but excluding:

a) any areas of excavation

b) any areas where a special ground surface treatment or Subgrade preparation is required, and

c) any areas underlaid by soft clay and where disturbance to the crust may give rise to construction issues (subject to confirmation by the Designer and agreed by the Administrator).

12.2.1.2 Filling holes and localised depressions

Any holes and localised depressions in the ground surface evident following clearing and grubbing and stripping of Topsoil shall be filled to the level of the surrounding ground surface. Fill Material shall be material similar to the surrounding ground material or material specified for the construction of embankments. The material shall be placed in the holes and depressions and compacted in accordance with Clause 15.

12.2.1.3 Compaction of insitu material below embankments

After any clearing and grubbing, stripping of Topsoil and replacement of Unsuitable Material, the exposed ground surface on which an Embankment is to be placed shall, as a minimum, be scarified and re-compacted to a depth of at least 150 mm in accordance with the requirements of Clause 15.

If the material below the ground surface on which an Embankment is to be placed is too wet or too dry to compact in accordance with Clause 15 and the material does not meet the requirements for Unsuitable Material as specified in Clause 9, the Moisture Content shall be adjusted as necessary to the appropriate depth to a maximum of 300 mm. Material below this depth shall be assessed under Clause 9.2.

This work may include tyning, adding water, mixing, draining, the addition of dry materials, removing and replacing and/or other appropriate treatments.

Alternatively, in the interests of expediency, the Contractor may elect to remove wet material and replace it with other material at the Contractor's own expense.

12.2.2 Ground surface treatment, special

Project-specific requirements for ground surface treatment shall be as specified in Clause 6.2 of Annexure MRTS04.1 to this Technical Specification.

12.2.3 Ground surface treatment – Insitu treatment of Acid Sulfate Soils

Where runoff or groundwater can leach from Acid Sulfate Soils, it shall be tested and neutralised in accordance with Clause 10.7.

Testing of Acid Sulfate Soils shall be in accordance with the requirements of Clause 10.

Lime shall be added to neutralise acidity. Addition and mixing of lime shall be in accordance with the requirements of MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime* with

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verification of Lime Content carried out in accordance with the requirements of MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime*.

Compaction shall be in accordance with the requirements of Clause 15.

12.2.4 Removal of Unsuitable Material

Procedures and processes for the identification, removal and replacement of Unsuitable Material shall comply with the provisions of Clause 9.

13 Excavation

13.1 General

Clause 13 applies to excavation where shown on the drawings or specified elsewhere in the Contract.

13.2 Blinding concrete

Blinding concrete shall be concrete of minimum Class N20/20 complying with the requirements of MRTS70 *Concrete*.

13.3 Construction

13.3.1 All excavations

Excavations shall be constructed to the shapes, lines, dimensions and other requirements shown on the drawings. The areas detailed in Clause 7 of Annexure MRTS04.1 to this Technical Specification shall be lightly tyned.

The use of excavated material in the construction of embankments, Subgrade treatments, or Backfill shall be subject to the requirements of the specific clauses.

Material within the lines of cuttings which is identified as Unsuitable Material in accordance with the provisions of Clause 9.2 shall not be used in the construction of embankments, Subgrade treatments or Backfill.

Excavated material which is surplus to the Project requirements shall be disposed of as stated in Clause 11. All permanent excavation batters shall be finished in accordance with Clause 16.

The bottom of excavations shall be trimmed to the tolerances specified in Clause 6 and any loose material removed from the surface.

In the event of any existing underground assets at risk of being fully or partly exposed during excavation Works, no backfilling or fill Works shall be undertaken until the surveying requirements have been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

13.3.2 Special requirements for cuttings

13.3.2.1 Bottom of excavation

When the level of excavation has reached Subgrade Level plus a nominal allowance determined by the Contractor, the Contractor shall carry out the requirements of the relevant provisions of Clause 18.3.3 and cease excavation until the Subgrade treatment type has been determined in accordance with Clause 18.3.3. **Hold Point 6**

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FOI 26-292 - Document 21

When determining the depth to cease excavation to satisfy this Clause, the Contractor's nominal allowance shall allow for any potential consolidation of the underlying material during Subgrade treatment Works and any trimming required to achieve the Subgrade Level.

Once Works are completed to Subgrade Level (including all Subgrade treatments), an As Constructed Survey of the bottom of the excavated area shall be undertaken as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

13.3.2.2 Unsuitable Material below the lines of cuttings

Material below the finished lines and levels of cuttings, which is Unsuitable Material in accordance with the provisions of Clause 9.2, shall be removed and disposed of in accordance with the provisions of Clause 9.4.

Backfilling of the excavation shall not commence until an As Constructed Survey of the excavation have been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

Where Unsuitable Material has been removed, the excavation shall be backfilled to the finished surface level with appropriate Fill Material as specified on the drawings or in accordance with Clause 18 and Clause 19.

After backfilling of the excavated are has been completed, an As Constructed Survey shall be undertaken as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

13.3.2.3 Pre-splitting

Batters specified in Clause 9 of Annexure MRTS04.1 to this Technical Specification and batters of rock cuttings with a slope of 2 vertical to 1 horizontal or steeper shall be pre-split prior to burden blasts to ensure protection of the batters.

The spacing of pre-split drill holes shall not exceed 1000 mm centre to centre. The actual spacing shall be determined by the Contractor.

13.3.2.4 Restoration of batters

If any section of a batter has been over-excavated beyond the tolerance limit specified, the Contractor shall re-form the batter to the average batter slope shown on the drawings, using an approved rectification method.

13.3.2.5 Berm drains

Berm drains shall be constructed where shown on the drawings. Unless shown otherwise, berm drains shall have a nominal depth of 100 mm and shall be two metres wide. Berm drains shall be concrete-lined in accordance with the requirements of MRTS03 *Drainage, Retaining Structures and Protective Treatments*.

13.3.3 Special requirements for Confined Excavations

13.3.3.1 Dimensions of excavations

Trench excavations and excavations for structures shall be carried out to the dimensions shown on the drawings or, where not so shown, to the minimum dimensions necessary to construct the Works accurately and safely under the Contract.

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Prior to any excavation Works or trench excavations, an assessment is to be undertaken to identify cadastral marks that may need protecting as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

13.3.3.2 Unsuitable Material in Confined Excavations

Material which is Unsuitable Material in accordance with the provisions of Clause 9.2 shall not be reused in the Works but shall be removed and disposed of in accordance with the provisions of Clause 9.4.

13.3.3.3 Protection of excavations

The Contractor shall take all necessary precautions to protect an excavation and all personnel and equipment in or about an excavation, including provision of all necessary temporary Works and equipment. Upon completion of construction within an excavation, all temporary Works shall be removed in such a way as not to damage any finished structure and ensure the finished Works meet the requirements of this Technical Specification in all regards.

13.3.3.4 Bottom of excavation

The material in the bottom of Confined Excavations shall comply with the density requirements of Clause 15. Where the insitu material does not comply, it shall be compacted to a depth of at least 150 mm in accordance with the requirements of Clause 15.

Placement of precast concrete items shall not be placed until the As Constructed Survey of the excavation for end structures have been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

Where precast concrete items (end structures, walls, kerbs, kerb and channels and so on) are to be placed in an excavation, a 50 mm layer of Bedding Material complying with the requirements of Clause 19.2.7 shall be placed and compacted to provide continuous, even support to the structure.

13.3.4 Special requirements for structure foundations

13.3.4.1 Excavation for load bearing footings

Excavation for foundations of structures shall be carried out to the dimensions and depths shown on the drawings. All excavations for foundations shall be drained.

When competent material has been reached at or below the depth shown on the drawings, the Foundation Surface shall be trimmed to a generally horizontal plane or to generally horizontal steps as appropriate, completely dewatered and presented for final inspection by the Contractor's Registered Professional Engineers of Queensland (RPEQ) geotechnical engineer. No work which will cover the surface of the foundation shall proceed until the foundation has been inspected and approved by the Contractor's RPEQ geotechnical engineer and approved by the Administrator. **Hold Point 7** The Contractor shall give the Administrator three days' notice of such inspection. **Witness Point 1**

A report from the Contractor's geotechnical engineer confirming that the profile of ground water and the strength and stiffness characteristics of foundation soil comply with the design assumptions shall be forwarded to the Administrator.

Where shown on the drawings or specified elsewhere, a layer of blinding concrete shall be placed over the foundation material as soon as practical. The top surface of the blinding concrete shall be screeded neatly to the shape and levels shown on the drawings.

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If the Foundation Surface has deteriorated since the time the foundation was approved and before blinding concrete or Backfill material has been placed, additional material shall be removed until competent material is reached as described above and then **Hold Point 7** shall be re-released.

No further work to cover the Foundation Surface shall proceed until the As Constructed Survey of the excavated area have been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

Additional requirements for culverts are given in Clause 13.3.6.

13.3.4.2 Excavation for pile caps

Excavation for pile caps shall be carried out to the dimensions and levels shown on the drawings.

13.3.5 Excavation to clear waterways

Excavation shall be carried out, where shown on the drawings, to clear the waterways at bridge abutments. The surface so formed shall be sealed by using a smooth drum roller.

13.3.6 Additional requirements for culverts

The widths of excavations for culverts shall be the minimum necessary for their construction and placement of Backfill against them, provided that nowhere shall such widths be more than those shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts.*

The material in the bottom of an excavation shall comply with the density requirements of Clause 15. Where the insitu material does not comply, it shall be compacted to a depth of at least 150 mm in accordance with the requirements of Clause 15.

13.3.7 Special requirements for drains

13.3.7.1 Culvert inlet / outlet drains

Culvert inlet / outlet drains shall be constructed from the extremities of end structures to culverts and shall transition smoothly to existing adjacent natural drainage channels or to the boundary of the Site, whichever is closer.

13.3.7.2 Diversion channels

Diversion channels shall be constructed to the details shown on the drawings.

13.3.7.3 Diversion drains

Diversion drains shall be constructed to the details shown on the drawings or, where not shown, as detailed on Standard Drawing 1178 *Diversion of Water – Diversion of Water from Roadway and Table Drains* and to any cross-sectional areas shown on the drawings.

13.3.7.4 Catch drains

Catch drains shall be constructed before or during the early stages of construction of the adjacent roadworks and shall be located as close as practicable to the adjacent batter edges.

Where the transverse slope of the ground surface allows this, catch drains shall be turned out away from the roadworks at frequent intervals in a manner which will minimise the scouring effect of any surface flows. Catch drains shall, where practicable, be terminated at inlet / outlet drains to culverts.

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13.3.7.5 Table drains

Where table drains cross accesses to private properties and details of the crossings are not specified, the drains shall be so constructed as to be trafficable to normal passenger vehicles.

13.3.7.6 Slope of drains

All drains shall have a continuous positive drainage slope in the required direction.

13.3.8 Dewatering of excavations

Where dewatering of excavations is required, it shall be carried out in compliance with the requirements of the Environmental Management Plan. Under no circumstances shall water be disposed of to sanitary sewers unless explicit permission to do so is granted by the relevant asset owner.

14 Embankments

14.1 General

Clause 14 applies to embankments constructed up to Subgrade Level, Subgrade treatments or as otherwise shown on the drawings or specified elsewhere in the Contract.

14.2 Materials

14.2.1 Introduction

Fill Material used in embankments shall be either Earth Fill or Rock Fill Material, and shall be sourced from:

- general excavations on the Site
- Borrow Areas on or off the Site, or
- other stockpiled materials (including quarried materials).

Where Fill Material is sourced from borrow, Borrow Areas shall be developed, operated and reinstated in accordance with the provisions of Clause 17.

Prior to incorporating any Earth or Rock Fill Material into the Works, the Contractor shall submit stockpile or source tests results as specified in Appendix A which demonstrate the source meets the specified material requirements. **Hold Point 8**

> Where embankments are being constructed as the Subgrade for pavements, the requirements of Clause 18 shall also apply, in addition to the requirements of this Clause 14.2.1.

14.2.2 Earth Fill Material

Earth Fill Material shall comply with the properties and classes stated in Table 14.2.2 and the additional requirements stated in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification.

The requirements for the percentage passing 0.075 mm and 0.425 mm test sieve, PI and WPI shall apply to source or stockpiled material (after pre-treatment in accordance with Test Method Q101E) and material compacted in place.

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Lot conformance is undertaken on test results from both source or stockpile samples and material sampled from the completed layer. Conforming source or stockpile or quarry test results do not, on their own, constitute a conforming Lot and do not justify a nonconformance in the compacted-in-place material. The Contractor is responsible for performing sufficient tests to ensure that the Works comply in all regards with the requirements of this Technical Specification.

Where a Lot is required to be reworked for any purpose, the material properties of the completed layer must be reassessed.

Where Earth Fill Material is used in the final batter slope surface of an Embankment, the material shall be tested and ameliorated, as per MRTS16 *Landscape and Revegetation Works* to ensure material in the outer 200 mm is chemically stable and capable of supporting long-term vegetation cover.

Where being used as Backfill, Earth Fill Material shall have all material passing the 25.0 mm test sieve (refer to Clause 19.2.2).

Table 14.2.2 – Earth Fill Material properties

Earth Fill Material	WPI	PI (%)	Minimum % passing 0.075 mm test sieve	Emerson Class Number
Class A1	< 1200	≥ 7	15	> 3
Class A2	< 1200	–	–	Note 2
Class B	1200 ≤ WPI < 2200			
Class C	2200 ≤ WPI < 3200			
Class D	3200 ≤ WPI < 4200	Note 1		–
Unsuitable	WPI ≥ 4200	–		

Notes:

1. Class D material that has PI > 50% is unsuitable Fill Material (refer Clause 9.2(d)).
2. Not specified unless required in accordance with Table 14.3.1.

Payment Note: Payment for the testing of final batter slope surface material (subsoil), supply of amelioration agents, spreading of amelioration agent on subsoil and incorporation with ground preparation work operations can be nominated in the Schedule of Rates of Standard Work Items 50701P, 50801, and 50802 as per Specification (Measurement) MRS16 *Landscape and Revegetation Works*.

In humid, tropical regions, the development of concretions in lateritic soils governs their engineering properties. Performance-based assessment applies. Details are required in the project-specific Annexure based on local experience.

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FOI 26-292 - Document 21

14.2.3 Rock Fill

Rock Fill shall consist of sound igneous, metamorphic or sedimentary rock or combination of these rock groups that will not disintegrate in water or when exposed to the weather. Rock Fill shall be free from overburden, Spoil, shale, clayey materials and organic matter. Rock Fill shall comply with the properties stated in Table 14.2.3. Rock shall be angular in shape and the least dimension of the rock shall not be less than half its greatest dimension.

Table 14.2.3 – Properties of Rock Fill prior to placement

Property	Requirement
Particle Size Distribution (Test Method AS 1141.11.1 *Methods for sampling and testing aggregates, Method 11.1: Particle size distribution – Sieving method* or Q230)	
• Maximum particle size	Refer Table 15.4
• Percentage passing:	
– 100 mm test sieve	< 20
– 19.0 mm test sieve	< 10
– 1.18 mm test sieve	< 5
Wet / Dry strength variation (Test Method AS 1141.22 *Methods for sampling and testing aggregates, Method 22: Wet / dry strength variation*)	35 (maximum)
Point load strength index Is(50) (Test Method AS 4133.4.1 *Methods of testing rocks for engineering purposes – Rock strength tests – Determination of point load strength index*)	Percentage of + 100 mm fraction with Is(50) less than 1 MPa = 10% (max)
Water Absorption (Test Method AS 1141.6.1 *Methods for sampling and testing aggregates, Method 6.1: Particle density and water absorption of coarse aggregate – Weighing in water method*)	< 5
	< 2.5 in wet areas and drainage layers
Degradation Factor (Test Method Q208B)[1]	30 (minimum)

Note:

1. Degradation Factor testing is only required if Rock Fill is subject to inundation for more than 12 hours.

Treat and shape the foundations under Rock Fill to maintain drainage and so erosion of the foundation will not occur. Place and spread the Rock Fill in such a way as to avoid segregation and so it is not contaminated with foreign material. The uncompacted Rock Fill layer thickness must not exceed the thickness given in Table 15 4. Do not dump rock against the columns or retaining walls but build it up evenly by gradually placing it around or against such structures. Compact the Rock Fill using the mechanical interlock method of construction as per Clause 15.4. When Rock Fill is used in the Core Zone or Outer Zone (Figure 14.3.1), or within a homogeneous Embankment, an Upper Zone of Class A1 or B material is required as a capping layer immediately above the Rock Fill.

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14.2.4 Verge material

Verge material shall be Earth Fill Material Class A1 or Class B complying with the properties stated in Clause 14.2.2.

14.2.5 Water retaining embankments

Fill Material used for the construction of levee banks, catch banks and other water retaining embankments shall be Earth Fill Material which complies with the requirements for Class A1 or Class B material in accordance with Clause 14.2.2 and Tables 14.2.2 and 14.2.3; however, the maximum particle size shall be limited to 50 mm.

The batter of the Embankment subject to temporary or permanent inundation shall be protected from saturation and slumping failures. Any Embankment batters subject to flood velocity greater than 2 m/s must be appropriately designed (not limited to scouring and Embankment stability).

14.2.6 Geotextile

Geotextile shall be a material of the appropriate strength class and filtration class, complying with the requirements of MRTS27 *Geotextiles (Separation and Filtration)*.

14.2.7 Geosynthetic reinforcement

Geosynthetic reinforcement in road embankments below Subgrade Level shall comply with the requirements of MRTS100 *High Strength Geosynthetic Reinforcement in Road Embankments*.

14.2.8 Special Embankment materials

Where special Embankment materials are required to be used, the material requirements are specified in Clause 9.2 of Annexure MRTS04.1 to this Technical Specification.

14.3 Construction

14.3.1 General

Embankments shall be constructed to the shapes, zones and other requirements shown on the drawings or as otherwise specified.

Where so stated in Clause 9.3 of Annexure MRTS04.1 of this Technical Specification, Fill Material shall be placed in zones as shown in Figure 14.3.1. Where not shown as being placed in zones, Fill Material shall be homogeneous.

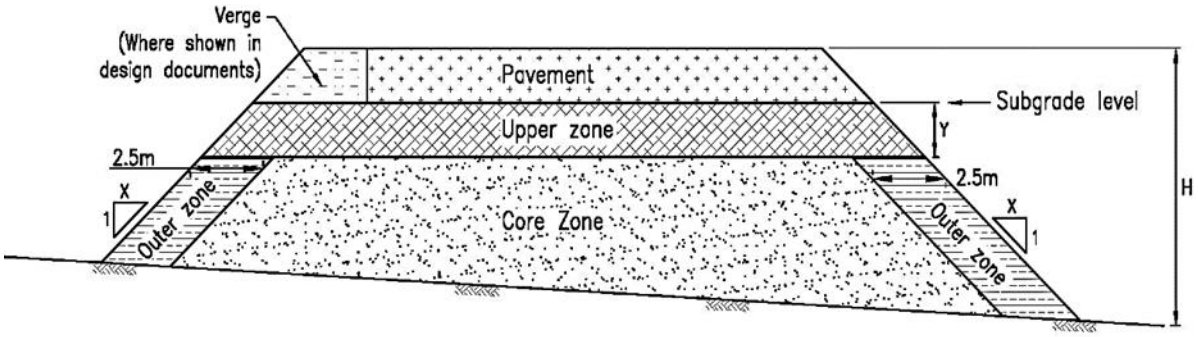
Notwithstanding any other specific requirement for Fill Material, material placed in an Embankment within a height 600 mm below Subgrade Level shall consist of material suitable for placement using the compacted layer method.

Prior to construction of the Subgrade, further construction of the Embankment shall not proceed until an As Constructed Survey of the Embankment, including batters, have been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

Earth Fill Material requirements for both homogeneous and zoned embankments, and cover requirements for zoned embankments, depend on Embankment height and rainfall zone. Unless shown otherwise in Clause 9.4 of Annexure MRTS04.1 to this Technical Specification, the requirements shall be as given in Table 14.3.1. The zone definitions for the cross-section and rainfall are shown in Figure 14.3.1 and Table 15.3(c) respectively.

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Figure 14.3.1 – Embankment zones



Note: It is preferred to construct the Core Zone and Outer Zone simultaneously in layers. If not, provide stepping as per Clause 14.3.3 between the Core Zone and Outer Zone.

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FOI 26-292 - Document 21

Table 14.3.1 – Embankment fill properties

Height (H)	Batter slope 'x'[1,6]	Rainfall zone[2]	Zoned cross-section				Homogeneous cross-section[3,5,7,9]
			Upper Zone Thickness Y (m)[1,4]	Earth Fill class[3]			
				Core[1]	Upper [1,5]	Outer[1,5]	
≤ 3 m	≥ 4	Low / Medium	**1.0 m** when Class C and **1.2 m** when Class D in Core	A1, A2, B, C, D	A1, B	A1, B, C	A1, A2, B, C[10]
		High	**0.8 m** when Class C and **1.0 m** when Class D in Core				
≤ 10 m	≥ 2	Low / Medium	**1.2 m** when Class C and **1.5 m** when Class D in Core			A1, B	A1, B
		High	**1.0 m** when Class C and **1.2 m** when Class D in Core				
≤ 10 m	≥ 1.5	–	600 mm of Class A1 or Class B[9]	Rock Fill, maximum rock size 300 mm (refer Table 15.4 for compaction)			
> 10 m				Rock Fill, maximum rock size 400 mm (refer Table 15.4 for compaction)			

Notes:

1. Refer to Figure 14.3.1 for definitions of x, y and Core, Upper and Outer Zones.
2. Refer to Table 15.3(c) for rainfall zone definitions.

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3. Refer to Table 14.2.2 for definitions of Earth Fill classes A1, A2, B, C and D.
4. As the Upper Zone (and Core Zone / Outer Zone) will form part of the pavement Subgrade, additional requirements stated in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification must also be satisfied.
5. Emerson Class Number > 3 for Outer Zone and Upper Zone materials as well as homogeneous cross-sections.
6. Minimum requirements are given in Figure 14.3.1 and Table 14.3.1. Embankments with height (H) > 10 m need to be geotechnically designed (example, Outer Zone thickness may need to be increased to satisfy the stability requirements).
7. For embankments within the Structure Zone of bridges over land, only Class A1 and/or Class B materials shall be used. For embankments within the Structure Zone of bridges over water, only Class A1 material shall be used. The maximum particle size shall be 75 mm.
8. For embankments within the Structure Zone of culverts, only Class A1 and/or Class B materials shall be used.
9. A geotextile separator as per Clause 14.3.2 shall be provided.
10. Class C materials shall not be used in the top 300 mm below Subgrade Level.

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The required Upper Zone thickness in Table 14.3.1 is mainly to minimise shrink / swell effects of the Core Zone materials on the pavement. As the Upper Zone, Core Zone and Outer Zone contribute to pavement support, the additional requirements stated in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification, and/or in the pavement design documentation, must also be satisfied to meet the pavement design requirements.

Where excess Fill Material is available from general excavations on the Site, care shall be taken to ensure that material in classes with the highest WPI is disposed of progressively.

Care shall be taken when sourcing Fill Material so that sufficient Class A1 and Class B materials are available to complete the Embankment in accordance with the requirements of this Technical Specification.

The method of construction employed shall be the compacted layer method and/or the mechanical interlock layer method in accordance with the requirements of Clause 15. Construction operations which involve tipping of material over the sides of a constructed section of Embankment are not permitted.

Compaction standards shall be as specified in Clause 15.

Permanent Embankment batters shall be finished in accordance with Clause 16.

14.3.2 Geotextile at changes in material type

Where Fill Material changes from material compacted by the mechanical interlock method to material compacted by the compacted layer method, a geotextile complying with the requirements of MRTS27 *Geotextiles (Separation and Filtration)* shall be installed at the interface unless approved by the Administrator.

Prior to installing the geotextile, the surface voids in the material at the interface shall be completely filled with smaller stones and fines to provide effective support for the geotextile.

14.3.3 Stepping the ground surface on which embankments are to be constructed

Where embankments are to be constructed on or against any slopes or batter of existing embankments (including batters resulting from the partial construction of Embankment, for example, Core Zone), steps shall be cut as follows:

a) where the ground surface has a slope steeper than 1V to 8H and shallower than 1V to 4H, a series of horizontal steps not less than 300 mm high shall be cut into the ground surface to be covered by the Embankment.

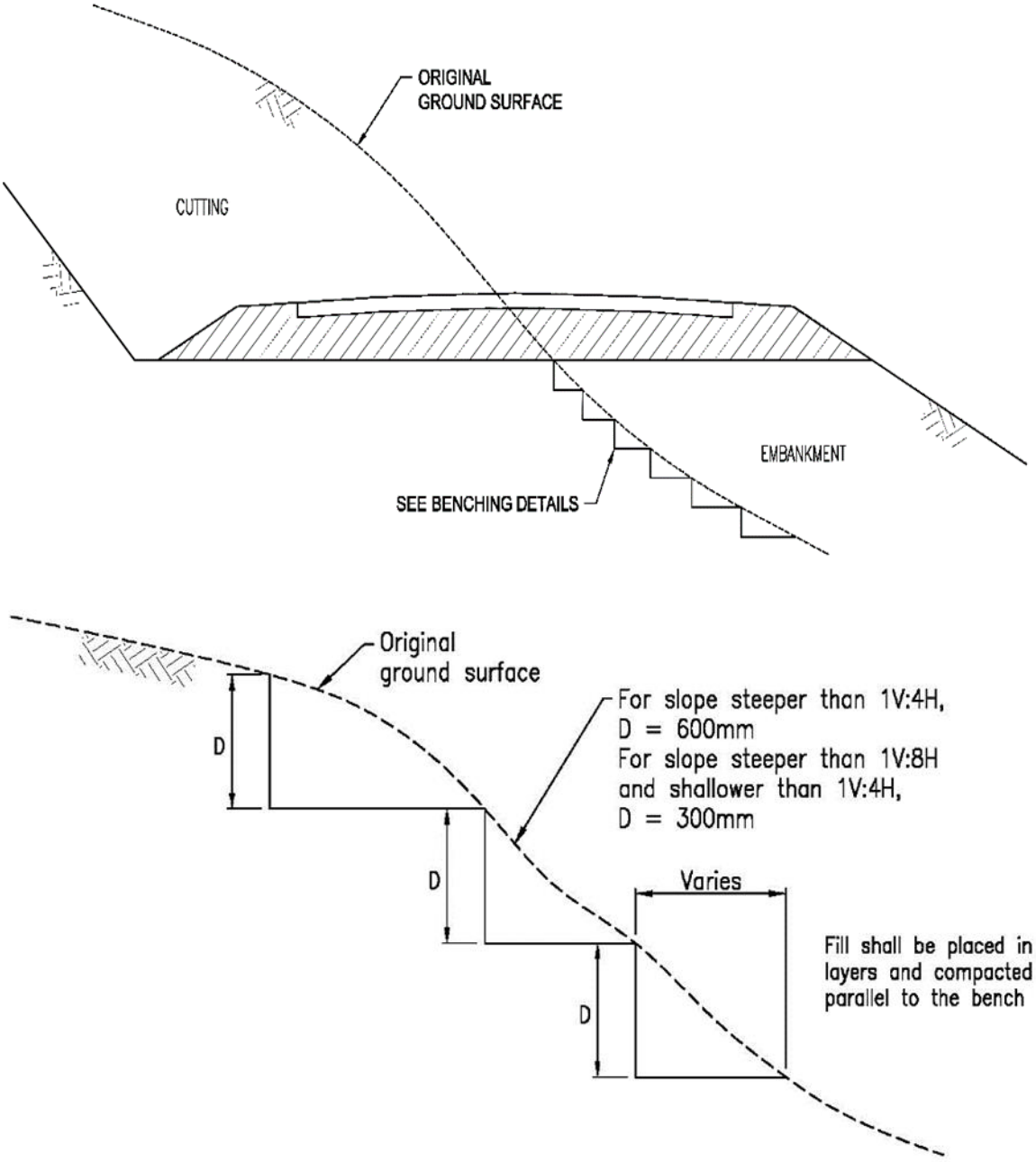
   Such steps shall be constructed both longitudinally and transversely (refer Figure 14.3.3(a))

b) where the existing slope or batter has a slope steeper than 1V to 4H, a series of horizontal steps not less than 600 mm high shall be cut into the ground surface to be covered by the Embankment.

   Such steps shall be constructed both longitudinally and transversely (refer Figure 14.3.3(b))

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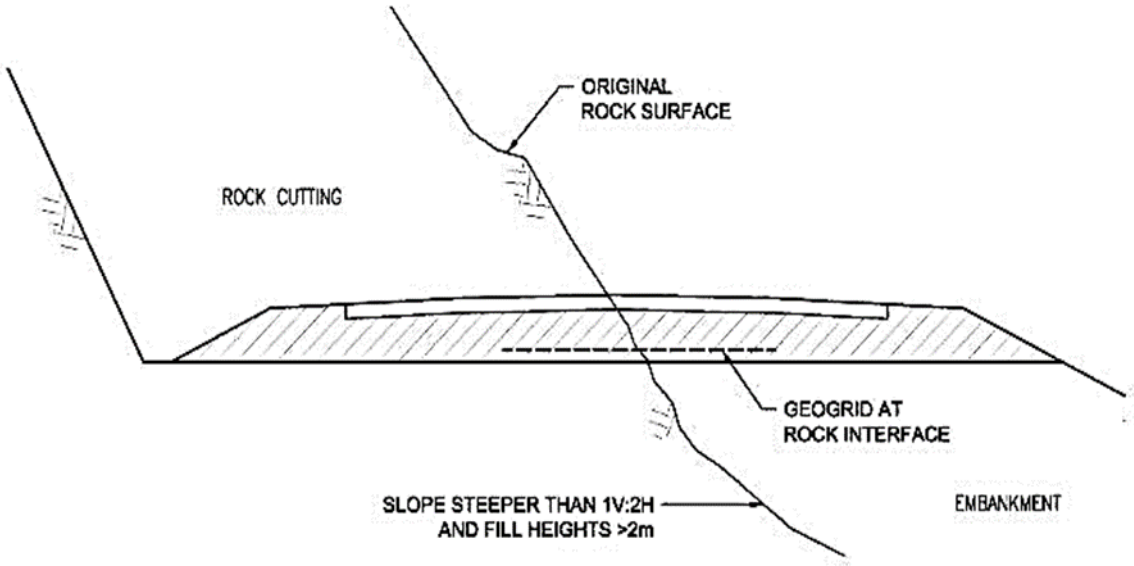
Figure 14.3.3(a) – Transverse transition in earth Cutting (also applies to longitudinal transition)



c) Where the material to be benched is hard rock, as a minimum, a geogrid reinforcement shall be placed at least 2 m either side of this interface at or below Subgrade Level (specific location to be nominated by the Designer) (refer Figure 14.3.3(b)).

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Figure 14.3.3(b) – Transverse transition in hard rock (also applies to longitudinal transition)



Inspect the floor of each step, in accordance with Clause 9 to check for any Unsuitable Material. Unless directed otherwise by the Administrator, incorporate the material thus excavated in embankments in accordance with Clause 14 or dispose of it as Spoil in accordance with Clause 11.

No account will be taken of the material removed in stepping when determining the general earthworks excavated volume.

Additional requirements for side-long embankments are given in Transport and Main Roads' *Geotechnical Design Standard – Minimum Standards*.

14.3.4 Special requirements for diversion blocks

Diversion blocks shall be constructed to the details shown on Standard Drawing 1178 *Diversion of Water – Diversion of Water from Roadway and Table Drains*.

The volume of each diversion block shall be not less than 1 m^3.

14.3.5 Special requirements for catch banks

Catch banks shall be constructed before or during the early stages of construction of the adjacent roadworks and shall be located as close as practicable to the adjacent batter edges of the roadworks.

Where the transverse slope of the ground surface allows this, catch banks shall be turned out away from the roadworks at frequent intervals in a manner which will minimise the scouring effect of any surface flows.

Catch banks shall be terminated at inlet drains to culverts.

14.3.6 Special requirements for Acid Sulfate Soil materials

Testing of Acid Sulfate Soils shall be in accordance with the requirements of Clause 10.

Where lime is to be added to Fill Material to neutralise acidity, the addition and mixing of lime shall be in accordance with the requirements of MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime* with verification of Lime Content carried out in accordance with the requirements of MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime*.

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15 Compaction

15.1 General

Clause 15 applies to the requirements for compaction of all earthworks materials.

15.2 Method of compaction and testing

The method of compaction and the required methods for verifying compliance with density requirements are dependent on the properties of the material being compacted. The categories of materials, their required method of compaction and the method for determination of density are summarised in Table 15.2.

Where the Contractor proposes to use materials other than those in the categories given in Table 15.2, the Contractor shall submit samples of the material and details of their proposed compaction and testing methods to the Administrator for acceptance.

Table 15.2 – Compaction method

Material category	Compaction method	Density compliance tests
Cohesion-less sands	Compacted layer method	Density Index where maximum Dry Density test gives meaningless answers, otherwise compaction (Dry Density ratio or Hilf density ratio)
Soils other than above which, after compaction, have < 35% of Stone retained on the 37.5 mm test sieve	Compacted layer method	Compaction (Dry Density ratio or Hilf density ratio)
Coarse grained soils with > 35% of Stone retained on the 37.5 mm test sieve	Mechanical interlock method	Nil on material in general

15.3 Compacted layer method of construction

Where the compacted layer method of construction is employed, the provisions of Clause 15.3 shall apply.

Where the Fill Material contains Stone, the Stone shall be of size not greater than two-thirds of the uncompacted layer thickness.

All Earth Fill Material shall be placed uniformly in layers. The allowable loose layer thickness for material compacted using the compacted layer method shall be as specified in Table 15.3(a).

The maximum allowable loose layer thickness for Earth Fill Material in road Embankment may be increased if the Contractor can demonstrate to the Administrator that the proposed compaction plant and work procedure will achieve the specified densities throughout the full depth of the compacted layer. Transport and Main Roads encourages such trials for Earth Fill Material and large earthworks projects, recognising that effective depth of compaction is dependent on the type of equipment being used; however, an equipment manufacturer's claim is not sufficient, and a quality control validation is required.

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Table 15.3(a) – Layer thickness for compaction

Material / Location	Loose layer thickness (mm)	
	Minimum	Maximum
Earth Fill Material (general)	150	300
Fill Material in water-retaining embankments	150	200
Backfill – except Sand	100	150
Backfill – Sand	150	300

In trenches and confined spaces, Backfill shall be placed at the minimum layer thickness in Table 15.3(a).

Where the uncompacted thickness of a layer would otherwise be less than the minimum thickness specified in Table 15.3(a), a lesser thickness of newly-placed Fill Material may be placed by loosening the underlying material to give a total depth equal to the minimum thickness.

Density requirements for materials compacted using the compacted layer method shall be as specified in Table 15.3(b). The characteristic value shall be calculated in accordance with Test Method Q020 using the individual compaction results reported for each Lot.

Table 15.3(b) – Density requirements

Application (reference Clauses)	Material	Compaction standard[1]	
		Minimum[2]	Maximum[3]
Existing Material and cuttings			
Insitu material for placement of Embankment fill (12.2.1.2, 12.2.1.3, 12.2.3)	Existing	95%	–
Bottom of excavations (13.3.3.4, 13.3.6)			
Subgrade Treatments			
Subgrade Treatment – specified layer thickness up to maximum 300 mm below Subgrade Level (18.3.3.3, 18.3.3.6)	Existing	97%	–
	Earth fill		
	Unbound granular or stabilised material		
	Cohesion-less[6]	70% (Density Index)	–
Subgrade Treatment – > 300 mm below Subgrade Level (18.3.3.3, 18.3.3.6)	Existing	95%	–
	Earth fill		
	Unbound granular or stabilised material		
	Cohesion-less[6]	70% (Density Index)	–

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Application (reference Clauses)	Material	Compaction standard[1]	
		Minimum[2]	Maximum[3]
Fill Material (including Embankment and Subgrade)			
Top 300 mm below Subgrade Level	Earth fill	97%	–
	Unbound granular or stabilised material		
	Cohesion-less[6]	70% (Density Index)	–
> 300 mm below Subgrade Level	Class A1, A2, or B	95%	–
	Unbound granular or stabilised material		
	Class C or D (low or medium rainfall zone)[4]	95%	–
	Class C or D (high rainfall zone)[4]	90%	96%
	Cohesion-less[6]	70% (Density Index)	–
Other			
Water retaining embankments and verge	Class A1 or B	97%	–
Embankment within Structure Zone	Class A1 or B	97%	–
Backfill (19.3.1)	Cohesive	95%	–
	Cohesion-less[6]	70% (Density Index)	–
Non-trafficked trench areas and ground surface treatment	Cohesive	90%	–
	Cohesion-less[6]	60% (Density Index)	
Non-trafficked landscaping areas[5]	Cohesive	80%	90%

Notes:

1. The compaction standard shall be compaction (Dry Density ratio or Hilf density ratio) except for cohesion-less material where Density Index shall be used.
2. Lower characteristic value unless otherwise required (refer Clause 5.4.3)
3. Upper characteristic value unless otherwise required (refer Clause 5.4.3)
4. Refer Table 15.3(c)
5. Landscape area to be approved by Administrator. This recognises heavy compaction inhibits plant growth.
6. Where 10 mm or 20 mm nominal size Bedding Material or drainage aggregate is used, Density Index testing is not required.

The Embankment material below Subgrade Level shall be placed and compacted at a Moisture Content within the range given in Table 15.3(c) or Table 15.3(d) where the values given are the moisture ratio or moisture variation (standard compaction). The rainfall zone shall be as given in Clause 10 of Annexure MRTS04.1 to this Technical Specification.

Where water is added to achieve the required Moisture Content, water shall be free from oil, acids, organic matter and any other matter which could be deleterious to earth fill properties.

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The Moisture Content of the compacted material shall be maintained within the specified range until covered with subsequent layers. Each layer shall be tested to conform the requirements as per Clause 5.6 before placing the subsequent layers. **Witness Point 2**

At all times, the Contractor shall ensure that no water is permitted to pond on or adjacent to an Embankment and that the surface of the Embankment is free draining. Any Unsuitable Material due to wetting up shall be reworked or removed and replaced as per Clauses 9.3 and 9.4. Such Unsuitable Material must be excavated to the extent and depth directed by the Administrator.

Table 15.3(c) – Allowable Moisture Content range for Embankment material (Moisture Ratio)

Rainfall zone	Median annual rainfall (mm)	Earth Fill Material Moisture ratio (%)			
		Class A1/A2[#]	Class B	Class C	Class D
High	> 1000	70 – 100	80 – 110	90 – 120*	100 – 130*
Medium	500 – 1000	70 – 90	70 – 100	80 – 110	80 – 110
Low	< 500	60 – 80	60 – 90	60 – 90	60 – 90

[#] For Class A1 and Class B materials within the Structure Zone, the relative moisture ratio must be between 60 – 80% for Class A1 and 60 – 90% for Class B respectively for all rainfall zones.

* These limits apply to material without added water. Where water is added to achieve compaction, the limits shall be 80 – 110.

Table 15.3(d) – Allowable moisture content range for Embankment material (moisture variation) – for Hilf compaction control testing

Rainfall zone	Median annual rainfall (mm)	Earth Fill Material moisture variation from optimum moisture content (%)			
		Class A1/A2[#]	Class B	Class C	Class D
High	> 1000	0 – 2.5 below optimum	3.0 below – 1.0 above optimum	2.0 below – 3.0* above optimum	0 – 5.0* above optimum
Medium	500 – 1000	1.0 – 2.5 below optimum	0 – 4.0 below optimum	3.0 below – 2.0 above optimum	4.5 below – 2.0 above optimum
Low	< 500	1.5 – 3.0 below optimum	1.5 – 6.0 below optimum	1.5 – 7.0 below optimum	2.0 – 9.0 below optimum

[#] For Class A1 and Class B materials within the Structure Zone, the relative moisture ratio must be between 1.5% – 3.0% below optimum for Class A1 and 1.5% – 6.0% below optimum for Class B respectively for all rainfall zones.

* These limits apply to material without added water. Where water is added to achieve compaction, the limits shall be 3.0% below – 2.0% above optimum.

15.4 Mechanical interlock method of construction

The mechanical interlock method of construction shall be employed for coarse granular soils and Rock Fill as specified in Clause 15.2, where mechanical interlock is relied upon for stability. All Fill Material

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shall be placed and compacted uniformly in layers. The maximum thickness of an uncompacted layer shall be determined from Table 15.4 unless otherwise agreed with the Administrator.

The module weights specified in Table 15.4 shall apply to drawn rollers and self-propelled single drum rollers. The maximum layer thicknesses for module weights between the values listed shall be interpolated.

The layer thickness and compaction equipment shall be chosen such that the maximum Stone size shall be less than or equal to half the uncompacted thickness.

Each layer shall be rolled until the rolled surfaces must not exhibit any permanent deformation, rutting, yielding, signs of distress or instability. **Witness Point 3**

Table 15.4 – Maximum thickness of uncompacted layers for mechanical interlock

Static module weight or vibrating drum equivalent (tonnes)	Maximum thickness of uncompacted layer (mm)	Maximum rock size (mm)
5	300	150
10	400	200
15	600	300
20	800	400

16 Finishing batters

16.1 General requirements

Batters shall be free of loose material and shall be trimmed neatly to the shapes specified.

No portion of a batter shall project beyond the design shape specified by more than 300 mm or one-third of the height of the batter, whichever is the lesser.

No portion of a rock batter shall overhang the outside edge of a table drain.

Batters shall continue in regular lines around curves.

Where vegetation treatments on cut or fill batters are shown on the drawings and/or specified, the following ground preparation Works shall be undertaken on the batters:

a) where batter slopes are flatter or equal to 1V : 4H, cultivation in accordance with MRTS16 *Landscape and Revegetation Works*, and

b) where batter slopes are steeper than 1V : 4H, roughening in accordance with MRTS16 *Landscape and Revegetation Works*.

Vegetation treatment of batters shall commence as soon as practicable, but not later than 14 days after substantial completion of earthworks on each batter.

Payment Note: Payment for the roughening and cultivation of cut and fill batters is included in the work operations of the Standard Work Item 50802 of Specification (Measurement) MRS16 *Landscape and Revegetation Works*.

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17 Borrow operations

17.1 General

Where material obtained from construction of excavations is insufficient for the construction of embankments and other fills, suitable material may be borrowed from areas on or off the Site.

17.2 Borrowing operations on the Site

Material may be borrowed on the Site from any areas stated in Clause 12.1 of Annexure MRTS04.1 to this Technical Specification. Where no areas are stated in Clause 12.1 of Annexure MRTS04.1 to this Technical Specification, material shall not be borrowed from the Site. Borrowing operations on the Site shall comply with any additional requirements stated in Clause 12.2 of Annexure MRTS04.1 to this Technical Specification.

Borrow Areas on the Site shall be developed, operated and reinstated in accordance with the following:

a) Borrow Areas shall be cleared and grubbed in accordance with the provisions of Clause 7

b) the area shall be stripped of Topsoil in accordance with the requirements of Clause 8.2 and the resulting material shall be stockpiled in accordance with the requirements of Clause 8.4.4 for subsequent reinstatement of the Borrow Area

c) the edges of the excavations shall be at least three metres clear of the Works, property boundaries, fences, Public Utility Plant, drainage lines and structures and any other installed components

d) excavations shall not be deeper than 500 mm, shall have side slopes not steeper than 1 on 4, and shall be graded to drain away from roadworks, and

e) on completion of borrowing operations, the area shall be trimmed to a neat and tidy shape that is able to freely drain. Previously stockpiled Topsoil shall be spread uniformly over the area.

Development, operation and reinstatement of Borrow Areas shall comply with the environmental requirements of the Contract.

17.3 Borrowing operations off the Site

Borrowing operations off the Site shall be carried out in compliance with all statutory requirements.

Borrow Material shall not be sourced from contaminated land and shall not contain Acid Sulfate Soils.

18 Subgrade

18.1 General

Clause 18 applies to the preparation of Subgrade below Subgrade Level in cuttings and Embankment.

All material within 1.5 m below Subgrade Level is considered to be Subgrade.

Stabilised Sand, Lean Mix Concrete, Sand and decomposed granite shall not be used in Subgrade fill except as shown on the drawings or specified elsewhere in the Contract.

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Subgrade is defined as the portion of the formation on which the pavement is constructed, and which provides support to the pavement. The depth of Subgrade is measured below 'Subgrade Level'.

Embankments and cuttings are required to be constructed to achieve the required support conditions adopted in the pavement design. These support conditions are typically specified using a minimum CBR (tested at the design moisture and density conditions).

The pavement designer should nominate (in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification) requirements for all materials within 1.5 m below Subgrade Level that are expected to have an influence on pavement support.

18.2 Materials

18.2.1 Fill Material

In addition to the requirements of Clause 14, Fill Material used within 1.5 m below Subgrade Level (that is within, the Subgrade), shall comply with the requirements specified in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification or elsewhere in the design documents. Where no indication is otherwise given, all Fill Material within the Subgrade shall have a minimum four-day soaked CBR of 3% when tested at 95% standard compaction and optimum moisture .

These requirements shall apply to fill used in embankments, Subgrade treatments and Backfill.

18.2.2 Unbound granular material

Where unbound granular material is to be used for the construction of Subgrade (including where it will be stabilised), it shall conform with the requirements of MRTS05 *Unbound Pavements* and shall be at least of the subtype specified in Clause 12.1 of Annexure MRTS04.1 to this Technical Specification, or where no such subtype is specified, at least subtype 2.4.

18.2.3 Unbound granular Drainage Layer material

Where unbound granular drainage material is to be used for the construction of Subgrade (including where it will be stabilised), it shall be subtype 2.4 conforming with the requirements of MRTS05 *Unbound Pavements* unless otherwise approved by the Administrator or shown elsewhere in the design documents; however, the particle size distribution of the material shall comply with the limits stated in Table 18.2.3.

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Table 18.2.3 – Drainage Layer – particle size distribution

Test sieve (mm)	Percent passing by mass
53.0	100
37.5	100
26.5	90 – 100
19.5	75 – 100
9.50	50 – 65
4.75	30 – 45
2.36	20 – 30
0.425	6 – 13
0.075	2 – 5

18.2.4 High-permeability drainage material

18.2.4.1 General

The unbound granular Drainage Layer material specified in Clause 18.2.3 may not always be sufficient to ensure an adequately permeable material for all situations. A high-permeability Drainage Layer may be required in some locations where higher water flows are expected.

High-permeability drainage material shall be Rock Fill complying with the requirements of Clause 14.2.3 and the additional and overriding requirements given in Table 18.2.4.1(a).

All high-permeability drainage material shall be sourced from a quarry registered and operated in accordance with the Transport and Main Roads Quarry Registration System requirements. The current *Quarry Registration Certificate* shall be submitted to the Administrator at least seven days before a material's supply or use. **Milestone**

Table 18.2.4.1(a) – Additional properties for high permeability Drainage Layer

Property	Requirement
Particle size distribution (Test Method AS 1141.11.1 or Q230)	Refer Table 18.2.4.1(b)
Wet strength (Test Method AS 1141.22)	100 kN (minimum)
Degradation Factor (Test Method Q208B)	40 (minimum)

The intent of this material specification is to provide a free-draining, highly permeable material that is sufficiently durable to withstand prolonged periods of inundation; therefore, the high permeable drainage material is intended to be supplied by a source registered and operated in accordance with the Department of Transport and Main Roads Quarry Registration System requirements. Where local conditions require otherwise, project-specific requirements will be specified at the time of tendering.

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Table 18.2.4.1(b) – Particle size distribution for high-permeability Drainage Layer

Test sieve (mm)	Percent passing by mass
125*	100
19.0	0 – 15
2.36	0 – 5
0.075	0 – 1

* The maximum particle size of the Rock Fill may be increased to 150 mm where the high-permeability Drainage Layer is at least 400 mm thick.

18.2.4.2 Material beneath high-permeability Drainage Layer

The CBR of the material on which the high-permeability Drainage Layer will be placed shall be determined by insitu DCP testing at the time of construction of the high-permeability Drainage Layer.

Where the CBR of the material is less than 1.0%, a specific assessment to determine the required properties and placement method of the Drainage Layer material is necessary.

Where the CBR of the material is greater than or equal to 1.0% at the time of construction, the high-permeability Drainage Layer should be a minimum thickness of 300 mm.

18.2.4.3 Cover over high-permeability Drainage Layer

Where the maximum particle size of the Rock Fill exceeds 100 mm, the top surface of the placed Rock Fill shall be covered (prior to encapsulating with geotextile) by smaller particle size Rock Fill, with a maximum particle dimension of 75 mm, to 'infill' the voids in the surface of the high-permeability Drainage Layer.

The proof rolling test shall be undertaken after placement of the smaller particle size Rock Fill.

In addition, where the high-permeability Drainage Layer is immediately below the pavement, it shall be covered by a minimum thickness of 150 mm of plant-mixed stabilised material in accordance with Clause 18.2.5 or a lightly bound improved layer in accordance with the requirements of MRTS10 *Plant-Mixed Lightly Bound Pavements*.

18.2.4.4 Construction requirements

The surface on which the Drainage Layer is placed shall be shaped in accordance with the design documents so that it does not pond water and is free draining.

High-permeability Drainage Layer material must be placed and compacted to achieve stability of the layer. The Administrator may require trial sections are constructed to verify that the proposed compaction procedure is acceptable.

High-permeability drainage layers shall be compacted using the mechanical interlock method of construction as per Clause 15.4.

18.2.5 Stabilised Subgrade material

18.2.5.1 General

The material to be stabilised may be Existing Subgrade Material or imported material. Existing Subgrade Material may be stabilised insitu. Imported materials may be stabilised either insitu or through plant-mixed stabilisation.

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Insitu or plant-mixed stabilisation may be undertaken with either lime, cement or cementitious blends in accordance with the requirements of Clauses 18.2.5.2 and 18.2.5.3.

For insitu stabilisation, the stabilising agent and its rate of application are nominated in Clause 12.2 of Annexure MRTS04.1 to this Technical Specification.

The following guidance is provided on the suitability of materials for either lime or cement / cementitious blend stabilisation.

Material requirements for stabilisation:

Lime	Cement or cementitious blend
a) PI > 10	a) PI ≤ 10
b) WPI > 1200	b) percentage passing the 0.075 mm sieve ≤ 25, and
c) maximum aggregate size of 75 mm	c) maximum aggregate size of 75 mm.
d) lime reacts as determined by Q133	
e) soluble sulfate ≤ 0.3%	
f) organic content* ≤ 1.0%, and	
g) ferric oxide* ≤ 2.0%.	
* These limits are a guide only; advice should be obtained before stabilising materials with ferric oxide contents > 2.0% or organic content > 5.0%.	
UCS of 1.0 – 2.0 MPa at 28 days	UCS of 1.0 – 2.0 MPa at 7 days

18.2.5.2 Lime stabilised Subgrade material

Unless otherwise directed by the Administrator, the material shall be stabilised with the amount of lime determined through the mix design process described in Section 7 of the Transport and Main Roads *Materials Testing Manual, Part 2 Application*.

In doing so, the stabilised material shall achieve a UCS of not less than 1.0 MPa and not greater than 2.0 MPa at 28 days.

Lime stabilisation is to be carried out in accordance with MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime*.

Where construction conditions do not permit the time required to undertake UCS-mix design testing, the Administrator may direct the Contractor as to the lime content to be used in the stabilisation process. Generally, the value nominated in this circumstance would be the lime demand value plus two percent.

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18.2.5.3 Cement or cementitious blend stabilised Subgrade material

Unless otherwise directed by the Administrator, the material shall be stabilised with the amount of cement or cementitious blend determined through the mix design process described in either:

- for insitu stabilisation – Section 3 of the *Materials Testing Manual, Part 2 Application*, or
- for plant-mixed stabilisation – the requirements for lightly bound improved layers specified in MRTS10 *Plant-Mixed Lightly Bound Pavements.*

In doing so, the stabilised material shall achieve a UCS of not less than 1.0 MPa and not greater than 2.0 MPa at seven days.

Insitu stabilisation is to be carried out in accordance with MRTS07B *Insitu Stabilised Pavements Using Cement or Cementitious Blends*.

Plant-mixed stabilisation shall be carried out in accordance with MRTS10 *Plant-Mixed Lightly Bound Pavements*.

> Where construction conditions do not permit the time required to undertake UCS-mix design testing, the Administrator may direct the Contractor on the stabilising agent content to be used in the stabilisation process. Generally, in this circumstance, GB cement (60% cement / 40% fly ash blend) at a target content of 2% (by mass) would be nominated.

18.2.5.4 Stabilised Subgrade mix design submission

The Contractor shall submit a mix design at least 14 days prior to the commencement of stabilisation. **Hold Point 9** The mix design shall use the same materials, including stabilising agent type and source, proposed for incorporation into the Works.

The mix design report shall include as a minimum:

a) details of the stabilising agent type and source

b) details of the material to be stabilised, including material type

c) test results for the material to be stabilised

d) seven-day UCS test results (for cement or cementitious blend stabilised material) and 28-day UCS test results (for lime stabilised material) at a number of stabilising agent contents (minimum three) to cover the range of upper and lower UCS limits, and the design stabilising agent content (Note: in Test Method Q115, one UCS test result is the average of three specimens), and

e) test results for determining the allowable working time in accordance with Test Method Q136A.

In addition to the above, where the material is plant-mixed, the mix design process specified in MRTS10 *Plant Mixed Lightly Bound Pavements* shall be followed.

Where the properties of the material to be stabilised vary significantly at different locations in the project, a mix design shall be submitted for each unique set of material properties.

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Where the Administrator nominates the lime, cement or cementitious blend content to be used in the stabilisation process, the requirement for this mix design submission may be waived.

18.2.6 Geotextile filter fabric

Geotextile for use in a Drainage Layer shall be of the appropriate strength class and filtration class in accordance with the requirements specified in MRTS27 *Geotextiles (Separation and Filtration)*.

18.2.7 Geosynthetic reinforcement

Geosynthetic reinforcement in Subgrade shall comply with the requirements of MRTS58 *Subgrade Reinforcement using Pavement Geosynthetics*.

18.3 Construction

18.3.1 General

The Subgrade shall be constructed and tested to Subgrade Level in accordance with the requirements of this Technical Specification prior to construction of the pavement. **Hold Point 10**

18.3.2 Proof rolling

At the completion of earthworks to Subgrade Level, the Contractor shall test for perceptible surface deformation by undertaking proof rolling. **Witness Point 4**

Testing shall be in accordance with Test Method Q723 unless otherwise approved by the Administrator. Testing for perceptible surface deformation is exempt from the requirement for NATA accreditation or construction material testing registration.

In areas where perceptible surface deformation is observed, the Contractor shall remove and replace the affected section, or take other corrective action to the satisfaction of the Administrator. In doing so, the Administrator may require the Contractor to carry out additional compliance testing to ensure that the affected section of pavement complies with the requirements of this Technical Specification. No additional payment will be made by the Principal for any such additional testing.

The proof rolling result reported for any Lot shall be representative of the condition of the Lot immediately prior to it being covered. If the Subgrade has been subjected to rainfall or moisture ingress in any way since proof rolling was undertaken, the Administrator may direct the Contractor to retest the Lot to prove conformance. If the retested results do not comply with the requirements of this Technical Specification, the Contractor shall dry back and/or reprepare the Subgrade such that it complies with the requirements of this Technical Specification. No addition payment will be made by the Principal for any such additional efforts.

Construction of the pavement shall not commence until an As Constructed Survey of the Subgrade has been met as specified in MRTS56 *Construction Surveying* and notice of such Works provided to the Administrator.

18.3.3 Subgrade treatment

18.3.3.1 General

Clause 18.3.3 applies to the construction of Subgrade in cuttings when excavation has progressed to Subgrade Level in accordance with Clause 13.3.2.1, or where directed by the Administrator, or shown on the drawings, on embankments, or at grade.

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FOI 26-292 - Document 21

The Subgrade treatments are nominated in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or shown on the drawings. In directing the required Subgrade treatment and providing authorisation to proceed past **Hold Point 6** (refer to Clause 13.3.2.1), the Administrator will consider:

a) the material encountered in the bottom of the excavation

b) the results of testing of the insitu material, where required under the Contract or directed by the Administrator, and

c) any adjustments to the pavement thickness considered necessary by the Administrator.

The Administrator may direct a Subgrade treatment that is not listed in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification in accordance with the Conditions of Contract.

Where the Contractor is required to undertake or is directed by the Administrator to undertake Existing Subgrade Material testing under the Contract, the period for determination by the Administrator of the Subgrade treatment to be adopted shall commence from the later of:

1. the time the test results are provided by the Contractor to the Administrator, and
2. when the level of excavation has reached Subgrade Level plus a nominal allowance (refer Clause 13.3.2.1).

A summary of the various types of Subgrade treatment is set out in Table 18.3.3.2.

Different Subgrade treatments may be required in separate areas of any Cutting or formation.

Material which is deemed to be Unsuitable Material, as defined in Clause 9, which is encountered in the zone below any Subgrade treatment shall be dealt with in accordance with Clause 13.3.2.2.

The Contractor shall clean out any loose material and ensure the bottom of the excavation is free-draining. Alternatively, where a free-draining state cannot be achieved, any undrained depressions shall be filled to provide a free-draining surface with a suitable crossfall. Unless otherwise directed by the Administrator, depressions shall be filled with a plant-mixed stabilised material in accordance with Clause 18.2.5.3.

18.3.3.2 Subgrade treatment types

Acceptable Subgrade treatments are described in Table 18.3.3.2.

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FOI 26-292 - Document 21

Table 18.3.3.2 – Summary of Subgrade treatments

Treatment type	Clause reference	Description	Drainage Layer required	Replacement material	Stabilisation method	Depth of treatment (mm)[1]
A	18.3.3.3	Compact existing	No	–	–	150
B	18.3.3.4	Replace with Earth Fill Material	No	Earth Fill Material	–	150
C	18.3.3.5	Replace with unbound granular material	No	Unbound granular material	–	150
D	18.3.3.6	Insitu stabilise existing	No	–	Insitu	150
E	18.3.3.7	Replace with plant-mixed stabilised material	No	Stabilised granular material	Plant-mixed	200
F1	18.3.3.8	Plant-mixed stabilised upper layer and unbound drainage lower layer	Yes	Stabilised granular material	Plant-mixed	150
				Unbound granular drainage material		100
F2	18.3.3.8	Plant-mixed stabilised upper layer and high-permeability drainage lower layer	Yes	Stabilised granular material	Plant-mixed	150
				High-permeability drainage material		300
G	18.3.3.9	Insitu stabilised Drainage Layer	Yes	Stabilised granular drainage material	Insitu	150
H	18.3.3.10	Plant-mixed stabilised Drainage Layer	Yes	Stabilised granular drainage material	Plant-mixed	150
I	18.3.3.11	High-permeability Drainage Layer	Yes	High-permeability drainage material	–	300
J	18.3.3.12	Bridging layer	No	Rock Fill	–	–
K	18.3.3.13	Special	[2]	[2]	[2]	[2]

[1] Unless otherwise specified on the drawings or Clause 12.3 of Annexure MRTS04.1 to this Technical Specification.

[2] As specified on the drawings.

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FOI 26-292 - Document 21

18.3.3.3 Subgrade treatment Type A, compact existing

For Subgrade treatment Type A, excavation shall be completed to Subgrade Level in accordance with Clause 13.3.1.

The material below Subgrade Level shall be compacted as specified in Clause 15.3 to a characteristic value of compaction as specified in Table 15.3(b).

The depth of compaction shall be as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 150 mm.

18.3.3.4 Subgrade treatment Type B, replace with Earth Fill Material

For Subgrade treatment Type B, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 150 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with Fill Material in accordance with Clause 18.2.1 and compacted as specified in Clause 15.3 to a characteristic value of compaction as specified in Table 15.3(b).

18.3.3.5 Subgrade treatment Type C, replace with unbound granular material

For Subgrade treatment Type C, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 150 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with unbound granular material, in accordance with Clause 18.2.2, and shall be constructed as specified in MRTS05 *Unbound Pavements* to a characteristic value of compaction of not less than that specified in Table 15.3(b).

18.3.3.6 Subgrade treatment Type D, insitu stabilise existing

For Subgrade treatment Type D, excavation shall be completed to Subgrade Level in accordance with Clause 13.3.1.

The existing material below Subgrade Level shall be insitu stabilised in accordance with the requirements of Clause 18.2.5, to the depth below Subgrade Level specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification, or where no such depth is specified, to a depth of 150 mm.

The stabilised material shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b).

18.3.3.7 Subgrade treatment Type E, replace with plant-mixed stabilised material

For Subgrade treatment Type E, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 200 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with plant-mixed stabilised unbound granular material, in accordance with Clauses 18.2.2 and 18.2.5. The stabilised material shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b).

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FOI 26-292 - Document 21

18.3.3.8 Subgrade treatment Type F1 and F2, unbound granular Drainage Layer

For Subgrade treatment Type F1 and F2, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, as given in Table 18.3.3.8. Excavation shall comply with the requirements of Clause 13.3.1.

Table 18.3.3.8 – Subgrade treatment Type F requirements

Treatment type	Unbound Drainage Layer type	Depth of excavation (mm)	Minimum thickness of unbound Drainage Layer (mm)
F1	Unbound granular drainage material (refer Clause 18.2.3)	250	100
F2	High-permeability drainage material (refer Clause 18.2.4)	450	300

Unless otherwise specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification, the unbound Drainage Layer of the nominated type shall be constructed to the thickness given in Table 18.3.3.8. The Drainage Layer shall be wrapped in a non-woven geotextile (top, bottom and all sides) in accordance with MRTS27 *Geotextiles (Separation and Filtration)*.

The remainder of the excavation shall then be backfilled to Subgrade Level with plant-mixed stabilised unbound granular material in accordance with Clauses 18.2.2 and 18.2.5.

The unbound granular drainage material and plant-mixed stabilised material shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b).

18.3.3.9 Subgrade treatment Type G, insitu stabilised Drainage Layer

For Subgrade treatment Type G, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 150 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with unbound granular drainage material, in accordance with Clause 18.2.3 and insitu stabilised in accordance with the requirements of Clause 18.2.5. The stabilised material shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b).

18.3.3.10 Subgrade treatment Type H, plant-mixed stabilised Drainage Layer

For Subgrade treatment Type H, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 150 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with plant-mixed stabilised unbound granular drainage material, in accordance with Clauses 18.2.3 and 18.2.5. The stabilised material shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b).

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18.3.3.11 Subgrade treatment Type I, high-permeability Drainage Layer

For Subgrade treatment Type I, excavation shall be continued to a depth below Subgrade Level as specified in Clause 12.3 of Annexure MRTS04.1 to this Technical Specification or, where no such depth is specified, to a depth of 300 mm. Excavation shall comply with the requirements of Clause 13.3.1.

The excavation shall be backfilled to Subgrade Level with high-permeability Drainage Layer material, in accordance with Clause 18.2.4. The Drainage Layer shall be wrapped in a non-woven geotextile (top, bottom and all sides) in accordance with MRTS27 *Geotextiles (Separation and Filtration)*.

> Subgrade treatment Type I is primarily intended to be used where a stabilised or lightly-bound layer (satisfying the requirements of Clause 18.2.4.3) will already be provided as part of the pavement design (for example, as a lightly-bound improved layer).
>
> Placing pavement directly over a high-permeability Drainage Layer without this overlying layer may lead to instability and difficulty achieving compaction in the structural pavement layers.
>
> Furthermore, moisture may enter the pavement structure through the Drainage Layer, leading to premature failure of the pavement.

18.3.3.12 Subgrade treatment Type J, bridging layer

Subgrade treatment Type J may be applied to Subgrade in cuttings, at the base of embankments or otherwise as directed by the Administrator.

The Contractor shall place Rock Fill complying with Clause 14.2.3 to construct a stable bridging layer by using the mechanical interlock method of compaction in accordance with Clause 15.4.

Where directed by the Administrator:

a) the bridging layer shall be wrapped in a non-woven geotextile (top, bottom and all sides) in accordance with MRTS27 *Geotextiles (Separation and Filtration)*, and/or

b) the bridging layer shall be wrapped in a high-strength geosynthetic reinforcement in accordance with MRTS100 *High Strength Geosynthetic Reinforcement in Road Embankments*.

18.3.3.13 Subgrade treatment Type K, special

Subgrade treatment Type K shall be in accordance with the provisions specified in Clause 12.4 of Annexure MRTS04.1 to this Technical Specification.

18.3.4 Earthworks transition from cut to fill

18.3.4.1 General

At all such transitions from cut to fill or fill to cut, the Embankment shall continue longitudinally and transversely up to the line where the Subgrade Level intercepts the Prepared Ground Surface unless stated otherwise in Clause 18.3.4.2.

Earthworks transitions from cut to fill shall be benched in accordance with Clause 14.3.3.

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18.3.4.2 Transition treatment

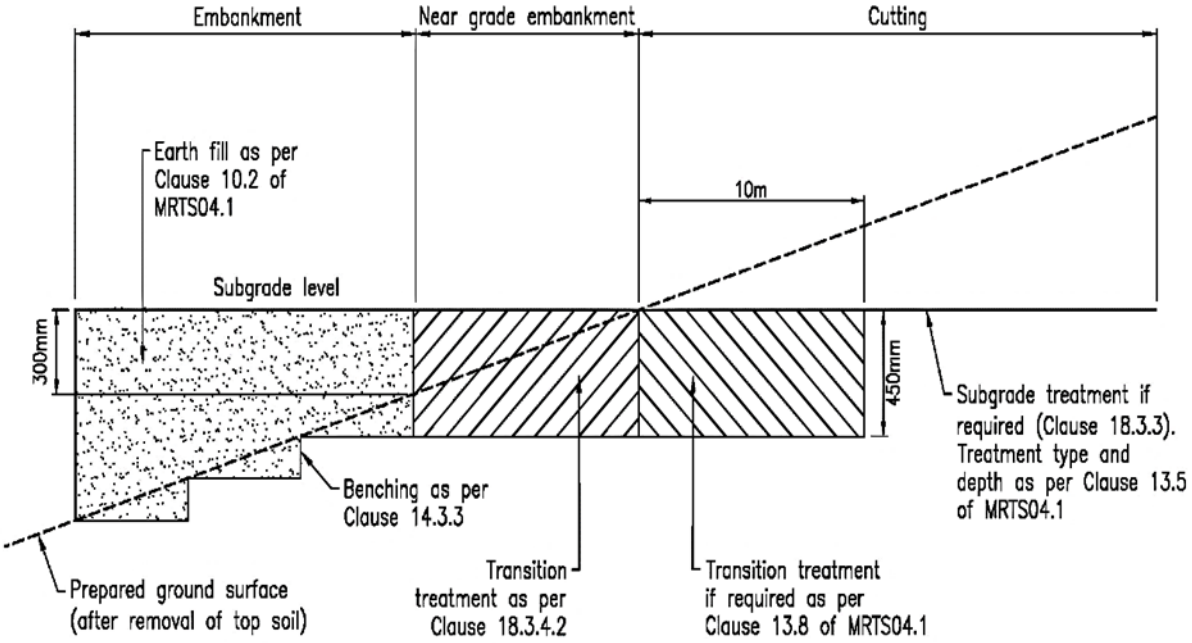
Where so stated in Clause 12.6 of Annexure MRTS04.1 to this Technical Specification, or directed by the Administrator in accordance with Clause 12.5 of Annexure MRTS04.1 to this Technical Specification, the properties of the existing foundation material beneath near grade embankments below Subgrade Level shall be tested for compliance with the requirements in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification to a depth of 450 mm. Existing foundation material which does not comply with these requirements shall be treated as Unsuitable Material.

Backfilling of Unsuitable Material excavations under near grade Embankments shall be carried out using material complying with the requirements of Clause 9.1 of Annexure MRTS04.1 to this Technical Specification. Backfill shall be compacted to a characteristic value of compaction not less than that specified in Table 15.3(b) for material below Subgrade Level.

Where nominated in Clause 12.6 of Annexure MRTS04.1 to this Technical Specification, the transition treatment to test and replace Unsuitable Material shall be carried out 10 m into the Cutting beyond the line where the Subgrade Level intercepts the Prepared Ground Surface.

A schematic representation of the treatment required is shown in Figure 18.3.4.2. This treatment shall be carried out transversely and longitudinally, wherever applicable.

Figure 18.3.4.2 – Longitudinal section of earthworks transition from fill to cut



18.4 Existing Subgrade testing

Where testing of the existing Subgrade is required to be undertaken by the Contractor as nominated in Clause 12.5 of Annexure MRTS04.1 to this Technical Specification, the requirements of Appendix B of this Technical Specification shall apply. The Contractor shall undertake testing of all Existing Subgrade Material to the depth nominated in Clause 18.1.

Where testing of existing Subgrade is only required to be undertaken by the Contractor as directed by the Administrator, as nominated in Clause 12.5 of Annexure MRTS04.1 to this Technical Specification, the requirements of Appendix B of this Technical Specification shall apply; however, the extents, frequency and location of these tests will be nominated by the Administrator. The Contractor shall

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FOI 26-292 - Document 21

undertake testing of all Subgrade material to the depth directed by the Administrator (up to the maximum depth nominated in Clause 18.1).

This Clause is not applicable to testing of Subgrade Fill Material – these requirements are specified in Appendix A of this Technical Specification.

> Where existing Subgrade testing is nominated 'as directed by the Administrator', it is intended this activity would be called up for specific activities such as determining Subgrade treatment types or verifying Subgrade conditions. In these instances, the Administrator may direct the Contractor not to test to the full depth of existing Subgrade (1.5 m below Subgrade Level) where only limited information on the upper layers is required (for example, where the investigations relate to insitu stabilisation of the upper Subgrade only).

19 Backfill

19.1 General

Clause 19 applies to backfilling adjacent to structures, pipes, culverts, conduits, pits, access chambers, gullies, sumps, end walls, and so on where shown on the drawings or specified elsewhere in the Contract. Clause 19 also applies to the backfilling of some excavations of Unsuitable Material in accordance with Clause 9.4.

Large areas of filling not in the immediate vicinity of structures, culverts, pipes and so on, shall be placed using the methods specified in Clause 14.

Prior to incorporating any Backfill material into the Works, the Contractor shall submit stockpile or source tests results as specified in Appendix A which demonstrate the source meets the specified material requirements. **Hold Point 11**

> Where Backfill will form part of the Subgrade for pavements, the requirements of Clause 18 shall also apply in addition to the requirements of this Clause.

19.2 Materials

19.2.1 General

All Backfill materials shall be free of soluble salts, organic matter and other deleterious matter.

19.2.2 Earth Backfill Material

Earth Backfill Material shall comply with the requirements of Earth Fill Material Class A1, Class A2 or Class B specified in Clause 14.2.2 except that 100% of the material shall pass 25.0 mm test sieve.

19.2.3 Select Backfill Material

Select Backfill Material shall be gravel or loam and shall have material properties as specified in Table 19.2.3.

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Table 19.2.3 – Select Backfill material properties

Test sieve (mm)	Percent passing by mass	
	Gravel	Loam
37.5	100	100
9.5	60 – 85	100
2.36	25 – 70	70 – 100
0.425	10 – 40	10 – 40
0.075	3 – 30	3 – 30
Other properties Linear shrinkage (%)	8 maximum	6 maximum

19.2.4 Free Draining Granular Material

Free Draining Granular Material shall be a non-cohesive well-graded granular material comprising sound Sand and Stone particles which do not break down under compaction, wetting or exposure to air. The material properties shall comply with those specified in Table 19.2.4.

Table 19.2.4 – Free Draining Granular Material properties

Property	Limit	Value
Stone size (mm)	maximum	19
Percent passing 0.150 mm	maximum	5
Linear shrinkage (%)	maximum	3

19.2.5 Sand (including recycled crushed glass)

Sand shall be either recycled crushed glass, natural Sand, manufactured Sand, or a blend of these materials comprising hard durable particles with the properties specified in Table 19.2.5.

Recycled crushed glass shall comply with the requirements of MRTS36 *Recycled Glass Aggregate*.

Table 19.2.5 – Sand properties (other than recycled crushed glass)

Property	Natural Sand	Blended and manufactured Sand
Percent passing 2.36 mm test sieve	85 – 100*	85 – 100*
Percent passing 0.075 mm test sieve	≤ 5	≤ 10
Linear shrinkage	≤ 3	≤ 6

* No oversize shall be greater than 6 mm.

The grading and linear shrinkage requirements given in Table 19.2.5 are not applicable for recycled crushed glass.

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The Contractor's recycled glass aggregate production procedure (refer MRTS36 *Recycled Glass Aggregate*) shall nominate the target particle size distribution (grading) envelope. Material incorporated into the Works shall comply with this grading envelope.

19.2.6 Coarse Sand (including recycled crushed glass)

Coarse Sand shall be either recycled glass, natural Sand, manufactured Sand, or a blend of these materials comprising hard durable particles with the properties specified in Table 19.2.6.

Recycled crushed glass shall comply with the requirements of MRTS36 *Recycled Glass Aggregate*.

Table 19.2.6 – Coarse Sand properties (other than recycled crushed glass)

Property	Coarse Sand
Percent passing 4.75 mm test sieve	100
Percent passing 0.300 mm test sieve	≤ 10
Linear shrinkage	≤ 3

The grading and linear shrinkage requirements given in Table 19.2.6 are not applicable for recycled crushed glass.

The Contractor's recycled glass aggregate production procedure (refer MRTS36 *Recycled Glass Aggregate*) shall nominate the target particle size distribution (grading) envelope. Material incorporated into the Works shall comply with this grading envelope.

19.2.7 Bedding Material and drainage aggregate (including recycled crushed glass)

Bedding Material (for the foundation, bedding, and Haunch Zone of drainage structures and services) and drainage aggregate shall be gravel, loam, Sand or mixtures thereof and shall be free from soluble salts, organic matter and other deleterious matter.

Well-graded Bedding Material may be manufactured from recycled crushed glass that complies with the requirements of MRTS36 *Recycled Glass Aggregate*.

Bedding Material and drainage aggregate shall have properties as given in Table 19.2.7.

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Table 19.2.7 – Bedding Material and drainage aggregate properties

Test sieve (mm)	Percent passing by mass		
	Well-graded[1]	20 mm nominal	10 mm nominal
19.0	100	85 – 100	100
9.5	–	25 – 55	85 – 100
2.36	50 – 100	0 – 5	0 – 10
0.600	20 – 90	–	–
0.075	0 – 10	0 – 2	0 – 2
Other properties Linear shrinkage (%)	6 maximum	3 maximum	3 maximum

[1] Well-graded aggregate requirements shall not apply to drainage aggregate.

The linear shrinkage requirements given in Table 19.2.7 are not applicable for recycled crushed glass.

Where 10 mm or 20 mm nominal size aggregate is used, a geotextile (as per Clause 14.2.6) is required to surround all Bedding Material. For pipes less than 250 mm in outside diameter, a 10 mm nominal sized material shall be used. The geotextile (and aggregate) shall not be exposed in any direction and shall be contained within wing walls or similar.

Compaction requirements as per Table 15.3(b) applies for Haunch and side support for all fills and trenches except where 10 mm or 20 mm nominal size aggregate is used.

Where 10 mm or 20 mm nominal size aggregate is used, the material shall be compacted until the surface of the material becomes stable under compaction equipment.

AS/NZS 3725 *Design for installation of buried concrete pipes*, Types U and H supports are not typically used.

A controlled low-strength material (CLSM) as per Appendix A of AS/NZS 3725 and Transport and Main Roads Technical Note TN187 *Controlled Low-Strength Material for Pipe Installation* may provide a viable alternative to compacted Bedding Material where any or all of the following Site conditions apply:

a) work area access is limited by time or congestion

b) where narrow trench width makes mechanical compaction of other types of Bedding Material in the Haunch and Side zones difficult

c) difficult to get the Bedding Material locally, and/or

d) trench fill subsidence needs to be minimised.

19.2.8 Filter material

Filter material shall be a natural or manufactured granular material free from organic matter with the particle size distribution limits as given in Table 19.2.8.

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Table 19.2.8 – Particle size distribution requirements for filter material

Test sieve (mm)*	Percent passing by mass
26.5	100
19.0	95 – 100
13.2	50 – 70
6.70	30 – 55
2.36	20 – 30
0.150	0 – 5

* Where filter material is used adjacent to slotted drainage pipe or proprietary drainage media, 98% of the filter material shall be retained on the test sieve size equal to or immediately greater than 1.5 times the slot width or opening diameter of the pipe or media.

19.2.9 Cement Stabilised Unbound Granular Material

Cement Stabilised Unbound Granular Material used as Backfill shall comply with the requirements of Clause 18.2.2 and Clause 18.2.5.

19.2.10 Stabilised Sand

Stabilised Sand shall comprise Sand meeting the requirements of Clause 19.2.5 in a mixture of (by volume) 12 parts Sand and 1 part of either Type GP or Type GB (as per AS 3972) cement mixed with the minimum quantity of water sufficient to allow ease of placement and compaction using concrete placement techniques.

19.2.11 Dry Stabilised Sand

Dry Stabilised Sand shall comprise Sand meeting the requirements of Clause 19.2.5 in a mixture of (by volume) 12 parts Sand and 1 part of either Type GP or Type GB (as per AS 3672) cement mixed with the minimum quantity of water to obtain a moisture content which is optimum for field compaction using compacted layer techniques.

19.2.12 Lean Mix Concrete

Lean Mix Concrete used as a Backfill material in Confined Excavations shall have a minimum strength of 5 MPa at 28 days and have nominal aggregate size of 20 mm in accordance with the provisions of MRTS70 *Concrete*.

The target slump shall be consistent with compacted layer method of construction (that is, the Lean Mix Concrete shall have nominally zero slump).

19.2.13 Backfill and Bedding Material for steel culverts

Backfill and Bedding Material for culverts fabricated from steel shall be in accordance with Clause 19.2.3 and Clause 19.2.7 respectively. Additionally, the material shall conform to the requirements for either Type 1 or Type 2 in Table 19.2.13.

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Table 19.2.13 – Properties of Backfill material for steel culverts

Property	Unit	Value	
		Type 1	Type 2
Electrical resistivity	ohm m	> 50	10 – 50
pH	–	5 – 10	5 – 10
Chloride content	mg/kg	–	< 200
Sulfate content	mg/kg	–	< 1000

19.2.14 Rock Fill material

Rock Fill material used as Backfill shall comply with the requirements of Clause 14.2.3.

19.3 Construction

19.3.1 Backfilling general

Material for Backfill shall be as shown on the drawings or as specified elsewhere in the Contract. Where not so shown or specified, material shall be Earth Backfill Material complying with the requirements of Clause 19.2.2. **Witness Point 5**

Unless specified otherwise in Clause 19.3 or elsewhere in the Contract, Backfill shall be compacted using the compacted layer method of construction in accordance with the requirements of Clause 15, except as may be modified by the requirements of Clause 19.

Backfill which extends into the Subgrade shall conform to the requirements of Clause 18.

Construction operations which involve puddling or jetting of material shall not be employed. Sand may be compacted by flooding and the use of immersion vibrators, provided that the process does not cause damage to adjacent Works.

Dry Stabilised Sand and Lean Mix Concrete shall be compacted using the compacted layer method of construction in accordance with the requirements of Clause 15. Compaction standards shall comply with the requirements of Clause 15.3.

Unless specified otherwise in the Contract, conduit trenches shall be backfilled as per Standard Drawing 1149 *Traffic Signals / Road Lighting / ITS – Installation of Underground Electrical and Communications Conduit* (including trenches along the verge / shoulder).

19.3.2 Backfill beneath structure foundations

Backfill beneath structure foundations to replace over-excavation or excavation of Unsuitable Material shall generally be Cement Stabilised Unbound Granular Material complying with the requirements of Clause 19.2.9 or Lean Mix Concrete complying with the requirements of Clause 19.2.12 to satisfy the foundation requirements of Clause 13.3.4.

19.3.3 Backfilling to in-place units

Placement and compaction operations around and adjacent to in-place units (culverts, structures, pipes, conduits, pits, and so on) shall not cause movement or damage to the units. Where Backfill material is fluid, precautions shall be taken against floatation of the units.

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FOI 26-292 - Document 21

Where the Backfill material is placed against precast structures, the operations shall be carried out in accordance with the precast component manufacturer's recommendations, except as otherwise provided for in the Contract.

Backfill material shall not be placed until culverts, structures, pipes, conduits, pits, and so on have been completed and inspected, and any specified curing periods have elapsed. **Hold Point 12**

Where the material is placed on opposite sides of a culvert, structure, pipe, conduit, pit, and so on, the difference in level of compacted material on the opposing sides shall not exceed 150 mm, unless shown otherwise on the drawings.

19.3.4 Backfill zones to concrete pipe culverts

Foundation bedding, Haunch, Side and Overlay zones for concrete pipe culverts shall be constructed as shown on Standard Drawing 1359 *Culverts – Installation, Bedding and Filling / Backfilling Against / Over Culverts.*

Materials for foundation bedding and Haunch Zone shall be Bedding Material complying with the requirements of Clause 19.2.7.

Material for a Side Zone shall be Select Backfill Material complying with the requirements of Clause 19.2.3.

For Overlay Zones, material within 300 mm of the structure, culvert, pipe, and so on shall be Earth Backfill Material complying with the requirements of Clause 19.2.2. Elsewhere, Overlay Zone material may contain Stone sized up to 150 mm maximum dimension.

The construction loads which shall be placed on the culvert shall be as per Clause 12 of MRTS03 *Drainage, Retaining Structures and Protective Treatments*.

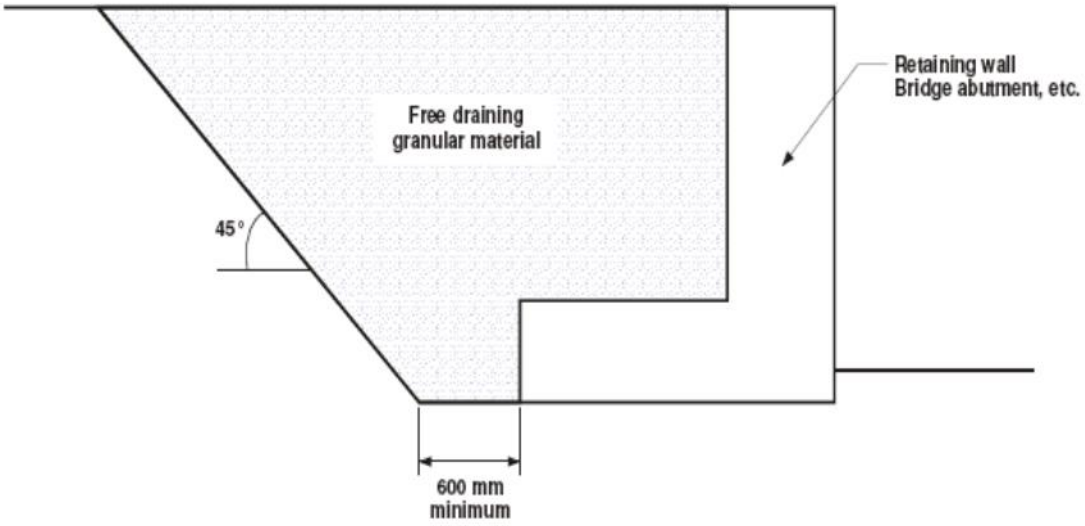
19.3.5 Backfill to soil retaining structures

Unless otherwise shown on the drawings, backfilling to all soil retaining structures, including all retaining walls and bridge abutments, shall be carried out using Free-Draining Granular Material complying with the requirements of Clause 19.2.4. Free-draining Backfill requirements for bridge abutments are shown in abutment protection Standard Drawings 2232 to 2238.

Backfilling to soil retaining structures shall be to the extent shown on the drawings or, where no such extent is shown on the drawings, to the minimum extent shown in Figure 19.3.5.

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Figure 19.3.5 – Minimum extent of Free-Draining Granular Material behind soil retaining structure



19.3.6 Special requirements for corrugated pipe, pipe-arch and arch-culverts

Backfilling against corrugated pipe, pipe-arch and arch-culvert components shall be carried out so as to not distort the components by more than 3% of the diameter, span or rise.

20 Turnouts, entrances and stopping places

Turnouts, entrances to private properties and stopping places shall be constructed to the shapes and other requirements shown on the drawings. The finished level and grade shall join smoothly with the new formation.

Construction of turnouts, entrances to private properties and stopping places shall comply with the provisions of the relevant clauses except where otherwise accepted by the Administrator.

21 Widening of existing formation to Subgrade Level

21.1 Construction

21.1.1 General

The formation is to be constructed as shown on the drawings for the entire length of the project.

Clearing and grubbing shall be carried out where earthworks are to be constructed, to the minimum width required to construct the Works, plus a margin of not more than two metres.

Ground surface treatment (excluding the areas in Clause 12.2.1.1) is to be carried out on the existing ground surface in all areas beneath any part of road Embankment or road pavement.

Cut batters are to be constructed to the details shown on the drawings.

Road Excavation as required shall be constructed to the details shown on the drawings to achieve the required formation width.

Table drains shall be constructed to the details shown on the drawings. Where details are not shown on the drawings, table drains shall be constructed parallel to the centreline of the road and evenly graded so as to prevent obstruction to the flow of water.

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At all culverts and at intervals not exceeding 120 m on grades up to 2%, 60 m on grades 2% – 4%, 30 m on grades 4% – 8%, and 15 m on grades over 8% (except in cuttings) and at the ends of cuttings, the table drain shall be blocked by a diversion bank and the water diverted by means of a diversion drain as shown on the drawings.

21.1.2 Subgrade heights

Where control is by reduced level, the Subgrade height shall be determined from the heights shown on the drawings.

Where control is by pavement depth and crossfall, the calculated Subgrade Level shall provide for a minimum total depth of pavement as shown on the drawings measured from the plane of the extension of the existing pavement surface, with due allowance for the specified crossfall.

22 Supplementary requirements

The requirements of MRTS04 *General Earthworks* are varied by the supplementary requirements given in Clause 13 of Annexure MRTS04.1 to this Technical Specification.

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Appendix A – Testing frequencies

Table A.1 sets out the requirements for source and/or stockpile testing of materials prior to construction. These requirements apply in addition to the requirements specified in Table A.2. Source and/or stockpile testing is undertaken to:

- provide an indication that the material is fit for purpose prior to placement
- assess properties with longer test times (for example, CBR) prior to incorporation into the Works rather than after compaction to reduce construction delays, and
- provide minimum material testing frequencies, assuming the materials are homogeneous. Further additional testing will be required, should the material type or classification change (based on visual assessment) during the period of supply.

Table A.2 sets out the requirements for construction testing – including, but not limited to geometrics, compaction, moisture and other post-compaction material properties.

Where a material has the same property specified in both Tables A.1 and A.2, the material needs to be testing both from the source / stockpile and after the completion of compaction.

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FOI 26-292 - Document 21

Table A.1 – Material testing – from source or stockpile, prior to incorporation into the Works (after pre-treatment in accordance with Test Method Q101E, where required)

No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.1	Earth Fill Material – other than in Backfill, Subgrade or verge (Clause 14.2.2)	Grading	AS 1289.3.6.1	5000 t	1000 m³	10,000 t	2000 m³
		PI	AS 1289.3.3.1 or AS 1289.3.3.2				
		WPI	Test Method Q252				
		Soaked / Unsoaked CBR and swell (where specified in Annexure MRTS04.1 to this Technical Specification or as per Drawings)	AS 1289.6.1.1				
		Emerson Class Number (homogeneous Embankment – Figure 2(b))	AS 1289.3.8.1				
		Emerson Class Number (Outer and Upper Zones – Figure 2(a))	AS 1289.3.8.1	1500 t	500 m³	3000 t	1000 m³

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No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.2	Rock Fill (Clause 14.2.3)	Grading and shape[5]	Test Method Q230 / AS 1141.11.1	As directed by Administrator		As directed by Administrator	
		Point load strength index	AS 4133.4.1	Refer *Quarry Registration Certificate – Testing Frequency Schedule* (Clause 8.1.1 of MRTS50 *Specific Quality System Requirements*)	1000 m³	Refer *Quarry Registration Certificate – Testing Frequency Schedule* (Clause 8.1.1 of MRTS50 *Specific Quality System Requirements*)	2000 m³
		Wet / dry strength variation	AS 1141.22				
		Degradation factor	Test Method Q208B				
		Water absorption	AS 1141.6.1				
1.3	Verge (Clause 14.2.4)	Grading	AS 1289.3.6.1	1000 t	250 m³	2500 t	500 m³
		PI	AS 1289.3.3.1 or AS 1289.3.3.2				
		WPI	Test Method Q252				
		Soaked / Unsoaked CBR and swell (where specified)	AS 1289.6.1.1				
		Emerson Class Number	AS 1289.3.8.1				

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No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.4	Subgrade treatment – materials (Clause 18.2)	Refer to the following: • Earth Fill - Item No. 1.1 • Rock Fill – Item No. 1.2 • high-permeability drainage material – Item No. 1.6 • unbound granular material – refer to MRTS05 *Unbound Pavements* • stabilised granular material – refer to MRTS07B *Insitu Stabilised Pavements Using Cement or Cementitious Blends* (insitu) or MRTS10 *Plant-Mixed Lightly Bound Pavements* (plant-mixed)					
1.5	Earth Fill Material - in Subgrade (Clause 18.2.1)	Grading	AS 1289.3.6.1	4000 t	1000 m³	8000 t	2000 m³
		PI	AS 1289.3.3.1 or AS 1289.3.3.2				
		WPI	Test Method Q252				
		Soaked / Unsoaked CBR and swell	AS 1289.6.1.1				
		Emerson Class Number (homogeneous Embankment – Figure 2(b))	AS 1289.3.8.1				
		Emerson Class Number (Outer and Upper Zones – Figure 2(a))	AS 1289.3.8.1	1500 t	500 m³	3000 t	1000 m³

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.6	High-permeability Drainage Layer (Clause 18.2.4)	Grading	AS 1141.11.1	2500 t	1000 m³	5000 t	2000 m³
		Wet strength	AS 1141.22	Refer *Quarry Registration Certificate – Testing Frequency Schedule* (Clause 8.1.1 of MRTS50 *Specific Quality System Requirements*)			
		Degradation factor	Test Method Q208B				
		Point load strength index	AS 4133.4.1				
		Wet / dry strength variation	AS 1141.22				
		Water absorption	AS 1141.6.1				
1.7	Backfill materials – Earth Fill Material (Clause 19.2.2)	Grading	AS 1289.3.6.1	5000 t	1000 m³	10,000 t	2000 m³
		PI	AS 1289.3.3.1 or AS 1289.3.3.2				
		Linear shrinkage	AS 1289.3.4.1				
		Emerson Class Number	AS 1289.3.8.1				
1.8	Backfill materials - Earth Fill Material for Subgrade (Clause 19.2.2)	Grading	AS 1289.3.6.1	4000 t	200 m³	8000 t	400 m³
		Plasticity Index	AS 1289.3.3.1 or AS 1289.3.3.2				
		Linear shrinkage	AS 1289.3.4.1				
		Soaked / Unsoaked CBR and swell	AS 1289.6.1.1				
		Emerson Class Number	AS 1289.3.8.1				

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.9	Backfill materials – Select (Clause 19.2.3)	Grading	AS 1289.3.6.1	2500 t	1000 m³	5000 t	2000 m³
		Linear shrinkage	AS 1289.3.4.1				
		Soaked / Unsoaked CBR and swell (where specified in Annexure MRTS04.1 to this Technical Specification or as per Drawings)	AS 1289.6.1.1				
1.10	Backfill materials (excluding recycled crushed glass – refer to MRTS36 *Recycled Glass Aggregate*) • free-draining granular • Sand / Coarse Sand • bedding and drainage (Clauses 19.2.4 to 19.2.7)	Grading	AS 1289.3.6.1	2500 t	1000 m³	5000 t	2000 m³
1.11	Backfill materials – Filter (Clause 19.2.8)	Grading	AS 1289.3.6.1	2500 t	1000 m³	5000 t	2000 m³
1.12	Backfill materials – Cement Stabilised Unbound Granular Material (Clause 19.2.9)	Refer to MRTS10 *Plant Mixed Lightly Bound Pavements*					

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No.	Activity	Verification requirements		Normal testing frequency		Reduced testing frequency[2]	
		Description	Test required	Minimum testing frequency[1]		Minimum testing frequency[1]	
				Material sourced from a registered quarry[3]	All other material[4]	Material sourced from a registered quarry[3]	All other material[4]
1.13	Backfill materials (stabilised) • Stabilised Sand • Dry Stabilised Sand (Clauses 19.2.10 and 11)	Grading	AS 1289.3.6.1	2500 t	1000 m³	5000 t	2000 m³
1.14	Backfill materials – Lean Mix Concrete (Clause 19.2.12)	Refer to MRTS70 *Concrete*					
1.15	Backfill and Bedding Material for steel culverts (Clause 19.2.13)	Grading	AS 1289.3.6.1	2500 t	1000 m³	5000 t	2000 m³
		Linear shrinkage	AS 1289.3.4.1				
		Electrical resistivity	Test Method Q122A, Test Method Q122B				
		pH	AS 1289.4.3.1				
		Chloride content	Test Method Q130A, Test Method Q130B[7]				
		Sulfate content	AS 1289.4.2.1[7]				
1.16	Backfill – Rock Fill (Clause 19.2.14)	Refer to Section 1.2 of this Table A.1.					

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FOI 26-292 - Document 21

Notes:

1. Maximum Lot Size shall be limited to each Material Type. Minimum number of two tests per material type is required. For material supplied from a registered quarry, historical test results (minimum of two per property), current within six months of supply, can be used to satisfy this requirement.
2. Reduced testing frequency can only be considered if the Fill Material is homogeneous and good quality and approved by the Administrator. Also refer Clause 8.6 of MRTS50 *Specific Quality System Requirements.*
3. Material supplied by a quarry registered under the department's Quarry Registration System, and a current registration certificate has been provided to the Administrator
4. Source materials such as materials won onsite and imported materials other than from the registered quarry.
5. The Administrator would typically direct the supplier for testing to confirm compliance only if it cannot be agreed upon from a visual inspection.
6. Material testing frequencies assume that the materials are homogeneous. For any change in materials, further testing is required.
7. Other published or validated classical chemistry technique or instrumentation techniques may also be used subject to approval from the Administrator

Australian Standards references not previously cited in this Technical Specification:

- No. 1.1:
  - AS 1289.3.6.1 *Methods of testing soils for engineering purposes, Method 3.6.1: Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving*
  - AS 1289.3.3.1 *Methods of testing soils for engineering purposes, Method 3.3.1: Soil classification tests – Calculation of the plasticity index of a soil*
  - AS 1289.3.3.2 *Methods of testing soils for engineering purposes, Method 3.3.1: Soil classification tests – Calculation of the plasticity index of a soil*
  - AS 1289.6.1.1 *Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen*
  - AS 1289.3.8.1 *Methods of testing soils for engineering purposes – Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen*
- No. 1.7:
  - AS 1289.3.4.1 *Methods of testing soils for engineering purposes, Method 3.4.1: Soil classification tests – Determination of the linear shrinkage of a soil – Standard method*
- No. 1.15:
  - AS 1289.4.3.1 *Methods of testing soils for engineering purposes, Method 4.3.1: Soil chemical tests – Determination of the pH value of a soil – Electrometric method*
  - AS 1289.4.2.1 *Methods of testing soils for engineering purposes, Method 4.2.1: Soil chemical tests – Determination of the sulfate content of a natural soil and the sulfate content of the groundwater – Normal method*

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FOI 26-292 - Document 21

Table A.2 – Testing frequencies – Construction

No.	Activity	Verification requirements		Normal testing level			Reduced testing level[1]		
		Description	**Test required**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**
2.1	Clearing and grubbing (Clause 7)	Geometrics	Horizontal clearance limits	1000 m	1 test per 100 m per side	1 per Lot	–	–	–
2.2	Stripping Topsoil (Clause 8)	Geometrics	Horizontal clearance limits	Not applicable	1 test per 100 m per side	–	–	–	–
		Geometrics	Vertical	Not applicable	1 test per 100 m per side	–	–	–	–
2.3	Acid Sulfate (Clause 10.4)	Acid Sulfate Soil testing	Field pH tests (pHF and pHFOX) SPOCAS testing / Chromium Suite MBO	As per Acid Sulfate Soils Laboratory Methods Guidelines in Queensland					
2.4	Ground surface treatment (Clause 12)	Compaction	AS 1289.5.4.1 or AS 1289.5.7.1	5000 m²	1 test per 500 m²	1 per Lot	–	–	–
2.5	Bottom of excavations (general) (Clause 13.3.3.4)	Compaction – to a depth of 150 mm below bottom of excavation	AS 1289.5.4.1 or AS 1289.5.7.1	each excavation	1 test per 50 m²	2 per Lot	–	–	–
		Geometrics	Profile	each excavation	1 test per 100 m	1 test per Lot	–	–	–
2.6	Bottom of excavations (for culverts and/or end structures) (Clause 13.3.6)	Compaction – to a depth of 150 mm below bottom of excavation	AS 1289.5.4.1 or AS 1289.5.7.1	each culvert or end structure	1 test per 50 m²	2 per Lot	–	–	–

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing level			Reduced testing level[1]		
		Description	**Test required**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**
		Geometrics	Profile	each culvert or end structure	All levels shown on drawings	–	–	–	–
2.7	Bottom of excavations (for channels and drains) (Clause 13.3.7)	Geometrics	Profile	each channel or drain	1 test per 100 m	2 per Lot	–	–	–
2.8	Earth Fill Material – other than in Backfill, Subgrade, or verge (Clause 14.2.2)	Testing after completion of compaction onsite							
		Compaction	AS 1289.5.4.1 or AS 1289.5.7.1	2000 m²	1 test per 500 m² (per layer)	4 tests per Lot	4000 m²	1 test per 1000 m²	4 tests per Lot
		Moisture ratio	AS 1289.5.4.1 or AS 1289.5.7.1						
		Grading	AS 1289.3.6.1		1 test per 1000 m² (per layer)	2 tests per Lot			
		PI	AS 1289.3.3.1 or AS 1289.3.3.2						
		WPI	Test Method Q252						
2.9	Verge (Clause 14.2.4)	Testing after completion of compaction onsite							
		Compaction	AS 1289.5.4.1 or AS 1289.5.7.1	1000 m²	1 test per 200 m²	4 tests per Lot	–	–	–
		Moisture ratio	AS 1289.5.4.1 or AS 1289.5.7.1				–	–	–
		Geometrics	Horizontal and vertical		All edges and interfaces at 20 m intervals	–	–	–	–

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing level			Reduced testing level[1]		
		Description	**Test required**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**	**Maximum Lot size[2]**	**Minimum testing frequency[2]**	**Minimum no. of tests**
2.10	Subgrade treatments (Clauses 18 and 13)	Compaction - depth as per Clause 13.5 of Annexure MRTS04.1 to this Technical Specification.	AS 1289.5.4.1 or AS 1289.5.7.1	single layer produced in a continuous operation in one day	1 test per 500 m²	4 per Lot	single layer produced in a continuous operation in one day	1 test per 1000 m²	1 per Lot
		Geometrics	Horizontal position	Not applicable	All edges and interfaces (at 20 m intervals)	–	–	–	–
			Vertical level		All edges and interfaces (at 20 m intervals)	–	–	–	–
			Deviation from a straight edge		1 test per 20 m (left and right)	–	–	–	–
			Crossfall		1 test per 10 m	–	–	–	–
		Proof rolling (Subgrade Level only)	Test Method Q723	Refer to Clause 18.3.2					
		Stabilisation of existing material	Refer to MRTS07A *Insitu Stabilised Subgrades Using Quicklime or Hydrated Lime* or MRTS07B *Insitu Stabilised Pavements Using Cement or Cementitious Blends*						

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing level			Reduced testing level[1]		
		Description	Test required	Maximum Lot size[2]	Minimum testing frequency[2]	Minimum no. of tests	Maximum Lot size[2]	Minimum testing frequency[2]	Minimum no. of tests
2.11	Earth Fill Material - in Subgrade (Clause 18.2.1 and Appendix B)	Testing after completion of compaction onsite							
		Compaction	AS 1289.5.4.1 or AS 1289.5.7.1	2000 m²	1 test per 500 m² (per layer)	4 tests per Lot	4000 m²	1 test per 1000 m² (per layer)	4 tests per Lot
		Moisture ratio	AS 1289.5.4.1 or AS 1289.5.7.1						
		Grading	AS 1289.3.6.1		1 test per 1000 m² (per layer)	2 tests per Lot		1 test per 2000 m² (per layer)	2 tests per Lot
		PI	AS 1289.3.3.1 or AS 1289.3.3.2						
		WPI	Test Method Q252						
		Geometrics	Horizontal and vertical	Single layer produced in a continuous operation in one day	All edges and interfaces at 20 m intervals	–	–	–	–
		Proof rolling (Subgrade Level only)	Test Method Q723	Refer to Clause 18.3.2					
2.12	High-permeability Drainage Layer (Clause 18.2.4)	Insitu CBR, determined from DCP (material below Drainage Layer)	Test Method Q114B	1000 m²	1 test per 200m²	5 per Lot	–	–	–

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FOI 26-292 - Document 21

No.	Activity	Verification requirements		Normal testing level			Reduced testing level[1]		
		Description	Test required	Maximum Lot size[2]	Minimum testing frequency[2]	Minimum no. of tests	Maximum Lot size[2]	Minimum testing frequency[2]	Minimum no. of tests
2.13	Existing Subgrade Material (Clause 18.4)	Grading	AS 1289.3.6.1	Refer Clause B.3 in Appendix B	–	5 test locations per Lot 1 test for each different material at each test location	–	–	–
		Plasticity Index	AS 1289.3.3.1 or AS 1289.3.3.2						
		Liquid limit	AS 1289.3.1.1						
		Soaked CBR and swell	AS 1289.6.1.1						
		Insitu CBR, determined from DCP	Test Method Q114B						
		Emerson Class Number	AS 1289.3.8.1						
		Insitu moisture content	AS 1289.2.1.1, AS 1289.2.1.2, AS 1289.2.1.4, AS 1289.2.1.5, AS 1289.2.1.6, AS 1289.5.8.1	Refer Clause B.3 in Appendix B	–	5 test locations per Lot 1 test for each different material at each test location	–	–	–
2.14	Backfill materials (including bedding) (Clause 19)	Testing after completion of compaction onsite							
		Compaction	AS 1289.5.4.1, AS 1289.5.7.1 or AS 1289.5.6.1	each culvert or structure	1 test per 100 m³	2 per Lot	each culvert or structure	1 test per 200 m³	2 per Lot
		Moisture ratio	AS 1289.5.4.1 or AS 1289.5.7.1						

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FOI 26-292 - Document 21

Notes:

1. The term layer used throughout this table refers to a compacted layer.
2. For Maximum Lot Sizes and Minimum Testing Frequencies expressed in units of m², this shall be taken as the requirement for a single constructed layer.

Australian Standards references not previously cited in this Technical Specification:

- No. 2.13:
  - AS 1289.3.1.1 *Methods of testing soils for engineering purposes, Method 3.1.1: Soil classification tests – Determination of the liquid limit of a soil – Four point Casagrande method*
  - AS 1289.2.1.1 *Methods of testing soils for engineering purposes, Method 2.1.1: Soil moisture content tests – Determination of the moisture content of a soil – Oven drying method (standard method)*
  - AS 1289.2.1.2 *Methods of testing soils for engineering purposes, Method 2.1.2: Soil moisture content tests – Determination of the moisture content of a soil – Sand bath method (subsidiary method)*
  - AS 1289.2.1.4 *Methods of testing soils for engineering purposes, Method 2.1.4: Soil moisture content tests – Determination of the moisture content of a soil – Microwave-oven drying method (subsidiary method)*
  - AS 1289.2.1.5 *Methods of testing soils for engineering purposes, Method 2.1.5: Soil moisture content tests – Determination of the moisture content of a soil – Infrared lights method (subsidiary method)*
  - AS 1289.2.1.6 *Methods of testing soils for engineering purposes, Method 2.1.6: Soil moisture content tests – Determination of the moisture content of a soil – Hotplate drying method*

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FOI 26-292 - Document 21

Appendix B – Existing Subgrade testing and design verification

B.1 Introduction

This Appendix sets out the minimum requirements to verify that Subgrade materials are of equal or better quality than that adopted in the pavement design. These requirements apply to existing insitu Subgrade materials only. These requirements do not apply to material that the Contractor imports or is won from other areas of the Site and used to construct Subgrade – these materials are considered as Subgrade fill.

The properties of Subgrade Fill Material are controlled through the requirements of Clause 18 of this Technical Specification.

The intent of this Appendix is to provide a means by which the Contractor can demonstrate, and the Administrator can verify, that materials that support the pavement are of equal or better quality than adopted in the pavement design. It is particularly relevant when limited Subgrade investigation and testing has been undertaken during the design stages of the project.

Due to the wide range of possible scenarios in relation to prior assessments of the relevant materials (such as local experience, source testing, geological data, previous project data, and test results from earlier project stages), which must be considered in conjunction with project alignment and project risk, it is not possible to provide standard requirements that will fit every project; therefore, it may be necessary for the Administrator to vary the requirements to suit the specific project.

The Administrator may consider a reduction, or removal of some, or all, of the requirements of this Appendix where the Administrator deems the requirements unnecessary to meet the intent detailed above; for example, it might be possible to reduce the testing requirements when a detailed Subgrade assessment was undertaken during the design stages of the project.

Generally, the pavement design engineer for the project should detail additional and/or alternative testing requirements for consideration by the Administrator.

B.2 Existing Subgrade design verification construction procedure

For Contracts where the Contractor is responsible for completing the pavement design (such as Design and Construct, Alliance and other similar Contracts), the Contractor shall submit an existing Subgrade design verification construction procedure to the Administrator at least seven days prior to commencing the existing Subgrade investigations and material sampling. **Hold Point 13**

The Subgrade design verification construction procedure shall detail:

a) proposed existing Subgrade Lot locations and extents, in accordance with Clause B.3 of this Technical Specification.

b) the methodology proposed to excavate test pits in accordance with Clause B.4.1 of this Technical Specification, and

c) any proposal by the Contractor to depart from the requirements of this Technical Specification.

The Administrator shall release the **Hold Point** if the Administrator deems that the Subgrade design verification construction procedure meets the intent of this Technical Specification.

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In assessing an alternative proposal, the Administrator should consider prior assessments of the relevant materials (such as local experience, source testing, geological data, previous project data, and test results from earlier project stages), in conjunction with project alignment and project risk. In this case, this Appendix should be used as a framework for guidance.

B.3 Existing Subgrade Lots

The existing Subgrade Lot sizes shall be determined based on uniform sections including:

a) topographical features including hills, valleys and the like

b) pavement location, both horizontally and vertically (cut, side cut, fill)

c) geological profile

d) influence and/or presence of water

e) material properties such as particle size distribution, plastic limit, liquid limit, insitu moisture content, PI and WPI, and

f) consistency of soil type.

g) In addition to the above, the maximum Lot size for testing of material shall be:

i. for normal carriageway, no longer than 1000 m in carriageway length

ii. each roundabout, and

iii. each intersection.

B.4 Existing Subgrade Sampling requirements

B.4.1 General

All sampling of existing Subgrade shall be undertaken by the Contractor, in the presence of the Administrator, unless directed otherwise by the Administrator. **Witness Point 6**

Sampling locations within a Lot shall be determined in accordance with Test Method Q050.

Existing Subgrade Material shall be sampled from its natural insitu location in accordance with AS 1289.1.2.1.

Unless otherwise directed by the Administrator, this Clause applies to all Existing Subgrade Material to the minimum depth below Subgrade Level as defined in Clause 9.1 of Annexure MRTS04.1 to this Technical Specification (or Clause 18.4 where no value is otherwise nominated).

Each different material encountered within the Subgrade shall be sampled and tested in accordance with this Technical Specification.

The Contractor shall obtain sufficient samples of all required materials to satisfy the testing and assessment requirements of this Technical Specification.

Existing Subgrade Material that breaks down under environmental and service conditions due to weathering (such as shales, claystones, siltstones and other soft laminated or jointed rocks), shall be pre-conditioned by artificial weathering in accordance with Test Method Q101E.

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Sampling of rock in cuttings is not required where the following conditions are satisfied:

1. the material is defined as 'non-rippable' in accordance with Clause 3.3.2 of Specification (Measurement) MRS04 *General Earthworks*
2. the rock will not break down, degrade or fracture during construction, and
3. the Contractor has requested an exemption from testing, providing all relevant supporting information to the Administrator, and the exemption has been granted by the Administrator.

B.4.2 Sampling process

Existing Subgrade Material shall be sampled from open test pits which are of an adequate size to allow sufficient material to be collected from each layer without mixing or contamination and allow any variation in material within the Subgrade to be logged accurately.

Logging of the test pit shall record:

- details of the pit location including surveyed coordinates, chainage, offset and so on
- the depth of the top and bottom of each layer, measured below Subgrade Level
- photographs of the excavated face
- an accurate description / classification of the material encountered in each layer
- information to identify the samples taken from each layer, and
- any other relevant comments.

Augering shall not be used to sample Existing Subgrade Material unless agreed by the Administrator.

Where the existing Subgrade includes pavement materials constructed as part of previous Works, or the Contractor must excavate through existing pavement to reach Subgrade material, the Contractors methodology must allow for breaking through any strong layers and sampling the underlying material to the full depth of Subgrade, unless otherwise agreed by the Administrator.

B.5 Existing Subgrade testing requirements

All testing shall be undertaken by the Contractor, in the presence of the Administrator, unless directed otherwise by the Administrator. **Witness Point 7**

The minimum testing requirements for each Lot are defined in Appendix A of this Technical Specification.

B5.1 General

Each Existing Subgrade Material sample shall be tested for:

a) laboratory CBR

b) swell

c) particle size distribution

d) maximum aggregate size of Fill Material

e) liquid limit

f) plastic limit

g) PI

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h) WPI, which is the PI multiplied by the percent passing the 0.425 mm test sieve

i) Emerson Class Number, and

j) insitu moisture content.

Existing Subgrade Material shall also be tested for insitu CBR, determined using the DCP.

Where laboratory pre-conditioning is undertaken, the plastic limit, liquid limit, PI, WPI, CBR and swell shall be determined on the samples after pre-conditioning, and the particle size distribution shall be determined both before and after pre-conditioning.

Where stabilisation of the Subgrade is proposed, refer to Clause 18.2.5 for testing necessary to undertake the mix design.

B5.2 CBR test conditions

The laboratory CBR and swell test conditions used for testing Existing Subgrade Material shall be as specified in Clause 4.2.

B.6 Reporting and pavement design requirements

B.6.1 General

The Contractor shall provide all the information to the Administrator as detailed in Clause B.6.2 or B.6.3 as relevant. **Hold Point 14**

B.6.2 Construct Only Contracts

For Contracts where the Principal has supplied the pavement design (that is, Construct Only or similar Contracts), the Contractor shall submit the following information to the Administrator for each existing Subgrade Lot:

a) test pit logs

b) all test results for each layer encountered within the test pit, including certified test certificates, and

c) marked-up drawings accurately showing all test locations within the Lot.

The Contractor shall allow a minimum period of 14 days for the Administrator to review the information prior to any Subgrade treatment and the placement of any overlying materials.

B.6.3 Contracts which include pavement design

For Contracts where the Contractor is responsible for completing the pavement design (such as Design and Construct, Alliance and other similar Contracts), the Contractor shall submit the following information to the Administrator for each existing Subgrade Lot:

a) test pit logs

b) all test results for each layer encountered within the test pit, including certified test certificates

c) marked-up drawings accurately showing all test locations within the Lot

d) a written engineering report detailing the Contractor's interpretation of the test results for each Lot, including the determination of a Lot CBR and Lot expansive nature classification – the report shall fully detail all assumptions and calculations

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e) a table which compares the test results with the design values, and which highlights any situations where the quality of the existing Subgrade is less than adopted in the pavement design (such as if the Lot CBR is less than the design CBR, or the Lot expansive nature classification is greater than that adopted in the design)

f) a proposal to revise the pavement design where the quality of the existing Subgrade is less than that adopted in the pavement design, and

g) revised design documentation (where relevant).

The Contractor shall allow a minimum period of seven days for the Administrator to review the information prior to any Subgrade treatment and the placement of any overlying materials.

The Contractor's interpretation of test results shall be in accordance with Clause B.7 of this Technical Specification, unless otherwise approved by the Administrator.

Where the redesigned pavement and Subgrade treatments require a significant change in the Subgrade Level, in relation to the testing already completed, additional Sampling and testing shall be carried out to assess the full depth of the Subgrade.

B.7 Determination of Lot CBR, swell and expansive nature classification

For each existing Subgrade Lot, the Lot CBR, Lot swell and Lot expansive nature classification shall be determined in accordance with this Clause.

The percentile value for a set of test results shall be determined by plotting the cumulative frequency distribution and interpolating from the curve the relevant percentile value.

> In accordance with the commentary in Clause B.1, the Contractor may propose to vary the requirements for determining the CBR, swell and expansive nature classification in arid climates in low-risk applications

For each existing Subgrade Lot, the lower 10th percentile of the laboratory CBR test results and, where relevant, the lower 10th percentile of the DCP test results shall be determined. The Lot CBR is the minimum of these two values.

For each Lot, the Lot swell is the upper 10th percentile of the swell test results.

The Lot swell and other material test results shall be used to determine the Lot expansive nature classification in accordance with this Technical Specification and the *Pavement Design Supplement*.

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Technical Specification

MRTS05 Unbound Pavements

March 2022

Queensland Government

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Contents

1 Introduction 1

2 Definition of terms 1

3 Referenced documents 3

4 Standard test methods 4

4.1 Supplementary requirements for Test Method Q113A and Q113C 5

4.1.1 Q113A 5

4.1.2 Q113C 5

4.2 Supplementary requirements for Test Method Q115 5

4.3 Supplementary requirements for Test Method AS 1141.22 5

5 Quality system requirements 6

5.1 Hold Points, Witness Points and Milestones 6

5.2 Construction procedures 6

5.2.1 General 6

5.2.2 Material production procedure 7

5.2.3 Unbound pavement construction procedure 7

6 Supplier registration and source material assessment 8

6.1 General 8

6.2 Type 1, Type 2 and Type 3 (excluding Subtypes 2.5 and 3.5) 8

6.3 Subtype 2.5, Subtype 3.5 and Type 4 8

6.4 Supplementary material 9

7 Material 9

7.1 Type 1 unbound material – High Standard Granular (HSG) 10

7.1.1 General 10

7.1.2 Coarse component 11

7.1.3 Fines component 12

7.1.4 Particle size distribution (grading) 12

7.2 Type 2 unbound material 13

7.2.1 General 13

7.2.2 Coarse component 15

7.2.3 Fines component 16

7.2.4 Particle size distribution (grading) 17

7.2.5 California bearing ratio 18

7.2.6 Type 2 materials containing Recycled materials 18

7.3 Type 3 unbound material 20

7.3.1 General 20

7.3.2 Coarse component 20

7.3.3 Fines component 20

7.3.4 Particle size distribution (grading) 21

7.3.5 California bearing ratio 21

7.4 Type 4 unbound material 22

7.5 All unbound materials 22

7.6 Supplementary materials 23

7.7 Stockpiling of materials 24

7.8 Water Quality 24

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

8 Construction 25
8.1 General 25
8.2 Trial pavement 25
8.3 Process requirements 26
8.3.1 Equipment 26
8.3.2 Paving 27
8.3.3 Layer thicknesses 27
8.3.4 Moisture content 28
8.3.5 Surface finish 30
8.3.6 Construction joints between adjacent paving runs 30
8.3.7 Contractor's responsibilities 31
8.3.8 Dust management 31
8.4 Product standards 31
8.4.1 Segregation 31
8.4.2 Post compaction grading of Type 1 (HSG) material 32
8.4.3 Compaction standard 32
8.4.4 Geometrics 33
8.4.5 Deviation from a straight-edge 35
8.4.6 Road roughness (surface evenness) 35
8.4.7 Ball penetration 36
9 Compliance testing 36
9.1 General 36
9.2 Test locations 37
9.3 Maximum lot sizes 37
9.4 Compliance testing requirements 37
9.4.1 Unbound pavement materials 37
9.4.2 Testing under Transport and Main Roads Quarry Registration System. 37
9.4.3 Segregation 37
9.4.4 Post compaction grading of Type 1 (HSG) materials 38
9.4.5 Degree of saturation 38
9.4.6 Compaction 38
9.4.7 Proof rolling 39
9.4.8 Ball penetration testing 39
9.4.9 Geometrics and deviation from a straight edge 40
9.4.10 Road roughness (surface evenness) 40
9.5 Compliance testing results 40
9.5.1 Acceptance of lots 40
9.5.2 Reworking of unbound pavement lots 40
10 Supplementary requirements 41
Appendix A: Maximum lot sizes and minimum testing frequencies 42

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

1 Introduction

This Technical Specification applies to the supply and construction of unbound granular pavements. Material from natural, quarried and recycled sources, or a combination of these, can all be used.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

The requirements of this Technical Specification are designed to provide a high probability of a satisfactory pavement being produced. However, it is acknowledged that alternative or supplementary requirements specific to local conditions and the known performance of local materials may be incorporated through project-specific supplementary requirements.

This Technical Specification assumes that the pavement is not excessively exposed to water and that protective measures are taken to assure this. Where exposure to moisture is expected, additional controls over and above the requirements of this Technical Specification may be warranted or the use of bound pavement materials should be considered in the pavement design.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
acid igneous rock	An igneous rock containing more than 65% SiO2 typically consisting of quartz, feldspar, biotite. Includes Rhyolite, Rhyodacite, Dacite, Tuffs (of same composition), Granite, Adamellite and Granodiorite.
adamellite	A granitoid igneous rock consisting of between 5% to 20% quartz and with alkali feldspar representing between 33% and 66% of the total feldspar. Typical mafic minerals are hornblende and biotite.
base	A course or courses principally intended to directly support the traffic loads.
basic igneous rock	An igneous rock containing between 44% and 54% SiO2 typically consisting of plagioclase, pyroxene, olivine and quartz free. Includes Basalt, Dolerite and Gabbro.
brick	A block of clay hardened in a kiln and suitable for use under the Building Code of Australia as a building material in domestic housing or industrial building construction. Recycled bricks may have mortar attached.
coarse component	The fraction of the material which does not pass the 0.425 mm test sieve.
duricrust	A layer formed on the surface of rock or soil by the natural accumulation of silica, calcium or iron oxides resulting in the formation of a hard rock like layer. Includes Silcrete, Calcrete and Ferricrete.
fines component	The fraction of the material passing the 0.425 mm test sieve.

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Term	Definition
fines ratio	The ratio of the percentage of the material passing the 0.075 mm test sieve and the percentage of the material passing the 0.425 mm test sieve.
Intelligent Construction (IC) Roller	A single (smooth) drum roller that incorporates equipment to measure the stiffness of compacted layers, while simultaneously tracking the position and number of passes using a global positioning system (GPS). Stiffness, position and coverage results are displayed in real time to the plant operator and the data can be exported to provide a complete record of compaction and undertake further analysis with Veta.
intermediate igneous rock	An igneous rock containing between 54% and 65% SiO2 typically consisting of plagioclase, amphibole, pyroxene and nil or minor quartz. Including Trachyte, Trachyandesite, Andesite, Tuffs (of same composition), Syenite and Diorite.
marine water	Water derived from an oceanic source or a source directly attached to an oceanic source and subject to tidal influences.
material group	A unique category selected on the basis of material classification, geological processes and material properties. Materials of one group may grade into another in the one quarry site, however each source will be classified based on the predominant material group.
metamorphic rock	A rock derived from a pre-existing rock by mineralogical, or structural changes in response to changes in the temperature and/or pressure. Including Hornfels, Quartzite, Metagreywacke, Greenstone, Slate and Amphibolite.
natural gravel or natural material	Naturally occurring granular alluvial, colluvial or residual deposits. Natural material may be used as a supplementary material, as an unbound material in its own right, or blended with recycled materials to produce an unbound granular pavement material.
pavement	The portion of the road placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.
quarry	A site from which construction materials are won by blasting, ripping or other excavation means for use in their natural state, or after processing such as by crushing, screening or combining with other materials. The term quarry also includes pits and natural deposits such as sand sources. When used in relation to Transport and Main Roads quarry registration system, a quarry may also include a material recycler.
Reclaimed asphalt pavement (RAP)	Asphalt that has been milled or excavated from existing pavements, or unused asphalt returned from job sites. RAP used in unbound pavement material may also contain a small proportion of other materials (such as granular material or subgrade) that is picked up during milling or excavation.
Recycled brick	Brick that is crushed and processed for use as an aggregate. Recycled bricks may have mortar attached.
Recycled concrete	Concrete that is crushed and processed for use as an aggregate. May include construction and demolition waste, concrete washout or returned concrete.
Recycled glass	Glass that is crushed and processed into an aggregate and complies with MRTS36 *Recycled Glass Aggregate.*
Recycled material	Recycled concrete, brick, glass or RAP that complies with the requirements of this specification.

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Term	Definition
Recycled material blend	A granular material blend produced from the crushing and/or processing of recycled materials within the proportions permitted by this Technical Specification. A recycled material blend contains a minimum of 70% (by mass) recycled materials and may contain up to 30% (by mass) of natural or quarried material.
sedimentary rocks	A rock formed from loose sediments or by biological activity which have, via the process of lithification been transformed into rock. Including Limestone, Mudstone, Sandstone, Arenite, Chert.
subbase course	A course or courses principally intended to distribute to the subgrade the loads from overlying course(s).
supplementary material	A generally fine-grained material which is blended into an unbound material, at a low concentration, to adjust the grading and/or plastic properties to ensure specification compliance. Supplementary materials shall be sourced from a registered site, but does not necessarily need to be sourced from the quarry providing the bulk of the material.
surfacing	The upper layer of the pavement which is directly trafficked (e.g. a sprayed bituminous treatment or asphalt surfacing).
Veta	A map-based software tool for Contractors and Administrators to standardise, display, analyse and report data collected by intelligent compaction (IC) and paver-mounted thermal profiling (PMTP) technologies during construction. Veta can import data from various IC machines and PMTP to perform editing, filtering, spot test correlation, and statistical analysis as a post-processing tool.

3 Referenced documents

The requirements of the referenced documents listed in Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
MRTS01	*Introduction to Technical Specifications*
MRTS36	*Recycled Glass Aggregate*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*
MRTS56	*Construction Surveying*
MTM	*Materials Testing Manual*, Transport and Main Roads
Pavement Design Supplement	*Pavement Design Supplement*, Transport and Main Roads
Quarry Registration System QRS1 to QRS6	*Quarry Registration System,* Transport and Main Roads
TN140	*Source Material Assessment for Subtype 2.5, Subtype 3.5 and Type 4 Unbound Pavement Materials*
TN171	*Use of High Standard Granular (HSG) Bases in Heavy Duty Unbound Granular Pavements*

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FOI 26-292 - Document 21

4 Standard test methods

The standard test methods specified in Table 4 are referenced in this Technical Specification.

Further details of test numbers and test descriptions are detailed in the *Materials Testing Manual* (MTM) and in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

Table 4 – Standard test methods

Property to be Tested	Method No.
Ball penetration	AG:PT/T251
Calculation of characteristic value of a lot	Q020
California bearing ratio	Q113A, Q113C
Conductivity (water)	APHA 2510-B
Crushed particles	AS 1141.18
Degradation factor	Q208B
Degree of saturation	Q146
Deviation from a three-metre straight edge	Q712
Dry strength	AS 1141.22
Flakiness index	Q201
Foreign materials	Q477
Light particles (%)	AS 1141.31
Linear shrinkage, Weighted linear shrinkage	Q106
Liquid limit	Q104A
Moisture content	AS 1289.2.1.1, AS 1289.2.1.4, AS 1289.2.1.6, Q141A
Organic content (%)	Q120B
Particle size distribution and fines ratio	Q103A
Permanent deformation and resilient modulus	Q137
Petrographic assessment of aggregates	Q188
pH (water)	APHA 4500-H B
pH (Type 2 material containing recycled concrete)	AS 1289.4.3.1
Proof rolling test	Q723
Relative compaction	Q140A
Road roughness (surface evenness)	Q708B, Q708C, Q708D
Sampling of soils, crushed rock and aggregates	Q060
Selection of sampling and testing location	Q050
Spot sampling of soils, crushed rock and aggregate	Q061
Texture depth	AG:PT/T250

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Property to be Tested	Method No.
Unconfined compressive strength	Q115
Water absorption	AS 1141.6.1
Wet strength	AS 1141.22
Wet / dry strength variation	AS 1141.22

4.1 Supplementary requirements for Test Method Q113A and Q113C

4.1.1 Q113A

No California Bearing Ratio (CBR) testing is required for materials that are to be compacted to 100% modified compaction.

Where CBR testing using standard compaction is required, the test result shall be reported at the maximum dry density and optimum moisture content as defined by the relevant test method.

4.1.2 Q113C

For Type 4 materials where a moisture content other than OMC is specified in Clause 2.3.2 of Annexure MRTS05.1, the CBR shall be determined from one single-point test, in accordance with Test Method Q113C.

This test shall be carried out at the maximum dry density of the material and at the relative moisture content specified in Clause 2.2.2 of Annexure MRTS05.1.

Where a soaked CBR is specified, the soaking period shall be four days unless otherwise nominated in the design documents.

4.2 Supplementary requirements for Test Method Q115

Unconfined compressive strength testing shall be undertaken at the optimum moisture content and maximum dry density determined using standard compaction.

4.3 Supplementary requirements for Test Method AS 1141.22

The Wet Strength and the Wet / Dry Strength Variation tests shall both be carried out on the fraction of the coarse component passing the 13.2 mm test sieve, but retained on the 9.5 mm test sieve.

The wet strength and the wet / dry strength variation tests must not be undertaken on other fractions.

The Wet Strength and the Wet / Dry Strength Variation tests are known to be sensitive to the fraction size tested.

Generally:

- the apparent wet strength will increase as the size of the fraction tested decreases, and
- the wet / dry strength variation will decrease as the size of the fraction tested decreases.

As such a standard particle size range is tested even if this constitutes only a small proportion of the material.

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5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are stated in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2.1	1. Acceptance of Construction Procedures for unbound pavement Works		
5.2.2			Submit Construction Procedure for aggregate production (seven days)
5.2.3			Submit Construction Procedure for unbound pavement construction (14 days)
6.1	2. Use of quarry or source		
6.2			Submit Quarry Registration Certificate (seven days)
6.3			Submit Source Material Report (seven days)
8.2	3. Demonstration of ability to manufacture and construct conforming pavement	1. Construction of Trial Pavement	
8.3.4.1	4. Increase DoS limit – Type 1 materials		
9.1	5. Demonstration of compliance prior to incorporation into pavement		
9.4.7		2. Proof Rolling	
9.5.1	6. Covering a pavement layer		

5.2 Construction procedures

5.2.1 General

The Contractor shall prepare documented procedures for all construction processes as defined in Clause 6 of MRTS50 *Specific Quality System Requirements*.

No unbound pavement Works shall commence until all relevant construction procedures have been accepted by the Administrator. **Hold Point 1**

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5.2.2 Material production procedure

For each supplier that will provide material to be used in the Works, the Contractor shall prepare a construction procedure for material production and detail the following for each subtype (or Type 1):

a) for natural gravel and quarried materials – the area (for example, face number, bench number and reduced level) of the quarry from which the material will be won

b) for recycled materials – procedures used to manage the source materials, including:

   i. how source material deliveries are inspected at the point of entry and during tipping

   ii. records that are kept for each delivery

   iii. sorting and stockpiling of source materials

   iv. selection of source material from feed stockpiles, and

   v. detection, management and removal of contaminants and excess foreign materials.

c) production process to be used including methods of winning / sourcing, crushing and blending the material

d) procedures for stockpile management and traceability as part of lot control and, as applicable, stockpile sub-lot control, and

e) quality control procedures.

The Material Production Procedures shall be submitted to the Administrator at least seven days prior to the commencement of material production for the Works. **Milestone**

5.2.3 Unbound pavement construction procedure

For unbound pavement materials to be used in the Works, the Contactor shall prepare a Construction Procedure, which details at least the following:

a) details of all plant associated with the Works, including the proposed paving plant (refer Clause 8.3.1)

b) details for all aspects of the pavement works, including:

   i. location of and management processes for stockpiles

   ii. location of unbound pavement material production / processing and logistics for operation of and the transport of materials from this location

   iii. the lengths and widths of each paving run

   iv. the location and detail of joints required between each paving run

   v. procedures for joint preparation

   vi. procedures for the transport, placement, compaction and trimming of the pavement material

   vii. the proposed rolling pattern and number of passes needed to achieve the specified compaction standard for each layer thickness and support condition (to be validated during the placement trial)

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viii. details for working up to or against to structures, kerbs, road safety barriers, access chambers, drainage gullies and other fixed infrastructure within or adjacent to the pavement, including how the material will be placed and compacted to meet the minimum requirements of this Technical Specification

ix. procedure and equipment proposed for proof rolling pavement layers

x. procedures and equipment to cut-back Type 1 layers prior to placing the next layer (refer Clause 8.3.1.2 and Clause 8.3.5.2) if applicable, and

xi. procedure and equipment to prepare the surface prior to sealing (refer Clause 8.3.1.2 and Clause 8.3.5.1).

c) process to provide traceability of unbound pavement materials from source through to material incorporated into the final pavement.

Where multiple unbound pavement materials are to be incorporated into the Works, the Contractor may prepare a single procedure provided that any differences in construction process for each material are clearly detailed.

The Unbound Pavement Construction Procedure shall be submitted to the Administrator at least 14 days prior to the commencement of unbound pavement Works. **Milestone**

6 Supplier registration and source material assessment

6.1 General

The written permission of the Administrator is required prior to material being supplied to or used in the Works from any source. **Hold Point 2**

6.2 Type 1, Type 2 and Type 3 (excluding Subtypes 2.5 and 3.5)

Type 1, Type 2 and Type 3 materials (including those sourced from recycled materials, but excluding Subtype 2.5 and Subtype 3.5) shall be provided by a supplier registered and operated in accordance with the Transport and Main Roads Quarry Registration System requirements. The supplier must be registered to supply the appropriate material subtype.

The coarse component shall be manufactured from source material from a supplier which has a current Transport and Main Roads Quarry Registration Certificate. Suppliers producing Type 2 materials containing more than 30% recycled materials, shall be registered as a Recycled Material Site in accordance with the Transport and Main Roads Quarry Registration System.

Supplementary material can be imported for use in these materials, provided it is also from a source registered and operated in accordance with the Transport and Main Roads Quarry Registration System requirements.

The current Transport and Main Roads Quarry Registration Certificates for all sources (including natural, quarried and recycled materials), shall be submitted to the Administrator at least seven days before a material's supply or use. **Milestone**

6.3 Subtype 2.5, Subtype 3.5 and Type 4

Subtypes 2.5, 3.5 and Type 4 materials may be provided from a supplier registered under the Transport and Main Roads Quarry Registration System in accordance with the requirements of Clause 6.

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Where a Subtype 2.5, 3.5 or Type 4 material is not sourced from a supplier registered under the Transport and Main Roads Quarry Registration System, a source material assessment shall be undertaken in accordance with TN140 *Source Material Assessment for Subtype 2.5, Subtype 3.5 and Type 4 Unbound Pavement Materials* for the material source from which the Subtype 2.5, Subtype 3.5 or Type 4 unbound pavement material is to be supplied. A copy of the Source Material Assessment Report shall be submitted to the Administrator at least seven days before supply or use. **Milestone**

6.4 Supplementary material

Supplementary materials shall be supplied from a source registered and operated in accordance with the Transport and Main Roads Quarry Registration System requirements.

7 Material

Unbound pavement materials specified in accordance with this Technical Specification have the following attributes:

Type 1 – High Standard Granular (HSG)

- A premium unbound granular pavement material, for use in the base course of heavy duty unbound pavements to produce a hard, durable and uniform material that enables a dense and homogeneous pavement to be constructed.
- Typically covered with a sprayed bituminous treatment or thin asphalt surfacing.
- Relies principally on the mobilisation of internal frictional forces to resist the applied load.
- Potentially highly permeable. Requires protection from moisture as soon as possible after construction. Will deteriorate rapidly if the surfacing fails.
- Permeability is reduced by specifying a higher minimum linear shrinkage requirement.
- A high compaction standard specified to provide some reduction in permeability as well as increased stiffness.
- Type 1 materials typically have a very low unconfined strength. Consequently, a single coat seal may not provide adequate confinement, particularly under heavy traffic and at least a double / double polymer modified seal or asphalt surfacing should be applied.
- Must not be subject to traffic without a surfacing and should be subject to traffic only for a very short period of time, if it is covered by a prime only.
- No direct strength test (CBR) is specified as optimum property limits are specified.
- Because of the extensive range of properties chosen to specify this material and because optimum property limits have been specified, Type 1 materials provide the highest probability of obtaining a consistently high-quality pavement material.
- Further information regarding the use of Type 1 (HSG) pavements materials is provided in TN171 *Use of High Standard Granular (HSG) Bases in Heavy Duty Unbound Granular Pavements.*

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Type 2 – Standard Material

- A high quality unbound granular pavement material, for use in base, subbase and lower pavement layers.
- Relies principally on the mobilisation of internal frictional forces and/or cohesion to resist the applied load.
- If a sprayed bituminous treatment or asphalt surfacing is not provided, consideration should be given to specifying a higher minimum linear shrinkage requirement.
- To comply with the CBR requirements (where specified), the Contractor may have to apply more stringent target properties to the material within the limits given in this Technical Specification.
- Commonly used in wet environments, hence the requirement for a soaked CBR (where specified) and more stringent durability requirements (compared to Type 3 materials).
- Type 2 material may be produced from either natural, quarried or recycled material.

Type 3 – Standard Material

- Attributes are as per Type 2, except intended for use in relatively dry environments, only where the pavement equilibrium moisture content is low, hence the requirement for an unsoaked CBR (where specified). Similarly, only the wet strength and the flakiness index properties for the coarse component are specified and the fines standards are less stringent than the values specified for Type 2 materials.
- Type 2 material of the same subtype produced from either natural, quarried or recycled material may be used where a Type 3 material is specified.

Type 4 – Non-standard material

- Relies principally on cohesion, but may also utilise the mobilisation of internal frictional forces to resist the applied load.
- The only default property specified for Type 4 materials is unsoaked CBR, to provide a hierarchy of the respective subtypes.
- To utilise a Type 4 material, the designer must develop the standards and requirements relevant to the particular material and include these in Annexure MRTS05.1.
- The use of a standard Type 2 or Type 3 material may not be suitable where a Type 4 material has been specified.

Typical applications for each material subtype are given in the Transport and Main Roads *Pavement Design Supplement*.

7.1 Type 1 unbound material – High Standard Granular (HSG)

7.1.1 General

Type 1 (HSG) material shall be hard, sound, durable and not breakdown in service.

The locations in which Type 1 (HSG) material is to be used, shall be shown in the design documentation or specified in Clause 2.1 of Annexure MRTS05.1.

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When properly constructed, a Type 1 (HSG) base provides a dense, relatively low-permeability structural layer, with increased durability. The Type 1 (HSG) requirements of this Technical Specification are based on historically specified Subtype 1.1 materials, modified to help ensure that this higher standard of pavement is able to be consistently achieved.

The use of Type 1 (HSG) materials in accordance with this Technical Specification has a number of specific requirements, including:

- material properties as specified in this Clause
- use of specific paving equipment and tighter process controls for adding moisture
- tighter controls on layer thickness and DoS
- texturing of the surface between layers, and
- checking of post-compaction gradings and assessment of compaction using modified compaction.

7.1.2 Coarse component

The coarse component properties for Type 1 (HSG) materials are specified in Table 7.1.2.

Table 7.1.2 – Coarse component properties – Type 1 (HSG)

Property	Material Group†			
	Acid Igneous	Basic Igneous	Intermediate Igneous and Metamorphic	Sedimentary Duricrust
Wet strength (kN)	≥ 130‡ *	≥ 150‡	≥ 140‡	≥ 130‡
Wet / Dry strength variation (%)	≤ 40‡	≤ 30‡	≤ 35‡	≤ 40‡
Degradation factor	≥ 40	≥ 50	≥ 45	–
Flakiness index (%)	≤ 35	≤ 35	≤ 35	≤ 35
Crushed particles (%)	≥ 70	≥ 70	≥ 70	≥ 70
Water absorption (%)	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0

† Materials are to be classified into a material group on the basis of the lithology of the major granular component, except where two or more components each constitute over 30% of the total, then the most stringent properties of these materials group shall be applied.

‡ If the material does not comply with the specified maximum Wet / Dry strength variation limits, the Wet / Dry strength variation requirement may be waived if the Wet Strength is at least 60 kN above the relevant specified minimum value.

* For Adamellite source material only (Acid Igneous Group), the minimum Wet Strength shall be 115 kN.

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Material tests are specified to assess the following properties:

- Wet Strength: strength.
- Wet / Dry Strength variation: indirect measure of durability.
- Degradation factor: indirect measure of durability by measuring the amount of secondary minerals in the aggregate.
- Crushed particles: indirect measure of aggregate surface roughness that generates internal friction. This property is particularly important for Type 1 (HSG) materials. For material manufactured exclusively from crushed quarry products, the Administrator may elect to waive the requirement to test for this property.
- Flakiness index: measures the amount of aggregate particles that are elongated and/or flat. 'Flaky' particles reduce workability and are prone to breakdown during compaction and in service.
- Water absorption: a complementary test to degradation factor to assess material durability. Also specified as a way of controlling the amount of moisture that aggregates can absorb during construction, which may later be released as pore water and lead to DoS issues.

7.1.3 Fines component

The fines component of Type 1 (HSG) material shall comply with the properties as specified in Table 7.1.3.

Table 7.1.3 – Fines component properties – Type 1 (HSG)

Property	Value
Liquid Limit	≤ 25
Linear Shrinkage (%)	1.5 – 3.5

Linear Shrinkage (LS) limits are specified for Type 1 (HSG) materials to control the content of plastic (that is, clay) materials. In Type 1 (HSG) materials, which are materials designed to carry load primarily through internal frictional forces (particle interlock), excess clay must be controlled as this may lead to a potential loss of stability of the material, due to the softening of the clay component from wetting up of the pavements.

Minimum LS limits are specified to enhance the performance of these unbound pavement materials by improving workability, providing some degree of cohesion and reducing permeability.

7.1.4 Particle size distribution (grading)

The particle size distribution requirement is specified in Table 7.1.4(a). The Contractor shall aim to produce material conforming to the target grading. The maximum and minimum limits define an acceptable zone of departure from this target grading for any sample taken prior to the construction of the pavement layer.

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Table 7.1.4(a) – Grading – Type 1 (HSG)

Test Sieve Size (mm)	Percent Passing by Mass		
	Target	Minimum	Maximum
37.5	100	100	100
26.5	100	100	100
19.0	100	95	100
13.2	85	78	92
9.5	73	63	83
4.75	54	44	64
2.36	39	30	48
0.425	18	14	22
0.075	9	7	11

In addition to the requirements for particle size distribution specified in Table 7.1.4(a), the fines ratio shall be between the limits specified in Table 7.1.4(b).

Table 7.1.4(b) – Ratio of 0.075 mm material to 0.425 mm material – Type 1 (HSG)

Material	Fines Ratio
Type 1	0.3 – 0.55

The fines ratio can be related to unbound pavement material performance as follows:

- higher ratio – leads to a reduction in stability and strength, and
- lower ratio – increases permeability, leads to poorer surface finish and reduces surface stability.

7.2 Type 2 unbound material

7.2.1 General

Type 2 materials may be produced from either natural gravel, quarried or recycled materials (or combination of these).

The allowable constituents for each subtype are given in Table 7.2.1(a).

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Table 7.2.1(a) – Constituents in Type 2 materials

Subtype	Maximum Limit of each Constituent (percent by mass)				
	Natural gravel or quarried material	Recycled materials			
		Recycled concrete	RAP	Recycled brick	Recycled glass ^
2.1	100	100	0	0	0
2.2	100		15	15	0
2.3	100		20	20	20
2.4	100			45	
2.5	100		45		

^ Recycled glass shall comply with the requirements of MRTS36 *Recycled Glass Aggregate*.

In addition to the requirements for allowable constituents specified in Table 7.2.1(a), Type 2 materials are classified into two categories as specified in Table 7.2.1(b).

Table 7.2.1(b) – Material categories of Type 2 materials

Material category	Limit of Constituents (percent by mass)	
	Natural gravel or quarried material	Recycled materials
General material	> 30%	< 70%
Recycled material blend	≤ 30%	≥ 70%

Where applicable, different requirements have been specified for general materials (which contain < 70% recycled materials) and recycled material blends (which contain ≥ 70% recycled materials).

For any requirement where no distinction is made between general materials and recycled material blends, the requirements shall apply to both.

Recycled materials may be used in base layers when:

- the average daily traffic in the design lane in year of opening is less than 500 Equivalent Standard Axles (ESAs), (the average daily traffic in the design lane in year of opening is given in Clause 2.2 of Annexure MRTS05.1), and
- an asphalt surfacing is provided over the base.

There are no restrictions to the use of recycled materials in other applications, for example non-trafficked shoulders, sub-bases, improved layers, or subgrade treatments.

Transport and Main Roads supports the use of recycled materials based on their highest and best use. The reuse of RAP in asphalt maximises the value of its high quality aggregates and residual binder.

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Where RAP is not suitable for reuse in asphalt (for example, other material has been mixed with it during removal or handling) this second class material may be recycled by incorporating it into unbound pavement materials.

The locations in which material of a specific subtype is to be used, shall be shown in the design documentation or specified in Clause 2.1 of Annexure MRTS05.1.

7.2.2 Coarse component

The coarse component properties for Type 2 material are specified in Table 7.2.2.

Table 7.2.2(a) – Coarse component properties – Type 2

Property	Subtype	Material Group‡				
		Acid Igneous	Basic Igneous	Intermediate Igneous and Metamorphic	Sedimentary Duricrust	Recycled Material Blend
Wet strength (kN)	2.1 2.2 2.3 2.4 2.5	≥ 115† ≥ 100† ≥ 85† ≥ 70† –	≥ 135† ≥ 115† ≥ 100† ≥ 85† –	≥ 125† ≥ 105† ≥ 90† ≥ 80† –	≥ 115† ≥ 100† ≥ 85† ≥ 70† –	≥ 85 ≥ 85 ≥ 70 ≥ 70 –
Wet / Dry strength variation (%)	2.1 2.2 2.3 2.4 2.5	≤ 40† ≤ 40† ≤ 45† ≤ 45† –	≤ 30† ≤ 30† ≤ 35† ≤ 35† –	≤ 35† ≤ 35† ≤ 40† ≤ 40† –	≤ 40† ≤ 40† ≤ 45† ≤ 45† –	≤ 35 ≤ 40 ≤ 40 ≤ 45 –
Degradation factor	2.1, 2.2 2.3, 2.4 2.5	≥ 40 ≥ 30 –	≥ 50 ≥ 40 –	≥ 45 ≥ 35 –	–	–
Flakiness index (%)	2.1, 2.2 2.3, 2.4 2.5	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –
Water absorption (%)	2.1, 2.2 2.3, 2.4 2.5	≤ 2.0 ≤ 2.5 –	≤ 2.0* ≤ 2.5* –	≤ 2.0 ≤ 2.5 –	≤ 2.0 ≤ 2.5 –	–

‡ Materials are to be classified into a material group on the basis of the lithology of the major granular component unless, where two components each constitute over 30% of the total, then the most stringent properties of either materials group for that subtype shall be applied.

† If the material does not comply with the specified maximum Wet / Dry Strength Variation limits, the Wet / Dry strength variation requirement may be waived if the Wet Strength is at least 60 kN above the relevant specified minimum value.

* Where the Transport and Main Roads Quarry Registration Certificate states the rock / material type is 'undersaturated glassy basalt' or 'oversaturated glassy basalt', the water absorption values specified in Table 7.2.2(b) shall apply.

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Table 7.2.2(b) – Water absorption values for Glassy Basalts

Property	Subtype	Undersaturated Glassy Basalt	Oversaturated Glassy Basalt
Water absorption (%)	2.1 & 2.2 2.3 & 2.4	≤ 3.0 ≤ 3.5	≤ 4.0 ≤ 4.5

Material tests are specified to assess the following properties:

- Wet Strength: strength.
- Wet / Dry Strength Variation: indirect measure of durability.
- Degradation factor: indirect measure of durability by measuring the amount of secondary minerals in the aggregate.
- Flakiness index: measures the amount of aggregate particles that are elongated and/or flat. 'Flaky' particles reduce workability and are prone to breakdown during compaction and in service.
- Water absorption: a complementary test to degradation factor to assess material durability. Also specified as a way of controlling the amount of moisture that aggregates can absorb during construction, which may later be released as pore water and lead to DoS issues.

7.2.3 Fines component

The fines component properties for Type 2 material are specified in Table 7.2.3(a) and Table 7.2.3(b).

Table 7.2.3(a) – Fines component properties – Type 2 – General Materials (containing < 70% recycled materials)

Property	Subtype				
	2.1	2.2	2.3	2.4	2.5
Liquid Limit (LL) (%)	≤ 25 *	≤ 25 *	≤ 28 *	≤ 35	≤ 40
Linear Shrinkage (LS) (%)	1.0 – 3.5	1.0 – 3.5	1.5 – 4.5	1.5 – 6.5	1.5 – 7.5
Weighted Linear Shrinkage (WLS)	≤ 85	≤ 85	≤ 110	≤ 195	–

* Where the Transport and Main Roads Quarry Registration Certificate states that the rock / material type is 'oversaturated glassy basalt', the following Liquid Limit values shall apply:

– Subtype 2.1 & 2.2 materials, LL ≤ 28%

– Subtype 2.3 materials, LL ≤ 30%

Table 7.2.3(b) – Fines component properties – Type 2 Recycled Material Blends (containing ≥ 70% recycled materials)

Property	Subtype				
	2.1	2.2	2.3	2.4	2.5
Liquid Limit (LL) (%)	≤ 35	≤ 35	≤ 35	≤ 40	≤ 40
Linear Shrinkage (LS) (%)	1.0 – 3.5	1.0 – 3.5	1.5 – 4.5	1.5 – 6.5	1.5 – 7.5
Weighted Linear Shrinkage (WLS)	≤ 85	≤ 85	≤ 110	≤ 195	–

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7.2.4 Particle size distribution (grading)

The grading envelopes for Type 2 materials are specified in Table 7.2.4(a) and Table 7.2.4(b).

Table 7.2.4(a) – Grading envelopes – Type 2 – General Materials (containing < 70% recycled materials)

Subtypes	2.1 and 2.2	2.3 and 2.4	2.5
Test Sieve Size (mm)	**Percent Passing by Mass**		
75.0	100	100	100
37.5	100	90 – 100	85 – 100
19.0	87 – 100	80 – 100	–
9.5	67 – 87	60 – 90	55 – 95
4.75	50 – 70	42 – 76	–
2.36	36 – 52	30 – 60	30 – 80
0.425	14 – 24	14 – 28	14 – 60
0.075	7 – 16	7 – 16	7 – 30

Table 7.2.4(b) – Grading envelopes – Type 2 – Recycled Material Blends (containing ≥ 70% recycled materials)

Subtypes	2.1 and 2.2	2.3 and 2.4	2.5
Test Sieve Size (mm)	**Percent Passing by Mass**		
26.5	100	100	100
19.0	95 – 100	95 – 100	84 – 100
13.2	78 – 92	75 – 95	69 – 95
9.5	63 – 83	60 – 90	56 – 90
4.75	44 – 64	42 – 76	37 – 77
2.36	30 – 48	28 – 60	23 – 63
0.425	13 – 21	10 – 28	8 – 30
0.075	5 – 11	3 – 11	2 – 14

In addition to the requirements of Table 7.2.4(a) and Table 7.2.4(b), the grading curve for the material shall be smooth. For Subtype 2.5, the grading between adjacent sieves, shall not vary from one outer third of the grading limits of one sieve to the opposite outer third of the grading limits of the next sieve.

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The specified gradings reflect the typical applications that each material subtype will be used in as per the Transport and Main Roads *Pavement Design Supplement*. For example:

- 2.1 and 2.2 materials are typically used in base courses.
- 2.3 and 2.4 materials are typically used in subbase courses, and
- 2.5 materials are typically used in lower subbases or subgrade.

Where a materials subtype is to be used in a different application, the designer may choose to specify an alternative grading.

7.2.5 California bearing ratio

The California Bearing Ratio requirements for Type 2 material are specified in Table 7.2.5.

Table 7.2.5 – California bearing ratio requirements – Type 2

Property	Subtype						
	2.1		2.2		2.3	2.4	2.5
Compaction standard (refer Clause 8.4.3)	Modified	Standard	Modified	Standard	Standard	Standard	Standard
CBR (4 day soaked)	Not specified	≥ 80	Not specified	≥ 60	≥ 45	≥ 35	≥ 15

Where specified, the strength of Type 2 material is principally assessed by the soaked California Bearing Ratio (CBR) test. To consistently comply with all of the relevant specification requirements, it may be necessary for the Contractor to develop a set of secondary requirements which comply with the list of primary requirements specified in Clauses 7.2.3 and 7.2.4 but, where necessary, are more stringent so that the specified CBR is achieved.

Where unbound materials conform with the coarse and fine material requirements of this Technical Specification and are compacted to 100% modified compaction or greater, experience has shown that the necessary CBR limit is readily achievable. As a result, the Technical Specification does not require CBR testing for materials where 100% modified compaction is both specified and achieved during construction and all other material properties are conforming.

7.2.6 Type 2 materials containing Recycled materials

7.2.6.1 pH

Where the recycled material blend is to be in direct contact with galvanised or aluminium components, the pH value of the recycled material blend shall comply with the requirements specified in Table 7.2.6.1.

Alternatively, the components shall be adequately protected from contact with the material to the satisfaction of the Administrator.

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Table 7.2.6.1 – pH of Type 2 material containing recycled concrete in direct contact with galvanised or aluminium components

Property	Maximum Value
pH	11

7.2.6.2 Unconfined Compressive Strength

Where a subtype includes recycled concrete, the Unconfined Compressive Strength (UCS) of the combined material shall comply with the requirements specified in Table 7.2.6.2.

Table 7.2.6.2 – Unconfined compressive strength of Type 2 material containing recycled concrete

Property	Maximum Value	Time for UCS Test
UCS	0.7 MPa	7 days

7.2.6.3 Foreign Material

Unless otherwise approved by the Administrator, where a subtype includes recycled materials, the foreign material shall comply with the limits specified in Table 7.2.6.3.

Table 7.2.6.3 – Limits of foreign materials in Type 2 material containing recycled materials

Foreign Material	Test Method	Subtype	Maximum Percent in Mix (% by Mass)
Brick	Q477	2.1	1
Asphalt		2.1	1
Metal, ceramics and slag (other than blast furnace slag)		All	3
Plaster, clay lumps and other friable material		All	1
Rubber, plastic, bitumen not part of asphalt, paper, cloth, paint, wood and other vegetable matter		All	0.2
Asbestos	Not permitted		

The Administrator may consider relaxing the requirement for foreign material testing where the source of the recycled material is very well controlled. For example concrete washout / returned concrete that is sent directly from a concrete batch plant to a quarry for blending with natural or quarried material.

This requirement should not be waived where the recycled material is sourced from any construction and demolition waste.

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7.3 Type 3 unbound material

7.3.1 General

The locations in which material of a specific subtype is to be used shall be shown in the design documentation or specified in Clause 2.1 of Annexure MRTS05.1.

Where a Type 3 material is specified, a Type 2 material of the same subtype may be used in its place.

> The requirements for a Type 2 recycled material blend are also suitable for use as a Type 3 material.

7.3.2 Coarse component

The coarse component properties for Type 3 material are specified in Table 7.3.2.

Table 7.3.2 – Coarse component properties – Type 3

Property	Subtype	Material Group ‡			
		Acid Igneous	Basic Igneous	Intermediate Igneous and Metamorphic	Sedimentary Duricrust
Wet strength (kN)	3.1 3.2 3.3 3.4 3.5	≥ 100 ≥ 80 ‡ ≥ 70 ‡ ≥ 60 ‡ –	≥ 115 ≥ 95 ≥ 85‡ ≥ 70‡ –	≥ 105 ≥ 90‡ ≥ 80‡ ≥ 65‡ –	≥ 100 ≥ 80‡ ≥ 70‡ ≥ 60‡ –
Flakiness index (%)	3.1, 3.2 3.3, 3.4 3.5	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –	≤ 35 ≤ 40 –

‡ Materials are to be classified into a material group on the basis of the lithology of the major granular component, unless where two or more components each constitute over 30% of the total, then the most stringent properties of the various materials group shall be applied.

> Material tests are specified to assess the following properties:
>
> - Wet Strength: strength.
> - Flakiness Index: measures the amount of aggregate particles that are elongated and/or flat. 'Flaky' particles reduce workability and are prone to breakdown during compaction and in service.

7.3.3 Fines component

The fines component properties for Type 3 material are specified in Table 7.3.3.

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Table 7.3.3 – Fines component properties – Type 3

Property	Subtype				
	3.1	3.2	3.3	3.4	3.5
Liquid Limit (LL) (%)	≤ 25 *	≤ 28 *	≤ 35 *	≤ 35	≤ 40
Linear Shrinkage (LS) (%)	1.0 – 3.5	1.0 – 4.5	1.5 – 6.5	1.5 – 6.5	1.5 – 7.5
Weighted Linear Shrinkage (WLS)	≤ 85	≤ 110	≤ 195	–	–

* Where the Transport and Main Roads Quarry Registration Certificate states that the rock / material type is 'oversaturated glassy basalt', the following Liquid Limit values shall apply:

– Subtype 3.1 materials, LL ≤ 28%

– Subtype 3.2 materials, LL ≤ 30%

7.3.4 Particle size distribution (grading)

The grading enveloped for Type 3 materials are specified in Table 7.3.4.

Table 7.3.4 – Grading envelopes – Type 3

Subtypes	3.1 and 3.2	3.3 and 3.4	3.5
Test Sieve Size (mm)	Percent Passing by Mass		
75.0	100	100	100
37.5	100	90 – 100	85 – 100
19.0	87 – 100	80 – 100	–
9.5	67 – 87	60 – 90	55 – 95
4.75	50 – 70	42 – 76	–
2.36	36 – 52	30 – 60	30 – 80
0.425	14 – 24	14 – 28	14 – 60
0.075	7 – 16	7 – 16	8 – 30

In addition to the requirements of Table 7.3.4, the grading curve for the material shall be smooth. For Subtype 3.5, the grading between adjacent sieves, shall not vary from one outer third of the grading limits of one sieve to the opposite outer third of the grading limits of the next sieve.

The specified gradings reflect the typical applications that each material subtype will be used in, as per the Transport and Main Roads *Pavement Design Supplement*. For example:

- 3.1 and 3.2 materials are typically used in base courses
- 3.3 and 3.4 materials are typically used in subbase courses, and
- 3.5 materials are typically used in lower subbases or subgrade.

Where a materials subtype is to be used in a different application, the designer may choose to specify an alternative grading.

7.3.5 California bearing ratio

The California Bearing Ratio requirements for Type 3 material are specified in Table 7.3.5.

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FOI 26-292 - Document 21

Table 7.3.5 – California bearing ratio requirements – Type 3

Property	Subtype						
	3.1		3.2		3.3	3.4	3.5
Compaction standard (refer Clause 8.4.3)	Modified	Standard	Modified	Standard	Standard	Standard	Standard
CBR (unsoaked)	Not specified	≥ 80	Not specified	≥ 60	≥ 45	≥ 35	≥ 15

Where specified, the strength of Type 3 material is principally assessed by the soaked CBR test. To consistently comply with all of the relevant Technical Specification requirements, it may be necessary for the Contractor to develop a set of secondary requirements which comply with the list of primary requirements specified in Clause 7.3.3 and 7.3.4 but, where necessary, are more stringent so that the specified CBR is achieved.

Where unbound materials conform with the coarse and fine material requirements of this Technical Specification and are compacted to 100% modified compaction or greater, experience has shown that the necessary CBR limit is readily achievable. As a result, the specification does not require CBR testing for materials where 100% modified compaction is both specified and achieved during construction and all other material properties are conforming.

7.4 Type 4 unbound material

Type 4 material is specified by its unsoaked CBR and any additional requirements specified in Clause 2.3.1 of Annexure MRTS05.1.

The California Bearing Ratio requirements are specified in Table 7.4.

Table 7.4 – California bearing ratio requirements – Type 4

Property	Subtype				
	4.1	4.2	4.3	4.4	4.5
Compaction standard	Standard	Standard	Standard	Standard	Standard
CBR (unsoaked)	≥ 80	≥ 60	≥ 45	≥ 35	≥ 15

The moisture content at which the CBR result is to be reported, may vary from OMC for Type 4 materials when specified in Clause 2.3.2 of Annexure MRTS05.1. However, if no alternative is specified, the CBR shall be reported at OMC.

7.5 All unbound materials

All pavement material incorporated into the finished pavement shall be free from sticks, organic matter, clay lumps and other deleterious material or contamination. Visual inspection of the material, during and after placement, shall be undertaken to ensure compliance with this clause.

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The constituent materials shall be blended using procedures that:

a) are controlled to ensure uniformity of the blended material (including moisture)

b) ensure that the blended material is processed to a well graded, free flowing and consistent state, and

c) consistently achieve the requirements specified in this Technical Specification.

7.6 Supplementary materials

Supplementary materials may be used in the production of Type 1, Type 2 and Type 3 materials to meet the material requirements specified in Clause 7.1, 7.2 and 7.3.

Where the Contractor elects to use a supplementary material, it shall:

a) be derived from sound and durable material

b) not be self-cementing or cementitious in nature (with the exception of recycled hardened concrete which may include some unhydrated cement resulting from the crushing of the concrete, but not added, but must comply with the UCS requirements specified)

c) be free of vegetable matter, lumps and balls of clay and oversize particles of rock

d) be sized so that it can be effectively and uniformly distributed throughout the crushed rock

e) be kept sufficiently dry to facilitate blending, and

f) be uniformly blended into the product using a mixing system approved by the Administrator.

The properties of supplementary material shall meet the requirements of Table 7.6 prior to blending.

Table 7.6 – Supplementary material properties

Property	Value
% passing 9.5 mm test sieve	100
% passing 4.75 mm test sieve	90 – 100
Liquid limit (%)	≤ 40
Linear shrinkage (%)	≤ 10
Light particles (%)	≤ 10
Organic content (%)	≤ 5

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The selection of supplementary materials to be used in an unbound pavement material to meet the specified product requirements, is highly dependent on the nature of the material that it is being blended with.

The above limits have been included to give the widest possible range of potential supplementary materials, however materials with properties approaching the upper limits of these properties, will not be appropriate in every case. The required properties of supplementary materials should be assessed on a case by case basis and continually checked through material testing.

It would be expected that the proportion of supplementary material used would be less than 10% of the total product, but no upper limit has been defined in this Technical Specification.

Recycled, natural and quarried materials (or a combination of these) may all be used as supplementary materials.

7.7 Stockpiling of materials

Stockpiles of unbound pavement materials shall be positioned as specified in Clause 2.4 of Annexure MRTS05.1. If no position is specified in the Annexure, the Contractor shall nominate the stockpile location as part of their Unbound Pavement Construction Procedure and the stockpile shall be located on clear, even, firm, well-drained ground in a location where it can be clearly identified.

There shall be a separate stockpile for each material with different specification requirements.

Unless otherwise approved by the Administrator, all stockpiles shall be separated from other stockpiles by at least two metres.

For the purpose of testing, each individual stockpile lot shall be clearly delineated by one of the following methods:

a) a separate stockpile shall be formed for each lot, or

b) material of the same specification requirements shall be added to a single stockpile incrementally so that a portion representing a lot is added up to the maximum lot tonnage specified in Appendix A, tested and found to be conforming before the next portion, representing the next lot, is added. Nonconforming lots shall be removed from the stockpile prior to the addition of further portions.

7.8 Water Quality

Water used in unbound pavement manufacture and construction shall be free from oil, acids, organic matter and other matter which could be deleterious to the mixture. Unless otherwise accepted by the Administrator, the water shall satisfy the following requirements:

a) have a pH within the range of six to ten, when tested using Test Method APHA 4500-H B or equivalent

b) have an electrical conductivity not more than 3500 µS/cm when tested using Test Method APHA 2510-B or equivalent, and

c) marine water shall not be used.

Unless otherwise accepted by the Administrator, water sources shall be tested at a maximum of 12 monthly intervals during the course of supply, or when the nature of the water source has changed.

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Water sources classified by the relevant water authority as 'potable water', shall be exempt from testing.

> Electrical conductivity is an indirect measurement of the concentration of salts dissolved in the water.
>
> pH measures the acidity or basicity of the water to assess its corrosiveness.
>
> Where the Contractor can demonstrate a proven history or conformance from a specific water source, such as might be required for ongoing environmental monitoring purposes, the Administrator may waive the requirement for water quality testing of non-potable water sources.

8 Construction

8.1 General

The locations in which specific pavement materials are to be used, shall be shown in the design documentation or specified in Clause 2.1 of Annexure MRTS05.1.

8.2 Trial pavement

Unless otherwise agreed by the Administrator, for Type 1 (HSG) materials, a trial of the manufacturing and laying operations is required prior to commencement of the work. **Witness Point 1**

The trial pavement must be more than 1000 m². Subject to the Administrator's approval, the trial may be incorporated into the permanent Works.

The purpose of the trial is to determine:

a) based on the characteristics of the material, its ability to be handled, spread and compacted to achieve the surface finish requirements of Clause 8.3.5

b) the adequacy of the joint and surface preparation procedures (including the ability to achieve the surface texture requirement specified in Clause 8.3.5.2

c) the rolling pattern and the number of passes of the rollers required to produce an acceptable compacted layer

d) the adequacy or otherwise of the manufacturing and construction plant proposed for the work, and

e) the ability for the material to comply with the specified post compaction grading requirements (refer Clause 8.4.2).

The Contractor shall carry out material and construction compliance tests in accordance with Clause 9, to confirm that the trial complies with the requirements of this Technical Specification. Prior to continuing Works after completion of the trial, the Contractor shall submit to the Administrator, for their acceptance, records which demonstrate this compliance. **Hold Point 3** If the trial does not conform in full to the requirements of this Technical Specification, the Contractor shall review their construction procedure and the properties of the proposed unbound materials and a further trial shall be undertaken.

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Where minor nonconformances occur in a trial and the Administrator accepts to incorporate the lot into the permanent Works (either at a reduced level of service or otherwise), the Administrator, at their sole discretion may elect to waive the requirement for a further trial to be undertaken.

8.3 Process requirements

8.3.1 Equipment

8.3.1.1 Paving Equipment

8.3.1.1.1 General

Irrespective of what equipment is used to construct the pavement, the mix shall be placed and spread so that there is no segregation of the mixture.

8.3.1.1.2 Paving Type 1 (HSG) material

Pavements layers incorporating Type 1 (HSG) materials shall be constructed using a self-propelled spreading machine purpose-built for this work (that is, a paver). Such machines shall have the capacity to either:

a) receive the material in a hopper and place and spread the material on the prepared surface to the required uncompacted layer thickness, width and shape in one pass, or

b) spread previously placed windrows of the material to the required uncompacted layer thickness, width and shape in one pass.

Where the material is being placed adjacent to a fixed edge or the width of the layer varies, the paver shall be fitted with a variable width screed.

The Administrator may approve other methods of paving (for example, using a grader) in areas where the pavement width is such that the use of a paver is not practical. In these instances, the Contractor shall document the paving equipment to be used and the proposed construction methodology in their Unbound Pavement Construction Procedure.

8.3.1.1.3 Paving Type 2, 3 or 4 materials

Pavement layers incorporating Type 2, 3 or 4 materials shall be constructed by either using a paver (in accordance with the requirements of Clause 8.3.1.2) or with a grader, unless specific plant is specified in Clause 3.1.1 of Annexure MRTS05.1.

The Administrator may approve other methods of paving (for example, using small plant) in areas where the use of a paver or grader is not practical (for example, at turnouts or other isolated areas). In these instances, the Contractor shall document the paving equipment to be used and the proposed construction methodology in their Unbound Pavement Construction Procedure.

8.3.1.2 Equipment for preparation of surfaces

The equipment used for the preparation of a surface to be covered by a sprayed bituminous treatment shall include:

- a static three-point roller or pneumatic (multi-tyred) roller, and
- a machine capable of sweeping the surface

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The use of drag broom in conjunction with the three-point or multi-tyred roller is recommended.

The equipment used for the preparation of a Type 1 layer prior to placing the next layer shall include:

- a machine capable of roughening the surface of the layer, and
- a machine capable of sweeping the surface.

8.3.1.3 Intelligent Construction Rollers

Intelligent Construction (IC) rollers shall be used to compact unbound pavement material where specified in Clause 3.1.2 of Annexure MRTS05.1.

The IC rollers shall meet the following requirements:

a) IC rollers shall be self-propelled, single smooth drum vibratory rollers equipped to measure the stiffness of the layer being compacted.

b) IC rollers shall be capable of recording and displaying:

   i. real-time, colour-coded maps of the roller position, coverage and stiffness of the compacted layer

   ii. number of roller passes

   iii. roller speeds, and

   iv. vibration frequency and amplitude of the roller drums.

c) The data output from the IC roller shall be compatible with Veta.

To comply with this Clause, all single smooth drum rollers shall be IC rollers.

8.3.2 Paving

Unbound pavements shall be constructed so that each individual layer is laid in one pass that meets the requirements of this Technical Specification, without the addition of extra material, except as detailed below.

The material laid ready for compaction shall not have any visible areas of segregation. Any segregated areas are to be removed and replaced with fresh mix prior to the commencement of compaction of the lot. Material removed for this reason shall be disposed of in accordance with Clause 10 of MRTS01 *Introduction to Technical Specifications* and shall trigger a nonconformance, under which the Contractor must identify the cause of the segregation and propose preventative action to prevent reoccurrence. **Nonconformance**

8.3.3 Layer thicknesses

Individual compacted layer thicknesses shall be chosen to suit the construction process and the requirements of the Contract. Unless otherwise approved by the Administrator, the completed layer thicknesses (after compaction and surface preparation) shall be in accordance with Table 8.3.3. Where multiple layers of the same material are placed in a single course, each layer shall be of equal thickness unless otherwise approved by the Administrator.

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Table 8.3.3 – Layer thickness requirements

Material	Minimum Value	Maximum Value
Type 1 (HSG)	100 mm	150 mm
All other Subtypes	75 mm	250 mm

Except in batters, each layer shall be constructed in a uniform thickness unless otherwise approved by the Administrator.

Constructing multiple layers in a single course to the same thickness, is intended to promote uniformity of each layer. However, there may be circumstances where this requirement is not able to be satisfied, such as where kerb and channel is being constructed. In such instances, the Administrator may allow this requirement to be relaxed.

The Contractor should consider the vibration requirements specified in MRTS51 *Environmental Management* in determining the size of compaction equipment used and the thickness of the layer in which the material is compacted.

8.3.4 Moisture content

8.3.4.1 Degree of saturation

The pavement layer shall have a moisture content so that the degree of saturation is less than the relevant limit specified in Table 8.3.4.1 at the time that it is covered by another pavement layer or surfacing. Unless otherwise accepted by the Administrator, these requirements shall also apply to trafficking unbound pavement layers.

Table 8.3.4.1 – Maximum degree of saturation

Material	Maximum Degree of Saturation (%)	
Compaction standard	Modified	Standard
Type 1 (HSG)	60 *	Not applicable
Type 2	70	65
Type 3	70	65
Type 4	Not applicable	65

* For Type 1 material, the Administrator may accept a higher degree of saturation limit (up to a maximum of 70%) when the Contractor **Hold Point 4**:

a) confirms the use of a higher moisture content limit will not impact on achieving the surface finish requirements stated in Clause 8.3.5, and

b) demonstrates adequate resistance to deformation at a higher DoS level. This demonstration shall at least include RLT testing in accordance with Test Method Q137 where the maximum DoS at the time of sealing shall be the maximum value providing:

   i. less than 1.5% permanent strain after 1000 cycles

   ii. less than 4.0% strain at 50,000 cycles, and

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iii. RLT test results shall be undertaken on the manufactured pavement material not more than 12 months prior to its intended incorporation into the Works.

A common factor affecting the premature failure of newly constructed unbound granular pavements, has been the presence of excess moisture within the pavement base prior to the application of the bituminous surfacing. A DoS above the specified limits can lead to:

- rapid failure including blow-outs and rutting of an unbound pavement layer due to shear failures
- lifting of the surfacing due to positive pore pressure, and
- embedment of cover aggregate due to the softness of the base.

8.3.4.2 Moisture content during construction

The unbound pavement material may have a moisture content greater than that represented by the relevant DoS limit specified in Clause 8.3.4.1 for the purpose of construction only, provided that the section of pavement is dried back to meet the requirements of Clause 8.3.4.1 at the time it is covered by another pavement or surfacing layer.

For Type 1 (HSG) material, water shall only be added to the unbound pavement material via a controlled and measured process and be uniformly mixed through the material using a pugmill (or equivalent mechanical process).

Water shall not drain freely from the pavement material during production, handling, transport or construction.

Sufficient moisture must be added to unbound pavement material to allow adequate lubrication of the particles to achieve compaction. Generally, unbound materials should be compacted near the relevant OMC to achieve maximum density; however, materials are often compacted slightly dry of OMC to reduce the time required to achieve dry back.

Developing optimum moisture content and density graphs for the material can be useful to characterise the material, indicate sensitivity to moisture content and inform compaction procedures. However, the required moisture content for field compaction will depend largely on the conditions onsite and must be chosen to align with the material's characteristics and the compaction equipment to be used.

Uniformity of moisture content in the material is important, as variations will likely affect compactability, leading to unsatisfactory variations in density.

Moisture conditioning unbound pavement materials prior to delivery to the roadbed, will assist in minimising segregation during the spreading stage. However, the type and capacity of the pugmill will determine the length of the mixing time. Too short a mixing time in the pugmill will result in uneven moisture content throughout the product and will adversely impact on the ability to readily achieve the required compaction result.

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8.3.5 Surface finish

8.3.5.1 General

From when the layer is presented to the Administrator for inspection (refer Hold Point 5), until immediately prior to covering, the finished surface of any unbound pavement layer shall:

- be hard and homogenous in appearance
- not have any loose, segregated or contaminated areas
- have the coarse particles slightly exposed
- not be affected by delamination
- not show signs of water pumping, and
- not visibly deflect under load when proof rolled in accordance with Clause 9.4.7.

For layers that are to be covered by a sprayed bituminous treatment, the surface shall have a maximum ball penetration value that complies with Clause 8.4.7.

As necessary, the Contractor shall trim, lightly water, broom and roll the pavement to achieve the above finish to the satisfaction of the Administrator.

8.3.5.2 Preparation of Type 1 (HSG) layers prior to placing the next layer

Where a Type 1 (HSG) layer is to be overlaid directly with another layer of Type 1 (HSG) material, the finished surface shall be prepared so that it has a hard-rough surface with a texture depth not less than 1 mm (when testing in accordance with Test Method AG:PT/T250) without reducing the density of the layer or compromising the integrity of the surface.

> The Contractor will nominate in their Construction Procedure, the proposed methodology to prepare the pavement. This may be undertaken by hard brooming using a drag broom, however other plant may be used dependent on the nature of the project and what equipment is available onsite for other processes.

Unless otherwise approved by the Administrator, the overlying layer of Type 1 (HSG) material must be constructed within three days of the construction of the underlying layer unless additional time is required to meet the DoS limit for the underlying layer. Where additional time is needed to dry back the underlying layer, the overlying layer shall be constructed as soon as the required DoS has been reached.

All cut back material shall be disposed of in accordance with Clause 10 of MRTS01 *Introduction to Technical Specifications*.

8.3.6 Construction joints between adjacent paving runs

To the extent practical, the Contractor shall spread the unbound pavement material in a manner that minimises the number of joints.

Joints shall be constructed such that the material at the joints comply in all ways with the requirements of this Technical Specification.

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Longitudinal joints must comply with the following requirements unless otherwise approved by the Administrator:

a) joints shall be offset by a minimum of 150 mm from a joint in the underlying layers, except where required, otherwise to achieve the design shape (for example to construct a crowned pavement)

b) joints shall be located away from trafficked wheel paths, and

c) joints in the final (uppermost) layer of unbound pavement bases shall coincide with the final traffic lane markings and/or line of change in crossfall (for example, crown of the pavement).

Transverse joints must be offset by a minimum of 2.0 m from a joint in any underlying layer, unless otherwise approved by the Administrator.

The Administrator may approve longitudinal joints in the final (uppermost) layer of the base course to be constructed away from lane marking where this represents the best outcome to achieve the pavement design intent. For example, when paving a single lane ramp with wide shoulders, the Administrator may allow the Contractor to form a single longitudinal joint along the centre of the ramp, rather than paving the ramp lane between the edge line marking and the subsequently paving shoulders on either side.

8.3.7 Contractor's responsibilities

The Contractor shall maintain each layer so that it complies with all aspects of this Technical Specification until it has been overlaid with another pavement layer, or surfaced with the final surfacing and then until the end of the defect liability period or as otherwise required under the Contract.

8.3.8 Dust management

Unbound pavement material shall be transported in covered vehicles and delivered with sufficient moisture to control dust. Materials shall not be worked dry, but rather with sufficient moisture to minimise dust.

The moisture content required to manage dust will vary from material to material, however, would generally be less than that required to place and compact the material as a conforming pavement layer.

8.4 Product standards

8.4.1 Segregation

Segregation is the uneven distribution of particle sizes. The construction process shall control segregation so that the particle size distribution of the unbound pavement material complies with the particle size distribution requirements in Clause 7 (for the relevant subtype and grading) prior to the commencement of compaction.

Where there are visible signs of segregation in any lot prior to the commencement of compaction, the Administrator may direct the area to be tested for conformance with the above requirements.

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8.4.2 Post compaction grading of Type 1 (HSG) material

For Type 1 (HSG) materials, material breakdown (and segregation) shall be assessed against the post-compaction grading requirements specified in Table 8.4.2.

Table 8.4.2 – Post compaction grading for Type 1 (HSG)

Test Sieve Size (mm)	Percent Passing by Mass	
	Minimum	Maximum
26.5	100	100
19.0	95	100
13.2	78	92
9.50	63	83
4.75	44	64
2.36	30	49
0.425	14	23
0.075	6	12

8.4.3 Compaction standard

The characteristic value of relative compaction for unbound pavements must comply with the requirements specified in Table 8.4.3(a).

Table 8.4.3(a) – Compaction requirements

Material	Location	Minimum Value
Type 1 (HSG)	All	100% (Modified Compaction)
Subtype 2.1 and 2.2	Base course	
Subtype 3.1 and 3.2		
Subtype 2.1 and 2.2	Other than base course	100% (Standard Compaction)
Subtype 3.1 and 3.2		
Subtype 2.3, 2.4 and 2.5	All	
Subtype 3.3, 3.4 and 3.5		
Type 4		

The base course would typically be shown on the drawings. Where the base course is not specifically shown on the drawings, the thickness of the base course may be determined in accordance with Figure 8.4 of the Austroads *Guide to Pavement Technology (Part 2: Pavement Structural Design)*.

Where unbound pavement materials are used in other applications (for example stabilised pavements) the compaction requirements of the relevant Technical Specification shall apply.

Where the use of IC Rollers is specified in Clause 3.1.2 of Annexure MRTS05.1, the lot coverage must comply with the requirements specified in Table 8.4.3(b).

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Coverage shall be calculated as:

1. the area of the lot (that is to be incorporated into the Works) which has achieved the minimum number of roller passes nominated in the Unbound Pavement Construction Procedure, divided by
2. the total area of the lot that is to be incorporated into the Works.

Table 8.4.3(b) – IC Roller Coverage

Property	Minimum Value
IC Roller coverage	90%

The intent of this Technical Specification is that all high standard and standard quality unbound base materials (that is, Type 1 (HSG), Subtypes 2.1, 2.2, 3.1, and 3.2) are to be compacted to 100% modified compaction. This higher standard of compaction has a number or advantages, including:

1. reduced permeability
2. increased strength of the unbound base, and
3. improved fatigue life of thin asphalt surfacings.

All other unbound materials (that is, Subtypes 2.3, 2.4, 2.5, 3.3, 3.4, 3.5, and Type 4) are intended to be used in lower trafficked applications or in lower pavement layers. Accordingly, these materials are intended to be compacted to 100% standard compaction in most applications. These materials may not be suitable for compaction to 100% modified compaction as follows:

a) lower strength materials may be prone to breakdown during compaction. This is particularly likely where the wet strength is ≤ 90kN, and/or

b) the underlying materials may not provide adequate support for compaction.

8.4.4 Geometrics

8.4.4.1 General

The pavement shall be constructed so as not to depart from the widths, length, height and shape specified in the design documentation by more than the tolerances stated in this clause.

The widths and heights of the surface of layers other than the final layer, shall be calculated by the Contractor using the widths, heights and shapes for the completed pavement and the depth to the surface of the particular layer within the pavement as described in the design documentation.

The location of longitudinal joins in paving runs must also comply with the requirements of Clause 8.3.6.

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8.4.4.2 Geometrics, horizontal tolerances

The horizontal location of any point on the pavement shall not differ from the corresponding point shown in the design documentation, or the point calculated as described in Clause 8.4.4.1, by more than ± 50 mm except for the following situations:

a) for pavement edges not adjacent to any other part of the pavement and not adjacent to any fixed infrastructure or adjoining road, the transverse tolerance shall be – 50 mm, + 250 mm (where the + tolerance is in the direction which increases the width of the pavement), and

b) where alignment of the pavement with an existing pavement or piece of fixed infrastructure is necessary, the new work shall be joined neatly to the existing work in a smooth manner as shown on the drawings, or if this is not shown, in a manner approved by the Administrator.

8.4.4.3 Geometrics, vertical tolerances

The vertical tolerances as specified in Table 8.4.4.3 shall apply for:

- the surface level (height) measured at any point on the surface of any layer, and
- the average total thickness of the unbound pavement constructed under the Contract in accordance with this Technical Specification. Assessed as either:
  - where the pavement contains only a single unbound pavement layer – the total thickness of that individual layer, or
  - where the pavement contains multiple unbound pavement, layers constructed immediately over on another in accordance with this Technical Specification – the total thickness of the overall unbound pavement material (which may include different unbound pavement material types).

The tolerance (alternative) that will apply to Type 2, 3 and 4 materials shall be as nominated in Clause 3.2.1 of Annexure MRTS05.1. Where not specifically nominated, Alternative A shall apply.

Table 8.4.4.3 – Primary geometric tolerances

Material [Tolerance Alternative]	**Surface Level / Height (Individual)**		**Total Thickness (Average)**
	When Covered with Asphalt Surfacing ≤ 50 mm Thick	All Other Cases	
Type 1 (HSG)	± 10 mm *		- 20 mm * + unspecified
Type 2, 3 and 4 [Alternative A]	± 10 mm	± 15 mm	- 20 mm + unspecified
Type 2, 3 and 4 [Alternative B]	not suitable	± 25 mm	- 20 mm

* Where the pavement is required to be prepared as specified in Clause 8.3.5.2, these tolerances shall apply after the pavement has been prepared ready for construction of the overlying layer.

At all times, the Contractor shall target construction at the mid-point of the surface level tolerances.

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8.4.4.4 Crossfall

For the final (uppermost) layer of unbound pavement to be constructed under the Contract, the crossfall shall not depart from the design crossfall by more than 0.5% absolute. These requirements shall also be applied to other layers where stated in Clause 3.2.3 of Annexure MRTS05.1.

This crossfall shall be measured:

a) between any two points more than two metres apart, excluding where the overall width of a single crossfall is less than two metres wide. For crossfalls less than two metres wide, the measurement shall be made between the extreme edges of the crossfall as shown in the design documentation

b) transverse to the centre line, and

c) within the boundaries of a cross-section element which has a constant crossfall as shown in the design documentation.

8.4.5 Deviation from a straight-edge

The deviation from a three metre long straight-edge placed anywhere on the surface of the final (uppermost) layer of unbound pavement, to be constructed under the Contract, shall be in accordance with the requirements of Table 8.4.5 with due allowance being made for design shape, where relevant. These requirements shall also be applied to other layers where stated in Clause 3.2.3 of Annexure MRTS05.1.

The tolerance (alternative) that will apply to Type 2, 3 and 4 materials shall be as nominated in Clause 3.2.2 of Annexure MRTS05.1. Where not specifically nominated, Alternative C shall apply.

Table 8.4.5 – Requirements for deviation from a straight-edge

Material [Tolerance Alternative]	Maximum Value
Type 1 (HSG)	5 mm
Type 2, 3 and 4 [Alternative C]	5 mm
Type 2, 3 and 4 [Alternative D]	8 mm

8.4.6 Road roughness (surface evenness)

Unless otherwise specified in Clause 3.2.4 of Annexure MRTS05.1, the road roughness of the final (uppermost) layer of an unbound pavement to be constructed under the Contract, shall be in accordance with the requirements of Table 8.4.6.

Table 8.4.6 – Road roughness requirements

Property	Maximum Value
Road roughness (Rs) (m/km)	2.31

The roughness of the following features is required to be noted during roughness testing, but shall be excluded from the ride quality assessment:

- roundabouts
- railway crossing and grids

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- bridge joints, and
- inspection pit covers (for example, drainage access chambers).

The Contractor shall nominate a methodology and provide calculations on ride quality for the Administrators acceptance, showing how each feature has been excluded from the assessment and the subsequent lot structure.

Pavement features (including joints) or signalised / unsignalized intersections (other than roundabouts) shall not be excluded from the ride quality assessment unless agreed by the Administrator.

The Administrator may waive the requirement for roughness testing where the unbound pavement will be overlayed with asphalt or another pavement material within the same Contract and there is a roughness requirement specified elsewhere in the Contract for the overlying layer.

8.4.7 Ball penetration

For layers that are to be covered be a sprayed bituminous treatment, the surface shall have a maximum ball penetration value that complies with the requirements specified in Table 8.4.7.

Table 8.4.7 – Ball penetration requirement

Property	Maximum Value
Ball penetration	3 mm

9 Compliance testing

9.1 General

Compliance testing of unbound pavements shall be undertaken on a lot basis in accordance with MRTS01 *Introduction to Technical Specifications*. A lot shall include only material of the same subtype.

For each lot, the Contractor is responsible for performing sufficient tests to ensure that the pavement complies in all regards with the requirements of this Technical Specification. As a minimum, the Contractor's testing program shall not be less than that specified in this clause.

The Contractor shall ensure that sufficient, clearly documented construction compliance records are provided to the Administrator to ensure that traceability of unbound pavement materials is provided from their source (for example, quarry face) to the constructed pavement.

The Contractor shall not incorporate materials into the work, unless it has demonstrated that the material complies fully with the requirements of this Technical Specification before delivery of the material to site. **Hold Point 5** Such conformance results shall be no more than 18 months old, unless otherwise agreed by the Administrator.

When test results are more than six months old, where requested by the Administrator, the Contractor shall undertake audit testing prior to submitting **[refer Hold Point 6]** to demonstrate the material still complies with the requirement of this Technical Specification.

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The requirements for audit testing of stockpiles greater than six months, old would typically involve undertaken grading, liquid limit and linear shrinkage testing.

Maximum lot sizes, minimum test frequencies and the minimum number of tests required are specified in Appendix A.

Where testing frequencies are specified as a number of tests per a quantity, the tests should be representative of the quantity of materials nominated, or part thereof.

For example, if a frequency of one test per 1000 m² is nominated and a lot includes 2500 m² of that material, a minimum of three tests would be required.

9.2 Test locations

Unless indicated otherwise in Clause 1 of Annexure MRTS05.1, or elsewhere in this Technical Specification, samples for material compliance testing shall be taken from the stockpile.

Locations for compliance testing shall be selected by random stratified sampling, as specified in Test Method Q050. Representative sampling shall be undertaken as detailed in Test Method Q060. Spot sampling shall be undertaken as detailed in Test Method Q061.

9.3 Maximum lot sizes

The maximum lot sizes for unbound pavements shall be as specified in Table A1 of Appendix A.

The material used in a small construction lot would generally be sourced from a larger material stockpile (supply of unbound material) lot that has been tested as a whole for conformance with this Technical Specification. Accordingly, the test results from a single material stockpile may be applicable to multiple construction lots.

9.4 Compliance testing requirements

9.4.1 Unbound pavement materials

Minimum testing frequencies for unbound pavement material source and product testing, shall be as specified in Table A2 of Appendix A.

9.4.2 Testing under Transport and Main Roads Quarry Registration System.

Source material testing frequencies are controlled by Transport and Main Roads Quarry Registration System (QRS).

For project conformance, the Contractor shall provide test results, undertaken in line with the QRS requirements, which represent the unbound pavement material supplied to the Works. These test results need to be provided to the Administrator as part of each applicable construction lot.

9.4.3 Segregation

Minimum testing frequencies for segregation shall be as specified in Table A3 of Appendix A.

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The Administrator may direct additional testing of any areas which show visible signs of segregation during construction.

9.4.4 Post compaction grading of Type 1 (HSG) materials

Minimum testing frequencies for post compaction grading of Type 1 (HSG) materials shall be as specified in Table A3 of Appendix A.

Breakdown (as well as segregation) of Type 1 material shall be assessed based on its post-compaction grading. The specimen to be tested shall:

a) be sampled from the compacted pavement

b) be sampled using Q061 Spot Sampling of Soils, Crushed Rock and Aggregates, and

c) be sampled at a location adjacent to the location of sampling for the Relative Compaction testing.

9.4.5 Degree of saturation

9.4.5.1 General

Minimum testing frequencies for degree of saturation shall be as specified in Table A3 of Appendix A.

The degree of saturation for each lot, shall be represented by the maximum characteristic value of the degree of saturation of the individual samples taken from the lot. The characteristic value shall be calculated in accordance with Test Method Q020.

The degree of saturation result reported for any lot, shall be representative of the condition of the lot immediately prior to it being covered by another pavement layer. Should the pavement lot have been subjected to rainfall or moisture ingress in any way since degree of saturation testing was undertaken, the Administrator may direct the Contractor to retest the lot in accordance with Clause 9.4.5.2 to prove conformance.

9.4.5.2 Retesting degree of saturation

Retesting of the Degree of Saturation shall include the measurement of both the compacted density, and the moisture content.

If the retested results do not comply with the requirements of this Technical Specification, the Contractor shall dry back and/or reprepare the pavement so that it complies with the requirements of this Technical Specification, prior to covering the lot.

9.4.6 Compaction

Minimum testing frequencies for compaction shall be as specified in Table A3 of Appendix A.

The compaction standard for each lot, shall be represented by the minimum characteristic value of relative compaction. The characteristic value shall be calculated in accordance with Test Method Q020, using the individual relative compaction results reported for each lot.

For each lot where IC is used, the Contractor shall use Veta to analyse the IC data for coverage.

The Contractor shall provide to the Administrator, all input files necessary to analyse the data in Veta and a report of the Veta analysis (which has been output directly from Veta). The Veta report shall include the locations and values of all individual compaction compliance test results.

All data and files must be clearly linked to the construction lot which they relate to.

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The Veta software is freely available on the website *https://www.intelligentconstruction.com/*

9.4.7 Proof rolling

Each unbound pavement layer shall be tested for perceptible surface deformation by 'proof rolling' the pavement, in the presence of the Administrator. **Witness Point 2** All areas of unbound pavements shall be 'proof rolled', including all trafficked lanes, shoulders and other areas.

Testing shall be in accordance with Test Method Q723, unless otherwise approved by the Administrator. Testing for perceptible surface deformation is exempt from the requirement for NATA accreditation or Construction Material Testing (CMT) registration.

In areas where perceptible surface deformation is observed, the Contractor shall remove and replace the affected section, or take other corrective action to the satisfaction of the Administrator. In doing so, the Administrator may require the Contractor to carry out additional compliance testing to ensure that the affected section of pavement complies with Clause 8.3.4 and 8.4.3. No additional payment will be made by the Principal for any such additional testing.

The proof rolling result reported for any lot, shall be representative of the condition of the lot immediately prior to it being covered by another pavement layer. If the pavement lot has been subjected to rainfall or moisture ingress in any way since proof rolling was undertaken, the Administrator may direct the Contractor to retest the lot to prove conformance. If the retested results do not comply with the requirements of this Technical Specification, the Contractor shall dry back and/or reprepare the pavement so that it complies with the requirements of this Technical Specification. No addition payment will be made by the Principal for any such additional efforts.

Test Method Q723 provides a method for using either a 7,000 Litre single rear axle or 10,000 Litre tandem rear axle loaded water tanker for proof rolling.

9.4.8 Ball penetration testing

For unbound pavement layers that are to be covered by a sprayed bituminous treatment, the Contractor shall undertake ball penetration testing in accordance with Test Method AG:PT/T251 on the completed layer, prior to undertaking the sprayed bituminous treatment.

Minimum testing frequencies for ball penetration testing shall be as specified in Table A3 of Appendix A.

In accordance with Test Method AG:PT/T251, ball penetration results are to be reported as both individual and average values.

For the average value to be adopted for lot conformance and seal design purposes, the results must be representative of a homogeneous section of pavement. Any areas represented by excessively low or high individual values, should be considered for sub-lotting and may require additional construction or testing actions before they can be incorporated into the final Works. Any such work is to be undertaken by the Contractor at no cost to the Principal.

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The ball penetration result reported for any lot, shall be representative of the condition of the lot immediately prior to it being covered. If the pavement lot has been subjected to rainfall or moisture ingress in any way since ball penetration testing was undertaken, the Administrator may direct the Contractor to retest the lot to prove conformance. If the retested results do not comply with the requirements of this Technical Specification, the Contractor shall dry back and/or reprepare the pavement so that it complies with the requirements of this Technical Specification. No additional payment will be made by the Principal for any such additional efforts.

9.4.9 Geometrics and deviation from a straight edge

Minimum testing frequencies for geometric tolerances and deviation from a straight edge, shall be as specified in Table A4 of Appendix A.

Horizontal position, vertical levels, cross-fall and layer thickness, shall be determined by survey unless otherwise agreed by the Administrator.

9.4.10 Road roughness (surface evenness)

The road roughness of the final (uppermost) layer of unbound pavement, shall be measured by Test Methods Q708B, Q708C or Q708D.

For road roughness testing, a lot shall not be less than 100 m or greater than 500 m in length, unless otherwise approved by the Administrator.

> The Administrator may waive the requirement for roughness testing where the unbound pavement will be overlayed with asphalt or another pavement material within the same Contract and there is a roughness requirement specified elsewhere in the Contract for the overlying layer.

9.5 Compliance testing results

9.5.1 Acceptance of lots

Unless otherwise approved by the Administrator, no unbound pavement layer shall be covered by a subsequent layer of pavement or by a surfacing until **Hold Point 6**:

a) all testing has been completed

b) the surface finish of the layer complies with the requirements of Clause 8.3.5

c) all test results comply with the requirements of this Technical Specification, or any nonconformances have been submitted, with corrective actions proposed by the Contractor, and accepted by the Administrator

d) the layer has been presented to the Administrator for inspection, and

e) the As Constructed Survey requirements of the lot have been met, as specified in MRTS56 *Construction Surveying* and notice of such Works has been provided to the Administrator.

9.5.2 Reworking of unbound pavement lots

Where the Administrator permits an unbound pavement lot to be reworked to achieve compliance with the specified requirements, the Contractor shall ensure that the material still meets with the requirements of this Technical Specification – including the requirements for particle size distribution prior to compaction.

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FOI 26-292 - Document 21

10 Supplementary requirements

The requirements of this Technical Specification are varied by the supplementary requirements specified in Clause 4 of Annexure MRTS05.1.

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FOI 26-292 - Document 21

Appendix A: Maximum lot sizes and minimum testing frequencies

Table A1 – Maximum lot size requirements

Construction Activity	Maximum Lot Size
Supply of unbound pavement materials	5000 tonnes
Supply of supplementary material (prior to blending)	1000 tonnes
Construction of unbound pavements	A continuous single layer constructed in one day's production
Road roughness testing	500 m

The default testing frequencies provided in this Appendix have been developed for use on typical Transport and Main Roads projects. Where projects warrant specific testing frequencies, these are to be specified using Annexure MRTS05.1.

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FOI 26-292 - Document 21

Table A2 – Unbound pavement materials – source and product testing

Property	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	Minimum No. of Tests	Minimum Testing Frequency	Minimum No. of Tests
Source Testing					
Default source testing frequencies are given below. A lesser minimum testing frequency is permitted for specific properties, where stated on the Transport and Main Roads Quarry Registration Certificate – Testing Frequency Schedule					
Petrographic assessment of aggregates	Q188	6 monthly	-	-	-
Wet strength	AS 1141.22	1 per 2500t	2 per lot	-	-
Wet / dry strength variation	AS 1141.22	1 per 2500t	2 per lot	-	-
Water absorption	AS 1141.6.1	1 per 2500t	2 per lot	-	-
Degradation factor	Q208B	1 per 2500t	2 per lot	-	-
Product Testing					
Crushed particles (Type 1 materials)	AS 1141.18	–	1 per lot	–	1 per lot
Flakiness index	Q201	1 per 2500t	2 per lot	–	1 per lot
California Bearing Ratio*	Q113A or Q113C	1 per 2500t	2 per lot	–	1 per lot
Grading	Q103A	1 per 1000t	–	1 per 2500t	–
Fines ratio	Q103A	1 per 1000t	–	1 per 2500t	–
Liquid limit	Q104A	1 per 1000t	–	1 per 2500t	–
Linear shrinkage	Q106	1 per 1000t	–	1 per 2500t	–
UCS (Type 2 materials containing recycled concrete)	Q115	–	1 per lot	–	1 per lot
Foreign material (Type 2 materials containing recycled material)	Q477	1 per 2500t	2 per lot	–	1 per lot

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FOI 26-292 - Document 21

Property	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	Minimum No. of Tests	Minimum Testing Frequency	Minimum No. of Tests
pH (Type 2 material containing recycled concrete)	AS 1289.4.3.1	bi-monthly	–	Monthly	–
pH (water)	APHA 4500-H B	12 month intervals	–	12 month intervals	–
Conductivity (water) #	APHA 2510-B	12 month intervals	–	12 month intervals	–
Supplementary Material Testing					
Grading	Q103A	Refer to Clause 8.1.1 of MRTS50 *Quality System Requirements*			
Liquid limit	Q104A				
Linear shrinkage	Q106				
Light particles	AS 1141.31				
Organic content	Q120B				

* CBR testing is not required for Type 1 materials or for Type 2 or 3 materials where the requirements of Clause 7.2.5 are satisfied.

Water sources classified by the relevant water authority as 'potable water', shall be exempt from testing.

Transport and Main Roads Quarry Registration System (QRS) assesses the suitability of the source material at quarries to produce materials that comply with the various Transport and Main Roads Technical Specifications.

Being registered under QRS does not guarantee a quarry's ability to produce conforming material.

Quarries are not required to submit conformance tests directly to QRS during production (however these results may be included in registration renewals from time to time). For this reason, it is important that all conformance tests specified in Table A2 are provided to the Administrator as part of each applicable construction lot.

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Table A3 – Construction standard testing

Property	Test Method	Normal Testing Level		Reduced Testing Level	
		Minimum Testing Frequency	**Minimum No. of Tests**	**Minimum Testing Frequency**	**Minimum No. of Tests**
Segregation	Q103A	1 per lot (Additional testing as directed by the Administrator)			
Post compaction grading (Type 1 materials only)	Q103A	1 per 2,500 m²	2 per lot	1 per 2,500 m²	2 per lot
Degree of saturation	Q146	1 per 500 m²	4 per lot	1 per 1000 m²	4 per lot
Compaction	Q140A	1 per 500 m²	4 per lot	1 per 1000 m²	4 per lot
Proof rolling	Q723	Refer Clause 9.4.7			
Ball penetration testing	AG:PT/T251	**For unbound pavement layers where the final surfacing (to be trafficked) is a sprayed bituminous treatment:** • 5 test chainages per lot. • Test chainages (longitudinal coordinates determined in accordance with Test Method Q050 – random stratified). • At each test location, an individual test must be undertaken in both the inner and outer wheel path for each traffic lane in the lot at that location. **For unbound pavement layers where the final surfacing (to be trafficked) is not a sprayed bituminous treatment (that is, the sprayed bituminous treatment will be covered by asphalt):** • 5 test chainages per lot. • Test chainages (longitudinal coordinates) determined in accordance with Test Method Q050 – random stratified). • At each test location, an individual test must be undertaken at the offset (lateral coordinate) determined with Test Method Q050 – random stratified.			

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Table A4 – Geometrics testing

Property	Test Method	Normal Testing Level	Reduced Testing Level
Layer thickness	Survey	1 per 20 linear m	1 per 50 linear m
Horizontal position and vertical levels	Survey	Each 20 linear metres^ – measured at all shoulder edges, lane lines and other changes in grade across the pavement.	
Deviation from a straight edge	Q712	a) **Within lane**: 1 per 20 linear metres^ along each paving run, unless otherwise approved by the Administrator. Measurements shall be taken in both the transverse and longitudinal directions. b) **Longitudinal joint**: 1 per 20 linear metres^ along each joint, unless otherwise approved by the Administrator. c) **Transverse joint**: 1 measurement per joint in each wheel path in each lane. For the measurement of joints, place the straightedge on the completed layer, perpendicular to the joint. With the end of the straightedge directly over the joint, gradually move the straightedge across the joint for its full length and identify the point on the layer that produces the largest deviation under the straightedge (between two points of contact). Record the deviation at this point. For all joints that tie the new Works to existing pavement (not constructed under the Contract), place the straightedge on the road surface perpendicular to the joint. With the end of the straightedge directly over the joint and the other end located within the Works, record the largest deviation under the straightedge (between two points of contact).	
Crossfall	Survey	1 per 20 linear metres^ – measured for all crossfalls shown in the design documentation at the point of testing	
Road roughness	Q708B, Q708C and Q708D	Refer Clause 8.4.6 and 9.4.10	

^ The Administrator may approve the adoption of a reduced testing frequency of 1 per 50 m in 'mid-block' applications (that is, areas of pavement not located in the vicinity of intersections, roundabouts, steep grades and/or sharp curves).

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Technical Specification

Transport and Main Roads Specifications MRTS14 Road Furniture

March 2022

Queensland Government

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Contents

1 Introduction 1

2 Definition of terms 1

3 Referenced documents 2

3.1 Standards 2

3.2 Standard Drawings 4

4 Standard test methods 5

5 Quality system requirements 5

5.1 Hold Points, Witness Points and Milestones 5

5.2 Construction procedures 6

6 Surplus material 7

7 Demolition of road furniture and roadside structures 7

7.1 General 7

7.2 List of items to be demolished 7

7.3 Construction 7

8 Removal and salvage of road furniture 7

8.1 General 7

8.2 List of items to be salvaged 7

8.3 Storage site 7

8.4 Construction 7

9 Removal and re-erection of road furniture 8

9.1 General 8

9.2 List of items to be removed and re-erected 8

9.3 Construction 8

10 Road edge guide posts 9

10.1 General 9

10.2 Material requirements 9

10.2.1 Rigid timber posts 9

10.2.2 Rigid posts other than timber 9

10.2.3 Flexible posts 10

10.2.4 Delineators 12

10.3 Construction 13

10.3.1 Location 13

10.3.2 Installation 13

10.3.3 Delineators 13

10.4 Guide post warranty 13

11 Fencing 13

11.1 General 13

11.2 Scope 13

11.3 Material requirements 13

11.3.1 General 13

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

11.3.2 Hardwood timber posts ... 13
11.3.3 Softwood timber posts (excluding Cypress Pine) ... 14
11.3.4 Cypress pine ... 14
11.3.5 Steel posts, stays and rails ... 14
11.3.6 Galvanised fencing wire (plain and barbed) ... 14
11.3.7 Galvanised chainwire ... 14
11.3.8 Galvanised wire netting ... 14
11.3.9 Welded mesh ... 14
11.3.10 Steel posts (Y-Section) ... 14
11.4 Construction ... 14
12 Gates ... 14
12.1 General ... 14
12.2 Scope ... 15
12.3 Material requirements ... 15
12.3.1 Gate frame ... 15
12.3.2 Mesh ... 15
12.3.3 Other fittings ... 15
12.4 Construction ... 15
13 Supply of road sign faces ... 15
13.1 General ... 15
13.2 Sign face layout ... 15
13.3 Material requirements ... 15
13.3.1 Sign substrate ... 15
13.3.2 Stiffener rails ... 16
13.3.3 Coatings ... 16
13.4 Fabrication ... 19
13.4.1 General ... 19
13.4.2 Message, shape, size, layout, colours ... 19
13.4.3 Substrate preparation ... 19
13.4.4 Sheeting application ... 19
13.4.5 Sign panel size and joints ... 20
13.4.6 Provision for mounting signs ... 20
13.4.7 Stiffener rails ... 20
13.4.8 Square holes for mounting signs ... 22
13.4.9 Panel sheet joints ... 22
13.4.10 Reference marking ... 23
13.4.11 Packing ... 24
13.4.12 Warranty ... 24
14 Installation of road signs ... 25
14.1 General ... 25
14.2 Materials and fabrication ... 25
14.2.1 Fabrication ... 25
14.2.2 Materials general ... 26
14.2.3 Posts ... 26
14.2.4 Connection straps ... 27
14.2.5 Brackets ... 27
14.2.6 Fixings ... 27
14.2.7 Sign frames ... 27
14.2.8 Anchor bolts ... 27
14.2.9 Handling, transport and storage ... 27
14.3 Construction of footings ... 28

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

14.4 Erection of signs 28
14.4.1 General 28
14.4.2 Location 29
14.4.3 Posts 29
14.4.4 Frames 29
14.4.5 Sign faces (erection) 29
15 Project signs 29
15.1 Introduction 29
15.2 Scope 30
15.3 Materials 30
15.4 Erection of project signs 30
15.5 Maintenance of project signs 30
15.6 Removal of signs 30
16 Contractor's information signs 30
17 Grids 30
17.1 General 30
17.2 Fabrication 30
17.3 Precast concrete 31
17.4 Material requirements 31
17.4.1 Steel plate and sections 31
17.4.2 Bolts, nuts and washers 31
17.4.3 Included road furniture 31
17.4.4 Concrete 31
17.4.5 Steel reinforcing 31
17.4.6 Cement mortar 31
17.5 Construction 31
17.5.1 General 31
17.5.2 Excavation and backfilling 32
17.5.3 Concrete work 32
17.5.4 Precast components 32
17.5.5 Installation of grid frame 32
17.5.6 Installation of fencing 32
17.5.7 Installation of road furniture 32
17.5.8 Reinstatement 32
17.5.9 Trafficking of grid 32
18 Road safety barrier systems 33
18.1 General 33
18.2 Public domain road safety barriers and end treatments 33
18.3 Proprietary road safety barriers and end treatments 33
19 Concrete road safety barrier (public domain) 33
19.1 General 33
19.2 Material 33
19.2.1 Concrete 33
19.2.2 Steel reinforcing 34
19.2.3 Prestressing strand 34
19.2.4 Cement mortar 34
19.2.5 Steel plate and sections 34

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

19.2.6 Bolts, nuts and washers ... 34
19.2.7 Electrical conduit and pits ... 34
19.2.8 Compressible filler ... 34
19.2.9 Joint sealant ... 34
19.2.10 Delineators ... 34
19.3 Fabrication ... 34
19.4 Construction ... 35
19.4.1 General ... 35
19.4.2 Surface preparation ... 35
19.4.3 Conduits and pits ... 35
19.4.4 Formwork ... 35
19.4.5 Steel reinforcing ... 35
19.4.6 Extruded concrete barriers ... 35
19.4.7 Placed concrete barriers ... 36
19.4.8 Cover plate assemblies ... 37
19.4.9 Tolerances ... 37
19.4.10 Delineator spacing ... 37
19.4.11 Precast concrete ... 37
20 Steel beam guardrail and end treatments (public domain) ... 37
20.1 General ... 37
20.2 Manufacture ... 37
20.2.1 Registered manufacturer ... 37
20.2.2 Registered manufacturer in Australia ... 38
20.2.3 Registered manufacturer – outside Australia ... 38
20.3 Supplier ... 39
20.3.1 Registered supplier ... 39
20.4 Material requirements ... 40
20.4.1 Steel components ... 40
20.4.2 Panels ... 40
20.4.3 Steel posts and blockouts ... 41
20.4.4 Steel plate, strip, bar and attachments ... 42
20.4.5 Material conformance ... 42
20.4.6 Material audit testing ... 42
20.4.7 Fasteners ... 43
20.4.8 Delineators ... 43
20.4.9 Cable and Cable assembly ... 43
20.5 Fabrication of guardrail components ... 43
20.5.1 Fabrication standard ... 43
20.5.2 Welding personnel in Australia ... 44
20.5.3 Welding personnel outside Australia ... 44
20.6 Installation ... 44
20.6.1 General ... 44
20.6.2 Posts for Longitudinal Barrier (excluding public domain end treatments) ... 45
20.6.3 Posts for public domain end treatments ... 46
20.6.4 Anchor cables ... 46
20.6.5 Delineator spacing ... 46
20.6.6 Tolerances ... 47
20.6.7 Acceptance of installation ... 47
21 Proprietary barrier systems and end treatments ... 49
21.1 General ... 49
21.2 Manufacture ... 49
21.2.1 Precast concrete barriers ... 49
21.2.2 Plastic block outs ... 49

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

21.3 Design of Proprietary Barrier Systems 50
21.4 Installation 51
21.4.1 General 51
21.4.2 Excavation 51
21.4.3 Placed concrete 51
21.4.4 Tensioned wire rope 51
21.4.5 Delineation 51
21.4.6 Measurement 52
21.4.7 Quality records 52
22 Tactile ground surface indicators (TGSI) 53
22.1 Supply of compliant products 53
22.2 Installation 53
22.2.1 Test methods 53
22.2.2 Testing frequencies 53
22.2.3 Maximum lot size 53
22.2.4 General 54
22.2.5 Alignment 54
22.2.6 Surface preparation 54
22.2.7 Installation 54
22.3 Protection of work 54
22.4 Quality records 54
22.5 TGSI removal 54
22.6 Placed concrete 54
22.7 Traffic management 54
23 Supplementary requirements 55

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

1 Introduction

This Technical Specification applies to the supply, construction, demolition, removal, salvage and re-erection of road signs, grids, steel beam guardrail, tensioned wire ropes barrier systems, steel traffic barriers, concrete traffic barriers, road edge guide posts, fencing and gates.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

The requirements for the manufacture and supply of steel components for guardrail components and signs as listed in Table 1 that are registered by Transport and Main Roads.

Table 1 – Items requiring use of registered suppliers and approved products

Clause	Category of Work
14.2.1.1	Fabrication of sign posts
20.2	Public Domain Guardrail Manufacturer
20.3	Public Domain Guardrail Supplier

For information regarding registered suppliers and approved products refer to the departmental website, www.tmr.qld.gov.au.

2 Definition of terms

The terms used in this Technical Specification are as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*.

Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Manufacturer	Any organisation or legal person who manufactures guardrail components under a company name of trademark.
Supplier	Any organisation or legal person in the supply chain who imports guardrail components and/or distributes the guardrail components to guardrail installers.
Fabricator	Any organisation or legal person who fabricates components via welding sections together.
Installers	Any organisation or legal person in the supply chain who installs road safety barrier systems which are sourced from a departmental approved guardrail manufacturer and or supplier.
Contractor	Any organisation or legal person who constructs infrastructure.

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3 Referenced documents

3.1 Standards

Table 3 lists documents referenced in this Technical Specification.

Table 3.1 – Referenced documents

Reference	Title
AS 1111.1	*ISO metric hexagon bolts and screws - Product grade C, Part 1: Bolts*
AS 1112.3	*ISO metric hexagon nuts, Part 3: Product grade C*
AS 1237.1	*Plain washers for metric bolts, screws and nuts for general purposes, Part 1: General plan*
AS 1391	*Metallic materials – Tensile testing at ambient temperature*
AS 1397	*Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinc and zinc alloyed with aluminium and magnesium*
AS 1743	*Road signs – Specifications*
AS 1744	*Standard alphabets for road signs*
AS 2082	*Timber – Hardwood – Visually stress-graded for structural purposes*
AS 2423	*Coated steel wire fencing products for terrestrial, aquatic and general use*
AS 2858	*Timber – Softwood – Visually stress graded for structural purposes*
AS 3569	*Steel wire ropes – Product specification*
AS 3972	*General purpose and blended cements*
AS 4663	*Slip resistance measurement of existing pedestrian surfaces*
AS 3730.10	*Guide to the properties of paints for buildings – Latex – Exterior – Gloss*
AS 3730.13	*Guide to the properties of paints for buildings – Primer – Wood – Solvent-borne – interior / exterior*
AS/NZS 1112.3	*ISO metric hexagon nuts - Product grade C*
AS/NZS 1163	*Cold-formed structural steel hollow sections*
AS/NZS 1214	*Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)*
AS/NZS 1252	*High strength steel fastener assemblies for structural engineering – Bolts, nuts and washers*
AS/NZS 1390	*Cup head bolts with ISO metric coarse pitch threads*
AS/NZS 1428.4.1	*Design for access and mobility – Part 4.1: Means to assist the orientation of people with vision impairment – Tactile ground surface indicators*
AS/NZS 1554.1	*Structural steel welding - Welding of steel structures*
AS/NZS 1580.481.1.10	*Paints and related materials - Methods of test - Coatings - Exposed to weathering - Degree of flaking and peeling*
AS/NZS 1580.602.2	*Paints and related materials - Methods of test - Measurement of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*
AS/NZS 1594	*Hot-rolled steel flat products*

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Reference	Title
AS/NZS 1734	*Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate*
AS/NZS 1906.1	*Retroreflective materials and devices for road traffic control purposes – Part 1: Retroreflective sheeting*
AS/NZS 1906.2	*Retroreflective materials and devices for road traffic control purposes - Retroreflective devices (non-pavement application)*
AS/NZS 3678	*Structural steel - Hot-rolled plates, floorplates and slabs*
AS/NZS 3679.1	*Structural steel - Hot-rolled bars and sections*
AS/NZS 3679.2	*Structural steel - Welded I sections*
AS/NZS 3845 Set	*Road safety barrier systems*
AS/NZS 4600	*Cold-formed steel structures*
AS/NZS 4680	*Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*
AS/NZS ISO 9001	*Quality management systems - Requirements*
MRTS01	*Introduction to Technical Specifications*
MRTS02	*Provision of Traffic*
MRTS04	*General Earthworks*
MRTS07A	*Insitu Stabilised Subgrades using Quicklime or Hydrated Lime*
MRTS07B	*Insitu Stabilised Pavements using Cement or Cementitious Blends*
MRTS07C	*Insitu Stabilised Pavements using Foamed Bitumen*
MRTS08	*Plant-Mixed Heavily Bound (Cemented) Pavements*
MRTS09	*Plant-Mixed Foamed Bitumen Stabilised Pavements*
MRTS10	*Plant-Mixed Lightly Bound Pavements*
MRTS50	*Specific Quality System Requirements*
MRTS70	*Concrete*
MRTS71	*Reinforcing Steel*
MRTS72	*Manufacture of Precast Concrete Elements*
MRTS73	*Manufacture of Prestressed Concrete Members and Stressing Units*
MRTS78	*Fabrication of Structural Steelwork*
MRTS91	*Conduits and Pits*
MRTS278	*Supply of Structural Fasteners*
MUTCD	Queensland *Manual of Uniform Traffic Control Devices*, Transport and Main Roads
SCM-P-015	Registration Scheme: Suppliers and products for Bridges and Other Structures
Technical Note 18	*Design Criteria for Motor Grids*
-	Building Timbers: *Properties and Recommendations for their Use in Queensland* (Queensland Department of Primary Industries)
-	*Traffic and Road Use Management Manual (TRUM), Volume 3, Part 5 - Design Guide for Roadside Signs*
-	*Road Safety Barrier Systems and Devices*
-	Queensland *Timber Utilisation and Marketing Act 1987*

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FOI 26-292 - Document 21

3.2 Standard Drawings

Table 3.2 lists the Standard Drawings referenced in this document.

Table 3.2 – Referenced Standard Drawings

Standard Drawing Number	Title
1170	*Flood Depth Indicators – Installation*
1294	*Sign – Roadwork Delineators*
1295	*Sign – Fingerboard, Geographical Feature and Street Name Sign Bracket Details*
1353	*Road Furniture – Vermin and Dog Fencing at Motor Grid*
1354	*Road Furniture – Standard Bicycle Safe Fitting to Existing Motor Grid*
1355	*Road Furniture – Alternative Bicycle Safe Fitting to Existing Motor Grid*
1356	*Road Edge Guide Posts – Post and Installation Details*
1363	*Traffic Sign – Multiple Traffic Sign Support (Drawing 1 of 2 and 2 of 2)*
1364	*Traffic Sign – Connection Strap and Erection Cleat Details*
1365	*Traffic Sign – Traffic Sign Support Breakaway Post Details (two or more supports)*
1368	*Traffic Sign – Single Traffic Sign Support*
1369	*Traffic Sign – Details of Sign Stiffening Extrusion*
1452	*Traffic Sign – Sight Board (Drawing 1 of 3 to Drawing 3 of 3)*
1458	*Single Slope Concrete Barrier - Precast Concrete Barrier Fabrication Details (Drawing 1 of 2 to 2 of 2)*
1466	*Concrete Barriers – Typical Delineator Bracket Details*
1467	*Concrete Barriers – Cast-in Anchor Assembly for Thrie Beam Terminal Connector*
1468	*Single Slope Concrete Barrier – Extruded Median Barrier – Barrier, Reinforcing and Expansion Joint Details (Drawing 1 of 2 and Drawing 2 of 2)*
1469	*Single Slope Concrete Barrier - Extruded Median Barrier - Details of Road Lighting Pole Cover Plates*
1470	*Single Slope Concrete Barrier – Concrete Terminal for Median Barrier with Thrie Beam Guardrail Connection (Drawing 1 of 2 and Drawing 2 of 2)*
1473	*Single Slope Concrete Barrier – Precast Concrete Barrier Installation Details*
1474	*Steel Beam Guardrail – Installation and Setout*
1475	*Steel Beam Guardrail – Installation on Bridge and Barrier Approaches*
1476	*Steel Beam Guardrail – Terminal Components*
1477	*Steel Beam Guardrail – Posts and Blockouts, Soil and Bearing Plates, Slip Base Plate*
1478	*Steel Beam Guardrail – W Beam Anchor Bracket Delineation Unit Post on Base Plate Abraham Blockout*
1479	*Steel Beam Guardrail – Bolts, Nuts, Screws and Washers Cable Assembly with Fasteners*
1480	*Steel Beam Guardrail – Fabrication Details for W Beam Rails and Rail Components*

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Standard Drawing Number	Title
1481	*Steel Beam Guardrail – Fabrication Details for Thrie Beam Rails and Rail Components*
1482	*Steel Beam Guardrail – W Beam and Thrie Beam Assemblies*
1486	*Single Slope Concrete Barrier – Concrete Terminal for Barrier with Thrie Beam Guardrail Connection (Drawing 1 of 2 and Drawing 2 of 2)*
1518	*Banners on Light Poles – 2 Metre Banner Installation and Support Details (Drawing 1 of 2 and Drawing 2 of 2)*
1561	*Road Furniture – Motor Grid – General Arrangement (Drawing 1 of 2 and Drawing 2 of 2)*
1562	*Road Furniture – Motor Grid – Cast Insitu Abutment*
1563	*Road Furniture – Motor Grid – Cast Insitu Base Slab (Drawing 1 of 2 and Drawing 2 of 2)*
1564	*Road Furniture – Motor Grid – Precast Base Slab (Drawing 1 of 2 and Drawing 2 of 2)*
1565	*Road Furniture – Motor Grid - Steelworks*
1600	*Fencing – Rural Fence and Gates Timber Posts and Stays*
1601	*Fencing – Rural Fence and Gates CHS Posts and Stays*
1602	*Fencing – Chainwire Fences and Gates*
1603	*Fencing – Koala Proof Fence and Gate*
1604	*Fencing – Galvanized Welded Mesh Fencing*

4 Standard test methods

The standard test methods given in Table 4 shall be used in this Technical Specification. Refer to Clause 22.2.2 for testing frequencies.

Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Specifications*.

Table 4 – Test Methods

Property to be Tested	Method No.
Skid resistance (British pendulum number)	AS 4663 (wet method)
Luminance contrast (on-site method)	AS 1428.4.1

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
8.2	1. Dismantling of items to be salvaged		Submission of schedule of items to be salvaged (seven days)

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Clause	Hold Point	Witness Point	Milestone
9.2	2. Dismantling of items to be re-erected		Submission of schedule of items to be re-erected (seven days)
13.3.1.1	3. Alternative sign face material		
14.2.1.3	4. Welding Personnel		
14.4.1		1. Erection of road signs	
16	5. Contractor's information signs		Submission of details of information signs (14 days)
19.4.6	6. Test section of extruded concrete traffic barrier		
20.4.5	7. Material Conformance	2. Test of steel where test certificates are not available	
20.4.6.1		3. Selection of posts and panels for audit testing	
20.4.6.3	8. Acceptance of materials prior to installation		
20.5.2	9. Welding Personnel in Australia		
20.6.7	10. Acceptance of Installation		
21.2	11. Manufacture of Proprietary steel barrier		
21.4.1	12. Acceptance of Installation		
21.4.4	13. Acceptance of Tension Report	4. Verification testing	
22.1			Submission of product details, and construction procedure
22.2.5	14. Alignment		
22.2.6		5. Surface preparation	
22.4			Submission of TGSI warranty

5.2 Construction procedures

Construction procedures which are required to be submitted in accordance with Clause 6 of MRTS50 *Specific Quality System Requirements* are listed in Clause 2 of Annexure MRTS14.1.

These procedures are critical. Note that the receipt of these procedures is often seen as a de facto approval. In every case a response should be made to the Contractor acknowledging receipt of the procedures.

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FOI 26-292 - Document 21

6 Surplus material

Surplus excavated, removed or demolished material shall be utilised or disposed of in accordance with the requirements of Clause 10 of MRTS01 *Introduction to Technical Specifications*.

7 Demolition of road furniture and roadside structures

7.1 General

Clause 7 describes the work to be carried out where existing road furniture or roadside structures are required to be demolished.

7.2 List of items to be demolished

The items of road furniture to be demolished and disposed of are listed in Clause 3 of Annexure MRTS14.1.

7.3 Construction

Where necessary, excavations shall be carried out to permit demolition and removal of existing road furniture.

Existing road furniture shall be demolished and removed in a manner which avoids damaging any adjacent work. All existing footings shall be removed.

Resulting excavations shall be backfilled and finished so as to reinstate the area to a safe and free-draining state. Backfilling shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

8 Removal and salvage of road furniture

8.1 General

Clause 8 describes the work to be carried out where existing road furniture is required to be removed and salvaged under the Contract.

8.2 List of items to be salvaged

Broadly, the items of road furniture to be salvaged are listed in Clause 1.1 of Annexure MRTS14.1.

Not less than seven days prior to the commencement of dismantling and removal of any existing road furniture, the Contractor shall submit a schedule of items of existing road furniture to be salvaged in accordance with the provisions of the design documentation. **Milestone**

Dismantling and removal shall not commence until expiration of the seven day period. **Hold Point 1**

8.3 Storage site

Salvaged items shall be transported to the storage site nominated in Clause 1.2 of Annexure MRTS14.1.

8.4 Construction

Where necessary, excavations shall be carried out to permit removal of existing road furniture.

Existing road furniture to be salvaged shall be dismantled and removed with minimum damage to the items.

Where possible, fittings shall be undone, components disassembled and supports removed without any damage and/or cutting of the components. Where this is not possible, the method of dismantling shall be included in the schedule mentioned in Clause 8.2.

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Any part of the existing installation which is not to be salvaged shall be demolished and removed in a manner which avoids damaging any adjacent work. All existing footings shall be removed.

Resulting excavations shall be backfilled and finished so as to reinstate the area to a safe and free-draining state. Backfilling shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

Salvaged materials shall be carefully transported to the storage site nominated in Clause 8.3.

Salvaged materials shall be neatly stacked at the storage site on appropriate timber packers.

Where salvaged items are damaged during dismantling, transport or storage, steps may be taken to recover the value of such items from the Contractor.

9 Removal and re-erection of road furniture

9.1 General

Clause 9 describes the work to be carried out where existing road furniture is required to be removed and re-erected under the Contract.

9.2 List of items to be removed and re-erected

The items of road furniture to be removed and re-erected shall be as listed in Clause 4 of Annexure MRTS14.1.

Not less than seven days prior to commencement of dismantling and removal of any road existing furniture, the Contractor shall submit a schedule of items of existing road furniture to be dismantled for re-erection in accordance with the provisions of the design documentation. **Milestone**

Dismantling and removal shall not commence until expiration of the seven day period. **Hold Point 2**

9.3 Construction

Where necessary, excavations shall be carried out to permit removal of existing road furniture.

Existing road furniture to be salvaged and re-erected shall be dismantled and removed with minimum damage to the items.

Where possible, fittings shall be undone, components disassembled and supports removed without any damage and/or cutting of the components. Where this is not possible, the method of dismantling shall be included in the schedule mentioned in Clause 9.2.

Any part of the existing installation which is not to be salvaged for re-erection shall be demolished and removed in a manner which avoids damaging any adjacent work. All existing footings shall be removed.

Resulting excavations shall be backfilled and finished so as to reinstate the area to a safe and free-draining state. Backfilling shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

Salvaged materials shall be safely stored on appropriate timber packers until they can be re-erected.

Salvaged material shall be re-erected in accordance with the appropriate clauses of this Technical Specification. New incidental materials that may be necessary to re-erect the road furniture shall be supplied (e.g. bolts, nuts, concrete, etc.).

Where salvaged items, recovered in accordance with Clause 9, are damaged during dismantling, transport, storage or re-installation, such items shall be replaced by the Contractor.

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10 Road edge guide posts

10.1 General

Clause 10 describes the work to be carried out where road edge guide posts are required to be installed under the Contract. Road edge guide posts shall fall into one of the following categories:

- Rigid: posts either incapable of returning to their original state post impact or requiring assistance by hand or mechanical means to return to, or within a margin of 5 degrees, of their original state. This category shall include all timber road edge guide posts and any other posts not meeting the requirements of Clause 10.2.3 of this document.
- Flexible: posts capable of returning to, or within a margin of 5 degrees, of their original state post impact without assistance. See Clause 10.2.3.7 of this document for more information.

10.2 Material requirements

10.2.1 Rigid timber posts

10.2.1.1 Hardwood

Hardwood posts shall be durability Class 1, 2 or 3 and have a stress grade of F5 or better, in accordance with AS 2082.

10.2.1.2 Softwood

Softwood posts shall be durability Class 1, 2, 3 or 4. Durability Class 4 softwood shall be preservative-treated to an H5 level in accordance with the *Timber Utilisation and Marketing Act 1987*, and any untreated heartwood shall not exceed 20% of the cross-sectional area. Softwood posts shall have a stress grade of F5 or better in accordance with AS 2858.

10.2.1.3 All timber

Timber guide posts shall be graded under the authority of a recognised timber quality assurance program and be branded with the registered trade mark of the program.

All timber which is prone to excessive shrinkage and/or distortion shall have a moisture content less than 18%. All other timber may be unseasoned.

All posts shall be cut to the dimensions shown on Standard Drawing 1356. Spring and bow in all posts shall not exceed 15 mm.

The above-ground section of posts shall be painted as follows:

a) the timber surface shall be cleaned

b) the surface shall receive one coat of pink solvent-borne wood primer in accordance with the requirements of AS 3730.13 and two coats of gloss latex paint in accordance with the requirements of AS 3730.10 with a gloss level in excess of 85 gloss units in accordance with the requirements of AS/NZS 1580.602.2.

10.2.2 Rigid posts other than timber

10.2.2.1 Materials

Road edge guide posts shall be composed of material which is heat resistant and fire retardant and which is capable of retaining 85% of its colour, appearance and physical properties for at least five years when exposed to weather conditions existing in Queensland. The materials shall be durable and resistant to mould growth and mildew and shall not be affected by hydrocarbon solvents. All materials shall be corrosion resistant or treated to resist corrosion. The post materials shall also be resistant to ultraviolet light.

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10.2.2.2 Colour

The surface of road edge guide posts shall be a durable gloss or semi-gloss opaque white colour.

10.2.2.3 Surface finish

Road edge guide posts shall be free of sharp edges, burrs, discolouration or other defects which may affect appearance and/or serviceability.

10.2.2.4 Dimensions

The cross-sectional area of road edge guide posts is not critical but shall not differ from post to post by more than 3%. The following dimensional requirements shall, however, be satisfied:

a) rigid posts shall have a minimum width of 80 mm facing traffic over at least the top 250 mm of their length

b) posts shall be of such length to provide a height of 1000 mm above the ground surface and minimum anchoring depths of approximately 500 mm for buried posts and 350 mm for driven posts respectively.

10.2.2.5 Bending strength

The minimum bending strength, at yield, at the weakest point of the road edge guide post (on a partially flattened section) shall be 0.3 kNm.

10.2.2.6 Weathering resistance

If a warranty for a minimum period of five years is not available for the guidepost, then a sample of the guide post shall be subject to artificial weathering for a period of 1000 hours in either:

a) Atlas Twin Sunshine Carbon Arc Weatherometer, or

b) Xeon Arc Weatherometer at 0.55 watts/m² irradiance level with Boro / Boro filters.

During the weathering of the sample it shall be subject to:

a) light and dark alternating cycles 20% of the testing time

b) temperature during light cycles shall be a minimum of 32 degrees

c) humidity temperatures shall be cyclic and be 20% of the testing time.

After exposure the surface shall be free from crazing or blistering. The degree of chalking and colour change shall not fall below a rating of five and the loss of gloss shall not exceed 20 gloss units (egg shell gloss) when evaluated in accordance with AS/NZS 1580.481.1.10 Method 481.1 and AS/NZS1580.602.2 Method 602.2 (Specular Gloss).

10.2.3 Flexible posts

10.2.3.1 General

The requirements of Clause 10.2.2 above shall apply to flexible posts except as modified by Clauses 10.2.3.2 to 10.2.3.7.

10.2.3.2 Dimensions

Flexible posts shall have a minimum width facing traffic of 100 mm.

10.2.3.3 Bending strength

No minimum bending strength shall apply to flexible posts.

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10.2.3.4 Additional testing

Evidence to confirm that the post has been subject to and passed the following tests shall be included in the quality records:

a) heat resistance in accordance with the requirements of Clause 10.2.3.5

b) cold resistance in accordance with the requirements of Clause 10.2.3.6

c) vehicle impact in accordance with the requirements of Clause 10.2.3.7.

10.2.3.5 Heat resistance

The following procedure shall be followed for heat resistance tests:

a) Condition two of the sampled posts at 60 ± 2°C for a minimum of two hours in an oven.

b) Remove one post from the oven, and clamp the base of the post at the installation mark. The post shall be clamped in a vertical position, aligned with the mark on the backboard. Inserts shaped to suit the profile of the post shall be used to ensure even clamping.

c) Bend the post to 90 degrees in the anticipated direction of traffic and immediately release. This process should be completed within five seconds.

d) The post should return to within five degrees of the vertical position within 30 seconds.

e) Testing as detailed in b) to d) shall be completed within two minutes of removal from the oven.

f) Repeat steps b) to e) a further three times, conditioning the post in the oven for two minutes between each test

g) Repeat steps b) to f) with the other post.

10.2.3.6 Cold resistance

The post shall be conditioned at 0ºC ± 2ºC (ice bath) for two hours prior to testing. Flexible posts shall be subjected to both the resilience and brittleness tests as detailed below. Semi flexible posts are only required to be tested to the brittleness test.

The following tests shall then be performed:

Resilience

a) Remove one post from the bath and clamp the base of the post at the installation mark. The post shall be clamped in a vertical position, aligned with the mark on the backboard. Inserts shaped to suit the profile of the post shall be used to ensure even clamping.

b) Bend the post to 90 degrees in the anticipated direction of traffic and immediately release. This bending process shall be completed within five seconds.

c) The post shall return to within five degrees of the vertical position within 30 seconds.

d) Testing as detailed in a) to c) shall be completed within two minutes of removal from the ice bath.

e) Repeat steps a) to d) a further three times, conditioning the post in the bath for two minutes between each test

f) Repeat steps a) to e) with the other post.

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Brittleness

a) Place the tested post used for the resilience test in the ice bath for a further two minutes.

b) Remove the guidepost from bath and place horizontally between two supports, clamping each end securely. The front face of the post shall face upwards, and there shall be 1 ± 0.05 m between the two supports.

c) Drop a steel ball of 1 ± 0.05 kg from a height of 1.5 ± 0.05 m through a vertical guide so that it impacts on the centre of the unsupported area of the post.

d) Testing as detailed in b) to c) shall be completed within two minutes

e) Repeat steps b) to d) an additional four times (a total of five impacts) conditioning the post in the bath for two minutes between each test.

10.2.3.7 Vehicle impact

The guide post shall be capable of self-erecting and remaining serviceable after being subjected to a series of direct impacts by a typical passenger vehicle at temperatures between 15ºC and 30ºC. The guide posts to be tested shall be installed in accordance with the recommendations of the manufacturer and shall be furnished complete with delineators. The guide post shall be capable of withstanding a series of 10 bumper bar impacts at a speed of 60 km/h and five bumper bar impacts at a speed of 100 km/h directed at 90 degrees to the front face of the guide post.

The impacting vehicle shall suffer little or no damage during the impact tests. The guide post shall return to within five degrees of vertical within 30 minutes of impact. Test results which show the guide posts are capable of withstanding the above vehicle impacts are to be provided. This should include video or photographic evidence. A minimum sample of three guide posts shall be tested.

10.2.4 Delineators

Each road edge guide post shall be supplied with either two delineators (one white and one red) or with a single delineator (red, white or yellow). Road edge guide posts must be installed as specified in the MUTCD.

Delineators shall be affixed so that they are weatherproof and vandal resistant. The delineators shall be centrally located and placed so that the top of the reflector is between 50 mm and 100 mm from the top of the post. Type 1A Class material shall be rectangular with a minimum area of 100 cm² and minimum width of 50 mm. Type A Corner cube material shall be circular (80 mm diameter) in configuration.

For rigid road edge guide posts, the delineators shall consist of either:

a) Type A (corner cube) material which conforms with the requirements of AS/NZS 1906.2, or

b) Prismatic lens sheeting which meets the requirements of Class 1A material, as defined in AS/NZS 1906.2.

As stated in Clause 5 of Annexure MRTS14.1.

For flexible road edge guide posts, the delineators shall consist of prismatic lens sheeting which meets the requirements of Class 1A materials, as defined in AS/NZS 1906.2. Corner cube or rigid backed delineators that can be damaged by vehicular impact shall not be used on flexible road edge guide posts.

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10.3 Construction

10.3.1 Location

Road edge guide posts shall be located as shown in the design documentation and/or as determined from Standard Drawing 1356.

10.3.2 Installation

Road edge guide posts may be installed by excavation and backfilling of a post hole or by driving, depending on the post material and the manufacturer's recommendations.

10.3.3 Delineators

On all carriageways, a red delineator shall be affixed to the face of the road edge guide post on the left-hand side of the carriageway and a white delineator shall be affixed to the face of the road edge guide post on the right hand side of the carriageway, as seen from oncoming traffic. On divided carriageways, no delineators shall be affixed to the face of the guide post facing away from oncoming traffic.

Only road edge guide posts which have been accepted for use by the Department of Transport and Main Roads shall be installed on Department of Transport and Main Roads infrastructure.

10.4 Guide post warranty

The period of warranty for guide posts shall be a minimum of five years. During the period of the warranty, the supplier shall, without delay and at no cost to the Principal, correct all defects and omissions covered by the warranty by way of repair, replacement or modification or other means. The warranty must be provided to the Department of Transport and Main Roads in writing. When a product fails this Technical Specification under the warranty period, the supplier is required to replace the product at no cost to the Principal.

11 Fencing

11.1 General

Clause 11 describes the work to be carried out where fencing is required to be installed under the Contract.

11.2 Scope

Details of the fencing required to be erected under the Contract are stated in Clause 6.1 of Annexure MRTS14.1.

11.3 Material requirements

11.3.1 General

Material requirements shall be as shown in the design documentation, or where not so shown, as shown on Standard Drawings 1600, 1601, 1602, 1603 and 1604.

11.3.2 Hardwood timber posts

In accordance with Building Timbers: *Properties and Recommendations for their Use in Queensland*, all hardwood timber posts shall be durability Class 1 or 2 and shall either have the sapwood removed from the section in the ground and to a distance of 100 mm above the ground or the sapwood shall be treated, to H5 level, with a fixed salt preservative of the CCA (Copper Chromium Arsenic) type to the requirements of the Queensland *Timber Utilisation and Marketing Act 1987*.

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11.3.3 Softwood timber posts (excluding Cypress Pine)

Softwood timber posts and fence droppers shall have no exposed heartwood, except on the ends, and the heartwood content shall not be greater than 10% of the cross-section area. All softwood posts shall be treated, to H5 level, with a fixed salt preservative of the CCA type to the requirements of the Queensland *Timber Utilisation and Marketing Act 1987*.

11.3.4 Cypress pine

Cypress pine posts shall be completely free from sapwood.

11.3.5 Steel posts, stays and rails

Steel posts, stays and rails shall comply with the requirements of AS/NZS 1163 and galvanised in accordance with AS/NZS 4680.

11.3.6 Galvanised fencing wire (plain and barbed)

Plain and barbed fencing wire shall comply with the requirements of AS 2423.

11.3.7 Galvanised chainwire

Galvanised chainwire shall comply with the requirements of AS 2423.

11.3.8 Galvanised wire netting

Galvanised wire netting shall comply with requirements of AS 2423.

11.3.9 Welded mesh

Welded mesh shall comply with the details shown in the design documentation.

11.3.10 Steel posts (Y-Section)

Unless shown in the design documentation as galvanised, steel posts (Y-section) shall be supplied with a bronze coloured coating. Where galvanising is specified, galvanising shall be in accordance with AS/NZS 4680.

11.4 Construction

Fencing shall be constructed in the locations and to the details shown in the design documentation.

Minimum clearing only shall be carried out to allow for construction of the fence. Localised excavations shall be constructed where necessary.

Strainer posts or strainer assemblies shall be located at every change in horizontal direction and to the maximum spacings shown in the design documentation.

In undulating country, fencing shall be erected so that the post tops follow a smooth line, wherever possible. Wires shall be strained in accordance with the manufacturer's recommendations and tied to the strainer posts and/or assemblies, intermediate posts and droppers with approved ties.

Special treatments at water crossings and grids, where necessary, shall be constructed to the details shown in the design documentation or, where not shown, be made secure against stock.

12 Gates

12.1 General

Clause 12 describes the work to be carried out where gates are required to be installed under the Contract.

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12.2 Scope

Details of the gates required to be erected under the Contract are stated in Clause 6.1 of Annexure MRTS14.1.

12.3 Material requirements

12.3.1 Gate frame

Gate frames shall be constructed to the details shown in the design documentation, or where not so shown, to the details shown on Standard Drawings 1600, 1601, 1602 and 1603, as applicable.

Gate frames shall be manufactured from round hollow section complying with AS/NZS 1163 and galvanised in accordance with AS/NZS 4680.

Fabrication shall be carried out in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

12.3.2 Mesh

Mesh shall comply with the requirements shown in the design documentation.

12.3.3 Other fittings

Other fittings shall be manufactured from steel complying with AS/NZS 3678, AS/NZS 3679.1 and AS/NZS 3679.2, as appropriate and hot-dipped galvanised in accordance with the requirements of AS/NZS 4680.

12.4 Construction

Gates shall be installed in the locations shown in the design documentation.

Erection details and clearance dimensions shall be as shown in the design documentation or, where not so shown, on Standard Drawings 1600, 1601, 1602 and 1603, as applicable.

13 Supply of road sign faces

13.1 General

Clause 13 describes the work to be carried out for the supply of regulatory, warning, direction and information sign faces under the Contract. For the purposes of this Technical Specification, the term 'sign face' shall include the sheet metal substrate, attached stiffeners and colour and/or reflective sheetings and/or coatings but not support frames or posts.

13.2 Sign face layout

All legend elements, including letters, numerals, symbols, colours and borders in all sign faces shall conform to the MUTCD and the Drawings.

Dimensional tolerances shall conform to the requirements detailed in AS 1743. Legends and lettering shall conform to AS 1744.

13.3 Material requirements

13.3.1 Sign substrate

13.3.1.1 General

The sign substrate shall be manufactured from aluminium except that regulatory parking signs (see Clause 13.3.1.6) may be manufactured from zinc / aluminium coated steel and temporary signs (see Clause 13.3.1.7) may be manufactured from zinc / aluminium coated steel, colorbond steel or corflute.

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Other materials may be considered but evidence of the full approval of the department will be provided to the Administrator prior to their use. **Hold Point 3**

The sign substrate shall be free of cracks, tears and other surface blemishes and the edges shall be true and smooth.

Tolerances on the overall dimensions of the sign substrate for signs other than guide signs and signs that are individually designed shall be ± 3 mm or 0.25% of the largest dimension, whichever is the greater. For guide signs and other signs that are individually designed refer to Clause 13.4.1. The maximum allowable warp, twist or other departure from flatness of the sign substrate shall be 2.5 mm/m in any direction.

13.3.1.2 Aluminium sheet

Aluminium sheet sign substrate shall be fabricated from 1.6 mm thick aluminium alloy sheeting, alloy type 5251, temper H38, or similar in accordance with the requirements of AS/NZS 1734 and stiffened where required in accordance with Clause 13.3.2.

13.3.1.3 Aluminium blade section

Fingerboards, geographical feature and street name signs which use the 200 mm aluminium blade section shall be fabricated from alloy type 6063, temper T5, or similar. Signs which require single-sided section either 200 mm or 300 mm deep may be constructed from aluminium plank boards.

13.3.1.4 Aluminium plank boards

Aluminium plank boards (200 mm and 300 mm deep sections) shall be manufactured from an extruded aluminium section, alloy type 6060, temper T5 or similar.

13.3.1.5 Flood depth indicators

Flood depth indicators shall be manufactured from an extruded aluminium rectangular hollow section, nominal size 200 mm x 38 mm x 3 mm, alloy type 6063, temper T5 or similar.

13.3.1.6 Regulatory parking signs

Regulatory parking signs may be fabricated from 1.2 mm thick zinc/aluminium coated steel complying with the requirements of AS 1397 and stiffened in accordance with Clause 13.3.2.

13.3.1.7 Temporary signs

Signs classified as temporary signs in the MUTCD may be manufactured from 1.0 mm thick hot-dipped zinc coated, aluminium / zinc coated or colour bonded steel complying with the requirements of AS 1397.

Temporary signs used at roadworks may be manufactured using 6 mm corflute that has been UV treated for external use.

13.3.2 Stiffener rails

Stiffener rails shall be manufactured from an extruded aluminium section, alloy type 6061 or 6063, temper T6 to the dimensions shown on Standard Drawing 1369. The section properties of stiffener rails shall be equal to or greater than those stated on Standard Drawing 1369. The section type shall be as shown on the drawings.

13.3.3 Coatings

13.3.3.1 General

The class of sign material for the legend and the background shall comply with the minimum standards stated in Clause 13.3.3.2 of this Technical Specification.

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All signs of a similar type shall be manufactured from the same materials and the finish coating density shall be consistent.

13.3.3.2 Retroreflective sheeting

13.3.3.2.1 Requirements

Retroreflective sheetings shall comply with AS/NZS 1906.1 and be either Class 1100, Class 400 or Class 400T.

Product categories shall only be used as specified in Table 13.3.3.2.1 following.

Table 13.3.3.2.1 – Minimum class of sign material

Sign Type	Sign Number	Class of Sign Face Materials	
		Legend	**Background**
Regulatory Signs			Screened
STOP	(R1-1)	Class 400	Class 400
GIVE WAY	(R1-2)	Black non reflective	Class 400
Roundabout	(R1-3)	Black non reflective	Class 400
Pedestrian Crossing	(R3-1)	Black non reflective	(fluorescent yellow-green)
All other Regulatory Signs		Class 400	Class 400
Warning Signs			
All Warning Signs		Class 400	Class 400
Roadworks		Black non reflective	Class 400
Special Purpose Signs		Black non reflective	Class 400
Hazard Markers		Black non reflective	Class 400
Flood Gauge Markers		Black non reflective	Class 400
Guide Signs			
Advance, Intersection, Reassurance Direction Signs and Advance Lane Signs		Class 400	Class 400
Tourist and Service Signs		Class 400	Class 400
Geographical Feature and Street Name Signs		N/A	Class 400
Freeway Signs (white on standard green background; black on white background; white on blue background; black on yellow background; white on red background)			
General application		Class 400	Class 400
Overhead and gantry application		Class 1100	Class 1100
Traffic Instruction Signs		Class 400	Class 400

The sheeting surface shall be compatible with transparent and opaque screening inks and show no loss of the colour coat with normal handling, cutting and application. The class and manufacturer of retroreflective sheeting shall be able to be determined by inspection using unaided sight.

A certificate, issued by the manufacturer of the retroreflective sheeting and endorsed by the sign face fabricator, stating that the retroreflective material complies in all respects with the requirements of AS/NZS 1906.1 (including the service life requirements) shall be included in the quality records.

13.3.3.2.2 Rotational sensitivity

Sheeting shall be tested for rotational sensitivity as per AS/NZS 1906.1.

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13.3.3.2.3 Durability tests

The test procedures for durability assessment are set out in AS/NZS 1906.1. Outdoor accelerated weathering testing shall be located at a site near the coast of North Queensland within 40 km of latitude 19°30'S and longitude 146°50'E or a location that has similar atmospheric conditions.

13.3.3.3 Non-reflective coatings

13.3.3.3.1 Non-reflective sheeting

Non-reflective material used for figures, letters, symbols and borders shall be of uniform density and compatible with the background material, both in application and durability, and shall be compatible with both the sign substrate material onto which it is applied and with any retroreflective sheeting applied over the top of the material.

13.3.3.3.2 Paint

All paints used on signs shall be of premium quality from a reputable manufacturer. Paints shall be approved by the manufacturer for the relevant application and exposure conditions.

Pre-primed and pre-painted material, such as colour bonded steel or aluminium, yellow in colour as specified in AS 1743, shall be used for temporary signs. Alternatively, temporary signs shall receive at least one coat of yellow full gloss enamel paint applied in accordance with the paint manufacturer's recommendations.

13.3.3.3.3 Screening inks and electro-cut films

Screening inks and electro-cut films shall be of an approved brand and shall be compatible with the substrate surface and the retroreflective sheeting, non-reflective sheeting or paint, whichever has been used. The screening ink or electro-cut film shall be applied using materials and techniques recommended by the sheeting manufacturer, where appropriate.

13.3.3.4 Security branding

As an optional security measure, a transparent screen-printed brand (customer logo or lettering) that has minimum impact on the retroreflective performance of the sign may be added (typically 1.4% black ink and 98.6% toner). It shall not exceed 75 mm square and have a minimum spacing of 350 mm.

Other security branding methods such as laser cutting of the aluminium substrate are also permitted, provided sign integrity is maintained. Laser cutting of the substrate shall not exceed 75 mm square, and shall be limited to a single location adjacent the sign edge.

13.3.3.5 Sign face material properties

The sign face or sheeting shall remain in good condition except for accidental damage or vandalism for the period specified in Clause 13.4.12.2, or if not stated there refer to AS/NZS 1906.1:

a) no evidence of cracking; crazing; peeling; lifting from the substrate; delamination blistering; chalking; wrinkling; bubbling; or edge shrinkage greater than 2 mm

b) no evidence of colour change or fading when compared to the supplied manufacturer's samples or new materials within the period compatible with the class or type of material

c) the sign is effective for its intended purpose when viewed from a moving vehicle under normal day or night driving conditions by a driver with normal vision.

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FOI 26-292 - Document 21

13.4 Fabrication

13.4.1 General

Sign faces shall be fabricated in accordance with the requirements of *Traffic and Road Use Management Manual (TRUM)* Volume 3, Part 5*: Design Guide for Roadside Signs*.

Signs shall be constructed to the size specified in the Contract.

For guide signs and other signs that are individually designed, the tolerance on dimensions shall be:

a) ± 50 mm for signs less than 2.44 square metres in area

b) ± 100 mm for signs larger than 2.44 square metres in area.

13.4.2 Message, shape, size, layout, colours

The sign message (including spelling), shape, size, layout and colours shall be as indicated by the Drawings in conjunction with the latest issue of the MUTCD.

13.4.3 Substrate preparation

13.4.3.1 General

After completion of the substrate sheet metal works and before the application of retroreflective sheeting, non-reflective sheeting or paint, the sign panel shall undergo one of the pre-treatments detailed in Clauses 13.4.3.2 and 13.4.3.3.

13.4.3.2 Aluminium panels

The aluminium panel shall be thoroughly cleaned and degreased and shall be mechanically abraded in accordance with the sheeting manufacturer's recommendations.

Chemical treatment shall not be used.

13.4.3.3 Zinc / Aluminium coated steel panels

The zinc / aluminium coated steel panel shall be thoroughly cleaned and degreased and shall be primed with an approved primer in accordance with the paint manufacturer's recommendations.

Alternatively, if the zinc / aluminium steel sheeting material has been shop primed by the sheeting manufacturer, the panel shall be thoroughly cleaned and degreased.

13.4.3.4 Corflute panels

The corflute panel shall be prepared in accordance with the sheeting manufacturer's recommendations.

13.4.4 Sheeting application

Retroreflective and non-reflective sheeting shall be applied to the face of the sign panel in a manner specified by the sheeting manufacturer.

All letters, arrows, symbols and borders shall be applied by:

a) a silk screening process

b) pre-cut retroreflective or non-reflective material

c) electro-cut translucent film, or

d) digital printing.

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Silk screening may be accomplished either before or after application of the sheeting to the sign blank. If required, retroreflectorised signs shall be clear coated in accordance with the retroreflective sheeting and/or ink manufacturer's recommendations.

13.4.4.1 Digital printing

Digital printing technologies may be used for manufacture of signs. If using digital printing, only matched component inks and printer devices recommended by the retroreflective sheeting manufacturer shall be used. The ink and any protective coating shall be compatible with the background material, both in application and durability.

13.4.5 Sign panel size and joints

In general, signs panels of size up to 2400 mm x 1200 mm shall be manufactured from one sheet of substrate material. Larger sign panels shall be manufactured either:

a) as modular panels which can be erected as separate sections and joined together without the need for on-site riveting, or

b) by joining a number of panels together in accordance with the provisions of Clause 13.4.9.

Modular panel signs shall be constructed in accordance with the typical details contained in the TRUM Volume 3, Part 5*: Design Guide for Roadside Signs*.

Plank boards shall have the planks in the horizontal direction.

13.4.6 Provision for mounting signs

In general, sign faces shall be manufactured with stiffener rails for support and for mounting purposes. Stiffener rails shall comply with the requirements of Clause 13.4.7

Signs up to both 950 mm in width (measured horizontally) and 1,000 mm in depth shall be provided with square holes for mounting instead of stiffener rails. Square holes shall comply with the requirements of Clause 13.4.8.

13.4.7 Stiffener rails

13.4.7.1 Location of stiffener rails

Stiffener rails shall be mounted horizontally and spaced equally.

Signs up to both 950 mm in width (measured horizontally) and 1000 mm in depth do not require stiffener rails unless specified. Signs that are wider than 950 mm measured horizontally and less than 1000 mm in depth require a minimum of two stiffener rails. Signs narrower than 950 mm in width measured horizontally and greater than 1000 mm in depth require stiffeners spaced as per Table 13.4.7.1.

Warning signs that are equal to and greater than 750 mm x 750 mm, shall include a minimum of three stiffener rails.

Stiffener rails shall be mounted horizontally and spaced equidistant (normally multiples of 25 mm). Type 1 and Type 2A stiffener rails (Standard Drawing 1369) or equivalent shall be used for signs greater than 1200 mm in depth as specified. Signs less than 1200 mm in depth, where the stiffener is non-structural, can use Type 1 stiffeners or any stiffener that is compatible with the standard fittings.

The maximum stiffener spacing for single panel signs shall be 500 mm and that for modular panel signs shall be 575 mm.

The maximum panel overhang between stiffener and the top or bottom of the sign shall be 150 mm. The maximum distance between the end of the stiffener rail and the edge of the sign shall be 50 mm.

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Information on stiffener rails for sight boards is given in Standard Drawing 1452.

Table 13.4.7.1 – Sign depth and stiffener requirements

Signs of Normal Construction		Signs of Modular Construction	
Sign Depth (mm)	**Minimum Number of Stiffeners**	**Sign Depth (mm)**	**Minimum Number of Stiffeners**
300 – 800	2†	300 – 1300	N/A
825 – 1300	3†	1325 – 1400	4
1325 – 1800	4	1425 – 1925	5
1825 – 2300	5	1950 – 2400	6
2325 – 2800	6	2425 – 2600	7
2825 – 3300	7	2625 – 3125	8
3325 – 3800	8	3150 – 3600	9
3825 – 4300	9	3625 – 3800	10
4325 – 4800	10	3825 – 4325	11
4825 – 5300	11	4350 – 4800	12
5325 – 5800	12	4825 – 5000	13
5825 – 6300	13	5025 – 5525	14
6325 – 3800	14	5550 – 6000	15
6825 – 7300	15	6025 – 6200	16
7325 – 7800	16	6225 – 6725	17
7825 – 8300	17	6725 – 7200	18
		7225 – 7400	19
		7425 – 7925	20
		7950 – 8400	21

† Required only for signs wider than 950 mm and warning signs in accordance with Clause 13.4.7.1.

13.4.7.2 Fixing sign panels to stiffeners

Fixing of sign panel substrate sheets to stiffener rails shall be accomplished by one of the following methods:

a) self-piercing riveting systems

b) 4.8 mm to 5 mm diameter monel or stainless steel pop rivets, or

c) 4.0 mm diameter blind aluminium head pop rivets.

The heads of rivets shall be coloured to match the surrounding material.

The maximum spacing of mechanical fixings shall be 200 mm and the distance from the first fixing to the edge of the stiffener shall not be greater than 30 mm nor greater than that specified by the supplier of the fixing system. An additional fixing shall be installed 20 mm from the first fixing.

The maximum spacing may be slightly increased for proprietary fixing systems provided that the manufacturer's recommendations are followed exactly. Information on stiffener rail fixing to sign panel for sight boards is given in Standard Drawing 1452.

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13.4.8 Square holes for mounting signs

Square holes provided for mounting as given in Clause 13.4.6, shall be 11 mm square to accept the square section of a 10 mm diameter cup head bolt.

Holes shall be cleanly punched in the vertical axis of sign panels at the spacings stated in Table 13.4.8 and placed an equal distance from the top and bottom of the sign panel.

Supply of a suitable washer shall be included with any twist type fasteners to avoid damage to the sign sheeting and failure of the substrate by tightening of the bolts.

Table 13.4.8 – Number and spacing of square holes

Sign Depth (mm)	Number of Holes	Hole Spacing (mm)
< 250	1	-
250 – 350	2	200
350 – 550	2	300
550 – 800	2	500
800 – 1000	2	750

13.4.9 Panel sheet joints

Where signs are of such a size as to require more than one sheet of substrate material, all joints shall comply with the following requirements:

a) sign substrate sheets shall be butted together with a maximum gap of 1 mm at any point along the joint. Overlapping plates shall not be permitted

b) all vertical joins shall be constructed to ensure no penetration of light. This may be achieved by either:

   i. complete coverage of the sign and any joints by the reflective sheeting, or

   ii. a backing strip of the same material as the substrate. The backing strip shall not be installed between the stiffener rails and the back surface of the sign substrate.

   The minimum width of the backing strip shall be 50 mm for rivet systems and for high bond adhesive tape systems with 18 mm x 50 mm strips at right angles to the joint at not more than 100 mm centres.

   Continuous high bond adhesive tape systems with a minimum width of backing strip of 25 mm may be used, provided that adequate strength is achieved to resist handling, transport and erection stresses.

c) at horizontal joints, the extrusion used as stiffener rails shall be used as a backing strip and the requirements for stiffener rails shall apply.

Signs that are less than a full sheet size as listed in Table 13.4.9 shall be manufactured without joins.

Signs that are greater than the basic sheet sizes may be manufactured in accordance with the above requirements, using the minimum length of join possible.

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Table 13.4.9 – Plate sheet sizes

Plate Sheet Sizes	Width (mm)	Depth (mm)
Common	1200 (2400)	2400 (1200)
Common	900 (1800)	1800 (900)
Not Common	3000 (750)	750 (3000)
Not Common	1800 (1200)	1200 (1800)

Signs made of more panels than the minimum possible shall not be accepted. Vertical or horizontal panels less than 300 mm shall not to be used except where required for modular sign construction, unless the panel weighs more than 20 kg.

13.4.10 Reference marking

All signs shall have painted, imprinted or indelibly marked onto the substrate on the reverse side of the sign in the lower right hand corner, the following:

a) The department's corporate logo of size minimum 25 mm high in the format shown in Figure 13.4.10. The dimensions of the reference marking shall be a minimum of 100 mm x 100 mm and maximum of 140 mm x 140 mm. When a marker size greater than 100 mm x 100 mm is used, the size of all information, excluding the company logo shall remain as shown in Figure 13.4.10.

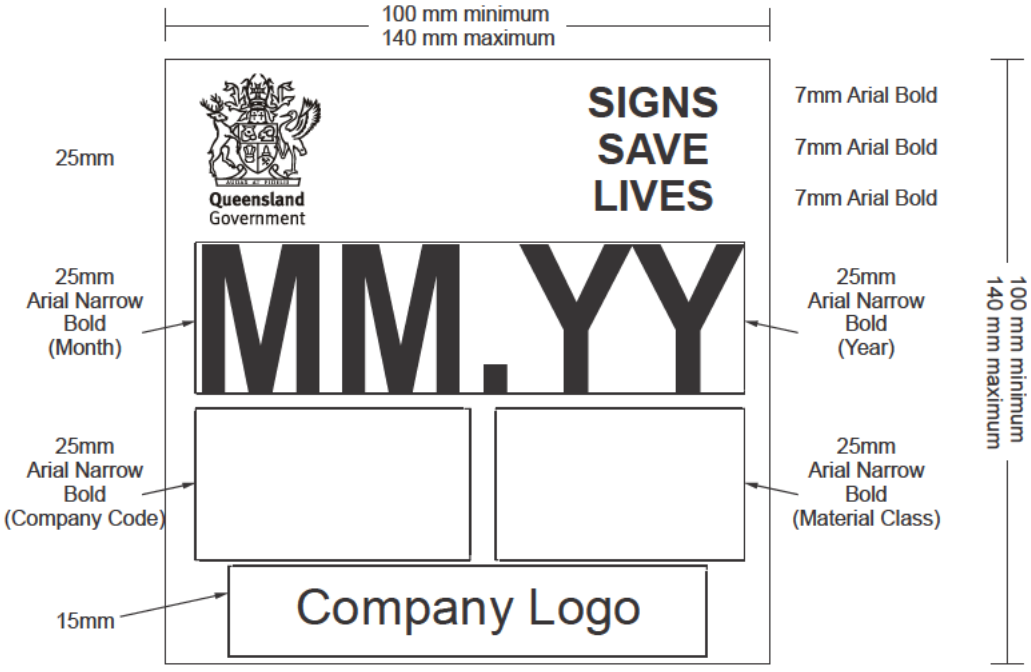
b) The month and year of manufacture.

c) The class and manufacturer's code of material used as background on the sign (codes - 3M, Ni, Ki, St, Re); or other approved system for identifying the manufacturer and sheeting supplier.

d) The class of material used as background on the sign (400, 1100), and

e) The legend 'Signs Save Lives'.

Figure 13.4.10 –Layout and minimum dimension of sign label



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The markings detailed in above shall be black. The lettering in (b), (c) and (d) shall be 25 mm high and located so as to be visible after the sign is erected and not in a position likely to be obscured by stiffener rails or mounting posts. The legend described in (e) shall be located next to the corporate logo in a clear location and shall not exceed the height of the logo.

Signs which are double-sided, e.g. fingerboards, shall have the same information detailed above painted, imprinted or indelibly marked onto one side of the sign in a location such that it is unobtrusive but not obscured after erection. The size of the reference marking for these signs shall be reduced to that required to fit, provided that the details are legible. The legend described in (e) above may be deleted.

13.4.11 Packing

Sign faces shall be suitably crated and/or packed to avoid damage during transport and handling.

Each sign shall be separated from adjacent signs to prevent damage to the sign surface.

If necessary, large signs shall have temporary stiffeners connected during transport.

13.4.12 Warranty

13.4.12.1 General

Where so stated in Clause 7.1 of Annexure MRTS14.1, a performance warranty statement from the sign panel manufacturer shall be included in the quality records.

The warranty shall cover the complete sign panel, including all components thereon or attached, except for the sign face or sheeting, and shall guarantee the sign panel against any defects caused by failure of the components for a period of at least 20 years from the date of manufacture.

Responsibility for failure shall be limited to the following:

a) poor workmanship

b) use of unapproved materials

c) inappropriate use of approved materials

d) incorrect construction including fastenings.

13.4.12.2 Retro-reflective sheeting (screen printing and digital printing)

A performance warranty statement from the retro-reflective sheeting manufacturer shall be included in the quality records. Retro-reflective materials must retain a photometric performance of at least the percentage shown above throughout the warranty period and, for non-reflective material, must retain integrity and effective colour and appearance. The warranty must include the full cost of sign replacement or repair, including all labour and materials involved. Any replaced or repaired signs must be covered by the remainder of this warranty period. Minimum warranty periods are contained in Table 13.4.12.2.

The warranty shall include the requirement that, if a sign needs to be replaced due to defects in the retro-reflective sheeting, and the sign manufacturer is no longer in business, the manufacturer of the retro-reflective sheeting shall undertake the replacement or repair, including all labour and material involved at the time of replacement. The full replacement warranty period for Classes 400 and 1100 shall not be less than 10 years.

The sign manufacturer shall provide certification confirming acceptance of this condition signed by an authorised corporate officer of the retro-reflective sheeting manufacturer.

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Table 13.4.12.2 – Warranty period for sign face materials for screen printing and digital printing

Sign Face Material	Sign Warranty Period (No of years, from date of manufacture)	Retro-reflective properties (% of new value retained)
Class 1100	10	80
Class 1100 (white with EC overlay film)	12	80
Class 1100 screen printed	10	80
Class 1100 fluorescent reflective orange	3	80
Class 1100 fluorescent reflective yellow and yellow green	10	80
Class 400	12	80
Class 400 (white with EC overlay film)	12	80
Class 400 screen printed	10	80
Class 400T sheeting for temporary roadwork signs	3	80

13.4.12.3 Limitations of warranties

Warranties shall not apply to signs damaged by vandalism, the effect of improper maintenance and cleaning practices and accidental damage caused by vehicle accidents or other events.

14 Installation of road signs

14.1 General

This Clause describes the work to be carried out for the installation of regulatory, warning, hazard, direction and information signs under the Contract.

14.2 Materials and fabrication

14.2.1 Fabrication

14.2.1.1 Registered fabricator

Steelwork used to support road signs shall be fabricated only by an approved fabricator. The requirements of registration are outlined in document SCM-P-015. For copy of this document refer to contract details in Clause 1.

This clause states that all steel fabrication shall be undertaken by a Transport and Main Roads Registered Fabricator. Structures Construction Materials is responsible for the approval of the fabricators on the departmental Registered Supplier List.

The list of registered suppliers is updated on a regular basis and it is recommended that before a contract commences, the Administrator obtains the current list of registered fabricators. For information regarding registered fabricators refer to the departmental website, www.tmr.qld.gov.au.

14.2.1.2 Fabrication standard

Except where otherwise stated in this Technical Specification, all fabrication shall be carried out in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

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14.2.1.3 Welding personnel

All welders shall:

a) Satisfy conditions A & B of Clause 4.12.2 of AS/NZS 1554.1.

b) For SP welding, have a trade qualification, or demonstrate competence equivalent to a trade qualification, and

c) Welding personnel who do not conform to the requirements of (b) then the following shall be met:

   i. welders shall be permitted to undertake only fillet welds up to a maximum of 8 mm

   ii. a representative of Transport and Main Roads Structures Construction Materials shall be present when macro samples are prepared to show conformance with Clause 4.12.2 (b) of AS/NZ 1554.1.The fabricator shall be responsible for covering all costs associated with witnessing the production of the macro samples; **Hold Point 4** and

   iii. welder re-certification is required every 12 months and the department reserves the right to withdraw welder certification if welding is below the department's requirements.

14.2.2 Materials general

All steel used for the fabrication of components and supports shall comply with the relevant Standard. These include (but not limited) to the following:

a) hot-rolled section - AS/NZS 3679.1

b) mild steel plate - AS/NZS 3678

c) cold-formed section - AS/NZS 4600, and

d) hollow sections - AS/NZS 1163 Grade LO.

Fabrication of steel members shall conform to the requirements of MRTS78 *Fabrication of Structural Steelwork*.

All steelwork shall be hot-dipped galvanised after fabrication in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

> All steelwork used in the manufacture of structural steelwork is required to comply with Australian Standards. This clause outlines the most commonly used Australian Standards used for the supply of the steel sections.

14.2.3 Posts

Posts for road signs shall generally be circular hollow section or rectangular hollow section unless specifically shown otherwise in the design documentation.

For posts with a total area of attached signs less than 1.0 m² with a maximum sign width of 1000 mm, posts shall be 60.3 OD x 2.9 mm CHS Grade C350 LO to AS/NZS 1163 and they shall comply with the details for low risk or frangible support posts with the base deformed to prevent rotation as shown on Standard Drawing 1368. Footings shall comply with Standard Drawing 1363. The location and height of signs shall comply with the requirements of the *Manual of Uniform Traffic Control Devices* (MUTCD).

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For other signs, the size of posts and numbers of posts for each sign shall be as shown in the design documentation. CHS and RHS shall be Grade 250/350/450 LO to AS/NZS 1163 as shown in the design documentation.

The spacing of posts and footings for posts shall be as shown in the design documentation.

Slip bases and fuse plates for posts, where required, shall be fabricated in accordance with the details shown on Standard Drawings 1365 and 1368.

All posts shall be hot-dipped galvanised in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

The top of posts shall be fitted with a hot-dipped galvanised steel cap.

14.2.4 Connection straps

Connection straps for installation of multi-post signs shall be fabricated from steel to the dimensions and in accordance with the requirements shown on Standard Drawing 1364.

Connection straps for installation of single-post signs shall be fabricated from steel to the dimensions and in accordance with the requirements shown on Standard Drawing 1368.

14.2.5 Brackets

Brackets for installation of fingerboards, geographical feature and street name signs shall be fabricated in accordance with the requirements shown on Standard Drawing 1295.

14.2.6 Fixings

Bolts, nuts and steel washers shall be hot-dipped galvanised and shall conform to the requirements of MRTS278 *Supply of Structural Fasteners*.

Bolts for slip bases shall be high strength bolts, Grade 8.8, and shall be supplied with a nut and five washers per bolt.

In special circumstances and where shown on the Drawings, stainless steel bolts, nuts and washers shall be used.

14.2.7 Sign frames

Sign frames shall be fabricated in accordance with the details shown in the design documentation.

The size of the frame shall be checked prior to fabrication to ensure that it can be hot-dipped galvanised after fabrication. The fabrication details shown in the design documentation shall not be amended unless it can be proven that a frame is too large to allow hot-dipped galvanising in Queensland. Double dipping shall be allowed.

14.2.8 Anchor bolts

Anchor bolts for cantilever and gantry signs shall be fabricated as shown in the design documentation. Only metric threads shall be used. All anchor bolts shall be provided with one nut and one steel washer.

Anchor bolts, nuts and washers shall be hot-dipped galvanised.

Anchor bolts shall be provided with a substantial steel template for use in locating the anchor bolts during placement of concrete.

14.2.9 Handling, transport and storage

All sign components shall be handled, transported and stored in such a manner as to prevent damage to members and/or coatings.

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Steel slings and tie downs shall not be used during handling and transport.

Sign posts and frames shall be stored on the Site on timber packing well clear of the ground and shall be kept free of dirt, grease and other foreign matter. Components shall be so arranged as to be free draining.

Sign faces shall be stored vertically on edge either in a rack or in such a way that they are supported vertically. Any banding around signs shall be cut and removed on delivery to site.

Signs stored indoors may be left in their original transport packaging provided the storage area is ventilated and the packaging is not wet. Signs stored outside shall be unwrapped from their transport packaging.

Direction and information signs shall be stored avoiding pressure points on sign faces and allowing air circulation between sign faces to prevent a build-up of moisture.

14.3 Construction of footings

Concrete footings for road sign posts shall be constructed:

a) where specific details for individual signs are shown in the design documentation, in accordance with such details

b) for circular hollow section and rectangular hollow section posts, in accordance with the details shown on Standard Drawing 1363, or otherwise.

Holes for sign footings shall be excavated to a minimum size as shown in the design documentation. Circular holes shall be excavated using an earth auger.

Anchor bolts for cantilever and gantry signs shall be assembled into the positioning template which shall be held firmly in place during placement of the concrete.

Concrete shall comply with the requirements of MRTS70 *Concrete*.

Unreinforced concrete shall not be less than grade N20/20 and reinforced concrete shall not be less than grade N32/20.

For frangible support posts, the Administrator can substitute the nominated concrete (N20/20) concrete with a departmental registered proprietary bagged concrete product which has a 28 day compressive strength of not less than 40 MPa. The proprietary bagged concrete shall be mixed, placed and cured as per the manufacturer's requirements.

Steel reinforcing shall comply with the requirements of MRTS71 *Reinforcing Steel*.

> For low risk or frangible support posts, are generally installed in locations with very small volumes of concrete required to install the sign.
>
> For these low risk signs, the department is prepared to allow installers to use a proprietary bagged product which can be mixed at the installation site, and therefore, reduce the cost of opening a concrete batch plant for a small load of concrete.
>
> The departmental approved proprietary bagged products can be found under the approved *Product Index for Bridges and Other Structures* on the departmental website.

14.4 Erection of signs

14.4.1 General

Erection of road signs shall be a **Witness Point 1**

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14.4.2 Location

Signs shall be erected at the locations shown in the design documentation or, where not so shown, in accordance with the requirements of the MUTCD.

The location of posts, transverse to the road centreline shall be in accordance with the details shown in the design documentation.

Orientation of signs shall be in accordance with the requirements of Clause 1.12.5.3 of Part 1 of the MUTCD.

14.4.3 Posts

Sign posts shall be erected true to vertical.

Slip bases, where required, shall be assembled strictly in accordance with the details shown on Standard Drawing 1363, 1365, or 1368 (as required). High strength bolts shall be tensioned as detailed on the relevant Standard Drawing.

14.4.4 Frames

Frames for cantilever and gantry signs shall be erected onto the anchor bolts on temporary packers set to the required level. Final adjustments shall be made so that the sign column is vertical. Once vertical the anchor bolts shall be snug tensioned.

The base plates shall be packed with cement mortar consisting of one part of type GP cement and three parts of clean sharp sand with sufficient water added to form a dry packing mortar. All materials shall comply with MRTS70 *Concrete*. The edges of the mortar shall be trimmed neatly to a constant bevel.

Once the mortar has achieved the required strength, the temporary packers shall be removed and the nuts on the anchor bolts shall be re-tightened.

The mortar where the temporary packers were located shall be repaired with cement mortar consisting of one part of type GP cement and three parts of clean sharp sand with sufficient water added to form a dry packing mortar. All materials shall comply with MRTS70 *Concrete*.

14.4.5 Sign faces (erection)

When all other erection has been completed, the sign faces shall be checked for message (including spelling, shape, size, layout and colours and then installed on the posts and/or frame. Sign faces shall be attached to posts or frames at all intersections between the stiffener rails and the post or frame.

Stiffener rails shall be attached to posts with saddles and cup head bolts and nuts. Saddles are not required where sign faces are attached to frames.

Where sign faces are supplied in sections for modular erection, sections shall be connected together with hexagonal-headed bolts, cup head bolts, plates, nuts and washers.

Extreme care shall be taken during erection of sign faces so that the coatings are not damaged and the substrate is not dented.

15 Project signs

15.1 Introduction

Clause 15 applies to the installation, maintenance and removal of project signs.

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FOI 26-292 - Document 21

15.2 Scope

Details of the project signs required to be erected under the Contract are stated in Clause 8 of Annexure MRTS14.1.

15.3 Materials

Signs shall comply with Clause 15.3 and 15.4 of this Technical Specification. Posts and brackets shall comply with Clause 14 of this Technical Specification.

15.4 Erection of project signs

The location of project signs (lateral clearance and mounting height) shall be in accordance with Part 1 Clause 1.12 and Part 2 Figure 2.4 of the MUTCD.

The longitudinal location of project signs shall be as shown on the Drawings or, where not so shown, as directed by the Administrator. The erection of signs shall be carried out in accordance with Clause 14.

15.5 Maintenance of project signs

Project signs shall be maintained in good order throughout the Contract.

15.6 Removal of signs

Where so stated in Clause 8 of Annexure MRTS14.1 and on completion of the Works, the project signs and supports shall be carefully removed. Footings shall be removed and holes backfilled and compacted to a standard similar to the adjacent material.

16 Contractor's information signs

Information signs and/or supplementary plates to project signs may be installed.

The location, number and legends of these signs shall comply with Transport and Main Road's policy. Details of such signs shall be submitted to the Administrator at least 14 days prior to commencement of manufacture. **Milestone**

Information signs shall not be manufactured until expiration of the 14 day period. **Hold Point 5**

All of the above signs and supplementary plates shall be removed within 14 days of the Date of Practical Completion.

17 Grids

17.1 General

Clause 17 describes the work to be carried out where a grid is required to be installed under the contract.

17.2 Fabrication

Grid frames shall be fabricated to the details shown on Standard Drawings 1565, or an approved design in accordance with Technical Note 18 *Design Criteria for Motor Grids*.

All steel fabrication shall be carried out in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

Components of grids shall be galvanised in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

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FOI 26-292 - Document 21

17.3 Precast concrete

Precast concrete components shall be manufactured in accordance with the relevant Standard Drawings or approved design and with the requirements of MRTS72 *Manufacture of Precast Concrete Elements*.

17.4 Material requirements

17.4.1 Steel plate and sections

Steel plate shall comply with the requirements of AS/NZS 3678 and shall be a minimum of Grade 250.

Rolled steel sections shall comply with the requirements of AS/NZS 3679.1 and shall be a minimum of Grade 300.

RHS section shall comply with the requirements of AS/NZS 1163 and shall be a minimum of Grade 450 LO. CHS sections for fencing shall comply with the requirements of AS/NZS 1163 and shall be a minimum of Grade 350 LO.

All materials shall be supplied in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

17.4.2 Bolts, nuts and washers

Bolts shall conform to the requirements of AS 1111.1, nuts shall conform to the requirements of AS 1112.3 and flat washers shall conform to the requirements of AS 1237.1. Bolts, nuts and washers shall be hot-dipped galvanised in accordance with the requirements of AS/NZS 1214.

All fasteners comply with the requirements of MRTS278 *Supply of Structural Fasteners*.

17.4.3 Included road furniture

Guide posts shall conform to the requirements of Clause 10.

Hazard markers shall conform to the requirements of Clause 14.

Fencing shall conform to the requirements of Clause 11.

Gates shall conform to the requirements of Clause 12.

17.4.4 Concrete

Concrete shall conform to the requirements of MRTS70 *Concrete*. Precast concrete components shall be manufactured in accordance with MRTS72 *Manufacture of Precast Concrete Elements*.

17.4.5 Steel reinforcing

Steel reinforcing shall conform to the requirements of MRTS71 *Reinforcing Steel*.

17.4.6 Cement mortar

Cement mortar shall consist of one part of Type GP cement AS 3972 and three parts of clean, sharp sand with sufficient water added to form a dry packing mortar. Alternatively, a proprietary bagged mortar may be presented to the Administrator for approval.

17.5 Construction

17.5.1 General

The grades, sizes and shapes, as relevant, of the concrete structures, steel components, fixtures, fittings and related road furniture shall be shown on Standard Drawings 1353, 1354, 1355, 1561, 1562, 1563, 1564 and 1565.

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Grids shall be constructed to the dimensions and other details stated in Clause 9 of Annexure MRTS14.1.

17.5.2 Excavation and backfilling

Excavations shall be carried out in accordance with the requirements of MRTS04 *General Earthworks*.

Where insitu material on or against which concrete abutments and/or slabs are to be constructed is other than rock, the material shall be compacted as for material at the bottom of excavations in accordance with the requirements stated in MRTS04 *General Earthworks*.

Backfilling to abutments and wing walls shall be carried out using selected excavated material in accordance with the requirements stated in MRTS04 *General Earthworks*.

17.5.3 Concrete work

Concrete abutments and slabs shall be constructed without foundation bedding.

Concrete shall be placed, compacted and finished in accordance with the requirements of MRTS70 *Concrete*. Steel reinforcing shall be placed in accordance with the requirements of MRTS71 *Reinforcing Steel*.

Prior to placing the concrete, all holding-down bolt assemblies and bed rail, where required, shall be securely fixed into their final positions so that they are not displaced during placement of concrete.

17.5.4 Precast components

Precast components shall be installed as indicated on the certified Engineering drawings.

17.5.5 Installation of grid frame

The grid frame shall not be supported by the concrete abutments until three days after the placement of the concrete or until the concrete has reached 50% of the specified 28 day characteristic strength, whichever is the lesser.

17.5.6 Installation of fencing

Fencing shall be constructed in accordance with the details shown on Standard Drawings 1353 and 1561 and the requirements of Clause 11.

Gates, where required, shall be installed in accordance with the details shown on Standard Drawing 1353 and to the requirements of Clause 12.

17.5.7 Installation of road furniture

Guide posts shall be installed in accordance with the requirements of Clause 10.

17.5.8 Reinstatement

Following construction of the grids, any disturbed pre-existing formation and/or pavement shall be reinstated to at least the same standard which existed prior to commencement of construction.

Additionally, any pre-existing fencing shall be reinstated to at least the same standard which existed prior to commencement of construction.

17.5.9 Trafficking of grid

Traffic shall not use the grid until the specified 28 day characteristic strength has been achieved and seven days from placement have passed.

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18 Road safety barrier systems

18.1 General

Unless expressly specified otherwise in the project design documentation only road safety barriers / systems and/or end treatments that are assessed and accepted for use on state-controlled roads in Queensland shall be used. Barrier Systems which are accepted for use on state-controlled roads in Queensland are listed in the Department of Transport and Main Roads document *Road Safety Barrier Systems and Devices*. This document is updated periodically.

For information regarding registered suppliers and approved products refer to the departmental website, https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers.

Road safety barriers / systems and end treatments are classified as either 'public domain' or 'proprietary'.

Wherever there is scope in the contract for the Contractor to select a product or device the Design Criteria / Performance Standards are specified in Clause 11 of Annexure MRTS14.1.

18.2 Public domain road safety barriers and end treatments

Public domain road safety barriers and road safety barrier end treatments are barrier systems details for which are provided on Department of Transport and Main Roads Standard Drawings.

Public domain road safety barriers and road safety barrier end treatments shall be installed in accordance with the Standard Drawings and as shown in and required by the project documentation. Any conflict shall be referred to the contract administrator for determination.

18.3 Proprietary road safety barriers and end treatments

Proprietary road safety barrier systems and road safety barrier end treatments are barrier systems that are subject to intellectual property rights within Australia.

Proprietary road safety barrier systems and road safety barrier end treatments shall be installed in accordance with the supplier’s / manufacturer’s installation manual and as shown in and required by the project documentation. Any conflict shall be referred to the contract administrator for determination.

19 Concrete road safety barrier (public domain)

19.1 General

Clause 19 describes the work to be carried out where public domain concrete road safety barrier is required to be constructed under the Contract.

19.2 Material

19.2.1 Concrete

19.2.1.1 General

Concrete shall conform to the requirements of MRTS70 *Concrete*.

19.2.1.2 Placed concrete

Concrete placed by conventional means shall be grade S40/20.

19.2.1.3 Fibre reinforced concrete

Extruded barriers shall use fibre reinforced concrete.

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Fibre reinforced concrete shall consist of grade S32/20, reinforced with nominal 50 mm virgin polypropylene fibrillated fibres incorporated at the rate of 0.9 kg/m³.

19.2.2 Steel reinforcing

Steel reinforcing shall conform to the requirements of MRTS71 *Reinforcing Steel*.

19.2.3 Prestressing strand

Prestressing strand shall conform to the requirements of MRTS73 *Manufacture of Prestressed Concrete Members and Stressing Units*.

19.2.4 Cement mortar

Cement mortar shall consist of one part of Type GP cement and three parts of clean, sharp sand with sufficient water added to form a dry-packing mortar. All materials shall comply with MRTS70 *Concrete*.

19.2.5 Steel plate and sections

Steel plate shall comply with the requirements of AS/NZS 3678 and shall be a minimum of Grade 250.

Rolled steel sections shall comply with the requirements of AS/NZS 3679.1 and shall be a minimum of Grade 300.

19.2.6 Bolts, nuts and washers

Bolts shall conform to the requirements of AS 1111.1, nuts shall conform to the requirements of AS 1112.3 and flat washers shall conform to the requirements of AS 1237.1. Bolts, nuts and washers shall be hot-dipped galvanised in accordance with the requirements of AS/NZS 1214.

19.2.7 Electrical conduit and pits

Electrical conduit and cable pits shall comply with the requirements of MRTS91 *Conduits and Pits*.

19.2.8 Compressible filler

Compressible filler shall consist of a bitumen-impregnated fibrous material.

Approved products are listed in Clause 10.1 of Annexure MRTS14.1. Alternative products may be submitted to the department for approval.

19.2.9 Joint sealant

Joint sealant shall be a polyurethane, elastomer-based two-component product suitable for application in vertical joints using a dispensing gun.

Approved products are listed in Clause 10.2 of Annexure MRTS14.1. Alternative products may be submitted to the department for approval.

19.2.10 Delineators

Delineators shall comply with the requirements specified in Clause 10.2.4 of this Technical Specification for delineators on rigid road edge guide posts.

19.3 Fabrication

Cover assemblies for light poles and cable pits shall be fabricated to the details shown on Standard Drawing 1469.

Cast-in anchor assemblies shall be fabricated to the details shown on Standard Drawing 1467.

Angle connectors and reinforcing connectors shall be fabricated in accordance with Standard Drawing 1473.

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All steel fabrication shall be carried out in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

Steelwork shall be hot-dipped galvanised in accordance with the requirements of AS/NZS 4680.

All bolts shall be hot dip galvanised in accordance with the requirements of AS/NZS 1214.

19.4 Construction

19.4.1 General

Concrete road safety barrier shall be constructed in the locations shown on the Drawings and to the details shown on Standard Drawings 1458, 1466 to 1473 inclusive and 1486.

19.4.2 Surface preparation

The surface on which concrete road safety barrier is to be placed shall be prepared by trimming, if required, and sweeping to provide a smooth, even surface for the extrusion machine to travel.

Where dowels are required, a 70 mm diameter hole shall be cored in the existing surface 300 mm long x 24 mm diameter 500N dowel bars shall be installed in the hole and set in cement mortar.

19.4.3 Conduits and pits

Where required, electrical conduit shall be installed longitudinally in the location shown on Standard Drawing 1468. Conduit shall be securely anchored to the existing surface so that it is not displaced during concreting operations.

Where required, cable pits shall be installed in the locations shown in the design documentation.

Conduit and cable pits shall be installed in accordance with the requirements of MRTS91 *Conduits and Pits*.

19.4.4 Formwork

Formwork shall be provided for barrier terminal end sections, barrier cast against walls and piers and any other location where discrete casting of barrier is required.

Compressible filler shall be placed against existing walls and/or piers against which half-section barrier is to be cast.

Anchor bolts or anchor assemblies for connection of steel beam guardrail to barrier terminal ends shall be held securely in place on the formwork so that they are not displaced during placement and compaction of concrete.

19.4.5 Steel reinforcing

Steel reinforcing shall be installed in the locations shown on Standard Drawings 1468, 1470 (includes Steel Schedules) and 1473.

19.4.6 Extruded concrete barriers

Extruded concrete road safety barrier shall be constructed using a proprietary concrete extruding machine. The machine shall be capable of extruding concrete barrier of the profile shown on Standard Drawing 1468 to the lines and levels shown in the design documentation.

The finished wall surfaces shall be smooth, without surface cracks and other imperfections. Curing of the extruded barrier shall be in accordance with MRTS70 *Concrete*.

An initial test section of concrete road safety barrier at least five metres long (and preferably the minimum length nominated in the Standard Drawings) shall be constructed. The test section of barrier

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FOI 26-292 - Document 21

shall be inspected for conformance to this Technical Specification and, if conformance is established, further extruded barrier may be constructed. **Hold Point 6**

Subject to satisfying the requirements of the Technical Specification, the test section may be part of the Works.

The concrete barrier shall be terminated and restarted at each road lighting pole location and at each cable pit. The ends of the concrete barrier at such locations shall be perpendicular to the longitudinal grade of the pavement.

19.4.6.1 Concrete

Unless noted otherwise on the drawings, the concrete for extruded concrete road safety barriers shall consist of grade S32/20 concrete compliant with MRTS70 *Concrete* with the following additional requirements:

a) reinforced with nominal 50 mm virgin polypropylene fibrillated fibres incorporated at the rate of 0.9 kg/m³

b) specified slump of 10 mm to 20 mm with an acceptance tolerance of ± 10 mm.

Testing and acceptance of concrete for strength and slump shall be in accordance with MRTS70 *Concrete*.

> The specified slump for extruded concrete is critical to suit the process and equipment used. Some variation on the specified slump may be required and can be accepted by the administrator but generally the process requires concrete with a slump between 0 and 20 mm.

19.4.7 Placed concrete barriers

Concrete in barrier terminal end sections, barrier cast against walls and piers and any other location where discrete casting of barrier is required shall be placed and compacted in accordance with the requirements of MRTS70 *Concrete*.

19.4.7.1 Expansion joints

Expansion joints in extruded concrete road safety barrier shall be provided at maximum intervals of 100 metres of continuous extrusion and at the junction between extruded barrier and terminal end sections. Expansion joints shall generally not be required where light poles are included in the line of the barrier.

Expansion joints shall be installed vertical, using compressible filler and 1 metre long x 16 mm or 24 mm diameter round dowel bar as shown on Standard Drawing 1468. The line of the expansion joint shall be perpendicular to the longitudinal grade of the pavement. The external edge of the joint shall be sealed with joint sealant.

19.4.7.2 Contraction joints

Contraction joints shall be provided at maximum intervals of four metres.

Contraction joints shall be formed by saw cutting to a depth of 50 mm right around the external surface of the barrier. The line of the saw cut shall be perpendicular to the longitudinal grade of the pavement.

The time of saw cutting shall be determined so that shrinkage cracking is eliminated but in no case shall be longer than 12 hours after extrusion of the barrier.

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19.4.8 Cover plate assemblies

Rolled steel angles for attaching cover plates shall be fixed to the ends of concrete barrier at light pole and cable pit openings using proprietary chemical anchors as shown on Standard Drawing 1469.

The gap between the ends of the barrier and the light pole footing or cable pit shall be filled with cement mortar, formed to the shapes shown on Standard Drawings 1469.

Cover plates shall be installed onto the attaching angles with M12 galvanised button head socket screws.

19.4.9 Tolerances

For insitu construction of concrete road safety barrier (i.e., excluding precast units) the dimensional tolerances provided in AS/NZS 3845 Set shall apply.

For precast units, unless specified elsewhere in the design documentation, the alignment in plan of the completed barrier shall not deviate from the design alignment by more than ± 20 mm at any point and the height shall not deviate from the design height by more than ± 20 mm at any point. The relative displacement of adjoining units shall not exceed 20 mm.

19.4.10 Delineator spacing

Delineators on concrete road safety barriers shall be mounted at the spacings prescribed in Part 2 of the MUTCD. The colour of delineators shall be in accordance with the requirements of the MUTCD. Delineators shall conform with the requirements of Clause 19.2.10 and shall be affixed to the barrier via a fixing bracket in accordance with Standard Drawing 1466. The fixing bracket shall be attached to the top of the concrete road safety barrier with one 10 mm diameter masonry anchor with a minimum of 30 mm into concrete.

19.4.11 Precast concrete

Precast concrete barriers and/or components shall be manufactured in accordance with the relevant Standard Drawings and with the requirements of MRTS72 *Manufacture of Precast Concrete Elements*. Precast concrete barriers shall be installed to the line and level shown in the design documentation. Barriers shall be installed to achieve the minimum barrier length as detailed in the design documentation. Individual precast concrete barriers shall be connected together with permanent connectors as specified in the design documentation.

20 Steel beam guardrail and end treatments (public domain)

20.1 General

Public domain steel barrier systems and end treatments are NOT to be used on new projects or installations. Clause 20 has been retained for the purposes of maintaining existing installations when repairs and replacements can be reasonably and readily undertaken.

20.2 Manufacture

20.2.1 Registered manufacturer

The manufacture of the steel beam guardrail posts, panels components and end treatments shall only be manufactured by a registered manufacturer. The requirements of registration are outlined in document SCM-P-015 (refer Transport and Main Roads website).

An exemption to this is the manufacture of the "W Beam to Thrie Beam Transition Rail (B007)" as shown in Standard Drawing 1481. In this instance, the supplier needs to provide the department the following document with the supplied product:

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- copies of material certificates in accordance with the relevant Australian Standards. Testing shall be performed by an ILAC accredited laboratory.

Registration as a manufacturer will be reviewed periodically or earlier if unsatisfactory performance is reported.

For information regarding registered suppliers and approved products refer to the departmental website, www.tmr.qld.gov.au.

Transport and Main Road Structure's section is responsible for the management and administration of the department's Registered Manufacturers list.

The list of registered manufacturers is updated on a regular basis. All tenderers and or contractors should refer to the latest list which can be found on the department's website, www.tmr.qld.gov.au. If the tenderer or contractor proposes to use an unregistered manufacturer, they should ensure that the manufacturer is registered prior to submission of the tender.

20.2.2 Registered manufacturer in Australia

To be registered as an approved manufacturer of Public Domain Steel Beam Guardrail and End Treatments, a manufacturer shall:

a) Operate a third party quality system certified to AS/NZS ISO 9001. The system will be audited by Transport and Main Roads to ensure that manufacturer is working as stated in their system requirements and the system conforms to the requirements of Transport and Main Roads contracts.

b) Demonstrate technical conformance to this Technical Specification.

c) Manufacture the posts, panels, yokes and slip base posts.

d) Provide traceability of all materials.

e) Maintain records of all products placed on the market for a minimum of 10 years, and

f) Make available all relevant documentation when product is supplied.

This clause outlines the minimum requirements which must be satisfied for a manufacturer wishing to supply public domain guardrail components in Australia.

Requirements to become an approved manufacturer are outlined in the Department of Transport and Main Roads *SCM-P-015 Registration Scheme – Suppliers and Products for Bridges and Other Structures*.

All manufacturers are required to provide the name and contacts from at least five English speaking referees, who can attest to the quality of the guardrail manufacturer, before any audits are undertaken.

20.2.3 Registered manufacturer – outside Australia

To be registered as an approved manufacturer of Steel Beam Guardrail and End Treatments, a manufacturer shall:

a) Operate a third party quality system certified to AS/NZS ISO 9001. The system will be audited by an Auditor acceptable to Transport and Main Roads. The Auditor shall ensure that the

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manufacturer is working as stated in their system requirements and the system conforms to the requirements of Transport and Main Roads contracts.

b) Demonstrate technical conformance to this Technical Specification. The technical capability shall be audited by an Auditor acceptable to Transport and Main Roads. The Auditor shall ensure that the manufacturer can demonstrate technical conformance to this Technical Specification.

c) Manufacture the posts, panels, yokes and slip base posts.

d) Provide traceability of all materials.

e) Maintain records of all products placed on the market for a minimum of 10 years.

f) Make available all relevant documentation when product is supplied.

This clause outlines the minimum requirements which must be satisfied for a manufacturer wishing to supply public domain guardrail components from outside Australia.

Requirements to become an approved manufacturer are outlined in the Department of Transport and Main Roads *SCM-P-015 Registration Scheme – Suppliers and Products for Bridges and Other Structures* on the departmental website via www.tmr.qld.gov.au.

All manufacturers are required to provide the name and contacts from at least five English speaking referees, who can attest to the quality of the guardrail manufacturer, before any audits are undertaken.

20.3 Supplier

20.3.1 Registered supplier

Steel beam guardrail components and end treatments shall only be supplied by an approved supplier. The requirements of registration are outlined in document SCM-P-015. For copy of this document refer to contract details in Clause 1.

To be registered as an approved supplier of Steel Beam Guardrail and End Treatments, a supplier shall:

a) Operate a third party quality system certified to AS/NZS ISO 9001. The system will be audited by Transport and Main Roads to ensure that manufacturer are working as stated in their system requirements and the system conforms to the requirements of Transport and Main Roads contracts.

b) Source the posts, panels, yokes and slip base posts from a departmental approved manufacturer.

c) Source other components used in the supply of guardrail and end terminals to the requirements of this Technical Specification.

d) Ensure the material test certificates supplied by the Manufacturer match the product supplied.

e) Maintain records of all products placed on the market for a minimum of 10 years.

f) Ensure the products supplied comply with the requirements of the departmental Standard Drawings and Technical Specifications.

g) Ensure the correct products are supplied to the projects and all documentation is correct.

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Registration as an approved supplier will be reviewed periodically or earlier if unsatisfactory performance is reported.

This clause states that all guardrail components shall be supplied by a Transport and Main Roads Registered Supplier. Transport and Main Roads Structure's is responsible for the approval and removal of the Suppliers on the departmental Approved Supplier List. An approved guardrail system assumes specific steel strength ductility characteristics and appropriate galvanising. It is important that only the approved products and materials are used.

The list of approved suppliers is a live database which is updated on a regular basis. The tenderer and or contractor should obtain the up to date list. A current list of approved suppliers is available from the departmental website, www.tmr.qld.gov.au.

20.4 Material requirements

20.4.1 Steel components

Steel components shall be manufactured to the details shown on Standard Drawings 1467, 1470, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481 and 1482.

All steel components shall be hot-dipped galvanised after manufacture in accordance with the requirements of AS/NZS 4680.

20.4.2 Panels

20.4.2.1 Material requirements

Steel beam guardrail panels shall be manufactured to the detail shown on Standard Drawings 1480 and 1481 from steel conforming to the requirements of AS/NZS 1594 grade HA350.

When tested in accordance with AS 1391, the mechanical properties of the base metal shall conform to the requirements of Table 20.4.2.1(a).

Table 20.4.2.1(a) – Base metal mechanical properties

Property	Limits
Yield Stress, Minimum	340 MPa
Ultimate Tensile Stress, Minimum	450 MPa
Elongation, Minimum	15%

The panel section after rolling shall have a maximum tolerance on camber in any 2,500 mm length of 4.5 mm.

The base metal strip used for fabrication of guardrail panels shall conform to the tolerances listed in Table 20.4.2.1 (b).

Table 20.4.2.1(b) – Base metal tolerances, panels

Property	Tolerance (mm)
Base metal thickness (2.7 mm)	+ 0.21
Mill tolerance on strip width	+ 2.5 – 0

Terminal sections and stiffener plates shall be fabricated from similar material to guardrail panels.

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20.4.2.2 Batch marking requirements

All panels shall be hard stamped during the manufacturing process with the following information:

a) Manufacturer's unique company identification.

b) Grade of material and base metal thickness, and

c) Unique batch number of product which is produced from:

   i. a single coil of steel

   ii. identifiable multiple coils of steel used in the manufacture process.

A single batch shall consist of no more than 2000 items.

Materials test certificates shall comply with the requirements of Clause 20.4.5.

Typical view of the hard stamped details on the guardrail panel



20.4.3 Steel posts and blockouts

20.4.3.1 Material requirements

Steel posts and blockouts shall be fabricated from steel conforming to the requirements of AS/NZS 1594 grade HA300.

20.4.3.2 Batch marking requirements

All steel posts and blockouts shall be hard stamped during the manufacturing process with the following information:

a) Manufacturer's unique company identification.

b) Grade of material and base metal thickness, and

c) Unique batch number of product which is produced from:

   i. a single coil of steel

   ii. identifiable multiple coils of steel used in the manufacture process.

A single batch shall consist of no more than 2000 items.

Materials test certificates shall comply with the requirements of Clause 20.4.5.

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20.4.4 Steel plate, strip, bar and attachments

Steel plate, strip, bar and attachments shall conform to the requirements specified on the Standard Drawings elsewhere mentioned in Clause 22.

Materials test certificates comply with the requirements of Clause 20.4.5.

20.4.5 Material conformance

All the steel manufacturer material test certificates shall be supplied to the Administrator. The steel manufacturer's test certificates shall show the following:

a) full chemical composition including the carbon equivalence, and

b) mechanical test results for yield, tensile and elongation.

The Administrator shall review and approve the material test certificates. **Hold Point 7**

If test certificates are not available, then the Contractor shall submit to the Administrator for approval a proposal for selecting samples for testing of mechanical properties and chemical analysis and in accordance with the appropriate Australian Standard at no expense to the Principal. **Witness Point 2** Minimum testing requirements are four samples of each production batch.

This clause requires the Contractor to supply the material test certificates for all material used in the manufacture of the guardrail components. This requirement was introduced as the department found that some steel merchants were sourcing materials which did not comply with the requirements of the relevant Australian Standards.

The manufacturer is required to trace the coil of steel to the product manufactured. The Contractor is required to submit the material test certificates with the guardrail components supplied to a project.

20.4.6 Material audit testing

All guardrail posts and panels shall be audit tested by the Administrator using one of the following options.

20.4.6.1 Project testing

All projects shall be supplied with a minimum of two extra posts and two extra panels from each batch of panels and posts supplied to the project.

The Administrator shall randomly select two post and two panels from each batch number for audit testing. **Witness Point 3**

20.4.6.2 Previous project testing

Posts and panels which have previously been project tested can apply to the Administrator for a concession on carrying out the project testing, provided the batch marking numbers match the audit test reports.

20.4.6.3 Testing requirements

The posts and panels shall have the following tests undertaken:

a) dimensional check with departmental Standard Drawings

b) full chemical composition including the carbon equivalence

c) determine the Base Metal Thickness (BMT), and

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d) mechanical test results for yield, tensile and elongation.

Installation shall not commence until the Administrator has confirmed the materials tested match the material test certificates supplied for the batch of guardrail components. **Hold Point 8**

Guardrail components which do not match the product supplied shall be rejected and replaced with new guardrail components with a different batch number.

> All guardrail posts and panels will be audit tested to ensure the material test certificates match the material supplied.

20.4.7 Fasteners

Hexagonal head bolts and nuts shall be manufactured to the dimensions shown on the Standard Drawings noted in Clause 20.4.1. These fasteners shall comply with the requirements of AS 1111.1, AS 1112.3, AS/NZS 1252 as appropriate. These fasteners shall be tested in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork.*

Mushroom head bolts, product Grade C, shall be manufactured to the details shown on Standard Drawing 1479 and shall comply with AS/NZS 1390. Mushroom head bolt assemblies designated as Class 4.6 shall have the chemical and mechanical properties outlined in AS 1111.1 and AS/NZS 1112.3. Mushroom head bolt assemblies designated as Class 8.8 shall have the chemical and mechanical properties outlined in AS/NZS 1252. These fasteners shall be tested in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

Where the length of the bolt, in accordance with AS/NZS 1252, both hexagonal and mushroom head, prevents it from being mechanically tested no assembly test will be required.

Circular washers to conform to AS 1237.1 and taper washers to conform to AS/NZS 1252.

All fasteners to be hot dip galvanised to AS/NZS 1214.

20.4.8 Delineators

Delineators shall comply with the requirements specified in Clause 10.2.4 and in accordance with the requirements of Standard Drawing 1478.

20.4.9 Cable and Cable assembly

Cable shall be right ordinary lay rope (sZ) conforming to AS 3569 and as detailed on Standard Drawing 1479. Cable assembly (FC01) shall be in accordance with Standard Drawing 1479. A NATA certified test certificate outlining the mechanical test results for breaking strength (must withstand 200kN minimum), of the cable assembly shall be included in the quality records.

The test certificate shall be traced back to the individual cable assemblies supplied to the project, via an identification tag.

20.5 Fabrication of guardrail components

20.5.1 Fabrication standard

Except where otherwise stated in this Technical Specification, all welded components shall be fabricated in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

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20.5.2 Welding personnel in Australia

All welders shall:

a) Satisfy conditions A & B of Clause 4.12.2 of AS/NZS 1554.1.

b) Welding personnel require macro re-qualification on a 12 monthly basis for each weld procedure undertaken on Transport and Main Roads projects.

c) For SP welding, have a trade qualification, or demonstrate competence equivalent to a trade qualification, and

d) Welding personnel who do not conform to the requirements of (b) then the following shall be met:

   i. welders shall be permitted to undertake only fillet welds up to a maximum of 8 mm, and

   ii. a representative of Transport and Main Roads Bridge Construction Maintenance and Asset Management shall be present when macro samples are prepared to show conformance with Clause 4.12.2 (b) of AS/NZS 1554.1.

   The fabricator shall be responsible for covering all costs associated with witnessing the production of the macro samples. **Hold Point 9**

Transport and Main Roads reserves the right to withdraw welder qualification if welding is below Transport and Main Roads requirements.

This clause outlines the requirements for the staff undertaking the welding of structural steelworks to ensure that the welders are suitably qualified for the welding to be undertaken on departmental projects.

20.5.3 Welding personnel outside Australia

All welding undertaken outside Australia shall:

a) Satisfy the conditions of Clause 4.12.2 of AS 1554.1. All welding personnel require macro re-qualification on a 12 monthly basis for each weld procedure undertaken on Transport and Main Roads projects, and

b) Have a trade qualification, or demonstrate competence equivalent to a trade qualification subject to approval by Director (Bridge Construction Maintenance and Asset Management).

Transport and Main Roads reserves the right to withdraw welder qualification if welding is below the department's requirements.

This clause outlines the requirements for the staff undertaking the welding of structural steelworks to ensure that the welders are suitably qualified for the welding to be undertaken on departmental projects.

20.6 Installation

20.6.1 General

Steel beam guardrail shall be installed in the locations shown in the design documentation and in accordance with the details shown on Standard Drawings 1467, 1470, 1474, 1475, 1476, 1477, 1478, 1479 and 1482.

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Where installation of posts cannot be placed in accordance with the design drawings, it may be necessary to drill additional holes to facilitate installation. In this instance, additional holes shall be drilled either by a magnetic or pneumatic drill and treated in accordance with AS/NZS 4680. No flame cutting is permitted.

All bolts and nuts shall be securely tightened after installation. Washers shall not be used except where shown on the drawings.

Bolts for slip base plates shall be fastened to the torque specified on Standard Drawing 1476.

Any damage to guardrail components which occurs during the Contract shall be repaired to a finish complying with the requirements of this Technical Specification.

This clause outlines the dimensional requirements for the guardrail and end treatment installation. The overall performance of the guardrail and end treatment relies on the correct installation.

Failure to install the guardrail and end treatment correctly could result in the guardrail and end treatment not performing as designed.

20.6.2 Posts for Longitudinal Barrier (excluding public domain end treatments)

Steel posts may be driven or installed by the excavation and backfilling of a post hole. Posts shall not be driven into any asphalt layer or into concrete or into rock or into any pavement layer constructed in accordance with the requirements of Technical Specification MRTS07A *Insitu Stabilised Subgrades using Quicklime or Hydrated Lime*, MRTS07B *Insitu Stabilised Pavements using Cement or Cementitious Blends*, MRTS07C *Insitu Stabilised Pavements using Foamed Bitumen*, MRTS08 *Plant-Mixed Heavily Bound (Cemented) Pavements*, MRTS09 *Plant-Mixed Foamed Bitumen Stabilised Pavements* or MRTS10 *Plant-Mixed Lightly Bound Pavements*.

Where a post is to be installed into an asphalt layer or into concrete or into rock or into any pavement layer constructed in accordance with the requirements of Technical Specification MRTS07A *Insitu Stabilised Subgrades using Quicklime or Hydrated Lime*, MRTS07B *Insitu Stabilised Pavements using Cement or Cementitious Blends*, MRTS07C *Insitu Stabilised Pavements using Foamed Bitumen*, MRTS08 *Plant-Mixed Heavily Bound (Cemented) Pavements*, MRTS09 *Plant-Mixed Foamed Bitumen Stabilised Pavements* or MRTS10 *Plant-Mixed Lightly Bound Pavements* the following procedure shall be used:

- a hole of at least 400 mm diameter shall be excavated or bored to within 300 mm of the bottom of the post or to not less than the underside of the constraining material as described above whichever is the shallowest
- the hole shall be located so that the intended location of the post is aligned either centrally in the hole or closer to the side of the hole closest to the traffic lane from which most errant vehicles will originate
- the post shall be driven to the correct height
- the hole shall be backfilled around and within the open section of the post with clean, well-graded sand compacted so that it does not settle or arch, nor do voids form within the backfill, and
- the top 40 mm shall be completed with a sand-cement mortar.

During the driving of any post, an appropriate packer shall be used to protect the head of the post from damage and no damage shall occur to the post or to any protective coating. Any coating that is

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damaged during driving shall be repaired in accordance with AS/NZS 4680. The recommended repair for damaged galvanising is to apply two coats of inorganic zinc primer applied by brush.

The method of installation shall be recorded in the quality documentation.

20.6.3 Posts for public domain end treatments

The in-ground part of each of the six slip-base posts comprising a Terminal Type 1 end treatment as depicted on Standard Drawing 1474 (and others) may be driven or installed in a concrete footing. The concrete footing for each slip-base post shall be grade N25/20 concrete of a minimum diameter of 450 mm and of full depth to the bottom of the installed post. Where slip-base posts one and two are installed in a concrete footing, the soil plates may be omitted from these two posts.

Where Terminal Type 1 end treatments are to be installed in bound (i.e. AC or CTB) pavements it may be convenient (to the installer) to drive the slip-base footings. If so, providing that the total bound pavement depth where the post is being installed is not less than 330 mm thick measured from the surface, the soil plates may be omitted from posts one and two. It shall be incumbent upon the contractor / installer to demonstrate that driving posts through the bound pavement does not cause damage to the post which will be detrimental to the performance or the durability of the post. The contractor / installer shall make good any damage to the pavement around the base of the post caused by the driving process.

Otherwise, the installation shall be in accordance with Standard Drawing 1474 and the soil plate shall be installed. Other slip base posts shall be erected strictly in accordance with the details shown on Standard Drawing 1476.

The proposed method of installation of guardrail posts shall be included in the Construction Procedures required under the provisions of Clause 6 of MRTS50 *Specific Quality System Requirements*.

The soil plate on the Type 2 (departure) terminal as depicted on Standard Drawing 1474 (and others) may not be omitted.

20.6.4 Anchor cables

Anchor cables shall be erected strictly in accordance with the details shown on Standard Drawings 1474, 1476 and 1477. The nuts at both ends of each cable shall be tightened to a torque of 50 Nm.

The test certificate shall be traced back to the individual cables supplied to the project, via an identification tag.

20.6.5 Delineator spacing

Delineators on public domain steel beam road safety barriers shall be mounted at the spacings prescribed in Part 2 of the MUTCD. The colour of delineators shall be in accordance with the requirements of the MUTCD.

Delineators shall conform with the requirements of Clause 10.2.4 and shall be attached to the barrier in accordance with the detail on Standard Drawing 1478.

The fixing bracket shall be attached to the top of the concrete road safety barrier with one 10 mm diameter masonry anchor with a minimum of 30 mm into concrete.

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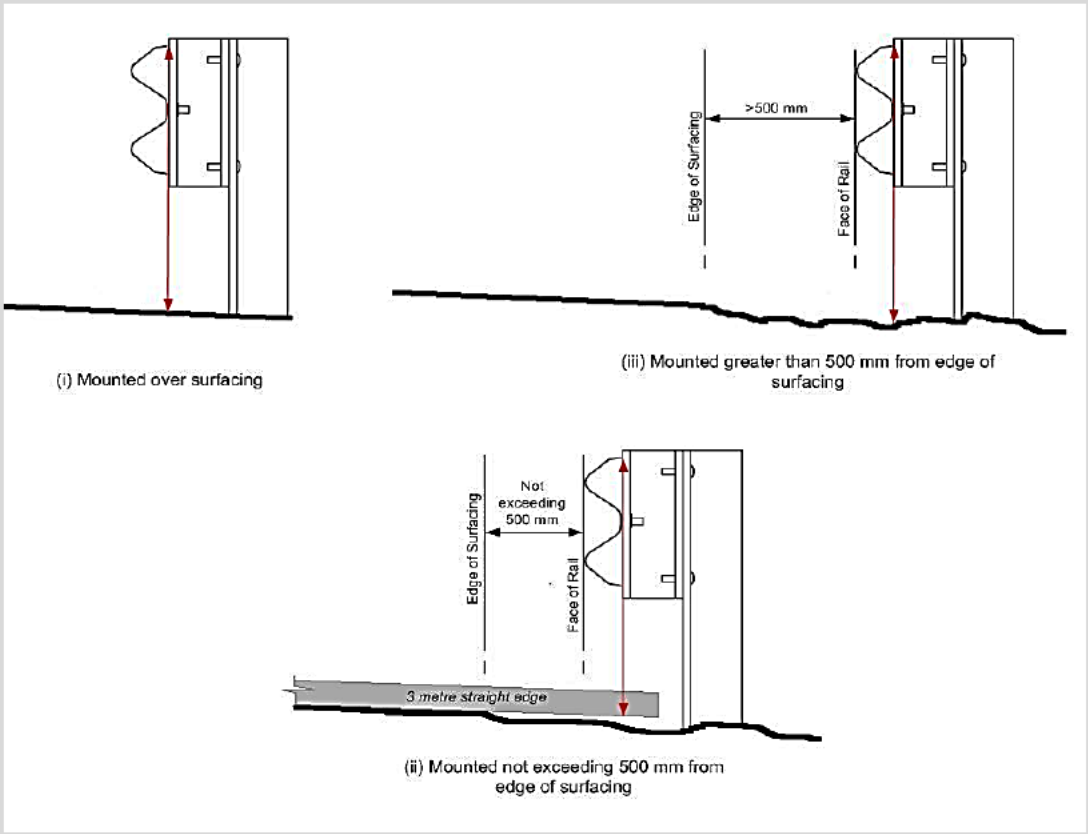
20.6.6 Tolerances

Steel beam guardrail shall be installed to the line and level shown in the design documentation. The tolerance on verticality of post shall be +/-15 mm measured at the top of the post. The tolerance on post height shall be +/-10 mm. The tolerance on rail height shall be +/-10 mm. Height to the top of rail shall be measured at midspan between posts:

- Where the face of steel beam guardrail is located above surfaced pavement, the height shall be measured from the pavement surface to the top of the rail.
- Where the face of steel beam guardrail is located not more than 500 mm beyond the edge of surfacing, a 3 m straight edge shall be lain perpendicular to the alignment of the road centreline to extrapolate the cross slope to meet a point plumb vertically below the back face of the rail. The height shall be measured vertically from this point to the top of the rail, and
- Where the face of steel beam guardrail is located beyond 500 mm from the edge of surfacing, the height shall be measured vertically from the ground surface to the top of the rail.

During installation, all elements of the steel beam guardrail shall fit together without the need to enlarge any holes, drill additional holes or modify any component.

How to measure the height of steel beam guardrail. Refer also to Standard Drawing 1474.



20.6.7 Acceptance of installation

Final acceptance of the guardrail installation shall not occur until the Administrator has reviewed that the installation has been installed as per the design documentation and in accordance with the details shown on Standard Drawings and released the Hold Point. **Hold Point 10**

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Guardrail components not installed in accordance with the requirements of the design documentation and in accordance with the details shown on Standard Drawings shall be removed and installed correctly.

Steel Quality

It is vital that all steel elements (steel beam, posts, blockouts, fittings etc) comply with the material quality and tolerance requirements. This is to ensure crashworthiness and longevity. Non-compliant steel can lead to rail rupture, post failure and significantly reduce in-service life.

Installation

Not all road safety barriers and end treatments have the same design intent, purpose or performance. Although they are crash tested, their in-service performance depends on proper application and installation as per the Standard Drawings and within the specified tolerances. Improper application or non-compliance installation (i.e. counter to the Standard Drawings and tolerances) can significantly reduce the systems intended performance and compromise the safety benefits.

The below two photographs are examples of incorrect installation.



The first photo (above) depicts frangible elements, slip base posts and tension cables, buried by concrete / median / kerbing level. This prevents the system from functioning and eliminates the intended safety benefits.

The next photograph (below) exhibits the same issue only 10 years later. Posts have been surrounded by concrete affecting system stiffness leading to rail rupture rather than redirection.



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21 Proprietary barrier systems and end treatments

21.1 General

Clause 21 describes the work to be carried out where a proprietary road safety barrier system and/or end treatment is required to be installed under the Contract.

Proprietary road safety barrier systems and/or end treatments accepted for use on state-controlled roads in Queensland are identified via Clause 18 of this Technical Specification.

21.2 Manufacture

Proprietary road safety barrier systems and/or end treatments shall be manufactured, fabricated and assembled in accordance with the design and specifications provided by the system and/or device designer for the purpose of getting the system and/or device tested and approved for use. This includes the quality and properties of materials.

The registered supplier of proprietary road safety barrier systems and/or end treatments must keep a signed certificate(s), from the manufacturer, stating that the manufactured / supplied system, device and/or components of a system or device comply with all aspects of the design of the system and/or device. The registered supplier must maintain separation between manufactured / supplied system, device and/or components, and any other materials and/or items to ensure there is no contamination of product. The manufacturer certificates and method of separation are subject to audit.

Once the barrier system and/or end treatment (device) are bundled / assembled for supply to a project, the registered supplier must label or tag the system and/or device with a unique identification number that will be used to link the supplied system and/or device with the required quality documentation.

The installer of proprietary road safety barrier systems and/or end treatments shall provide the following quality document(s) to the Administrator prior to commencement of installation of the system and/or device: **Hold Point 11**

- a signed certificate (from the registered supplier) that the supplied system and/or device has been bundled / assembled correctly in accordance with the design and specifications provided by the system and/or device designer and that the bundling / assembly process only used components supplied from the system and/or device manufacturer.

  The certificate must state the unique identification number given to the system and/or device (as above).

21.2.1 Precast concrete barriers

Proprietary concrete barriers shall be manufactured accordance with the requirements of MRTS72 *Manufacture of Precast Concrete Elements*.

If so requested, an installed concrete barrier shall be made available for inspection by the Administrator during the 28 day period described above.

21.2.2 Plastic block outs

Plastic block outs for use in lieu of public domain steel block outs are proprietary components. They may be used only if accepted for use in accordance with Clause 18.1 of this Technical Specification.

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The department currently has no detailed Technical Specification for plastic block outs. The use of proprietary plastic block-outs in lieu of public domain steel block-outs will be assessed in accordance with the process described in the document *Road Safety Barrier Systems and Devices* as referenced in Clause 18 of this Technical Specification.

Any submission for use of a proprietary plastic block-out for use in lieu of public domain steel block-out as part of a longitudinal steel rail barrier system would need to include, among other things, the following:

- demonstration that the component meets the crash test requirements of Australian Standard AS/NZS 3845 Set
- demonstration that the component can maintain mechanical and elongation properties for a minimum of 20 years
- fabrication drawings which include description of the grade of materials and relevant standards with which the materials are required to comply.

21.3 Design of Proprietary Barrier Systems

Post spacings for proprietary road safety barrier systems and rope tensions (for wire rope barrier systems) are system dependent, details of which are to be determined by the system designer and included in the quality records. Details of the working width of the system (including expected deflection) shall be included in the quality records.

The maximum span between end anchors and between intermediate anchors is proprietary system dependent and design dependent and is to be determined by the system designer and included in the quality records. Wherever there is scope in the contract for the Contractor to select a product or device the Design Criteria / Performance Standards are specified in Clause 11 of Annexure MRTS14.1.

If a specific product is nominated in the design documentation with scope for the use of an alternative product, then the design rationale for selecting that specific product should be documented and made available to the Contractor. This should include among other things:

a) selected containment capacity

b) expected deflection and working-width (which should be maintained free from objects)

c) post spacing

d) expected maintenance and repair costs

e) minimum / maximum system length

f) terminal type and details of any transitions to other barriers, and

g) failure (e.g. terminal anchor release) mechanism.

Where words such as 'or approved equal' or 'or equivalent' are used in the design documentation, the extent to which equivalence is to be demonstrated by the Contractor should be identified by the designer. Where a Contractor / installer has scope to install a system either as an alternative to a nominated variant or from a generic list, then the implications of any such decision need to be made clear to and accepted by the Principal / end user.

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21.4 Installation

21.4.1 General

A proprietary road safety barrier system and/or end treatment shall be installed as shown in and required by the design documentation, and in accordance with the requirements of the installation manual.

Where the design is provided by the Principal, any conflict between the design documentation and the supplier's requirements shall be referred to the Administrator for resolution prior to commencement of installation.

Where the design is provided by the Contractor, a complete set of the proprietary product specific design, installation drawings and specifications, as well as evidence and conditions of acceptance for use on state-controlled roads in Queensland shall be provided to the Administrator prior to commencement of installation of the product. **Hold Point 12**. All such documentation shall be included in the quality documentation.

21.4.2 Excavation

Excavation shall be undertaken in accordance with the supplier's requirements, and in accordance with the requirements of MRTS04 *General Earthworks*. Subject to the requirements of supplier, holes for post footings shall be excavated to a minimum size as shown in the design documentation.

21.4.3 Placed concrete

Concrete work shall be in accordance with the requirements of MRTS70 *Concrete*. Steel reinforcing shall be in accordance with the requirements of MRTS71 *Reinforcing Steel*.

21.4.4 Tensioned wire rope

The posts supporting a tensioned wire rope barrier system shall be white.

All ropes shall be tensioned appropriate to the ambient temperature in accordance with the supplier's instructions. Initial tensioning of each rope shall not proceed until at least seven days after pouring the last anchor block or post footing which will be affected by tension in the ropes. Not less than three months after the initial tensioning of the wire rope safety barrier, the contractor shall undertake verification testing by checking the tension in each rope for compliance with the specified requirements **Witness Point 4**. If necessary, the Contractor shall re-tension the ropes to comply with the supplier's specification. Upon completion of the verification of tension and any re-tensioning undertaken, the Contractor shall complete and submit to the Administrator for acceptance a Tension Report. **Hold Point 13**

21.4.5 Delineation

In terms of material and reflectivity, delineation on proprietary road safety barrier systems shall conform to the requirements of Clause 10.2.4 of this Technical Specification for delineation on road edge guide posts.

Delineation on proprietary road safety barrier systems shall be mounted at the spacings prescribed in Part 2 of the MUTCD. The colour of delineators shall be in accordance with the requirements of the MUTCD.

The reflective area of delineator units and the method of mounting of delineation on proprietary road safety barrier systems shall be as per the supplier's instructions. Exclusively for proprietary wire rope barrier systems, the reflective area of delineator units shall be as large as is practically possible in a single rectangular block.

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Where the reflective area of delineator units is less than the minimum requirement prescribed in Clause 10.2.4 of this Technical Specification, then the spacing between adjacent delineators shall be decreased in order to provide not less than an equivalent aggregate reflective area of delineation per linear metre of barrier system.

Commentary on Clause 21.4.5

Part 2 of the MUTCD prescribes the spacing requirements for delineators mounted on road safety barrier systems. Where the dimensions of the road safety barrier constrain the size of the delineator unit to be less than that prescribed in Clause 10.2.4 of this Technical Specification, it is appropriate to increase the frequency of delineators in order to provide an equivalent area of delineation.

For example, if the design requirement is 10,000 mm² of delineation at 20 m spacings (which is equivalent to 500 mm² of reflective area per linear metre of barrier), it is acceptable to provide delineators of 5,000 mm² reflective area at not greater than 10 m spacings, or 3,200 mm² at not greater than 6.4 m spacings.

21.4.6 Measurement

21.4.6.1 Height

The height of the system shall be measured in accordance with the supplier's instructions or otherwise measured and recorded vertically from the pavement surface level immediately below the traffic face of the system.

21.4.6.2 Tolerances

A proprietary barrier system or end treatment shall be constructed in accordance with the tolerances specified by the supplier.

Where tolerances are not specified, the alignment on plan of the completed barrier shall not deviate from the design alignment by more than ± 20 mm at any point and the height shall not deviate from the design height by more than ± 10 mm at any point.

21.4.7 Quality records

The Quality Records for proprietary roadside safety barrier systems and/or end treatments shall include at least:

i. Evidence and conditions of acceptance for use of the system or device on state-controlled roads in Queensland.

ii. A copy of the supplier's instructions and any other procedures for the installation and ongoing maintenance and repair.

iii. Details of the country of manufacture of all components.

iv. Quality documentation including certification from an appropriately accredited laboratory showing that the supplied components are in accordance with the supplier's specification.

v. A copy of the detailed design (where the design is not provided by the Principal), and

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vi. (For tensioned wire rope) a copy of the Calibration Certificate for the tensioning device. The certificate shall be dated no more than 12 months earlier than the date of installation of the last length of rope to be tensioned

Where installation spans more than 12 months, separate calibration certificates shall be provided.

22 Tactile ground surface indicators (TGSI)

22.1 Supply of compliant products

The department maintains a list of registered products used for TGSI. The products listed on this register have been assessed and determined as being compliant to AS/NZS 1428.4.1 and other criteria as determined by Transport and Main Roads.

Only registered products listed on the *Compliant Products Register for Tactile Ground Surface Indicators (TGSI)* shall be used, and any conditions of registration listed on the register (including usage limitations) must be complied with.

At least 14 days before placement of TGSI, the Contractor shall submit to the Administrator:

- details of the registered product, and
- construction procedure to be used. **Milestone**

The construction procedure to be used for the Works shall be consistent with:

- the manufacturer's current recommendations, and
- the requirements of the manufacturer's warranty.

22.2 Installation

22.2.1 Test methods

The standard test methods given in Table 4 shall be used in this Technical Specification. Further details of test numbers and test descriptions are given in Clause 4 of MRTS01 *Introduction to Technical Specifications.*

22.2.2 Testing frequencies

The minimum testing frequencies for coloured surface treatments are given in Table 22.2.

Table 22.1 – Testing frequencies

Property	Test Method	Minimum Testing Frequency	Requirement
Skid resistance (British pendulum number)	AS 4663 (wet method)	First lot: 2 tests Other lots: if ordered by the Administrator.	>=P4
Luminance contrast (on-site method)	AS 1428.4.1	First lot: 2 tests Other lots: if ordered by the Administrator.	As per Section 2.2 (b) of AS/NZS 1428.4.1

22.2.3 Maximum lot size

A lot shall consist of an area of work that is constructed using a single batch of TGSI and with the TGSI being placed on the same surface material with similar colour.

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22.2.4 General

The installation of the TGSI shall be as specified on the drawings and shall occur in accordance with the approved product's instructions as provided by the manufacturer, such that the installation is subject to any and all warranty conditions imposed by the supplier and/or manufacturer.

Where the design is provided by the Principal, any conflict between the design documentation and the supplier's requirements shall be referred to the Administrator for resolution prior to commencement of installation.

22.2.5 Alignment

TGSI shall be set out to align correctly at the pedestrian crossing location so as to correctly direct the pedestrian, where applicable. **Hold Point 14**

22.2.6 Surface preparation

In accordance with the manufacturer's recommendation the surface shall be cleaned and prepared for the installation of the TGSI. **Witness Point 5**

22.2.7 Installation

TGSI shall be installed in accordance with the manufacturer's recommendation. The base surface of an integrated directional TGSI shall be not more than 3 mm above the abutment surface of the surrounding floor or ground surface.

22.3 Protection of work

The Contractor shall take all necessary precautions to protect the work from damage and/or contamination, until such time that the new TGSI has developed sufficient strength to carry normal traffic without damage.

22.4 Quality records

The Contractor shall provide the Administrator a copy of the product warranty. The warranty shall be for five years from the date of installation and shall not include any exemptions which would void the warranty due to UV exposure. **Milestone**

22.5 TGSI removal

The removal of existing TGSI shall be performed immediately prior to the re-installation of replacement TGSI where applicable, subject to any minimum waiting periods that may be required for surface preparation.

The Contractors chosen method of removal will be such that any impact on surrounding infrastructure is minimised, and all affected infrastructure will be restored to a like for like condition upon completion of the Works.

22.6 Placed concrete

Concrete work shall be in accordance with the requirements of MRTS70 *Concrete*. Steel reinforcing shall be in accordance with the requirements of MRTS71 *Reinforcing Steel*.

22.7 Traffic management

Appropriate traffic management requirements shall be identified by the Contractor and undertaken in accordance with MRTS02 *Provision for Traffic*.

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FOI 26-292 - Document 21

23 Supplementary requirements

The supplementary requirements given in Clause 12 of Annexure MRTS14.1 shall apply.

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Technical Specification

Transport and Main Roads Specifications MRTS16 Landscape and Revegetation Works

July 2017

Queensland Government

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Contents

1 Introduction 1

2 Definition of terms 1

3 Referenced documents 3

3.1 Material and practices 3

3.2 Standard drawings 4

4 Standard test methods 4

4.1 Test methods 4

4.2 Testing laboratory standards 5

5 Quality system requirements 6

5.1 Hold Points, Witness Points and Milestones 6

5.2 Plans to be included in the Contract Plan 7

5.2.1 Soil Management Plan – Construction 7

5.2.2 Non-Potable Water Management Plan (dam, creek, river and bore water) 8

5.3 Proposals 8

5.3.1 Seed Supply Proposal 8

5.3.2 Seed Harvesting Proposal 9

5.3.3 Plant Supply Proposal 10

5.3.4 Plant Harvesting Proposal 11

5.4 Quality system supplementary requirements 11

6 General requirements 11

6.1 Landscape Representative 11

6.2 Soil Assessor accreditation 13

6.3 General requirements supplementary requirements 13

7 Materials 13

7.1 Soil 13

7.1.1 Subsoil 13

7.1.2 Topsoil 14

7.2 Soil amelioration agents 14

7.2.1 Agricultural lime, agricultural dolomite and agricultural gypsum 15

7.2.2 Fertiliser 16

7.2.3 Organic soil conditioner 16

7.2.4 Microbial inoculants 16

7.2.5 Soil wetting and water holding agents 17

7.3 Pesticides 17

7.3.1 Knock-down herbicides 17

7.3.2 Target herbicides 18

7.3.3 Insecticides 18

7.3.4 Fungicides 18

7.4 Seeding 18

7.4.1 Drill seeding 18

7.4.2 Broadcast Seeding 18

7.4.3 Hydromulch - Standard 19

7.4.4 Hydromulch - Bonded Fibre Matrix 20

7.4.5 Hydro-compost 23

7.4.6 Straw Mulching 24

7.4.7 Organic Blanket 25

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

7.4.8 Seeded mesh lined drain ... 26
7.4.9 Seeds ... 27
7.4.10 Seeding fertilisers ... 31
7.5 Turfing ... 31
7.5.1 Turfing treatment material ... 31
7.5.2 Turf ... 32
7.5.3 Turf fertiliser ... 32
7.6 Planting ... 33
7.6.1 Planting treatment materials ... 33
7.6.2 Containerised plants and ex-ground stock ... 34
7.6.3 Mulch ... 35
7.6.4 Organic matting ... 35
7.6.5 Stakes and guys ... 36
7.6.6 Subsoil drain ... 36
7.6.7 Planting fertilisers ... 36
7.7 Water ... 37
7.7.1 Recycled water ... 37
7.7.2 Non-potable water (dam, creek, river and bore water) ... 37
7.8 Planting bed edging ... 38
7.8.1 Concrete planting bed edging ... 38
7.9 Irrigation system ... 38
7.10 Material supplementary requirements ... 38
8 Construction ... 38
8.1 Sampling and testing ... 38
8.1.1 Subsoil sampling and testing ... 38
8.1.2 Topsoil sampling and testing ... 40
8.1.3 Non-potable water (dam, creek, river and bore water) sampling and testing ... 42
8.1.4 Seed Testing ... 43
8.2 Site manufactured materials ... 43
8.2.1 Manufacture of site topsoil ... 43
8.2.2 Manufacture of site mulch ... 44
8.2.3 Harvesting of site vegetation material ... 44
8.3 Weed control ... 44
8.4 Ground preparation works ... 45
8.4.1 Subsoil operations ... 45
8.4.2 Topsoil operations ... 47
8.5 Vegetation works ... 47
8.5.1 Seeding ... 47
8.5.2 Turfing ... 55
8.5.3 Planting ... 57
8.6 Hardscape works ... 60
8.6.1 Concrete planting bed edging ... 60
8.6.2 Irrigation system ... 60
8.7 Construction supplementary requirements ... 62
9 Establishment and monitoring ... 62
9.1 Establishment Period ... 63
9.1.1 Establishment Period operations ... 63
9.1.2 Establishment Period completion criteria ... 71
9.2 Monitoring Period ... 72
9.2.1 Monitoring Period operations ... 72
9.2.2 Monitoring Period completion criteria ... 76

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FOI 26-292 - Document 21

9.3 Establishment and monitoring supplementary requirements 77

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1 Introduction

This Technical Specification applies to the construction of landscape and revegetation treatments in road works.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Additional terms used in this Technical Specification are defined in Table 2.

Table 2 – Definition of terms

Term	Definition
> 1 on 4 Slopes	Slopes steeper than 1V on 4H.
≤ 1 on 4 Slopes	Slopes equal to or flatter than 1V on 4H.
Biosecurity Instrument Permit	An authority issued by Biosecurity Queensland under the *Biosecurity Act* 2014 for movement of a carrier of a regulation biosecurity matter under a biosecurity zone regulation to a place outside the zone or into an area subject of a movement control.
Biosecurity Matter	Biosecurity matter as defined in the *Biosecurity Act* 2014 including but not limited to invasive plants (weeds) and animals.
Broadacre	The areas beyond the toe of a fill embankment or top of a cut batter that are generally flat to gently sloping.
Clear zone	The area that commences at the edge of the trafficable lane and is available for emergency use by errant vehicles. The distance that the clear zone extends from the carriageway edge is dependent on the traffic volume, road geometry and design speed of the road. This area may consist of a shoulder, parking bays, a recoverable slope or a clear run-out area. Refer to the Department's *Road Landscape Manual – Safety* chapter.
Contained areas	Medians, separators; and planting beds bordered by hard constructed garden edging.
DEHP	Department of Environment and Heritage Protection
Dolomite	Agricultural dolomite (calcium magnesium carbonate $CaMg(CO_3)_2$).
Gypsum	Agricultural gypsum (calcium sulfate $CaSO_4 2H_2O$).
High profile areas	Off road areas, highly visible to the public including: a) pedestrian areas and shared paths b) transport stations c) areas fronting residential property, and d) key entries, gateways and intersections.
Lime	Agricultural lime (calcium carbonate $CaCO_3$).

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Term	Definition
Pesticide	A pesticide is the collective term for herbicides, insecticides and fungicides.
Potable water	Water of a quality suitable for drinking.
Propagules	The reproductive parts of plants including seeds, stolons, roots, corms, bulbs and stems.
Recycled water	Appropriately treated effluent or storm water meeting standards in this Technical Specification.
Representative soil sample	A representative soil sample is a sample that is representative of a single soil type and a single soil layer.
Seed germination / viability tests	Tests that indicate the live / viable seed percentages in a sample of seeds.
Seed purity test	A test that shows the percentages of pure seed, inert matter and other seed species in a sample of seeds.
Sight visibility zone	An area calculated to provide the driver with adequate time to observe the road layout and react and stop if necessary, before entering a potential conflict zone. Refer to the Department's *Road Landscape Manual* – Safety chapter.
Soil	For the purposes of this Technical Specification, soil is considered to be in two distinct layers: a) topsoil, and b) subsoil.
Stripped site topsoil	Non-ameliorated Site topsoil stripped and stockpiled after the clearing and grubbing process.
Subsoil	For the purposes of this Technical Specification, subsoil is considered: a) the soil below the topsoil layer b) the outer face / surface of a cut or fill embankment (subgrade), or c) the exposed soil in areas that have been stripped of topsoil in broadacre areas.
Topsoil	For the purposes of this Technical Specification, topsoil refers to: a) surface soil that contain organic material b) screened and ameliorated site topsoil that complies with Form D of Appendix MRTS16, or c) imported topsoil that complies with Form C of Appendix MRTS16.
Vegetation Treatment	Turfing, Seeding or Planting.
Weeds	Plants which include declared plants, environmental weeds and the wrong plant in the wrong place or non-specified species. Plants that are known to impact negatively on the vigour and sustainability of the specified species.

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3 Referenced documents

3.1 Material and practices

Table 3.1 lists documents referenced in this Technical Specification.

Table 3.1 – Referenced documents

Reference	Title
	Biosecurity Act (2014) and Biosecurity Regulation (2016)
	*Chemical Usage (Agricultural and Veterinary) Control Ac*t (1988)
	*Agricultural Chemicals Distribution Control A*ct (1966)
	Land Protection (Pest and Stock Route Management) Act 2002
	Land Protection (Pest and Stock Route Management) Regulation 2003
	Queensland Water Recycling Guidelines (EPA 2005)
	Recycled Water Management Plan and Validation Guidelines (DEWS 2008)
	Guide to Workplace use of Non-potable Water Including Recycled Waters (DIER 2007)
-	Transport and Main Roads *Materials Testing Manual*
-	*Soil Chemical Methods : Australasia* – Rayment & Lyons, CSIRO 2011
AS 1289.3.8.1	*Methods of testing soils for engineering purposes - Soil classification tests - Dispersion - Determination of Emerson class number of a soil*
AS 2303	*Tree Stock for Landscape Use*
AS 2439.1	*Perforated plastics drainage and effluent pipe and fittings Perforated drainage pipe and associated fittings*
AS 3896	*Waters - Examination for Legionella spp. including Legionella pneumophia*
AS 4276.7	*Water microbiology - Escherichia coli and thermotolerant coliforms - Membrane filtration method*
AS 4373	Pruning of Amenity Trees
AS 4419	Soils for landscaping and garden use
AS 4454	*Compost, soil conditioners and mulches*
AS 4964	*Method for the qualitative identification of asbestos in bulk samples*
AS 5013.24.2	*Microbiology of food and animal feeding stuffs – Horizontal method for the detection and enumeration of Listeria monocytogenes - Enumeration method*
AS/NZ 1319:1994	*Safety Signs for the Occupational Environment*
MRTS01	*Introduction to Technical Specifications*
MRTS04	*General Earthworks*
MRTS21	*Bituminous Emulsion*
MRTS27	*Geotextiles (Separation and Filtration)*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*
MRTS70	*Concrete*

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Reference	Title
MRTS228	*Electrical Switchboards*
MRTS256	*Power Cables*
RLM	*Road Landscape Manual* (Transport and Main Roads)

3.2 Standard drawings

Table 3.2 lists standard drawings referenced in this Technical Specification.

Table 3.2 – Standard drawings

Standard Drawing Number	Title
1643	*Vegetation Ground Works - Planting Container Stock Kerbed Medians and Separators*
1644	*Vegetation Ground Works - Hardstand Abutments to Vegetation Works*
1647	*Vegetation Works - Matting*
1650	*Vegetation Works - Turfing*
1651	*Vegetation Works - Seeding*
1653	*Vegetation Works - Planting Container Stock < 25 L Container*
1654	*Vegetation Works - Planting Container Stock > 25 L Container*

4 Standard test methods

4.1 Test methods

Testing of all work shall be undertaken in accordance with Clause 4 of MRTS01 *Introduction to Technical Specifications*.

The standard test methods listed in Table 4.1 shall be used in this Technical Specification.

Table 4.1 – Test methods

Material	Test Method
Site Topsoil	*Form C of Appendix MRTS16*
Imported Topsoil	*Form C of Appendix MRTS16*
Manufactured Site Topsoil	*Form D of Appendix MRTS16*
Subsoil	*Form E of Appendix MRTS16*
Drainage Basin Soil	*Form F of Appendix MRTS16*
Organic Soil Conditioner	AS 4454 and *Form G of Appendix MRTS16*
Non-potable Water	*Form I of Appendix MRTS16*
Imported Mulch	AS 4454

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Soil test methods have been developed by the department specifically for Queensland soils to ensure:

- topsoil is capable of supporting pasture grasses and native vegetation, and
- subsoil is capable of supporting plant growth and to identify and manage dispersive / sodic / saline soil risks.

The test forms are based primarily on components of AS 4419 *Soils for landscaping and garden use*, and *Soil Chemical Methods: Australasia*. The number of test parameters and parameter requirements have been reduced relevant to naturally occurring soils and their use in road building projects.

The Topsoil Testing form is relevant to naturally occurring topsoils and their reuse in road building projects.

The Manufactured Site Topsoil Compliance Testing form is relevant to stripped site topsoils which have undergone amelioration processes, and is based on testing those parameters affected by the amelioration process (including agricultural lime, dolomite, gypsum and / or organic soil conditioner).

The Subsoil Testing form is relevant to subsoils and their use in road building projects where present as either as insitu materials or reconstructed in bulk earthworks. It has been developed to identify and manage erosion / dispersion / sodicity risks and other critical chemical properties to ensure the outer layer of subsoil is capable of supporting plant growth.

The Drainage Basin Soil Testing form has been developed to ensure basin material is a suitable construction material and capable of supporting plant growth.

The Organic Soil Conditioner Testing form has been developed to ensure material will not cause health issues to workers or the general public. The Nitrogen Drawdown Index (NDI) parameter is tested to ensure material has reached maturity levels and is not detrimental to soil or vegetation establishment. Electrical conductivity is limited to ensure material does not inhibit seed germination and plant development.

The Non-potable Water Testing and Assessment Report form has been developed to ensure material will not cause health issues to workers or the general public. The requirements also ensure the chemical properties do not have a detrimental effect on soil or vegetation establishment.

4.2 Testing laboratory standards

Laboratory testing required as part of this technical specification shall be carried out by a laboratory accredited by the National Association of Testing Authorities (NATA).

Laboratories that typically test for the engineering or geotechnical characteristics of soils are often not equipped or experienced in carrying out the soil test methods required for testing topsoil and subsoil. It is recommended Australasian Soil and Plant Analysis Council (ASPAC) certified laboratories be used to ensure correct test methods are undertaken.

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5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications* and Clause 8.3 of MRTS50 *Specific Quality System Requirements*.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 5.1.

Table 5.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2.1	1. Submission of a Soil Management Plan – Construction and assessment of suitability		Submission of a Soil Management Plan – Construction
5.2.2	2. Submission of Non-Potable Water Plan and applicable permits, and assessment of suitability		
5.3.1	3. Submission of a Seed Supply Proposal and assessment of suitability		
5.3.2	4. Submission of a Seed Harvesting Proposal and assessment of suitability		
5.3.3	5. Submission of a Plant Supply Proposal and assessment of suitability		
5.3.3.1		1. Nursery inspection of container stock	
5.3.4	6. Submission of a Plant Harvesting Proposal and assessment of suitability		
8.2.1	7. Manufactured site topsoil is in accordance with Form D of MRTS16 Appendix		
8.3		2. Weed treatment prior to other ground preparation operations	
8.4.1.1	8. Spreading of amelioration agents on subsoil		
8.4.1.2		3. Ripping of subsoil	
8.4.1.3		4. Cultivation of subsoil	
8.4.1.4		5. Roughening of subsoil	
8.4.2.1		6. Installation of topsoil	
8.5.3.1		7. Plant delivery	
8.5.3.2		8. Plant delivery	

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Clause	Hold Point	Witness Point	Milestone
8.5.1	9. Sample installation of hydraulically applied seeding operations		
8.5.1	10. Inspection and verification of seeding materials and quantities		
8.5.3.3	11. Inspection of plant setting-out prior to planting.		
8.6.2.1	12. Submission of an irrigation system design.		
8.6.2.2	13. Commissioning and testing of the irrigation system.		
9.1			Issue of the Certificate of Commencement of the Establishment Period
9.1.1.7	14. Interim evaluation of treatments to determine if it is on track to meet the completion criteria		
9.1.2			Issue of the Certificate of Completion of the Establishment Period
9.2			Issue of the Certificate of Commencement of the Monitoring Period
9.2.2			Issue of the Certificate of Completion of the Monitoring Period

5.2 Plans to be included in the Contract Plan

5.2.1 Soil Management Plan – Construction

The Soil Management Plan – Construction shall be:

a) prepared in accordance with Form A of Appendix MRTS16

b) submitted as part of the Environmental Management Plan – Construction and prior to clearing and grubbing, and stripping of topsoil operations. **Milestone**

c) regularly updated and re-submitted when subsoil and topsoil testing occurs, and

d) assessed for suitability by the Administrator, prior to carrying out the implementation of the above operations and activities. **Hold Point 1**

The initial submission prior to clearing and grubbing, and stripping of topsoil requires at a minimum *Section 1 – Topsoil volumes assessment* and *Section 2 – Integrated soil management activities* to be completed to identify topsoil material requirements and demonstrate soil related activities are considered and addressed at the commencement of the project.

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Where a soil management plan from the planning and design phases of the project is provided by the Principal, it shall be specified in Clause 1.1 of the Annexure MRTS16.1. Where a soil management plan is provided by the Principal, the Contractor shall prepare a Soil Management Plan – Construction and validate soil material requirements.

The intent of the Soil Management Plan – Construction is to:

- provide an understanding of project soil volumetric issues including total topsoil required for revegetation works, available stripped site soil, site soil shortfalls and requirements for imported topsoils, consideration of revegetation treatment type options
- identify and understand soil characteristics, deficiencies and associated risks
- determine amelioration types and rates
- ensure the appropriate management of soil throughout construction
- reduce the short and long term risk of erosion, vegetation failure and associated rework, and
- provide a Quality System to document soil material and construction related activities.

5.2.2 Non-Potable Water Management Plan (dam, creek, river and bore water)

Where a Contractor proposes to water vegetation works with non-potable water (dam, creek, river and bore water), they shall:

a) obtain the necessary permits and approvals for the use of water from proposed water source, and

b) submit a Non-Potable Water Management Plan in accordance with *Form H of Appendix MRTS16*.

The Non-Potable Water Management Plan shall be assessed for suitability by the Administrator, prior to use. **Hold Point 2**

This Clause excludes recycled water; recycled water shall be in accordance with Clause 7.7.1

5.3 Proposals

5.3.1 Seed Supply Proposal

The Contractor shall initially submit a Seed Supply Proposal for a determination as to its suitability by the Administrator, within 30 days of the date of Possession of Site or as specified in the Contract. **Hold Point 3** For projects with a long duration, updates shall be provided as seed availability and quality may vary over time.

The Seed Supply Proposal shall include:

a) seed supplier(s) details

b) Clause 3.2.2 or 3.2.3 of the Annexure MRTS16.1 with:

   i. seed species, application rates

   ii. adjusted application rates, where seed purity and germination / viability percentages are less than 95% purity and 80% germination / viability, and

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iii. total required seed for each species / seed mix.

c) seed pre-treatment requirements for hard cased native seeds in accordance with Clause 7.4.9.2, and seed pre-treatments such as inoculation, coating or anticide in accordance with Clause 3.2.1 of the Annexure MRTS16.1, or as shown on the drawings

d) seed test certificates, in accordance with Clause 8.1.4

e) the timing and management of seed procurement in particular large volumes of species and or species diversity, and

f) proposed substitute species where seed species are unavailable.

Where seed supply is proposed to be supplied or supplemented by harvesting seed from site, a Seed Harvesting Proposal shall be prepared in accordance with Clause 5.3.2.

The Seed Supply Proposal is a management tool to:

- promote the timely supply of seed species and quantities, reducing the need for substitutes
- where substitute species are unavoidable, allow the Administrator to review and assess for suitability substitute and additional species
- allow the Administrator to confirm the species to be supplied and application rates meet the requirements of the Contract, and
- allow the Administrator to confirm seed pre-treatment requirements for hard cased native seeds are nominated.

5.3.2 Seed Harvesting Proposal

Where seed harvesting is to occur, the Contractor shall submit a Seed Harvesting Proposal for a determination as to its suitability by the Administrator, prior to harvesting seeds. **Hold Point 4**

The Seed Harvesting Proposal shall:

a) be prepared by a seed collector / merchant / specialist, and

b) be included as an annexure to the Seed Supply Proposal.

The Contractor shall obtain all relevant permits prior to harvesting, in accordance with DEHP requirements and MRTS51.

The Contractor shall collect, manage and store seed in accordance with the *Flora Bank Model Code of Practice and associated Guidelines*.

Collected seed shall be tested in accordance with Clause 8.1.4.

The Seed Harvesting Proposal shall include:

a) species to be harvested and their location

b) timing / season of harvesting for each species

c) seed harvester details / licences / permits

d) method of harvesting

e) method of storage and care

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f) location for storage, and

g) seed test certificates.

5.3.3 Plant Supply Proposal

The Contractor shall submit a Plant Supply Proposal for a determination as to its suitability within 30 days of the date of Possession of Site or as specified in the Contract. **Hold Point 5**

The Plant Supply Proposal shall include:

a) plant nursery(s) details

b) the plant species, planting densities and quantities in accordance with Clause 3.4.1 of the Annexure MRTS16.1, or as shown on the drawings

c) the timing and management of plant procurement, in particular large volumes of species, container stock ≥ 25 L and specified stock required for critical and specialised functional roles (median headlight screening, noise wall screening, rehabilitation of environmental areas)

d) proposed substitute species where specified plant species are unavailable

e) inspection report forms and documentation in accordance with AS2303 *Tree Stock for Landscape Use*, for all tree stock in containers ≥ 25 L and ex-ground stock

f) proposed plant delivery program, including method of transport

g) installation methodology and work method statements for container stock > 100 L, and

h) dates for joint inspections at the nursery in accordance with Clause 5.3.3.1.

Where plant supply is proposed to be supplied or supplemented by harvesting plant material from Site, a Plant Harvesting Proposal shall be prepared in accordance with Clause 5.3.4

The Plant Supply Proposal is a management tool to:

- promote the timely procurement and supply of the specified container stock, reducing project delays or the need for substitutes. Large volumes of plants are typically contract grown and sufficient lead time is required to allow this process.
- allow the Administrator to confirm the species and quantities to be supplied meet the requirements of the Contract, and
- where substitute species are unavoidable, allow the Administrator to review and assess for suitability substitute species to determine their suitability.

5.3.3.1 Nursery inspections

Joint nursery inspections are required:

a) prior to the delivery of plants to Site

b) within sixty days of the Administrator deeming the Plant Supply Proposal suitable, and

c) every sixty days where the growing period is greater than sixty days.

The Contractor shall give a minimum 5 days' notice of joint inspections at nurseries. **Witness Point 1**

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Plant root inspection shall:

a) not exceed 2% of the total of each species, or

b) not exceed two containers if less than 100.

If samples inspected are found to be defective, the entire species represented by the defective samples may be rejected. All plants rendered unsuitable as a result of an inspection will be rejected and considered as samples on which payment cannot be claimed.

5.3.4 Plant Harvesting Proposal

Where plant harvesting is to occur, the Contractor shall submit a Plant Harvesting Proposal for a determination as to its suitability prior to harvesting plants. **Hold Point 6**

The Plant Harvesting Proposal shall be:

a) prepared by a revegetation or horticultural specialist, and

b) included as an annexure to the Plant Supply Proposal.

The Contractor shall obtain all relevant permits prior to harvesting, in accordance with DEHP requirements and MRTS51.

The Plant Harvesting Proposal shall include:

a) species to be harvested and their location

b) harvester details / licences / permits

c) method of harvesting and transport to storage facility

d) method of storage and care

e) location (on-site or nursery) for storage

f) any specific installation requirements, and

g) any specific maintenance and monitoring requirements under the permit.

5.4 Quality system supplementary requirements

Quality system supplementary requirements of MRTS16 *Landscape and Revegetation Works* shall be specified in Clause 1.1 of the Annexure MRTS16.1.

6 General requirements

6.1 Landscape Representative

Where required in the General Conditions of Contract Appendix A, the Contractor shall employ a suitably qualified and experienced personnel as Landscape Representative(s).

Except where modified by the General Conditions of Contract Appendix A, the Landscape Representative(s) shall:

a) have a minimum five years of experience in supervising or carrying out large scale landscape and rehabilitation / revegetation projects, with demonstrated experience in:

   i. managing a program of landscape and revegetation works

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ii. soil management as it relates to revegetation and erosion control, and

iii. design, implementation and establishment of works.

b) be engaged prior to clearing and grubbing, to have an active role in:

i. clearing and grubbing

ii. identification of topsoil suitable for stripping / stockpiling

iii. manufacture and storage of topsoil

iv. manufacture and storage of mulch

v. seed and plant procurement / harvesting

c) be available on Site when landscape and revegetation activities are being carried out, the Landscape Representative(s) does not necessarily need to be on Site full time, but shall be on Site when landscape and revegetation activities are being carried out

d) be available during the establishment and monitoring periods, until the end of the Date of Final Completion

e) assist in the development of the Contractor's Plans in accordance with Clause 5.2, and Proposals in accordance with Clause 5.3

f) ensure that the landscape and revegetation treatments are implemented in accordance with the design and this Technical Specification

g) prepare electronic (daily or as required by installation program) diaries including photographic evidence of the activities involved in each lot for uploading into the QA database. Supplementary evidentiary support documents such as supplier certifications of materials maybe uploaded separately into the QA database or associated management plans, and

h) ensure that the landscape and revegetation treatments established and monitored to meet the completion criteria of Clause 9.1.2 and Clause 9.2.2.

Nominating a Landscape Representative(s) on large and / or complex projects can save project funds by reducing failures and associated rework, providing a more robust landscape for the Department at handover. Landscape and revegetation activities are unique to other road building activities as they involve the use of living materials (plant material) that require establishment so as to successfully reach their intended function.

Landscape Representative(s) should be engaged early in the project life to ensure adequate planning and co-ordination with civil works programme and to undertake material procurement in accordance with the project Proposals of Clause 5.3

The Landscape Representative should not be confused with the Environmental Representative as they have distinctly separate qualifications, skills and experience.

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6.2 Soil Assessor accreditation

The Contractor shall have sampling, assessment and interpretation of soil test results carried out by a:

a) Certified Professional Soil Scientist (CPSS), or

b) soil scientist or agronomist with:

   i. educational qualifications relating to soil science, and

   ii. at least ten years relevant experience in soil assessment and management.

It is important soil sampling, assessment, interpretation and recommendations are provided by appropriately qualified and experienced specialists. Incorrect interpretation and recommendations can lead to additional costs, project delays and / or rework.

6.3 General requirements supplementary requirements

General requirements supplementary requirements of MRTS16 *Landscape and Revegetation Works* shall be specified in Clause 2.1 of the Annexure MRTS16.1.

7 Materials

The material requirements used throughout this Technical Specification are given below.

Materials imported to Site shall be free of prohibited or restricted biosecurity matter.

The Contractor shall store materials to ensure no deterioration or contamination occurs, including the potential for environmental harm.

7.1 Soil

For the purposes of this Technical Specification, soil is considered to have two distinct layers:

a) Subsoil:

   i. the soil below the topsoil layer

   ii. the outer face / surface of a cut or fill embankment (subgrade), and

   iii. the exposed soil in broadacre areas that have been stripped of topsoil.

b) Topsoil:

   i. manufactured from site topsoil, and

   ii. imported topsoil.

Soil shall be free of contaminants harmful to plant growth.

7.1.1 Subsoil

Subsoil shall:

a) be sampled and tested, in accordance with Clause 8.1.1, and

b) be ameliorated, in accordance with the recommendations of the *Soil Management Plan – Construction*.

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7.1.2 Topsoil

Topsoil shall be:

a) Site topsoil in accordance with Clause 7.1.2.1, or

b) imported topsoil in accordance with Clause 7.1.2.2.

Where practicable, Site topsoil shall be prioritised over imported topsoil.

7.1.2.1 Site topsoil

Site topsoil shall be:

a) topsoil stripped during clearing and grubbing operations, in accordance with MRTS04 *General Earthworks*, or topsoil in areas that have not been stripped

b) sampled and tested in accordance with Clause 8.1.2, and

c) manufactured in accordance with Clause 8.2.1.

When it is intended to use site topsoil, ensure the relevant clauses of Annexure MRTS04.1 *General Earthworks* is completed to promote the provision of adequate quantities of suitable material. Where insufficient quantities are available, additional imported materials may be required.

7.1.2.2 Imported topsoil

Imported topsoil shall:

a) be sampled and tested:

i. in accordance with Clause 8.1.2, and

ii. no later than six months before delivery to Site

b) be certified free prohibited or restricted biosecurity matter.

The Contractor shall provide quality assurance documentation from the supplier to demonstrate the imported topsoil is in accordance with the requirements of this Clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the Soil Management Plan – Construction.

7.1.2.3 Backfill soil material

Backfill soil material, used in planting holes deeper than 300 mm, shall be ameliorated subsoil excavated from the planting hole.

7.2 Soil amelioration agents

Soil amelioration agents may include:

a) agricultural lime

b) agricultural gypsum

c) agricultural dolomite

d) fertiliser

e) organic soil conditioner

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f) microbial inoculants

g) soil wetting agents, and

h) water holding agents.

7.2.1 Agricultural lime, agricultural dolomite and agricultural gypsum

Agricultural lime, agricultural dolomite and agricultural gypsum shall not be in a liquid form.

Agricultural lime shall be naturally occurring limestone (calcium carbonate $CaCO_3$).

Agricultural dolomite shall be naturally occurring dolomite (calcium magnesium carbonate $CaMg(CO_3)_2$).

Agricultural lime and agricultural dolomite shall meet the following parameter requirements:

a) have a neutralising value (NV) of 90 or above, determined using the Test Method 19A1 from the *Soil Chemical Methods: Australasia* (2011) by Rayment and Lyons

b) have a pH value of 8.5 +/- 0.5, determined using the test method in accordance with Clause 5.5 of AS 4419, and

c) have a particle size distribution of:

   i. 100% by weight to pass a 5 mm sieve

   ii. 95% by weight to pass a 3.5 mm sieve, and

   iii. 40% by weight to pass a 0.15 mm sieve.

Agricultural gypsum shall be naturally occurring grade 1 gypsum (calcium sulfate $CaSO_4 2H_2O$). Crushed plaster board is not permitted.

Agricultural gypsum shall meet the following parameter requirements:

a) a minimum 80% of gypsum

b) a moisture content of < 20%

c) have sodium content < 0.8%

d) have a total content (x-ray fluorescence test) of:

   i. 20% calcium (Ca)

   ii. 15% sulphur (S), and

   iii. < 2% sodium chloride (NaCl).

e) if manufactured – have a total content of heavy metals:

   i. < 0.001% cadmium (Cd), and

   ii. < 0.01% lead (Pb).

f) have a particle size distribution of:

   i. 100% by weight to pass a 6 mm sieve

   ii. 80% by weight to pass a 4 mm sieve, and

   iii. 50% by weight to pass a 2 mm sieve.

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The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this Clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the *Soil Management Plan – Construction*.

7.2.2 Fertiliser

Fertiliser shall be delivered to the project in bags or containers, each labelled in accordance the Queensland Agricultural Standards Regulation 1997.

Planting treatments shall be fertilised with controlled / slow release fertilisers.

Seeding and turf treatments shall be fertilised with a combination of soluble and controlled / slow release fertilisers.

Controlled / slow release fertilisers:

- provide nutrients to plants over a longer period of time compared to uncontrolled release fertilisers
- are cost effective by reducing the requirement for additional fertilising, and
- have a reduced risk of nutrient deficient related failures in planting treatments.

Soluble fertilisers:

- provide immediate but relatively short supply of nutrients
- are water soluble and highly leachable, with potential for translocating into water bodies or adjacent vegetation treatments and potentially causing potential harm, and
- have a higher risk of nutrient deficient related vegetation failures if not reapplied during vegetation development.

The N:P:K:S rates are intended to:

- address nutrient requirements for each vegetation treatment type, and
- allow flexibility to address soil nutrient deficiencies identified in the *Soil Management Plan – Construction*.

7.2.3 Organic soil conditioner

Organic soil conditioner shall comply with:

a) AS 4454 Clause 3.1.1.1 (d) mature compost

b) AS 4454 Clause 3.1.1.2 (a) soil conditioner, and

c) Form G of Appendix MRTS16.

The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this Clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the *Soil Management Plan – Construction*.

7.2.4 Microbial inoculants

Biological growth stimulants shall:

a) not be toxic to plant growth

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b) improve soil structure

c) stimulate seed germination

d) improve overall plant health and development, and

e) increase root mass and nutrient uptake.

Microbial inoculants shall comprise of one or more of the following:

a) beneficial bacteria / microbes, and / or

b) beneficial fungi / mycorrhizal fungi.

Where humic acid / humates are proposed for use, they must be combined with beneficial bacteria.

The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this Clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the *Soil Management Plan – Construction*.

7.2.5 Soil wetting and water holding agents

7.2.5.1 Soil wetting agents

Soil wetting agents (surfactants) shall:

a) have a life of at least three months from the time of application

b) reduce soil water repellence / hydrophobicity

c) reduce surface tension of soil particles

d) increase water penetration to soil, and

e) be free from matter toxic to plant growth.

7.2.5.2 Water holding agents

Water holding agents shall:

a) have a life of at least six months from the time of installation

b) hold water equal to at least 200 times their own mass

c) be hydrated / activated prior to installation, and

d) be free from matter toxic to plant growth.

Water holding agents shall be incorporated into the topsoil or installed in individual planting holes.

7.3 Pesticides

Pesticides shall:

a) be registered for use on roadsides and rights of way under the *Chemical Usage* (Agricultural and Veterinary) *Control Act* 1988, and

b) be registered for treatment of weeds by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

7.3.1 Knock-down herbicides

Knock-down herbicides shall be a broad spectrum, non-residual, glyphosate based herbicide that has been specifically manufactured for low aquatic toxicity.

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FOI 26-292 - Document 21

7.3.2 Target herbicides

Target herbicides shall be used exclusively for the eradication of the target plant species. The type of herbicide and target vegetation to be controlled shall be specified in Clause 3.1.1 of the Annexure MRTS16.1.

7.3.3 Insecticides

Insecticides shall treat target insect species infesting vegetation works.

7.3.4 Fungicides

Fungicides shall treat target diseases infesting vegetation works.

7.4 Seeding

7.4.1 Drill seeding

Drill seeding treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) fertiliser (Clause 7.4.10), and

g) water (Clause 7.7).

7.4.2 Broadcast Seeding

Broadcast seeding treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) dry coarse sand or sawdust

g) fertiliser (Clause 7.4.10), and

h) water (Clause 7.7).

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7.4.3 Hydromulch - Standard

Standard hydromulch treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the Soil Management Plan – Construction (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) fibre (Clause 7.4.3.1)

g) binder (Clause 7.4.3.2)

h) fertiliser (Clause 7.4.10), and

i) water (Clause 7.7).

7.4.3.1 Fibre

Fibres shall be free from matter toxic to plant growth, prohibited or restricted biosecurity matter, plant propagules, soil, rubbish, seed germination inhibitors and other deleterious materials. Fibre shall be in accordance with AS4454 Test Method I and Test Method M.

Fibre shall disperse into a uniform slurry when mixed with water.

Fibres shall have a mixture of fine material and longer fibres to promote interlocking and erosion control and provide a suitable environment for seed germination.

Fibre shall be supplied in bales covered with UV stabilised and weather resistant plastic, with a maximum moisture content of 15%. Fibre rates specified within respective construction clauses of this Specification are dry weight, with moisture content no greater than 15%.

Fibres shall be combined with a marker / tracer dye. Dye may be either pre-packaged with the fibre or included with the binder.

Fibres may be any of the following or combination of these fibres.

a) Sugar cane

Sugar cane fibre shall:

i. be predominantly sugar cane tops, and

ii. mechanically processed

b) Wood

Wood fibre shall:

i. be defibrated or other suitable fiberising process, and

ii. mechanically and thermally processed.

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c) Straw

Straw fibre shall:

i. be crop residue

ii. be predominantly stalk material, and

iii. mechanically and thermally processed.

d) Paper

Paper fibre shall:

i. be manufactured from hammer-milling or other suitable fiberising process, and

ii. be combined with other fibres, and be no greater than 25% of the total fibre weight used.

e) Coir

Coir fibre shall:

i. be a fine / peat grade product, suitable for use in seed raising, and

ii. be combined with other fibres, and be no greater than 25% of the total fibre weight used.

7.4.3.2 Binder

Standard hydromulch binder shall:

a) have a minimum two month functional longevity

b) be free from:

i. matter toxic to plant growth / seed germination

ii. plant propagules

iii. soil

iv. rubbish, and

v. other deleterious materials.

c) be manufactured for use in hydromulch or similar seeding applications

d) be readily dispersible

e) be highly soluble / hydro-colloidal

f) display a delayed development of viscosity before setting, and

g) be applied in accordance with manufacturer's specification.

Binders may be pre-packaged with fibre.

7.4.4 Hydromulch - Bonded Fibre Matrix

Bonded fibre matrix is a hydraulically applied mix of fibres and binder. Bonded fibre matrix products shall be proprietary products that have been tested to meet Table 7.4.4, or other suitable independent testing method deemed suitable. The Contractor shall provide quality assurance documentation from

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the supplier to demonstrate material is in accordance with Table 7.4.4, prior to delivery to Site. Bonded fibre matrix treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) fibre (Clause 7.4.4.1)

g) binder(Clause 7.4.4.2)

h) fertiliser (Clause 7.4.10), and

i) water (Clause 7.7).

Table 7.4.4 – Bonded Fibre Matrix Performance Standards

Property	Test Method	Tested Value
Functional longevity [1]	Observation	6 months
Minimum application rate	Observation	5000 kg/ha (500g/m^2)
Minimum application wet thickness	Observation	5 mm
Typical maximum slope gradient	Observation	≤ 1:2
Maximum uninterrupted slope length	Observation	20
Maximum C-Factor [2] (1:3 test)	ASTM 6459, or other suitable independent testing deemed suitable	0.05
Minimum vegetation establishment [3]	ASTM D7322, or other suitable independent testing deemed suitable	≥ 300%
Cure time	Observation	4 – 24 hour

[1] A manufacturer's estimated time period, based on field observations, that a product can be anticipated to provide effective erosion control.

[2] "C" Factor calculated as ratio of soil loss from a slope with the applied product, to a ratio of soil loss from an unprotected control slope.

[3] Calculated, as outlined in ASTM D7322, as a percentage by dividing the plant mass per area of the applied product plot by the plant mass per area of the untreated control plot.

7.4.4.1 Fibre

Fibres shall be free from matter toxic to plant growth, prohibited or restricted biosecurity matter, plant propagules, soil, rubbish, seed germination inhibitors and other deleterious materials. Fibre shall be in accordance with AS4454 Test Method I and Test Method M.

Fibre shall disperse into a uniform slurry when mixed with water.

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Fibres shall have a mixture of fine material and longer fibres to promote interlocking and erosion control and provide a suitable environment for seed germination.

Fibre shall be supplied in bales covered with UV stabilised and weather resistant plastic, with a maximum moisture content of 15%. Fibre rates specified within respective construction clauses of this Specification are dry weight, with moisture content no greater than 15%.

Fibres shall be combined with a marker / tracer dye. Dye may be either pre-packaged with the fibre or included with the binder.

Fibres may be any of the following or combination of these fibres.

a) Sugar cane

Sugar cane fibre shall:

i. be predominantly sugar cane tops, and

ii. mechanically processed

b) Wood

Wood fibre shall:

i. be defibrated or other suitable fiberising process, and

ii. mechanically and thermally processed.

c) Straw

Straw fibre shall:

i. be crop residue

ii. be predominantly stalk material, and

iii. mechanically and thermally processed.

d) Paper

Paper fibre shall:

i. be manufactured from hammer-milling or other suitable fiberising process, and

ii. be combined with other fibres and be no greater than 25% of the total fibre weight used.

e) Coir

Coir fibre shall:

i. be a fine / peat grade product, suitable for use in seed raising, and

ii. be combined with other fibres and be no greater than 25% of the total fibre weight used.

7.4.4.2 Binder

Bonded fibre matrix binder shall:

a) have a minimum six months functional longevity

b) be non-re-wettable

c) be crosslinked hydro-colloidal

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d) be free from:
   i. matter toxic to plant growth / seed germination
   ii. plant propagules
   iii. soil
   iv. rubbish, and
   v. other deleterious materials.
e) be readily dispersible
f) be highly soluble
g) display a delayed development of viscosity before setting, and
h) be applied in accordance with manufacturer's specification.

Binders may be pre-packaged with fibre.

Where binder is supplied / packaged separately from fibre, the manufacturer of the proprietary product(s), must provide certification the supplied materials and quantity / ratio is in accordance with the tested product, to meet the requirements of Table 7.4.4.

7.4.5 Hydro-compost

Hydro-compost is a hydraulically applied mix of compost, fibres and binder. The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the following compost, fibres and binder requirements, prior to delivery to Site.

Hydro-compost treatment:

a) topsoil (Clause 7.1.2) Note - Where a site topsoil is tested in accordance with Form C of Appendix MRTS16 and has less than 3% organic matter, Hydro-compost may be used to address organic matter requirements of the topsoil in lieu of ameliorating the stockpiled topsoil with organic soil conditioner.
b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)
c) topsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)
d) compost be a minimum 60% of the total product and shall comply with, or an approved equivalent of, the following:
   i. AS 4454 Clause 3.1.1.1 (d) mature compost
   ii. AS 4454 Clause 3.1.1.2 (a) soil conditioner, and
   iii. Form G of Appendix MRTS16.
e) soil microbial inoculants (Clause 7.2.4)
f) soil wetting agent (Clause 7.2.5.1)
g) seed (Clause 7.4.9)
h) fibre (Clause 7.4.4.1)

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i) binder (Clause 7.4.4.2)

j) fertiliser (Clause 7.4.10), and

k) water (Clause 7.7).

7.4.6 Straw Mulching

Straw mulching treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) dry coarse sand or sawdust, if broadcast seeding

g) straw mulching fibre (Clause 7.4.6.1)

h) bituminous emulsion binder (Clause 7.4.6.2)

i) fertiliser (Clause 7.4.10), and

j) water (Clause 7.7).

7.4.6.1 Fibre

Straw mulch shall:

a) be crop residue

b) be predominantly stalk material, and

c) be free from matter toxic to plant growth, plant propagules, soil, rubbish, and other deleterious materials.

Fibre rates specified within respective construction clauses of this Specification are dry weight, with moisture content no greater than 15%.

7.4.6.2 Binder

Bituminous binder shall:

a) be slow setting anionic bituminous emulsion (ASS) in accordance with the requirements of MRTS21 *Bituminous Emulsion*

b) be free from petroleum solvent or other components toxic to plant growth

c) be readily dispersible, and

d) display a delayed development of viscosity before setting.

Bituminous binder shall be further diluted 50 / 50 with water.

Application rates specified in Clause 8.5.1.6 is a diluted 50 / 50 rate.

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7.4.7 Organic Blanket

Organics blanket treatment:

a) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

b) soil microbial inoculants (Clause 7.2.4)

c) soil wetting agent (Clause 7.2.5.1)

d) seed (Clause 7.4.9)

e) binder (Clause 7.4.7.1)

f) fertiliser (Clause 7.4.10)

g) water (Clause 7.7), and

h) mulch and soil conditioner materials compliant with

   i. AS 4454 Clause 3.1.1.1 (d) mature compost

   ii. Form G of Appendix MRTS16, and

   iii. mulch particle size distribution of

< 75 mm	100%
> 16 mm	10-20%
5 - 16 mm	30 – 50%, and
< 5 mm	30 – 50%.

7.4.7.1 Binder

Standard hydromulch binder shall:

a) have a minimum two month functional longevity

b) be free from:

   i. matter toxic to plant growth

   ii. plant propagules

   iii. soil

   iv. rubbish, and

   v. other deleterious materials.

c) be manufactured for use in hydromulch or similar seeding applications

d) be readily dispersible

e) be highly soluble / hydro-colloidal

f) display a delayed development of viscosity before setting, and

g) be applied in accordance with manufacturer's specification.

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FOI 26-292 - Document 21

7.4.8 Seeded mesh lined drain

Seeded mesh lined drain treatment:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) seed (Clause 7.4.9)

f) organic mesh (Clause 7.4.8.1)

g) bituminous emulsion binder (Clause 7.4.8.2)

h) fertiliser (Clause 7.4.10), and

i) water (Clause 7.7)

7.4.8.1 Organic Mesh

Mesh used with seeding operations shall:

a) be an open jute or coir mesh material suitable for seeding operations

b) protect topsoil and seeding from water and wind erosion

c) be made from 100% biodegradable fabric

d) allow the exchange of air and water, and

e) not contain matter toxic to plant growth.

Fixing pins used to secure mesh shall be a minimum 30 x 200 mm steel U-pins.

The type of organic mesh shall be as specified in Clause 3.2.4 of the Annexure MRTS16.1.

> Jute mesh has an approximate life of 3 - 6 months in a drainage structure.
>
> Coir mesh has an approximate life of 6 – 18 months in a drainage structure.

7.4.8.2 Binder

Bituminous binder shall:

a) be slow setting anionic bituminous emulsion in accordance with the requirements of MRTS21 *Bituminous Emulsion*

b) be free from petroleum solvent or other components toxic to plant growth

c) be readily dispersible

d) be highly soluble, and

e) display a delayed development of viscosity before setting.

Bituminous binder shall be further diluted 50 / 50 with water.

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Application rates specified in Clause 8.5.1.8 is a diluted 50 / 50 rate.

7.4.9 Seeds

Grass seed shall be in accordance with Clause 7.4.9.1.

Woodland / forest seed shall be in accordance with Clause 7.4.9.2.

Seeds shall be tested in accordance with Clause 8.1.4.

Minimum seed application rates are based on a seed purity of 95% and germination / viability of 80%. Where purity and germination / viability test certificates indicate seed lots are outside these parameters, the contractor shall adjust the application rate of the species to meet the minimum requirements. Where purity and germination / viability is low, consideration should be given to seeking an alternate supply or using a substitute species with higher purity and germination / viability.

Seed pre-treatments such as inoculation, coating or anticide in accordance with Clause 3.2.1 of the Annexure MRTS16.1, or as shown on the drawings.

Seed shall be supplied in containers or bags at a size suitable for use per load by the seeding contractor (will vary depending on type of seeding and equipment used), or by area (for example, per 500 m^2).

Seed shall be supplied in sealed containers or bags labelled with:

a) Project identification

b) Lot / bag number

c) mix name

d) species and quantities of each species

e) total bag weight, and

f) date.

The seed supplier shall provide certification of the supplied seed per lot / bag number, including the individual species and weight per bag to demonstrate material is in accordance with the requirements of this Clause and the Seed Supply Proposal, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the *Seed Supply Proposal*.

Where seed species are unavailable the Contractor shall submit a proposal to substitute species, in accordance with the Seed Supply Proposal. Substitute species shall be suitable to the site conditions and be suitable for use in areas with applicable design constraints (clear zone, sight visibility and other vegetation setbacks and clearances)

Where seed species and application rates are specified in Clause 3.2.2 or Clause 3.2.3 of the Annexure MRTS16.1 or shown on the drawings, the Contractor:

a) shall regard the seed mix and application rates as the required minimum, and

b) may increase the seed species and / or application rates to ensure Clause 9.1.2 and / or Clause 9.2.2 completion criteria is achieved.

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It is recommended experienced agronomists, revegetation specialist and seed suppliers are consulted to develop seed mixes that are well suited to Site specific conditions, particular geographic regions and climatic zones of Queensland.

In developing seed mixes, consideration should be given to the adjoining landholder requirements (for example environmentally sensitive areas such State Forests / National Parks or pastoral / agricultural land) and minimising potential impacts.

A mixture of perennial grasses is required to reduce the risk of not achieving a suitable outcome. Perennial grass species selection should prioritise species:

- commonly found in the area, particularly turf or pasture areas
- suitable for the soil type and annual rainfall of the site / treatment area, and
- that are commercially available and cost effective.

It is important to note that some native grass species may not be suitable for seeding due to:

- lower germination and establishment rates
- shape / morphology relative to mechanical applicators
- an inability to compete with exotic grass species (included in the seed mix or in sites adjoining the Site), and
- availability.

7.4.9.1 Grass seed

Grass seed mix application rates shall be:

a) in accordance with Table 7.4.9.1

b) specified in Clause 3.2.2 of the Annexure MRTS16.1and / or shown on the drawings

c) included in the Seed Supply Proposal, and

d) based on a minimum 95% purity and 80% germination / viability.

Perennial grass species shall:

a) be perennial species

b) not exceed a mature height of 700 mm, and

c) be commonly found in the region.

Seeds shall be tested in accordance with Clause 8.1.4. The Contractor shall use the purity and germination / viability test certificates to adjust the application rates to achieve the minimum purity and germination / viability requirements.

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Table 7.4.9.1 – Grass seed mix application rate

Time of Year	Description	Total Application Rate kg / ha
Perennial Species		
All	Cynodon dactylon (Green Couch) – Hulled	10
	Cynodon dactylon (Green Couch) – Un-Hulled	10
	Mix of three additional perennial grass species*	15
Cover Crop Species		
Apr - Aug	50% Annual Rye and 50% Annual Millet	10
Sep - Mar	100% Annual Millet	

Perennial grass species, shall contain a minimum 50% by weight of species existing within or adjoining the Site.

* Urban Areas (High profile areas, as per Table 2 – Definition of Terms) – a default mix of Cynodon dactylon 20 kg / ha hulled, 20 kg / ha unhulled and 10 kg / ha cover crop shall be used.

A mixture of perennial grasses is required to reduce the risk of not achieving a suitable outcome. Perennial grass species selection should prioritise species:

- commonly found in the area, particularly turf or pasture areas
- suitable for the soil type and annual rainfall of the site / treatment area,
- that are commercially available and cost effective, and
- are suitable to exposed, full sun conditions.

It is important to note that some native grass species may not be suitable for seeding due to:

- lower germination and establishment rates
- shape / morphology relative to mechanical applicators
- an inability to compete with exotic grass species (included in the seed mix or in sites adjoining the Site), and
- availability.

7.4.9.2 Woodland / forest seed

Woodland / forest seed mix application rates shall be:

a) in accordance with Table 7.4.9.2

b) specified in Clause 3.2.3 of the Annexure MRTS16.1 and / or shown on the drawings

c) included in the Seed Supply Proposal, and

d) based on a minimum 95% purity and 80% germination / viability.

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Woodland / forest species shall:

a) be endemic to the region

b) be species with a mature height and width greater than 1.2 m

c) not include groundcover species, and

d) not include vine or climbing species.

Grass species shall be in accordance with Clause 7.4.9.1

Hard cased woodland / forest species seed shall be pre-treated by the supplier, by scarification of the seed case, unless otherwise specified in Seed Supply Proposal, and

Seeds shall be tested in accordance with Clause 8.1.4. The Contractor shall use the purity and germination / viability test certificates to adjust the application rates to achieve the minimum purity and germination / viability requirements.

Table 7.4.9.2 – Woodland / forest seed mix application rate

Time of Year	Description	Total Application Rate kg / ha
Native Woodland / Forest Species		
All	Mix of a minimum of three Acacia species*	5
	Mix of a minimum of three tree species*	2
	Mix of a minimum of three shrub species	1
Perennial Grass Species		
All	Cynodon dactylon (Green Couch) - Hulled	10
	Cynodon dactylon (Green Couch) – Un-Hulled	10
	Mix of three perennial species	15
Cover Crop Species		
Sep - Mar	100% Annual Millet	10
Apr - Aug	50% Annual Rye and 50% Annual Millet	

Woodland / Forest Species and Perennial grass species shall contain a minimum 50% by weight of species existing within or adjoining the Site.

* Where woodland / forest seed mix is proposed within road design constraint areas (clear zone and other vegetation setbacks and clearances), shrub species shall be used.

The intent of the woodland / forest species mix is to establish pioneer plant species to stabilise the site and provide a framework for natural successional processes to occur. The grass species provide the initial stabilisation of the Site, reducing runoff, increasing water absorption and improving soil biological systems. The acacia species are pioneer species which, over several years, assist in further stabilising the Site and developing soil conditions conducive to allowing subsequent succession with climax species.

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7.4.10 Seeding fertilisers

Fertiliser shall:

a) be in accordance with Clause 7.2.2

b) be in accordance with Table 7.4.10, and

c) be in accordance with the *Soil Management Plan – Construction*.

Fertiliser shall be applied in the N:P:K:S rates in Table 7.4.10, unless specified otherwise in the *Soil Management Plan – Construction*.

The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this Clause, prior to delivery to site. The documentation shall be incorporated as an Appendix to the *Soil Management Plan – Construction*.

Table 7.4.10 – Seeding Fertiliser N:P:K:S Rates

	Soluble	Controlled / Slow Release
N	20 – 40 kg / ha	10 – 15 kg / ha
P	10 - 40 kg / ha	
K	20 - 80 kg / ha	
S	5 – 30 kg / ha	
Trace elements	As required	

An example fertiliser NPKS analysis of 10:10:20:6 applied at 100 kg / ha delivers approximately the following quantities of NPKS.

N – 10 kg/ha

P – 10 kg/ha

K – 20 kg/ha

S – 6 kg/ha

Accordingly, a minimum 200 kg / ha of the example fertiliser would need to be applied to meet the minimum NPKS rates.

7.5 Turfing

7.5.1 Turfing treatment material

Turfing treatment materials:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

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e) turf (Clause 7.5.2)

f) fertiliser (Clause 7.5.3), and

g) water (Clause 7.7).

7.5.2 Turf

Turf shall:

a) have a minimum 30 mm depth of sod

b) be in a healthy condition

c) be free from prohibited or restricted biosecurity matter, pests, diseases and matter toxic to plant growth

d) show signs of active growth, and

e) be true to the form of the specified species.

A-grade turf shall consist of a minimum 95% of the specified turf species.

B-grade turf shall consist of a minimum 80% of the specified turf species.

Turf species, turf grade and roll width shall be specified in Clause 3.3.1 of the Annexure MRTS16.1.

The Contractor must provide Turf Certification of the species.

A-grade turf must be used in high profile urban areas such as:

- pedestrian areas and shared paths
- transport stations, and
- areas fronting residential property.

B-grade turf is suitable for all other areas other than high profile urban areas as noted above.

7.5.3 Turf fertiliser

Fertiliser shall:

a) be in accordance with Clause 7.2.2

b) be in accordance with Table 7.5.3, and

c) be in accordance with the *Soil Management Plan – Construction.*

Fertiliser shall be applied in the N:P:K:S rates in Table 7.5.3, unless specified otherwise in the *Soil Management Plan – Construction.*

The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this Clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the. *Soil Management Plan – Construction.*

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Table 7.5.3 – Turf Fertiliser N:P:K:S Rates

	Soluble	Controlled / Slow Release
N	20 – 40 kg / ha	10 – 15 kg / ha
P	10 – 40 kg / ha	
K	20 – 80 kg / ha	
S	5 – 30 kg / ha	
Trace elements	As required	

An example fertiliser NPKS analysis of 10:10:20:6 applied at 100 kg / ha delivers approximately the following quantities of NPKS.

N – 10 kg/ha

P – 10 kg/ha

K – 20 kg/ha

S – 6 kg/ha

Accordingly, a minimum 200 kg / ha of the example fertiliser would need to be applied to meet the minimum NPKS rates.

7.6 Planting

7.6.1 Planting treatment materials

Planting treatment materials:

a) topsoil (Clause 7.1.2)

b) subsoil ameliorants (gypsum, lime, dolomite) where required by the *Soil Management Plan – Construction* (Clause 7.2.1)

c) soil microbial inoculants, where specified in Clause 3.6 of the Annexure MRTS16.1(Clause 7.2.4)

d) soil wetting agent (Clause 7.2.5.1)

e) water holding agents, where specified in Clause 3.6 of the Annexure MRTS16.1 (Clause 7.2.5.2)

f) containerised plants and ex-ground stock (Clause 7.6.2)

g) mulch (Clause 7.6.3)

h) organic matting, where specified (Clause 7.6.4)

i) stakes and guys (Clause 7.6.5)

j) subsoil drain, where required, (Clause 7.6.6)

k) fertiliser (Clause 7.6.7), and

l) water (Clause 7.7).

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FOI 26-292 - Document 21

7.6.2 Containerised plants and ex-ground stock

Plants may be obtained from:

a) nurseries, and / or

b) harvested plant material from Site.

Nurseries shall be members of *Nursery and Garden Industry Australia / Queensland*.

Plant container sizes include:

a) < 25 L container stock:

   i. Viro tube (macrophytes only)

   ii. Full native tube (50 x 50 x 130)

   iii. 140 mm

   iv. 200 mm, and

   v. 300 mm.

b) ≥ 25 L container stock:

   i. 25 L

   ii. 45 L

   iii. 100 L

   iv. 200 L

   v. 400 L, and

   vi. ex-ground stock.

Plant material shall:

a) be acclimatised to the conditions of the Site – by sun hardening and reducing watering

b) be of a size appropriate to the container size

c) be in a healthy condition free from weeds, pests and diseases

d) be free of prohibited or restricted biosecurity matter

e) not be showing signs of nutrient or water deficiency, heat stress, notable pest damage or other physical damages

f) be showing signs of active growth relative to season and true to form of the species

g) have a healthy root system and not be pot bound

h) be clearly and correctly labelled according to botanical name

i) have water resistant labels and tied securely to a minimum one species per tray, and

j) be delivered to site in fully enclosed trucks (container stock < 200 L).

Trees shall have a single, healthy, undamaged leading stem unless otherwise specified.

Trees shall be in accordance with AS2303 *Tree Stock for Landscape Use*.

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Plant species, quantities, container sizes, mature heights and widths; and planting densities shall be specified in Clause 3.4.1 of the Annexure MRTS16.1 and shown on the drawings.

7.6.3 Mulch

Mulch shall be:

a) Site manufactured mulch, or

b) imported mulch.

7.6.3.1 Site manufactured mulch

Site manufactured mulch shall:

a) be manufactured from vegetation material set aside during clearing and grubbing operations in accordance with MRTS04 *General Earthworks*

b) be free from contaminants, rubbish and deleterious material

c) be free from weeds, including prohibited or restricted biosecurity matter, and

d) be manufactured in accordance with Clause 8.2.2.

> Where vegetation exists on site and it is intended to use it to produce site manufactured mulch for use in permanent landscape works or temporary erosion and sediment control works, ensure the retention of adequate quantities of suitable material is nominated in the Annexure MRTS04.1 *General Earthworks*.

7.6.3.2 Imported mulch

Imported mulch shall:

a) comply with the requirements of AS 4454, Clause 3.1.1.1 (c) composted product

b) be free from contaminants, rubbish and deleterious material, and

c) be certified free from weeds, including prohibited or restricted biosecurity matter.

The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this clause, prior to delivery to Site.

Mulch type and size shall be as specified in Clause 3.4.2 of the Annexure MRTS16.1.

7.6.4 Organic matting

Organic matting used with container planting operations shall:

a) be a high density material suitable for container planting operations

b) be made from 100% biodegradable fabric

c) minimise weed growth

d) reduce soil moisture loss

e) protect topsoil from water and wind erosion

f) allow the exchange of air and water, and

g) not contain matter toxic to plant growth.

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Organic matting used with container planting operations in drainage structures shall be capable of withstanding design water velocities until vegetation is established.

Jute or coir mesh may be used to secure mulch on 1:2 scopes.

Fixing pins used to secure matting shall be a minimum 30 x 200 mm steel U-pins.

The type of organic matting shall be as specified in Clause 3.4.3 of the Annexure MRTS16.1

7.6.5 Stakes and guys

Stakes and guying shall be in accordance with Table 7.6.5.

Table 7.6.5 – Stakes and guys

Description	Container	Ties	Number of Stakes
600 x 10 mm diameter bamboo	Tube – 200 mm stock (marker for supplementary planting in seeded areas only)	-	1
1500 x 25 x 25 mm hardwood	25 – 45 L (tree species only)	✓	2
1800 x 50 x 50 mm hardwood	100 L stock (tree species only)	✓	
Guys*	≥ 200 L and ex-ground	-	4

*Guys shall be a proprietary underground tree guying system, installed in accordance with a manufacturer's recommendations.

7.6.6 Subsoil drain

Subsoil drains shall:

a) have a 100 mm perforated drainage pipe with textile sleeve compliant with AS 2439.1

b) have backfill material consisting of a single-sized aggregate of 20 mm or 10 mm particle size, with a maximum of 5% passing the AS 0.15 mm sieve, and

c) have a geotextile surround compliant with Clause 6 of MRTS27 *Geotextiles (Separation and Filtration)*.

7.6.7 Planting fertilisers

Fertilisers shall:

a) be in accordance with Clause 7.2.2

b) be controlled / slow release, minimum 6 months

c) applied in accordance with the manufacturer's application rate, and

d) have an N:P:K analysis within the following ranges, unless specified otherwise in the *Soil Management Plan – Construction*:

   i. N: 7 – 22

   ii. P: 1 – 6

   iii. K: 2 – 10

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The Contractor shall provide quality assurance documentation from the supplier to demonstrate material is in accordance with the requirements of this clause, prior to delivery to Site. The documentation shall be incorporated as an Appendix to the *Soil Management Plan – Construction*.

7.7 Water

Water used for vegetation works shall be:

a) potable water, or

b) recycled water, in accordance with Clause 7.7.1, or

c) non-potable water (dam, creek, river and bore water) in accordance with Clause 7.7.2.

7.7.1 Recycled water

Recycled water used for vegetation works shall:

a) contain no substances toxic to plant growth

b) have a pH between 6 and 8.5 (inclusive)

c) have a total soluble salts concentration less than 1000 mg / L, and

d) be Class A or A+ only, in accordance with the *Queensland Water Recycling Guidelines (EPA 2005)*

e) be sourced from a supplier with a Recycled Water Management Plan prepared in accordance with the *Recycled Water Management Plan and Validation Guidelines (DEWS 2008)*

f) be managed and handled in accordance with the *Guide to Workplace use of Non-potable Water Including Recycled Waters (DIER 2007)*, and

g) have relevant signage erected in accordance with the AS/NZ 1319:1994 – *Safety Signs for the Occupational Environment*.

7.7.2 Non-potable water (dam, creek, river and bore water)

Non-potable water (excluding recycled water) used for vegetation works shall:

a) contain no substances toxic to plant growth

b) have a pH between 6 and 8.5 (inclusive)

c) have a total soluble salts concentration less than 1000 mg / L, and

d) be sampled and tested in accordance with Clause 8.1.3

e) be managed and applied, in accordance with the *Form H of MRTS16 Appendix*, and

f) have relevant signage erected in accordance with the AS/NZ 1319:1994 – *Safety Signs for the Occupational Environment*.

Water from sediment basins shall not be used for irrigating landscape and revegetation treatments.

> Sediment basins are typically required to be flocculated and discharged within 5 days of a rain event. This timeframe does not allow for adequate testing. There is a high risk of water being toxic to vegetation where over flocculation occurs with salt and metal based flocculants.

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7.8 Planting bed edging

7.8.1 Concrete planting bed edging

Concrete planting bed edging shall:

a) be 150 x 150 mm

b) be Class N25/10 concrete, in accordance with MRTS70 *Concrete*

c) have expansion joints installed at regular intervals not exceeding 20 m

d) have contraction joints between expansion joints at regular intervals not exceeding 5 m and / or at changes of curvature, and

e) be installed on subgrade compacted in accordance with the requirements of Clause 15 of MRTS04 *General Earthworks*.

Concrete testing not required.

7.9 Irrigation system

Irrigation system materials shall:

a) comply with relevant Australian Standards, and

b) meet the requirements of the applicable Local Government.

Materials used for electrical cabling and fittings shall comply with the requirements of MRTS228 *Electrical Switchboards* and MRTS256 *Power Cables*.

Specific irrigation design type and requirements shall be specified in Clause 3.5 of the Annexure MRTS16.1.

7.10 Material supplementary requirements

Material supplementary requirements of MRTS16 *Landscape and Revegetation Works* shall be specified in Clause 3.6 of the Annexure MRTS16.1.

8 Construction

The extent and types of vegetation treatments shall be installed as shown on the drawings, or as specified elsewhere in the Contract.

8.1 Sampling and testing

8.1.1 Subsoil sampling and testing

8.1.1.1 Subsoil sampling

Sampling shall be conducted by a soil scientist with qualifications in accordance with Clause 6.2. Where an accredited soil scientist is unavailable in a remote location, soil sampling will be carried out under the direction of the Administrator.

Sampling for each test shall comply with the following requirements:

a) be representative of the subsoil type and not include different subsoil types or topsoil layers

b) be in accordance with Table 8.1.1.1

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c) be composed of a composite of 10 sub-samples representative of the subsoil lot (top 200 mm final trimmed cut batter face or bench, final trim fill batter face, final trimmed broadacre areas beyond the batter)

d) be approximately 1 kg

e) be placed in clean, sealable, durable plastic bags clearly labelled with:

   i. Project name

   ii. Job / Contract number

   iii. Sample date

   iv. Sample Location, including GPS or chainage reference

   v. Sample material layer / type, and

   vi. Lot / sub-lot identification.

f) be submitted to a laboratory for testing with a copy of the relevant testing Form, in accordance with Clause 8.1.1.2.

Table 8.1.1.1 – Subsoil sampling requirements

Subsoil	Sampling Frequency
Subsoil	One test per subsoil type
Drainage Basin	One test per subsoil type / 1 test per drainage basin

Consider undertaking field testing (for example, pH, EC and dispersion/slaking) to validate representative sampling.

Consideration should be given to increasing sampling and frequencies, as benefits include:

- reduced risk of anomalies or errors made during the sampling process
- greater certainty of results and recommendations, minimising the risk of poor outcomes
- reduced risk of inadequate amelioration recommendations for stockpiled topsoil, resulting in non-compliant results during compliance testing, required rework and further testing, and
- a relatively small increase in sampling / testing costs compared with the high costs and program delay of rework operations.

8.1.1.2 Subsoil testing

Testing shall be in accordance with Table 8.1.1.2.

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Table 8.1.1.2 – Subsoil testing requirements

Soil Testing	Set of Tests Required
Subsoil	*Form E of MRTS16 Appendix*
Drainage Basin	*Form F of MRTS16 Appendix*

A Soil Assessment Report shall be:

a) prepared for each sample

b) prepared by a soil scientist with accreditations in accordance with Clause 6.2

c) in accordance with *Form B of MRTS16 Appendix*

d) used to develop the *Soil Management Plan – Construction*, and

e) incorporated as an Appendix to the *Soil Management Plan – Construction*.

Guidance on amelioration strategies, rates and targets are provided in *Form B of MRTS16 Appendix*.

8.1.2 Topsoil sampling and testing

8.1.2.1 Topsoil sampling

Sampling shall be conducted by a soil scientist with qualifications in accordance with Clause 6.2. Where an accredited soil scientist is unavailable in a remote location, soil sampling will be carried out under the direction of the Administrator.

Sampling for each test shall comply with the following requirements:

a) be representative of the topsoil type and not include different soil types or layers

b) be in accordance with Table 8.1.2.1

c) where sampling stockpiles, sub-samples shall be sampled from various locations, 0.5 m within the stockpile

d) be composed of a composite of 10 sub-samples representative of the topsoil

e) be approximately 3.0 kg

f) be placed in clean, sealable, durable plastic bags clearly labelled with:

   i. Project name

   ii. Job / Contract number

   iii. Sample date

   iv. Sample Location, including GPS or chainage reference

   v. Sample material layer / type, and

   vi. Lot / sub-lot identification.

g) be submitted to a laboratory for testing with a copy of the relevant testing Form, in accordance with Clause 8.1.2.2.

Compliance sampling of manufactured site soil should ideally be tested between one and four weeks after manufacture.

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Table 8.1.2.1 – Topsoil sampling requirements

Topsoil	Sampling Frequency
Insitu Topsoil	1 per 2500 m^2 with a minimum of 1 test per topsoil type
Site Stockpiled Topsoil	2 per 500 m^3 with a minimum of 1 test per topsoil type
Manufactured Site Topsoil Compliance Testing	2 per 500 m^3 with a minimum of 1 test per topsoil type
Imported Topsoil	1 per 500 m^3 with a minimum of 1 test per manufactured batch

Allow sufficient time for soil sampling, testing assessment reporting to minimise delays in the construction program.

Consider sampling and testing site topsoil prior to stripping, for efficient and effective incorporation of ameliorants during the stripping process.

A soil sample should not contain any large particles whereas the sampled stockpile may; the soil sample would comply relevant to this requirement but not the stockpiled soil in general, therefore observation of the stockpiled soil is necessary.

Consideration should be given to increasing sampling and frequencies, as benefits include:

- reduced risk of anomalies or errors made during the sampling process
- greater certainty of results and recommendations, minimising the risk of poor outcomes
- reduced risk of inadequate amelioration recommendations for stockpiled topsoil, resulting in non-compliant results during compliance testing, required rework and further testing, and
- a relatively small increase in sampling / testing costs compared with the high costs and program delay of rework operations.

8.1.2.2 Topsoil testing

Testing shall be in accordance with Table 8.1.2.2.

Table 8.1.2.2 – Topsoil testing requirements

Topsoil	Set of Tests Required
Site Topsoil	*Form C of MRTS16 Appendix*
Manufactured Site Topsoil Compliance Testing	*Form D of MRTS16 Appendix*
Imported Topsoil	*Form C of MRTS16 Appendix*

A Soil Assessment Report shall be:

a) prepared for each sample

b) prepared by a soil scientist with accreditations in accordance with Clause 6.2

c) in accordance with *Form B of MRTS16 Appendix*

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d) used to develop the *Soil Management Plan – Construction*, and

e) incorporated as an Appendix to the *Soil Management Plan – Construction*.

Guidance on amelioration strategies, rates and targets are provided in *Form B of MRTS16 Appendix*.

8.1.3 Non-potable water (dam, creek, river and bore water) sampling and testing

8.1.3.1 Non-potable water sampling

Sampling location and frequency shall be in accordance with Table 8.1.3.1.

Table 8.1.3.1 – Non-potable water sampling

Type	Sample Location	Sampling Frequency
Dams	Away from the edge 500 mm below the surface. If it is not possible, sample close to where the pump draws water, or at the first outlet along the supply line.	When water levels fluctuate, or when water quality visually changes
Creeks or Rivers	From the main flow where water movement is constant. Do not sample where there is little or no flow.	When water levels / flow rates fluctuate, or when water quality visually changes
Bores	Before sampling, allow the water to flow for sufficient time to remove standing water in pipes.	When water quality visually changes, or when an odour occurs

Sampling for each test shall comply with the following requirements:

a) be approximately 1 L

b) contain no air spaces in the bottle

c) be placed in a clean, sealable, durable plastic bottle clearly labelled with

   i. Project name

   ii. Job / Contract number

   iii. Sample date

   iv. Sample Location, including GPS or chainage reference

   v. Sample material layer / type, and

   vi. Lot / sub-lot identification.

d) be submitted to a laboratory for testing with a copy of the *Form I of MRTS16 Appendix*, in accordance with Clause 8.1.3.2.

8.1.3.2 Non-potable water testing

A Non-Potable Water Testing and Assessment Report shall be:

a) prepared for each sample tested

b) in accordance with *Form I of MRTS16 Appendix*

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c) used to develop the *Non-potable Water Management Plan*, and

d) incorporated as an Appendix to the *Non-potable Water Management Plan*.

8.1.4 Seed Testing

Seeds shall be tested to determine:

a) purity percentage, and

b) germination / viability percentage.

A certificate for each species shall be included in the Appendix of the Seed Supply Proposal, and include the following:

a) species of the seed

b) purity percentage

c) germination / viability percentage, and

d) pre-treatments or coatings that have been applied to the seed.

Grass seed purity and germination / viability certificates shall be no older than 6 months old.

Tree and shrub seed purity and germination / viability certificates shall be no older than 1 year old.

> Projects with a long duration require seed testing to be conducted regularly to ensure the minimum certificate ages are within the required timeframes.

8.2 Site manufactured materials

8.2.1 Manufacture of site topsoil

Site topsoil shall be manufactured in accordance with the *Soil Management Plan – Construction* by:

a) ameliorating topsoil with amelioration agents, and

b) screening, or similar operation, to achieve particle size requirements and / or to incorporate amelioration agents.

Note - fertilisers and wetting agents shall be applied during the installation of the vegetation works treatments.

Where not in accordance with *Form D of MRTS16 Appendix*, manufactured site topsoil shall have additional amelioration and testing until compliance is achieved. Manufactured site topsoil shall be in accordance with *Form D of MRTS16 Appendix* prior to being used. **Hold Point 7**

Where manufactured topsoil is to be stockpiled greater than two weeks, it shall be suitably stabilised by either seeding with a cover crop or applying a polymer based soil binder.

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Consideration should be given to testing topsoils prior to stripping to identify the most suitable topsoils and stripping depths. This may also allow for application of ameliorants to the topsoil surface prior to stripping. This is an efficient method to incorporate the ameliorants during the stripping process.

Where site constraints do not allow for stockpiling of stripped site topsoil, it may be more cost effective to use a topsoil free vegetation treatment such as organics blanket seeding in lieu of importing and spreading topsoil.

8.2.2 Manufacture of site mulch

Site mulch shall be produced from material set aside during clearing and grubbing operations as specified in Annexure MRTS04.1 *General Earthworks*. Material must not contain prohibited or restricted biosecurity species.

Mulch shall be manufactured by:

a) double tub grinding vegetation to produce a fine material, with a maximum dimension of 75 mm

b) stockpiling material to a maximum height of 2 m, and

c) initially watering the stockpile so the entire stockpile is moist.

Mulch stockpiles shall:

a) not be located near water bodies or concentrate drainage flows or timber structures

b) not be located within the drip line of retained trees, and

c) be maintained weed free; weeds which appear shall be treated immediately.

8.2.3 Harvesting of site vegetation material

8.2.3.1 Harvesting of site seed material

Seeds shall be harvested and stored for in accordance with the *Seed Harvesting Proposal*.

8.2.3.2 Harvesting of site plant material

Plant material shall be harvested, stored and cared for in accordance with the *Plant Harvesting Proposal*.

8.3 Weed control

Prior to the commencement of ground preparation operations, the area shall be in a weed free condition. **Witness Point 2**

All prohibited and restricted Biosecurity Matters shall be addressed as per MRTS51 *Environmental Management* and the EMP-C.

Weed control methods include:

a) mechanical application of herbicide using boom spray or high volume power applicator

b) manual application of herbicide from knapsack or similar applicator, or

c) manual methods, including removal and disposal of weeds.

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Application devices shall be calibrated to deliver prescribed rates of product in accordance with the manufacturer's instructions.

Where a herbicide is required to be applied to hazardous areas, as defined by the *Agricultural Chemicals Distribution Control Act (1966)*, the Contractor shall obtain and submit a distribution permit to the Administrator.

Handling and application of herbicides shall:

a) only be carried by a licensed contractor who possess qualifications and licences relevant to the products being applied

b) be in accordance with the *Agricultural Chemicals Distribution Control Act (1966)*

c) be in accordance with permit instructions under the *Chemical Usage (Agricultural and Veterinary) Control Act (1988)*

d) be in accordance with the manufacturer's instructions, and

e) be applied with biodegradable, non-toxic tracer dye to highlight areas sprayed.

The Contractor shall maintain records of spray activities.

Where herbicides are prohibited from use, weeds shall be removed by hand and disposed off site in accordance with Clause 11 of MRTS04 *General Earthworks* and relevant bio-security requirements.

Manual methods of weed control, weed removal and target vegetation shall be specified in Clause 3.1.2 of the Annexure MRTS16.1.

8.4 Ground preparation works

Ground preparation work operations include:

a) subsoil operations, and

b) topsoil operations.

8.4.1 Subsoil operations

Subsoil operations include:

a) sampling and testing, in accordance with Clause 8.1.1

b) spreading amelioration agents on subsoil, in accordance with Clause 8.4.1.1

c) ripping, in accordance with Clause 8.4.1.2

d) cultivation, in accordance with Clause 8.4.1.3, and

e) roughening, in accordance with Clause 8.4.1.4.

8.4.1.1 Spreading of amelioration agents on subsoil

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Ground preparation operations shall occur immediately after the application of amelioration agents.

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The actual type and quantity of amelioration agent to be applied is determined through testing the subsoil and completing the relevant sections in the Soil Assessment Report and Soil Management Plan – Construction.

8.4.1.2 Ripping

Ripping shall be used in areas to be vegetated with slopes ≤ 1 on 4 where soil has been compacted. For example, decommissioned site compounds and building pads, parking areas, stockpile areas, roads and haul routes, and general areas compacted by construction works.

Ripping shall:

a) be a minimum 300 mm depth, with rip lines at 500 mm maximum spacing

b) be to just below the depth of the compacted layer

c) incorporate amelioration agents into the subsoil

d) occur when soils are dry enough to shatter compacted subsoil sufficiently to allow subsequent cultivation operation

e) be parallel to the contour

f) not invert soil layers, and

g) be followed with the spreading of amelioration agents **Witness Point 3**

h) be followed with the cultivation operation, in accordance with Clause 8.4.1.3, to produce a finely tilled planting bed.

Ripping shall not occur within the drip line of vegetation to be retained, or within 300 mm of paths, kerbs, road furniture or structures.

8.4.1.3 Cultivation

Cultivation shall be used in areas to be vegetated with slope ≤ 1 on 4.

Cultivation shall occur immediately after the application of amelioration agents. **Witness Point 4**

Cultivation shall:

a) be a minimum 150 mm depth

b) incorporate amelioration agents into the subsoil

c) occur when soils are dry enough to break up the surface of the subsoil to produce a finely tilled planting bed, and

d) be parallel to the contour.

All stone, rubble and other deleterious material greater than 40 mm that is brought to the surface in areas to be mown / slashed in the future shall be removed.

Cultivation shall not occur within the drip line of vegetation to be retained, or within 300 mm of paths, kerbs, road furniture or structures. Hand cultivation is required in these locations.

8.4.1.4 Roughening

Roughening shall be used in areas to be vegetated with slope > 1 on 4.

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Roughening shall occur immediately after the application of amelioration agents. **Witness Point 5**

Roughening shall:

a) be approximately 50 mm depth

b) incorporate amelioration agents into the subsoil

c) occur when soils are dry enough to roughen / break up / crumb the surface, and

d) be parallel to the contour and form keys in the subsoil to prevent subsequent material slipping down the face of the slope

8.4.2 Topsoil operations

Topsoil work operations include:

a) sampling and testing, in accordance with Clause 8.1.2

b) manufacture of topsoil, in accordance with Clause 8.2.1

c) importation of topsoil, and

d) installation of topsoil, in accordance with Clause 8.4.2.1.

Allow sufficient time for soil sampling, testing assessment reporting; and amelioration and screening operations to minimise delays in the construction program.

Where topsoil is scheduled in the plans and allowance should be made for manufacturing site topsoil and / or for the importation of topsoil. Generally, the department prioritises the use of site won materials; however when there is a shortfall, or when it is not feasible to ameliorate or where site storage constraints apply, importation of topsoil may be required. Alternatively the use of an alternate treatment such as organic blanket which does not require topsoil, may be considered.

8.4.2.1 Installation of topsoil

Topsoil shall be installed within three days of the subsoil operations.

Topsoil shall be spread to the depths described in the relevant vegetation works operation, and allow for settlement after installation.

The Contractor shall give at least three days notice before installation of topsoil. **Witness Point 6**

8.5 Vegetation works

Vegetation work operations include:

a) seeding

b) turfing, and

c) planting.

8.5.1 Seeding

Seeding operations include:

a) drill seeding

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b) broadcast seeding

c) hydromulch - standard

d) hydromulch - bonded fibre matrix

e) hydro-compost

f) straw mulching, and

g) organics blanket.

Do not apply seeding during rain or where the soil is too wet for machinery.

The Contractor shall prepare a sample installation to provide an agreed quality control for further installations **Hold Point 9**

All seeds, wetting agents, binders, fibre and fertilisers are to be bought to site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

Sample installation shall form part of the final project. A sample area shall be prepared for each distinct area / and or seed mix. A sample area shall remain valid as a sample area for a maximum fourteen days (growth of cover crop / grass will change the appearance of a sample area).

The Contractor and Administrator shall:

a) determine the volume of fibre the tank can apply (volume varies with tank / pump and fibre / binder used) to determine a suitably sized sample area (minimum 100 m²)

b) clearly mark out the extent of the sample area

c) verify quanitites to be loaded into the tank / machinery

d) apply the seeding to the sample area in accordance with the relevant seeding clause. Ensure the minimum fibre depth is achieved (depth achieved will vary with fibre type / product and the roughness of the surface; the rougher the surface, the more fibre required to achieve the minimum depths).

e) where required, increase the fibre rate in order to achieve the minimum depth coverage based on the typical roughness / finish of the surface.

8.5.1.1 Drill seeding

Drill seeding shall be in accordance with Table 8.5.1.1.

Table 8.5.1.1 - Drill seeding

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering
≤ 1 on 4	1651	1*	Ripping* 300 mm Cultivation 150 mm	75 mm	10 L /m²
> 1 on 4	Not suitable for drill seeding machinery				

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

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FOI 26-292 - Document 21

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Drill seeding shall be installed within two days from the completion of the topsoil operation.

All seed, wetting agents and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

Drill seeding shall be installed:

a) parallel to the contour

b) by drilling seed and fertiliser into the topsoil, ensuring the seed is covered by topsoil, and

c) by watering, on the day of installation, with a solution of water and wetting agent, until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

8.5.1.2 Broadcast seeding

Broadcast seeding shall be in accordance with Table 8.5.1.2.

Table 8.5.1.2 – Broadcast seeding

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering
≤ 1 on 4	1651	1*	Ripping* 300 mm Cultivation 150 mm	75 mm	10 L /m²
> 1 on 4	1651	2	Roughening 50 mm		

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Broadcast seeding shall be installed within two days from the completion of the topsoil operation.

All seed, wetting agents and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

Broadcast seeding shall be installed:

a) by blending a broadcast mixture of seed, fertiliser and a bulking agent such as dry, sharp sand or sawdust

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b) by broadcasting the blended mixture on the topsoil

c) by lightly working the topsoil surface parallel to the contour by harrowing, raking, tracking or chain dragging, to ensure seeds are covered with topsoil, and

d) by watering, on the day of installation, with a solution of water and wetting agent until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

8.5.1.3 Hydromulch – Standard

Standard hydromulch shall be in accordance with Table 8.5.1.3.

Table 8.5.1.3 – Standard Hydromulch

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering	Minimum Fibre	Minimum Finished Fibre Depth
≤ 1 on 4	1651	1*	Ripping* 300 mm Cultivation 150 mm	75 mm	NA	4000 kg/ha	4 mm
> 1 on 4	1651	2	Roughening 50 mm				

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Sample areas shall be installed in accordance with Clause 8.5.1 **Hold Point 9**

All seeds, wetting agents, binders, fibre and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10** Note, some proprietary products are packaged with pre-blended fibre, binder and wetting agents, which is suitable.

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Standard hydromulch shall be installed within two days from the completion of the topsoil operation.

Standard hydromulch shall be installed:

a) by moistening the topsoil layer with a solution of water and wetting agent

b) by applying the hydromulch slurry in an indirect, dispersed spray pattern, from opposing directions during each pass, to achieve a complete coverage and a uniform finish. Best results are obtained when applied at a range of angles from the toe of the slope and the top of the slope. In scenarios where this in not practicable because access is restricted, apply in a forward and then backward manner as the area is traversed

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c) by applying the hydromulch slurry in a minimum two pass process as follows:

   i. the first pass shall consist of a slurry of water, 1000 kg/ha of fibre, binder, fertiliser and 90% of the seed mix. The first pass shall become tacky (not dry) before subsequent passes are applied, and

   ii. the subsequent passes shall consist of a slurry of water, balance of the fibre required, binder and 10% of the seed mix.

d) with no soil visible after installation and a minimum finished fibre depth of 4 mm to be achieved at any location, and

e) with no initial watering on the day of installation to allow the binder to set.

A minimum two pass process is required to ensure seed is in contact with the topsoil and is covered by mulch, reducing its exposure to the elements and predation by insects and birds.

8.5.1.4 Hydromulch - Bonded Fibre Matrix

Bonded fibre matrix shall be in accordance with Table 8.5.1.4.

Table 8.5.1.4 – Bonded Fibre Matrix

Slope	Standard Drawing	Detail	Subsoil Operation		Topsoil Depth	Initial Watering	Minimum Fibre	Minimum Finished Fibre Depth
≤ 1 on 4	1651	1*	Ripping* Cultivation	300 mm 150 mm	75 mm	NA	5000 kg/ha	5 mm
> 1 on 4	1651	2	Roughening	50 mm				

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Regular sample areas shall be installed in accordance with Clause 8.5.1. **Hold Point 9**

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Bonded fibre matrix shall be installed within two days from the completion of the topsoil operation.

All seeds, wetting agents, binders, fibre and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10** Note, some proprietary products are packaged with pre-blended fibre, binder and wetting agents, which is suitable.

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Bonded fibre matrix shall be installed:

a) by moistening the topsoil layer with a solution of water and wetting agent

b) by applying the bonded fibre matrix slurry in an indirect, dispersed spray pattern, from opposing directions during each pass, to achieve a complete coverage and a uniform finish. Best results are obtained when applied at a range of angles from the toe of the slope and the top of the slope. In scenarios where this in not practicable because access is restricted, apply in a forward and then backward manner as the area is traversed

c) by applying the bonded fibre matrix slurry in a minimum two pass process as follows:

   i. the first pass shall consist of a slurry of water, 1000 kg/ha of fibre, binder, fertiliser and 90% of the seed mix. The first pass shall become tacky (not dry) before subsequent passes are applied, and

   ii. the subsequent passes shall consist of a slurry of water, balance of the fibre required, binder and balance of the seed mix.

d) with no soil visible after installation and a minimum finished fibre depth of 5mm to be achieved at any location, and

e) with no initial watering on the day of installation to allow the binder to set.

A minimum two pass process is required to ensure seed is in contact with the topsoil and is covered by mulch, reducing its exposure to the elements and predation by insects and birds.

8.5.1.5 Hydro-compost

Hydro-compost shall be in accordance with Table 8.5.1.5.

Table 8.5.1.5 – Hydro-compost

Slope	Standard Drawing	Detail	Subsoil Operation		Topsoil Depth	Initial Watering	Minimum Finished Fibre Depth
≤ 1 on 4	1651	3*	Ripping* Cultivation	300 mm 150 mm	75 mm**	NA	10 mm
> 1 on 4	1651	4	Roughening	50 mm			

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Regular sample areas shall be installed in accordance with Clause 8.5.1. **Hold Point 9**

Where a site topsoil is tested in accordance with *Form C of Appendix MRTS16* and has less than 3% organic matter, Hydro-compost may be used to address organic matter requirements of the topsoil in lieu of ameliorating the stockpiled topsoil with organic soil conditioner.

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

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Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Hydro-compost shall be installed within two days from the completion of the topsoil operation.

All seeds, wetting agents, binders, fibre and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10** Note, some proprietary products are packaged with pre-blended compost, fibre, binder and wetting agents, which is suitable.

Hydro-compost shall be installed:

a) by moistening the topsoil layer with a solution of water and wetting agent

b) by hydraulically applying the hydro-compost slurry in an indirect, dispersed spray pattern, from opposing directions during each pass, to achieve a complete coverage and a uniform finish. Best results are obtained when applied at a range of angles from the toe of the slope and the top of the slope. In scenarios where this in not practicable because access is restricted, apply in a forward and then backward manner as the area is traversed

c) by applying the hydro-compost slurry in a minimum two pass process as follows:

   i. the first pass shall consist of a slurry of water, compost / fibre, binder, seed and fertiliser. The first pass shall become tacky (not dry) before subsequent passes are applied, and

   ii. the subsequent passes shall consist of a slurry of water, balance of the compost / fibre required, seed, binder, and fertiliser.

d) with no soil visible after installation and a minimum finished fibre depth of 10mm to be achieved at any location, and

e) with no initial watering on the day of installation to allow the binder to set.

8.5.1.6 Straw mulching

Straw mulching shall be in accordance with Table 8.5.1.6.

Table 8.5.1.6 – Straw mulching

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering	Fibre	Bitumen Emulsion	Minimum Finished Fibre Depth
≤ 1 on 4	1651	1*	Ripping* 300 mm Cultivation 150 mm	75 mm	10 L/m²	5000 kg/ha	20000 L / ha	25 mm
> 1 on 4	1651	2	Roughening 50 mm					

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Regular sample areas shall be installed in accordance with Clause 8.5.1. **Hold Point 9**

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Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Seeding shall be installed within two days from the completion of the topsoil operations. All seeds, wetting agents, binders, fibre and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

Straw mulch seeding shall be installed:

a) by installing seed as per drill seeding Clause 8.5.1.1, or broadcast seeding Clause 8.5.1.2, including the initial watering

b) by covering the finished drill / broadcast seeding with a mixture of straw and bituminous emulsion. Straw shall be spread with a purpose made blower. The emulsion may be incorporated into the airstream of the blower, or sprayed over the straw as a separate operation immediately after the application of straw

c) with no soil visible after installation and a minimum finished fibre depth of 25 mm to be achieved at any location, and

d) with no initial watering after the application of the straw mulch to allow the bituminous emulsion to set.

8.5.1.7 Organics blanket

Organic blanket shall be in accordance with Table 8.5.1.7.

Table 8.5.1.7 – Organics blanket

Slope	Standard Drawing	Detail	Subsoil Operation	Initial Watering	Organics Blanket Depth
≤ 1 on 4	1651	5*	Ripping* 300 mm Cultivation 150 mm	5 L/m²	40 mm
> 1 on 4	1651	6	Roughening 50 mm		

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Regular sample areas shall be installed in accordance with Clause 8.5.1. **Hold Point 9**

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Organics blanket shall be installed within two days from the completion of the subsoil operations. All seeds, wetting agents, binders and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

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Organics blanket shall be installed:

a) by spreading the organic blanket with a pneumatic blower, with binder and seed mixed into the blanket as it is being installed

b) with no soil visible after installation and a minimum finished fibre depth of 40 mm to be achieved at any location, and

c) by watering, on the day of installation, with a solution of water and wetting agent, until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

8.5.1.8 Mesh lined drain

Mesh lined drain shall be in accordance with Table 8.5.1.8.

Table 8.5.1.8 – Mesh lined drain

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering	Bitumen Emulsion
All	1647	3	Roughening 50 mm	75 mm	10 L/m²	20000 L/ha

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Regular sample areas shall be installed in accordance with Clause 8.5.1. **Hold Point 9**

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Seeding shall be installed within two days from the completion of the topsoil operations. All seeds, wetting agents, binders, fibre and fertilisers shall be brought on site in separately labelled containers and mixed on-site to allow verification of materials and quantities. **Hold Point 10**

Mesh lined drains shall be installed:

a) by installing seeding as per Clause 8.5.1.1 – Clause 8.5.1.7

b) by covering the finished seeding treatment with jute or coir mesh. Mesh shall be pulled taut and secured with pins in accordance with the manufacturers requirements, with the following exclusion – mesh to be secured with pinning only; securing ends of mesh using trenches is not permitted

c) by spraying mesh with a bituminous emulsion, and

d) with no watering after the application of the mesh to allow the bituminous emulsion to set.

8.5.2 Turfing

Turfing shall be in accordance with Table 8.5.2.

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Table 8.5.2 – Turfing

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Initial Watering
≤ 1 on 4	1650	1*	Ripping* 300 mm Cultivation 150 mm	75 mm	25 L /m²
> 1 on 4	1650	2	Roughening 50 mm		

*Ripping only required where soils are compacted. For example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

Amelioration agents, where specified in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the specified rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth. **Witness Point 6**

Turf shall be installed within two days from the completion of the topsoil operations.

Turf shall be delivered within one day of cutting, and installed within two days of cutting.

Turf shall be installed:

a) by spreading fertiliser over the topsoil and raking the surface smooth

b) to the prepared surface that has been moistened with a solution of water and wetting agent

c) on the day turf is delivered to site

d) by laying rolls parallel to the contour, in a staggered brick pattern, and

e) by watering, within 2 hours of installation, with a solution of water and wetting agent until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

Turf in high profile areas shall be top-dressed to ensure there are no gaps between rolls and to correct any uneven areas. Top-dressing shall be washed and graded sand specifically produced for the horticultural industry.

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8.5.3 Planting

8.5.3.1 Planting Containers < 25 L

Planting of containers < 25 L shall be in accordance with Table 8.5.3.1

Table 8.5.3.1 –Planting < 25 L Containers

Slope	Standard Drawing	Detail	Subsoil Operation	Topsoil Depth	Mulch Depth	Alternate Surface Treatment	Initial Watering
Planting Contained Areas							
≤ 1 on 4	1653	1*	Ripping* 300 mm Cultivation 150 mm	300 mm	100 mm	-	10 L / m²
Planting Contained Areas – Median and Separators**							
≤ 1 on 4	1643	1	Ripping 300 mm Cultivation 150 mm	300 mm	100 mm	-	10 L / m²
Planting Broadacre Areas							
≤ 1 on 4	1653	2*	Ripping* 300 mm Cultivation 150 mm	150 mm	100 mm	-	10 L / m²
Planting Slopes > 1 on 4							
> 1 on 4	1653	3	Roughening 50 mm	75 mm	100 mm	-	10 L / m²
> 1 on 4	1653	4		Per hole			
Planting in Seeding Areas							
≤ 1 on 4	1653	5*	Ripping* 300 mm Cultivation 150 mm	75 mm	-	Seeding	10 L / m²
> 1 on 4	1653	6	Roughening 50 mm				
Planting in Matting							
Drains	1647	1	Roughening 50 mm	75 mm	-	Matting	10 L / m²
> 1 on 4	1647	2	Roughening 50 mm	75 mm	100 mm	Mesh	10 L / m²

*Ripping only required where soils are compacted, for example, decommissioned site compounds, building pads, parking areas, stockpile areas, roads and haul routes.

**In medians, separators or contained areas within pavements, subsoil drainage shall be installed in accordance with Standard Drawing 1643.

Amelioration agents, where required in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface at the required rates prior to subsoil operations. **Hold Point 8**

Subsoil operations shall occur immediately after the application of amelioration agents. **Witness Point 3, 4 or 5**

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Topsoil shall be installed within three days from the completion of the subsoil operations. Topsoil shall be spread to the required depth over the prepared surface. Topsoil shall be moistened with a solution of water and wetting agent. **Witness Point 6**

Mulch shall be installed within one day from the completion of the topsoil operations. Mulch shall be spread to the required depth over the prepared surface.

Plants shall be installed within five days from the completion of the mulch operations.

Plants shall be installed within two days of delivery to site. The Contractor shall give two days notice prior to delivery of plants to allow inspection of the plants. **Witness Point 7**

Prior to installing plants, plants shall be set out in accordance with Clause 8.5.3.3. **Hold Point 11**

Plants shall be:

a) thoroughly watered 1-2 hours prior to planting

b) installed with controlled / slow release fertiliser, placed in each planting hole

c) installed with water holding agents, where specified

d) staked, where required, and

e) watered, on the day of installation, with a solution of water and wetting agent until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

Topsoil per planting hole – should only be used in small areas given the high labour costs associated with incorporating topsoil to individual planting holes.

Jute or coir mesh may be used to secure mulch on steep batters.

8.5.3.2 Planting Containers ≥ 25 L

Plants ≥ 25 L shall be installed in accordance with Table 8.5.3.2

Table 8.5.3.2 – Planting ≥ 25 L Containers

Slope	Standard Drawing	Detail	Subsoil Operation	Backfill Soil Per Hole	Topsoil Depth	Mulch Depth	Initial Watering
Planting Mulch Areas**							
≤ 1 on 4	1654	1	Ripping base of hole 200 mm and Roughening side of hole	Varies with container size - Remaining depth of hole	300 mm	150 mm	20 L per plant
Planting Grass Areas**							
≤ 1 on 4	1654	2	Ripping base of hole 200 mm and Roughening side of hole	Varies with container size - Remaining depth of hole	300 mm	150 mm	20 L / per plant

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Slope	Standard Drawing	Detail	Subsoil Operation	Backfill Soil Per Hole	Topsoil Depth	Mulch Depth	Initial Watering
Planting Slopes > 1 on 4 – Free Draining Soils							
> 1 on 4	1654	3	Ripping base of hole 200 mm and Roughening side of hole	Varies with container size - Remaining depth of hole	300 mm	150 mm	20 L / per plant
Planting Slopes > 1 on 4 – Poor Draining Soils							
> 1 on 4	1654	4	Ripping base of hole 200 mm and Roughening side of hole	Varies with container size - Remaining depth of hole	300 mm	150 mm	20 L / per plant
Planting in Contained Areas							
-	1643	2	Ripping base of hole 200 mm and Roughening side of hole	Varies with container size - Remaining depth of hole	300 mm	100 mm	20 L / per plant

**In medians, separators or contained areas within pavements, subsoil drainage shall be installed in accordance with Standard Drawing 1643.

Prior to installing plants, plants shall be set out in accordance with Clause 8.5.3.3. **Hold Point 11**

The planting hole shall be excavated and the base of the hole ripped and the sides of the hole roughened in accordance with Table 8.5.3.2. **Witness Point 3 or 5**

Amelioration agents, where required in the *Soil Management Plan – Construction*, shall be spread over the subsoil surface and sides of holes at the required rates prior to subsoil operations. **Hold Point 8**

Plants shall be installed within two days of delivery to site. The Contractor shall give two days notice prior to delivery of plants to allow inspection of the plants. **Witness Point 7**

The plant, backfill material, topsoil shall be installed within one day from the completion of the planting hole. **Witness Point 6**

Planting shall be:

a) thoroughly watered 1-2 hours prior to planting

b) installed with controlled / slow release fertiliser, placed in each planting hole

c) installed with water holding agents, where specified

d) staked or guyed

e) installed with mulch, and

f) watered, on the day of installation, with a solution of water and wetting agent until the topsoil layer is moist. Watering shall be applied in multiple applications to ensure surface erosion does not occur.

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FOI 26-292 - Document 21

8.5.3.3 Setting-out of plants

Prior to setting-out plants the Contractor shall determine locations and extent of the following elements:

a) services

b) services easements

c) road furniture

d) lighting

e) road signs

f) structures

g) clear zones, and

h) sight visibility zones.

The Contractor shall:

a) set out plants in the locations as shown on the drawings

b) adjust locations, as required, in accordance with vegetation setback and clearance table and notes:

c) as shown on the Drawings, or

d) in accordance with the *Road Landscape Manual – Appendix 4*, where not shown on the Drawings.

e) allow the inspection of plant set out in accordance with Clause 8 of MRTS01 *Introduction to Technical Specifications*. **Hold Point 11**

8.6 Hardscape works

Hardscape work operations include:

a) planting bed edging, and

b) irrigation.

8.6.1 Concrete planting bed edging

Concrete planting bed edging shall:

a) be 150 x 150 mm

b) have expansion joints installed at regular intervals not exceeding 20 m

c) have contraction joints between expansion joints at regular intervals not exceeding 5 m and / or at changes of curvature, and

d) be installed on subgrade compacted in accordance with the requirements of Clause 15 of MRTS04 *General Earthworks*.

8.6.2 Irrigation system

Permanent irrigation systems shall:

a) only be provided where specified in the Contract

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b) provide a functioning sprinkler and / or drip irrigation system that delivers a quantity of water sufficient to maintain plant health and growth that is suitable to the Region, and

c) meet the requirements of the applicable Local Government.

8.6.2.1 Irrigation System Design

Prior to installation, the proposed design shall be submitted for a determination as to its suitability. **Hold Point 12**

Design of the irrigation system shall:

a) be in accordance with Clause 8.6.2

b) be carried out by a suitably qualified, certified landscape and turf irrigation designer

c) have 240V electrical components designed by an electrical engineer, and

d) be certified by the consultant organisation which carried out the design.

Documents produced shall include:

a) schematic drawings of the irrigation system showing:

   i. the number and sequence of watering stations

   ii. the locations of:

      - water filters
      - water isolation valves
      - irrigation controller, and
      - electrical isolation equipment

b) detailed drawings of the irrigation system showing:

   i. all pipe installations

   ii. conduits

   iii. sprinkler or dripper emitters

   iv. manual or automatic valve details

   v. backflow prevention devices

   vi. water filters

   vii. rain gauge / weather station / rain sensor

   viii. controllers

   ix. protection boxes and cabinets

   x. electrical connections, and

   xi. water supply connections.

c) a schedule showing the rates of application of all water outlet devices

d) installation specifications

e) a commissioning schedule and checklist

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f) a statement of the design warranty, and

g) a comprehensive operating manual, including a parts list which sets out the description and suppliers of all components.

8.6.2.2 Supply, installation and commissioning

The irrigation system shall be installed:

a) in accordance with the approved design

b) in accordance with relevant Australian Standard listed in, but not limited to, Table 3.1, and

c) by a suitably qualified, certified irrigation contractor.

All electrical installations shall be installed by a registered electrical contractor as defined under the *Electricity Act 1994*.

The Contractor shall commission and test the irrigation system, at current local government supply pressure or design operating pressure respectively for a minimum period of 30 minutes, prior to covering. **Hold Point 13**

The Contractor shall provide training to the Principal's nominated representatives in the set up and operation of the irrigation system.

8.6.2.3 Warranties, Manuals and As Constructed Drawings

The Contractor shall provide:

a) construction and installation warranties

b) three hard copies of a comprehensive operating manual, including a parts list which sets out the description and suppliers of all components

c) three hard copies (A3 format) of the As-Constructed Drawings and specifications, and

d) three copies of an editable, electronic format copy of the As-Constructed Drawings and specification.

8.7 Construction supplementary requirements

Construction supplementary requirements of MRTS16 *Landscape and Revegetation Works* shall be specified in Clause 3.6 of the MRTS16.1 Annexure.

9 Establishment and monitoring

Vegetation works maintenance consists of two distinct periods:

a) the Establishment Period, and

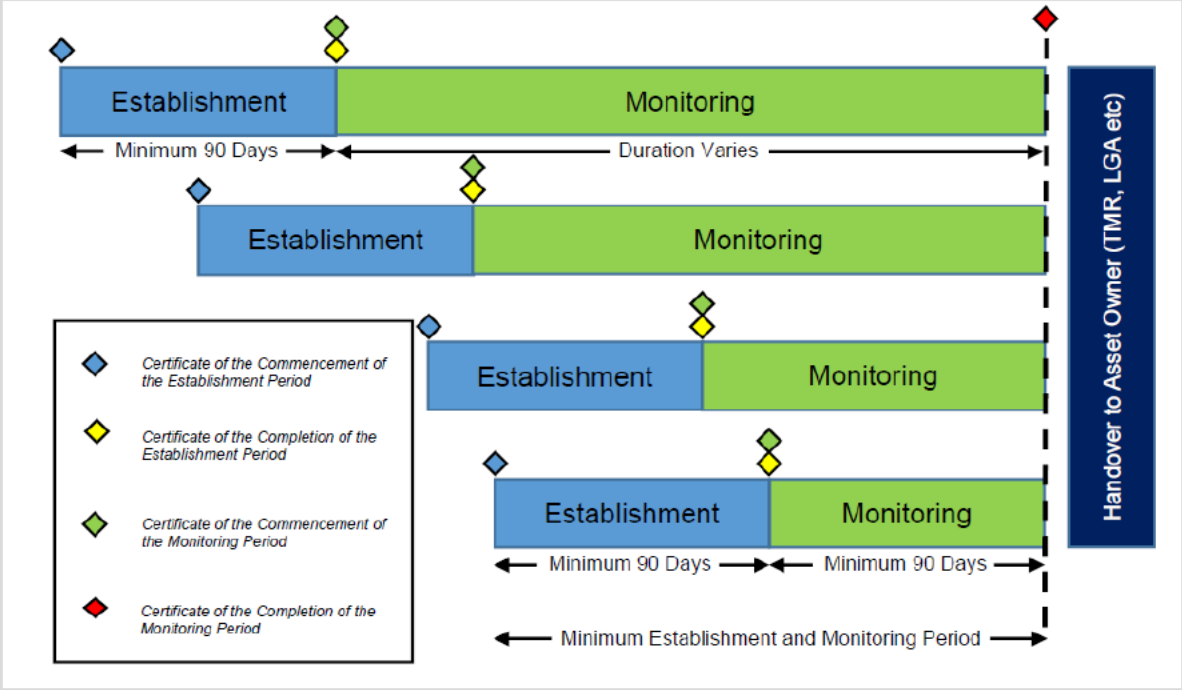
b) the Monitoring Period.

Contracts with native seeding and / or container stock treatments shall undertake an Establishment Period and Monitoring Period.

Contracts consisting of only grass seeding and / or turfing treatments may omit the Monitoring Period. Omission of the Monitoring Period shall be specified as per Clause 9.2.

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Vegetation works maintenance is required for a lot or series of lots within a Contract. All vegetation work Monitoring Periods are required to be completed and to satisfy the completion criteria before the specified end date of the Defects Liability Period.



Where a lot's Monitoring Period finishes outside the Defects Liability Period, the creation of a Separable Portion may be required to be negotiated with the Contractor.

9.1 Establishment Period

The Establishment Period shall commence when the installation of treatments is deemed compliant and a *Certificate of Commencement of the Establishment Period* has been issued by the Administrator. **Milestone**

Where the Contractor has installed works in a series of lots, the Administrator shall issue a *Certificate of Commencement of the Establishment Period* for each lot. The Establishment Period shall:

a) be evaluated at four weeks (interim evaluation), in accordance with Clause 9.1.1.6 to determine if it is on track for meeting the completion criteria

b) be a minimum duration of ninety days from the date of *Certificate of Commencement of the Establishment Works*, and

c) where completion criteria has not been achieved, continue beyond the minimum ninety day until vegetation treatments meet the completion criteria of Clause 9.1.2.

9.1.1 Establishment Period operations

The Contractor shall care for the installed vegetation treatments to ensure their long term sustainability and to meet the completion criteria of Clause 9.1.2.

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Establishment Period operations include:

a) watering

b) fertilising

c) weed control

d) pest and disease control

e) protection of vegetation works

f) interim evaluation

g) repair or re-installation of treatments

h) mowing, slashing and brush cutting

i) pruning

j) selective removal of non-complying plants

k) topping up of mulch, and

l) monthly program and inspection reporting.

9.1.1.1 Watering

During the Establishment Period watering shall:

a) be 'misted' or conducted in a manner that does not cause damage, run-off or subsequent erosion or displacement of treated areas

b) not spray onto, flow across or pond on paved areas including roadways, bikeways and footpaths, and

c) be in accordance with the minimum watering schedule and watering rates of Table 9.1.1.1(a) and Table 9.1.1.1(b), unless otherwise specified in Clause 4.1 of the Annexure MRTS16.1.

Watering must be applied in sufficient quantities and regularity to ensure:

a) soil moisture is maintained

b) germination of seedling occurs

c) emergence and establishment of seedlings, and

d) maintain and encourage deep rooting, and

e) the completion criteria of Clause 9.1.2 is achieved.

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Table 9.1.1.1(a) – Minimum watering schedule – Establishment Period

Vegetation Treatment	% of watering rate in Table 9.1.1.1(b)	Frequency of watering days		
		Week 1, 2 and 3	Week 4 and 5	Remainder of Establishment Period
Seeding				
Drill Seeding*	100%	Daily	Every second day	As required to meet the completion criteria.
Broadcast Seeding*	100%	Daily	Every second day	
Hydromulch – Standard*	75%	Daily	Every second day	
Hydromulch – BFM*	75%	Daily	Every second day	
Hydro – compost*	75%	Daily	Every second day	
Straw mulching*	50%	Daily	Every second day	
Organic Blanket*	50%	Daily	Every second day	
Seed mesh lined drain*	75%	Daily	Every second day	
Turfing				
Turf	75%	Daily	Every second day	As required to meet the completion criteria.
Planting				
Mass Plantings – of container stock	100%	Every second day		As required to meet the completion criteria.
25 L – 45 L	200%	Every second day		
100 L – 200 L	300%	Every second day		
≥ 400 L	400%	Every second day		
The minimum relevant watering L/m² rate, as per Table 9.1.1.1(b) shall be applied. *Prior to the development of cover crop in seeding areas, apply the required minimum L/m² rate in two separate passes to minimise the risk of erosion. It is recommended, where practicable, watering occur in the morning or evening to increase infiltration and minimise evaporation.				

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Table 9.1.1.1(b) – Watering rate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG Oct - Mar	AVG Apr - Sep
SEQ Districts	11	11	11	9	8	8	8	9	10	11	13	13	**12**	**10**
Mackay Whitsunday, Fitzroy and Wide Bay Districts	13	12	11	10	9	9	9	10	11	13	15	13	**13**	**10**
Far North and Northern Districts	13	12	12	11	10	10	10	11	12	15	16	14	**14**	**11**
Central Queensland and South West Districts	14	14	11	11	9	9	9	9	11	13	15	14	**14**	**10**
North West Districts	16	16	15	13	11	11	11	13	15	16	18	16	**16**	**12**

The rates in Table 9.1.1.1(b) are based on average daily pan evaporation rates + 5L to ensure water moisture is maintained consistent in the soil. The additional daily 5L/m² accounts for inefficiencies in the watering process.

Prior to the development of cover crop in seeding areas, apply the required minimum L/m² rate in two separate passes to minimise the risk of erosion.

Watering rates or frequency should be increased during periods of wind, drought and / or where soils have low moisture retaining characteristics.

Regular checks of soil moisture shall be undertaken to determine if watering rates require adjustment due to site, soil or seasonal conditions.

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Table 9.1.1.1(b) is based on historic data from the Bureau of Meteorology and shall be used to adjust application rates and quantity allowances.

Prioritise early morning or night watering to lessen evaporation.

Temporary irrigation systems can be highly effective and efficient in delivering watering requirements, compared to watering with water trucks with cannons.

Below is a worked example for calculating water quantity requirements for a hydromulch seeding (75%) operation in summer in SEQ (avg 12L/m²), based on an area of 1 hectare.

Week 1 – 3	12 L x 75% x 21 days x 10,000 m² =	1,890,000 L =	1890 kilolitres / ha
Week 4 – 5	12 L x 75% x 7 days x 10,000 m² =	630,000 L =	630 kilolitres / ha
Week 6 – 12	As required to meet completion criteria – varies with treatment and conditions		

The above worked example is based on no rain events occurring within the 90 day Establishment Period. Depending on the location and season, natural rainfall events may reduce the required watering frequency. Where soil moisture is naturally maintained, watering frequency may be reduced.

Temporary irrigation system

Where the Contractor proposes to use a temporary irrigation system for Establishment Period watering purposes, the temporary irrigation system shall:

a) be designed and installed as such to deliver the quantities of water and frequency of watering in accordance with Clause 9.1.1.1

b) be conducted in a manner that does not cause damage or subsequent erosion or displacement of treated areas

c) not spray onto, flow across or pond on paved areas including roadways, bikeways and footpaths or active construction areas, and

d) be removed at the end of the maintenance period.

Depending on the scale of the project, temporary irrigation can significantly reduce the costs associated with watering, particularly where traffic control is required to apply water. Temporary irrigation is also highly effective at delivering required water levels and can be readily adjusted to cater for drier and wetter conditions.

Temporary irrigation should be set up outside of exclusion zones such that it can be accessed during daylight hours for repairs.

9.1.1.2 Establishment Period Fertilising

Seeding, turfing and planting treatments shall be fertilised at 6 weeks in accordance with Table 9.1.1.2, then as required, to ensure plant health and to achieve the completion criteria.

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Table 9.1.1.2 – Establishment Period Fertilising Rates

	N	P	K	S	Trace Elements
Seeding	10 - 30 kg/ha	1 - 10 kg/ha	10 - 40 kg/ha	5 -15 kg/ha	As required
Turf	10 - 20 kg/ha	1 - 10 kg/ha	10 - 40 kg/ha	5 -15 kg/ha	As required
Planting	As required				

9.1.1.3 Weed control

Vegetation treatments shall be maintained in a weed free condition.

Handling and application of herbicides shall be in accordance with Clause 8.3.

Where vegetation treatments are poisoned due to overspray, the Contractor shall replace the vegetation treatment with the originally specified treatment.

Restricted, prohibited and invasive species shall be managed in accordance with MRTS51 and associated *Biosecurity Act 2014*.

9.1.1.4 Pest and disease control

Vegetation treatments shall be maintained in a pest and disease free condition.

Handling and application of pesticides shall be in accordance with Clause 8.3.

Restricted, prohibited and invasive species shall be managed in accordance with MRTS51 and associated *Biosecurity Act 2014*.

9.1.1.5 Protection of vegetation works

During the Establishment Period the Contractor shall install appropriate temporary measures, relative to the context and season, to protect installed works from surface water flows caused by watering and typical seasonal rainfall events. These measures must cater for the catchment area and not cause ponding on the pavement nor contribute to hydroplaning. These measures must be removed at the completion of the end of the Establishment Period.

9.1.1.6 Interim evaluation

After four weeks from installation, treatments shall be evaluated against the following criteria to determine if it is on track to meet the completion criteria. **Hold Point 14**

Repair or reinstate the area within seven days of issues being identified.

Seeding treatments

Seeding treatments shall have an even strike of cover crop.

Turfing treatments

Turfing treatments shall have a healthy grass cover and show signs of growth.

Container and ex-ground stock treatments

Throughout the Establishment Period container stock that dies shall be replaced, within seven days of being identified, with the same species and container size as originally specified.

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9.1.1.7 Repair or re-installation of treatments

The Contractor shall repair / re-install failed or damaged treatments.

Where subsoil or topsoil is eroded, the Contractor shall repair and re-ameliorate the subsoil, re-apply topsoil to the affected area and reinstall the vegetation treatment.

Prior to re-installation, the Contractor shall investigate the failed treatment to determine the cause of poor performance or failure.

> The most common cause of vegetation failure, presuming the subsoil and topsoil have been adequately ameliorated, is through a lack of water and / or a lack of nutrients.
>
> If treatments are performing poorly, increased / modified watering rates and additional fertilising should be considered before complete re-installation of treatments.
>
> Where watering rates are adjusted and re-fertilising does not rectify the situation, the Quality Systems should be checked by the Administrator, prior to re-installing works.

9.1.1.8 Mowing, slashing and brush cutting

Slashing and brush cutting shall:

a) be in accordance with Table 9.1.1.8

b) be evenly windrowed or dispersed over the area, and

c) shall not disperse clippings into mulched planting beds.

Table 9.1.1.8 – Mowing, slashing and brush cutting schedule – Establishment Period

Vegetation Treatment (as shown in the Drawings)	Mow	Intervention Level	Average Finished Height
High Profile Areas			
Turfed Areas	1st and consecutive	50 mm	30 mm
Grass Seeded Areas (Couch or other turf species)	1st	200 mm	50 mm
	2nd	75 mm	40 mm
	3rd and consecutive	50 mm	30 mm
All Other Areas			
Turfed and Grass Seeded Areas	1st	200 mm	100 mm
	2nd and consecutive	300 mm	100 mm
Woodland / forest seeded areas	NA		

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9.1.1.9 Pruning

Pruning shall:

a) be used to remove damaged, diseased or pest infested parts of plants

b) be used to formatively prune trees to clean lower sections of trunks, to allow the tree to develop appropriate form relative to pedestrian and sight visibility requirements, and

c) be in accordance with AS 4373 *Pruning of Amenity Trees*.

Care shall be taken to avoid placement of prunings in a manner that may be hazardous to public safety. Placement of prunings in clear zones, sight visibility zones and pedestrian areas is prohibited.

Pest or disease infested prunings shall be disposed off site in accordance with Clause 11 of MRTS04 *General Earthworks*.

9.1.1.10 Selective removal of non-complying vegetation

Potentially non-complying tree and shrub vegetation shall be removed in areas including:

a) sight visibility zones

b) clear zones

c) CCTV sight visibility zones

d) vegetation setbacks

e) below overhead services or structures

f) above underground services, and

g) service easements.

9.1.1.11 Topping up of mulch

Thirty days before the completion of the Establishment Period, mulched treatments shall be topped up with mulch to achieve the originally specified depths.

9.1.1.12 Monthly program and inspection report

A report shall be submitted to the Administrator every month, within seven days of the inspection.

The report shall include:

a) monthly program of maintenance works

b) dates of maintenance visits and inspections

c) maintenance works undertaken

d) maintenance works in progress

e) watering application dates and volumes

f) failed or failing vegetation treatments, their general locations on marked up plans, and suspected cause of failure

g) repair or re-installation of failed treatments

h) weeds identified and method of treatment

i) issues identified during inspections and actions required to remedy these, and

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j) damage to vegetation caused by vandalism or theft of vegetation.

All vandalism and theft claims shall be supported by photographic evidence and / or police report.

9.1.2 Establishment Period completion criteria

The Establishment Period shall be completed when the lot has met the following completion criteria:

a) the area is weed free in accordance with Clause 9.1.1.3

b) seeding treatments meet the completion criteria of Clause 9.1.2.1

c) turfing treatments meet the completion criteria of Clause 9.1.2.2,

d) planting treatments meet the completion criteria of Clause 9.1.2.3, and

e) the lot has been established for a minimum 90 day duration.

At the completion of the Establishment Period a *Certificate of Completion of the Establishment Period* shall be issued by the Administrator. **Milestone**

9.1.2.1 Seeding treatments

Seeding treatments:

a) have a uniform cover of perennial and cover crop grasses over a minimum 90% of the area

b) have a minimum perennial cover of 30%

c) show no signs of nutrient deficiency

d) show no signs of water deficiency

e) have no rills or sheet erosion

f) have no bare areas > 1 m², and

g) grass seeded areas shall be mowed / slashed at a height in accordance with Clause 9.1.1.8.

9.1.2.2 Turfing treatments

Turfing treatments:

a) show no signs of nutrient deficiency

b) show no signs of water deficiency

c) shall be top dressed and contain no uneven jointing in pedestrian areas

d) have a healthy root system that has penetrated into the ground so that the turf cannot be easily lifted, and

e) are mowed / slashed at a height in accordance with Clause 9.1.1.8.

9.1.2.3 Planting treatments

Planting treatments:

a) show no signs of nutrient deficiency

b) show no signs of water deficiency

c) show no signs of pests or disease

d) are established and well formed, showing evidence of growth

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e) have a healthy root system that has penetrated into the ground so that the plant cannot be easily lifted out of the ground

f) tree trunks shall be vertical

g) tree rootball cannot be tilted

h) where required ties shall be repaired, and

i) have a mulch depth in accordance with Clause 9.1.1.11.

9.2 Monitoring Period

The Monitoring Period shall commence with the issuing of the *Certificate of Commencement of the Monitoring Period* by the Administrator, following the completion of the Establishment Period.

Milestone

Where the Contractor has installed works in a series of lots, the Administer shall issue a *Certificate of Commencement of the Monitoring Period* for each lot.

All Monitoring Period lots must be handed over to the Authority in a single package at the completion of the Monitoring Period.

The Monitoring Period for each Lot shall:

a) be a minimum duration of 90 days, unless otherwise specified in Clause 4.2 of the Annexure MRTS16.1, from the date of *Certificate of the Commencement of the Monitoring Period*, and

b) continue until all vegetation treatments / Lots meet the completion criteria of Clause 9.2.2.

Where a lot's Monitoring Period finishes outside the Defects Liability Period, the creation of a Separable Portion may be required to be negotiated with the Contractor.

Where native seed mixes are installed in Autumn and Winter consideration should be given to increasing the minimum Monitoring Period until the end of Summer to ensure seeding has been successful. It is suggested to increase the Monitoring Period to the end of the wet season in this instance.

Where container stock has been installed, consideration should be given to increasing the Monitoring Period to ensure plants are mature enough to out-compete weeds beyond handover. It is suggested to increase the Monitoring Period to 180 days or greater.

For projects with Defects Liability Periods greater than 180 days it is suggested the Monitoring Period finish in line with the Defects Liability Period.

9.2.1 Monitoring Period operations

The Contractor shall care for the installed vegetation treatments to ensure their long term sustainability and to meet the completion criteria of Clause 9.2.2.

Monitoring Period operations include:

a) watering

b) fertilising

c) weed control

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d) pest and disease control

e) repair or re-installation of failed treatments

f) mowing, slashing and brush cutting

g) pruning

h) selective removal of non-complying plants

i) topping up of mulch, and

j) monthly program and inspection reporting.

9.2.1.1 Watering

During the Monitoring Period watering shall:

a) be undertaken as required to achieve the completion criteria

b) be conducted in a manner that does not cause damage, run-off or subsequent erosion or displacement of treated areas, and

c) not spray onto, flow across or pond on paved areas including roadways, bikeways and footpaths or active construction areas.

Specific watering requirements may be nominated in Clause 4.1 of the Annexure MRTS16.1.

> Watering should be undertaken to ensure soil moisture is maintained to promote plant health and to achieve the completion criteria. During periods of wind, drought and / or where soils have low moisture retaining characteristics, watering may be required. During periods of high rainfall, watering is not required.
>
> Consideration should be given to potential costs, particularly on large projects, where multiple lots are installed and are monitored for durations longer than the minimum monitoring period nominated in the Contract.

9.2.1.2 Fertilising

Seeding, turfing and planting treatments shall be fertilised, as required, to ensure plant health and to achieve the completion criteria.

One month before the completion of the Monitoring Period, all container stock treatments shall be fertilised with an all-purpose controlled / slow release fertiliser, in accordance with manufacturers' specifications.

9.2.1.3 Weed control

Vegetation treatments shall be maintained in a weed free condition.

Handling and application of herbicides shall be in accordance with Clause 8.3.

Where vegetation treatments are poisoned due to overspray, the Contractor shall replace the vegetation treatment with the originally specified treatment.

Restricted, prohibited and invasive species shall be managed in accordance with MRTS51 and associated *Biosecurity Act 2014*.

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9.2.1.4 Pest and disease control

Vegetation treatments shall be maintained in a pest and disease free condition.

Handling and application of pesticides shall be in accordance with Clause 8.3.

Restricted, prohibited and invasive species shall be managed in accordance with MRTS51 and associated *Biosecurity Act 2014*.

9.2.1.5 Protection of vegetation works

During the Monitoring Period the Contractor shall install appropriate temporary measures, relative to the context and season, to protect installed works from surface water flows caused by typical seasonal rainfall events.

These measures must cater for the catchment area and not cause ponding on the pavement nor contribute to hydroplaning.

These measures must be removed thirty days prior to the completion of the end of the Monitoring Period.

9.2.1.6 Not Used

9.2.1.7 Repair or re-installation of treatments

The Contractor shall repair / re-install failed or damaged treatments.

Where subsoil or topsoil is eroded, the Contractor shall repair and re-ameliorate the subsoil, re-apply topsoil to the affected area and reinstall the vegetation treatment.

Prior to re-installation, the Contractor shall investigate the failed treatment to determine the cause of poor performance or failure.

Throughout the Monitoring Period container stock that dies shall be replaced, within seven days of being identified, with the same species and container size as originally specified.

> The most common cause of vegetation treatment failure, presuming the subsoil and topsoil have been adequately ameliorated, is through a lack of water and / or a lack of nutrients.
>
> If treatments are performing poorly, increased /modified watering rates and additional fertilising should be considered before complete re-installation of treatments.

9.2.1.8 Mowing, slashing and brush cutting

Mowing, slashing and brush cutting shall:

a) be in accordance with Table 9.2.1.8

b) be evenly windrowed or dispersed over the area, and

c) shall not disperse clippings into mulched planting beds.

Do not mow or slash in native woodland / forest seeded areas.

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Table 9.2.1.8 – Mowing, slashing and brush cutting schedule – Monitoring Period

Location	Intervention Level	Average Finished Height
Turf / High Profile Areas / Pedestrian Areas	50 mm	30 mm
Roadside grass verge areas, grass drains, and grass sight visibility areas	300 mm	100 mm

9.2.1.9 Pruning

Pruning shall:

a) be used to remove damaged, diseased or pest infested parts of plants

b) be used to formatively prune trees to clean lower sections of trunks, to allow the tree to develop appropriate form relative to pedestrian and sight visibility requirements, and

c) be in accordance with AS 4373 *Pruning of Amenity Trees*.

Care shall be taken to avoid placement of prunings in a manner that may be hazardous to public safety. Placement of prunings in clear zones, sight visibility zones and pedestrian areas is prohibited.

Pest or disease infested prunings shall be disposed off site in accordance with Clause 11 of MRTS04 *General Earthworks*.

9.2.1.10 Selective removal of non-complying vegetation

Potentially non-complying tree and shrub vegetation shall be removed in areas including:

a) sight visibility zones

b) clear zones

c) CCTV sight visibility zones

d) vegetation setbacks

e) below overhead services or structures

f) above underground services, and

g) service easements.

9.2.1.11 Topping up of mulch

Thirty days before the completion of the Monitoring Period, mulched treatments shall be topped up with mulch to achieve the originally specified depths.

9.2.1.12 Monthly program and inspection report

A report shall be submitted to the Administrator every month, within seven days of the inspection.

The report shall include:

a) monthly program of maintenance works

b) dates of maintenance visits and inspections

c) maintenance works undertaken

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d) maintenance works in progress

e) watering application dates and volumes

f) failed or failing vegetation treatments, their general locations on marked up on plans, and suspected cause of failure

g) repair or re-installation of failed treatments

h) weeds identified and method of treatment

i) issues identified during inspections and actions required to remedy these, and

j) damage to vegetation caused by vandalism or theft of vegetation.

All vandalism and theft claims shall be supported by photographic evidence and / or police report.

9.2.2 Monitoring Period completion criteria

The Monitoring Period shall be completed when the lot has met the following completion criteria:

a) the area is weed free in accordance with Clause 9.2.1.3

b) seeding treatments meet the criteria of Clause 9.2.2.1

c) turfing treatments meet the criteria of Clause 9.2.2.2

d) planting treatments meet the criteria of Clause 9.2.2.3, and

e) the lot has been monitored for a minimum 90 day duration, or as otherwise specified in Clause 4.1 of the Annexure MRTS16.1 or the Contract.

Upon successful completion of the Monitoring Period the *Certificate of Completion of the Monitoring Period* shall be issued by the Administrator. **Milestone**

9.2.2.1 Seeding treatments

Seeding treatments shall:

a) have evidence of healthy growth

b) show no signs of nutrient deficiency

c) contain no bare areas > 1 m², and

d) contain no rills or sheet erosion.

Grassing treatments shall:

a) have 90% perennial grass coverage, and

b) roadside grass verge areas, grass drains, and grass sight visibility areas are mowed / slashed at a height in accordance with Table 9.2.1.8.

Woodland / forest treatments:

a) have 90% perennial grass coverage, and

b) contain native seed strike throughout the treatment area, or

c) where the Monitoring Period has been extended to 365 days or greater, have tree or shrub strike of nominally one plant per 16 m² (nominally 4 m centres).

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Where high concentrations of shrubs and trees seedlings stricke and shade out grass species, lower percentage of perennial grass coverage is suitable. The intent of the coverage is to provide slope / surface stability.

9.2.2.2 Turfing treatments

Turfing treatments shall:

a) show no signs of nutrient deficiency

b) contain no uneven surfaces or jointing in pedestrian areas

c) have a healthy root system that has penetrated into the ground so that the turf cannot be easily lifted, and

d) are mowed / slashed at a height in accordance with Table 9.2.1.8.

9.2.2.3 Planting treatments

Planting treatments shall:

a) show no signs of nutrient deficiency

b) show no signs of water deficiency

c) show no signs of pests or disease

d) are established and well formed, showing evidence of growth typical of the species

e) tree rootball cannot be tilted

f) be formatively pruned in pedestrian areas, high profile areas or where directed, in accordance with Clause 9.2.1.9

g) have all stakes and ties removed, and

h) have a mulch depth in accordance with Clause 9.2.1.11.

9.3 Establishment and monitoring supplementary requirements

Establishment and monitoring supplementary requirements of MRTS16 *Landscape and Revegetation Works* shall be specified in Clause 4.4 of the Annexure MRTS16.1.

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Technical Specification

Transport and Main Roads Specifications MRTS28 Contractor's Site Facilities and Camp

November 2019

Queensland Government

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Contents

1 Introduction 1

2 Definition of Terms 1

3 Referenced documents 1

4 Establishment, maintenance and disestablishment of contractor's site facilities 1

4.1 Description of site facilities 1

4.2 Location of site facilities 2

4.3 General requirements 2

4.4 Meeting room and office accommodation for the Administrator 2

4.4.1 Facilities for QA audit and meetings 2

4.4.2 Office accommodation for the Administrator 3

4.5 Other requirements 3

4.5.1 Documentation for Contractor's site facilities 3

4.5.2 Visibility to the public 4

4.5.3 Noise 4

4.5.4 Dust suppression 4

4.5.5 Flooding responsibility 4

4.5.6 Access 4

4.5.7 Environmental management 5

5 Establishment, operation, maintenance and disestablishment of contractor's camp 5

5.1 Description of contractor's camp 5

5.2 Location of contractor's camp 5

5.3 General requirements 5

6 Supplementary requirements 5

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FOI 26-292 - Document 21

1 Introduction

This Technical Specification applies to the provision of Contractor's Site facilities and camp.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate. The provision of Contractor's site facilities and camp shall comply with MRTS51 *Environmental Management*.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of Terms

The terms in this Technical Specification shall be as defined in Clause 2 and Clause 3 of MRTS01 *Introduction to Technical Specifications.*

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 1547	*On-site domestic wastewater management*
MRTS01	*Introduction to Technical Specifications*
MRTS16	*Landscape and Revegetation Works*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*
MRTS52	*Erosion and Sediment Control*
-	*Environmental Processes Manual*
-	*Cultural Heritage Process Manual*
-	*Queensland Plumbing and Wastewater Code*
-	*Australian Code for the Transport of Dangerous Goods by Road and Rail*

4 Establishment, maintenance and disestablishment of contractor's site facilities

4.1 Description of site facilities

Contractor's Site facilities include all Site facilities established by the Contractor for the construction of the Works, including structures for housing plant and materials, provision of offices, workshops and other buildings as are necessary for the construction of the Works, compound and storage areas used by the Contractor for storage of materials and equipment including Principal's materials and equipment.

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4.2 Location of site facilities

The areas shown within Clause 1 of Annexure MRTS28.1 are available for the establishment of Contractor's Site facilities and / or storage of plant and / or materials.

If no areas are indicated in Clause 1 of Annexure MRTS28.1, the Contractor shall be responsible for obtaining any necessary areas either through purchase or rent, including obtaining any required licenses, permits and approvals. Facilities should avoid areas containing remnant native vegetation and should be sited within the approved project area.

4.3 General requirements

The Contractor shall supply, equip, service and neatly maintain all necessary buildings, workshops, parking areas and storage areas for the satisfactory completion of the Work. The Contractor shall provide properly constructed toilets, drinking water, eating and washing facilities at the Contractor's site facilities for the use of personnel and connect to town sewer where possible and shall comply with AS 1547 On-site domestic wastewater management and the Queensland Plumbing and Wastewater Code.

Appropriate First Aid facilities should be made available at the site facilities and camp.

Erosion and sedimentation control measures shall be implemented during the construction and operation of the Contractor's site facilities. These measures shall be included in the Contractor's overall project erosion and sediment control plan and shall comply with MRTS52 *Erosion and Sediment Control* (E&SC). The E&SC plan shall be sent to the Administrator for comment on its suitability prior to commencement.

The Contractor shall ensure that adequate waste (rubbish and recycling) receptacles are provided at the Contractor's site facilities. Any project waste shall be managed in accordance with MRTS51 *Environmental Management*.

The Contractor shall be responsible for the security of the buildings, construction plant and machinery. The Contractor shall also take all necessary precautions to make the area safe to the public, including provision of signs outlining relevant project contact details, safety requirements and any other relevant details on the main entry gate.

On completion of the Works, all areas disturbed by the Contractor's construction activities (such as areas for compounds, material storage, access and haul roads) shall be restored to their original condition, or as may be otherwise acceptable to the Administrator. Restoration shall include but not limited to, ripping, topsoiling of the area and seeding and planting in accordance with MRTS16 *Landscape and Revegetation Works*. Weed species that have grown at the Site since establishment shall be removed as appropriate.

4.4 Meeting room and office accommodation for the Administrator

4.4.1 Facilities for QA audit and meetings

If so stated in Clause 2 of Annexure MRTS28.1, the Contractor shall provide a separate and quiet room located within the Contractor's site facilities for the use of the Administrator in the examination and auditing of the Contractor's Quality System documentation and for the holding of private meetings with the Administrator and Principal. If stated as required in the annexure and no specific requirements for the meeting room is included in the annexure, then the Contractor shall provide a room as stated below.

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The room shall be of dimensions not less than 6 m length, 3 m width and 2.4 m height and be equipped with one 0.75 kW reverse cycle air conditioner, adequate lighting and two double power points. The room shall be furnished with two office tables 1.2 m by 0.9 m each and four office chairs. The room shall be equipped with computers (with internet access where possible) and printer (with photocopy facility).

4.4.2 Office accommodation for the Administrator

If so stated in Clause 3 of Annexure MRTS28.1, the Contractor shall provide a separate room for the Administrator within the Contractor's site facilities. The office accommodation is for exclusive use of the Administrator during Work Under the Contract and the size and any amenities required to be provided by the Contractor as stated in the Clause 3 of Annexure MRTS28.1. To encourage collaboration between all parties, the room shall be in the same building with the rest of the Contractor's staff and is to enable private meetings as required between the Administrator and the Principal.

4.5 Other requirements

4.5.1 Documentation for Contractor's site facilities

If so stated in Clause 4 of Annexure MRTS28.1, the Contractor shall also provide for the Administrator's approval, prior to proceeding with the construction of Site facilities:

a) A drawing of the proposed Contractor's Site facilities detailing:
   i. location and sizes of buildings and plant maintenance areas
   ii. any adjoining land uses including sensitive receptors such as private residences
   iii. location of sensitive environmental areas such as watercourses, protected vegetation (as present)
   iv. location of waste storage areas, including domestic effluent control details (ensure suitable turning circles are provided to enable trucks to enter Site)
   v. location of access roads
   vi. location of material storage areas
   vii. stormwater drainage details
   viii. fuel storage locations and bunding details.
   ix. sketch of office emergency evacuation plan and location of assembly point.
   x. location of parking area.
   xi. location of electricity generator if specified or proposed.

b) The Environmental Management Plan (Construction) for the project in accordance with MRTS51 *Environmental Management*, which addresses the Site facilities and camp.

c) An erosion and sedimentation control plan for the site of the proposed facilities in accordance with MRTS52 *Erosion of Sediment Control* (to be included in the contractor's overall project erosion and sediment control plan).

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d) A waste management plan to address all waste generated including but not limited to vegetation, concrete, asphalt, bitumen, contaminated land, domestic effluent and putrescible waste, in accordance with MRTS51, detailing but not limited to:

   i. a description of waste likely to be generated from the site of the proposed facilities

   ii. methods to avoid or minimise the volumes of waste generated

   iii. methods of waste treatment and disposal

   iv. method and frequency of waste removal, and

   v. destination of waste.

e) A hazardous materials management strategy to prevent environmental and human health risks as a result of the transportation, storage and use of hazardous materials (hazardous materials include but are not limited to materials listed in the *Australian Code for the Transport of Dangerous Goods by Road and Rail*).

f) Documentary evidence of all statutory approvals permits necessary under relevant legislation.

4.5.2 Visibility to the public

Where so stated in Clause 5 of Annexure MRTS28.1, the site facilities established by the Contractor shall be screened from public view as stated in this clause.

Site facilities shall be screened using an opaque material which camouflages the facilities from public view and provides an aesthetically pleasing appearance blending into the existing background.

External lights on the facilities and camps should be positioned or shielded to minimise light overflow onto neighbouring properties.

4.5.3 Noise

Noise generated from the site facilities shall be kept to a minimum and managed in accordance with MRTS51. Where all effective mitigation methods are employed and it is predicted that noise levels generated by activities within the site facilities are in excess of the performance criteria specified elsewhere within the Contract, the Contractor shall construct noise amelioration devices around the site facilities to bring the noise levels within specified criteria.

4.5.4 Dust suppression

The Contractor shall provide for dust suppression of the site in accordance with the air quality section of MRTS51 *Environmental Management*. All access roads to and from the Contractor's site facilities and the compound areas shall be sealed if so stated in Clause 6 of Annexure MRTS28.1. Water carts shall be made available at all times to prevent generation of dust.

4.5.5 Flooding responsibility

The Contractor's facilities shall be located in areas which are free from flooding and clear of any natural watercourses and stormwater courses.

4.5.6 Access

The Contractor's site facilities shall be located so as to provide safe ingress and egress of traffic to the Site and public roads and shall not deteriorate the existing traffic operation.

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4.5.7 Environmental management

Provision of the Contractor's Site facilities and camp shall comply with MRTS51 *Environmental Management* and MRTS52 *Erosion and Sediment Control*, including addressing the facilities and camp within the project's Environmental Management Plan (Construction). The Site facilities and camp are taken to be included within the definition of 'Worksite' provided in MRTS51.

If the Site facilities and camp are not currently addressed within the Contractor's environmental and cultural heritage documentation, then the Site shall be assessed in accordance with the *Environmental Processes Manual* and *Cultural Heritage Process Manual*.

5 Establishment, operation, maintenance and disestablishment of contractor's camp

5.1 Description of contractor's camp

Contractor's camp if it is included in the Contract, includes all facilities established by the Contractor for housing of and sleeping of Contractor's personnel.

5.2 Location of contractor's camp

The area stated in Clause 7 of Annexure MRTS28.1 is available for the establishment of camp facilities. If no areas are included in Clause 7 of Annexure MRTS28.1, the Contractor shall be responsible for obtaining any necessary areas for the establishment of a camp, if required, including obtaining any required licenses, permits and approvals. Camp(s) should avoid areas containing remnant native vegetation and should be sited within the approved project area.

5.3 General requirements

The provisions of Clauses 4.3 and 4.5 shall also apply to the Contractor's camp.

6 Supplementary requirements

The requirements of MRTS28 *Contractor's Site Facilities and Camp* are varied by the supplementary requirements given in Clause 8 of MRTS28.1.

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Technical Specification

Transport and Main Roads Specifications MRTS51 Environmental Management

July 2020

Queensland Government

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Contents

1 Introduction 1

2 Definition of terms 1

3 Referenced documents 5

4 Standard test methods 7

4.1 Compliance testing 7

5 Quality system requirements 7

5.1 Hold Points and Milestones 7

5.2 Non-conformances with this Technical Specification 8

6 Environmental management 8

6.1 General requirements 8

6.2 Contract-specific requirements 8

6.3 Environmental Management Plan (Construction) 8

6.4 EMP(C) updates 9

7 EMP(C) Administrative requirements 9

7.1 Weekly Site Inspections 9

7.2 Notification of visits by Administering Authorities 9

7.3 Complaint management 10

7.4 Principal's surveillance and audits 10

7.5 Environmental monitoring 10

7.6 Monthly environmental reporting 10

7.7 Notification and management of environmental incidents 11

7.7.1 Notification 11

7.7.2 Management 12

7.8 Records and registers 12

7.9 Environmental roles and responsibilities of personnel 13

7.10 Selection and management of sub-contractors 14

7.11 Approvals 14

7.12 Site induction 14

8 EMP(C) specific element requirements 15

8.1 General 15

8.2 Water quality 16

8.2.1 General 16

8.2.2 Performance requirements 16

8.2.3 Monitoring 18

8.2.4 EMP(C) requirement for water quality 20

8.3 Erosion and sedimentation 21

8.4 Cultural Heritage 21

8.4.1 General 21

8.4.2 Performance requirements 21

8.4.3 Monitoring 22

8.4.4 EMP(C) requirements for Cultural Heritage 23

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FOI 26-292 - Document 21

8.5 Noise 23
8.5.1 General 23
8.5.2 Performance requirements 23
8.5.3 Monitoring 24
8.5.4 EMP(C) requirements for noise 24
8.6 Vibration 25
8.6.1 General 25
8.6.2 Performance requirements 25
8.6.3 Monitoring 27
8.6.4 EMP(C) requirements for vibration 28
8.7 Air quality 28
8.7.1 General 28
8.7.2 Performance requirements 28
8.7.3 Monitoring 29
8.7.4 EMP(C) requirements for air quality 29
8.8 Acid sulfate soils 29
8.9 Contaminated Sites 30
8.9.1 General 30
8.9.2 Performance requirements 30
8.9.3 Monitoring 31
8.9.4 Compliance testing 31
8.9.5 EMP(C) requirements for Contaminated Sites 31
8.10 Native fauna 31
8.10.1 General 31
8.10.2 Performance requirements 31
8.10.3 Monitoring 33
8.10.4 EMP(C) requirements for native fauna 34
8.11 Vegetation 34
8.11.1 General 34
8.11.2 Performance requirements 34
8.11.3 Monitoring 36
8.11.4 EMP(C) requirements for vegetation management 36
8.12 Biosecurity 36
8.12.1 General 36
8.12.2 Performance requirements 36
8.12.3 Monitoring 37
8.12.4 EMP(C) requirements for biosecurity 37
8.13 Waste 38
8.13.1 General 38
8.13.2 Performance requirements 38
8.13.3 EMP(C) requirements for Waste management 39
8.14 Chemicals and fuels 40
8.14.1 General 40
8.14.2 Performance requirements 40
8.14.3 EMP(C) requirements for management of chemicals and fuels 40
8.15 Sourcing of construction materials (non-commercial sources) 41
8.15.1 General 41
8.15.2 Performance requirement 41
8.15.3 Monitoring 41
8.15.4 EMP(C) requirements for material sourcing 42
9 Permanent environmental infrastructure 42
10 Supplementary requirements 42

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1 Introduction

This Technical Specification applies to environmental management requirements applicable to Work under the Contract. Where other statutory requirements (e.g. *Environmental Protection Act* 1994) demand higher standards of environmental management, the higher standards require adoption.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS52 *Erosion and Sediment Control* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual. This Technical Specification is not intended to address environmental management related to planning and design of transport infrastructure or activities related to transport infrastructure.

2 Definition of terms

The terms in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*.

Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Administering Authority	An Authority with legislative jurisdiction.
Air Blast Overpressure	Air Blast overpressure (or air blast level) is the energy transmitted from the blast Site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave is known as the peak air overpressure, generally measured in decibels using the linear frequency-weighting. Air blast measurement and reporting shall be conducted using methodologies in accordance with the provisions of Australian Standard AS 2187.2:1993 Appendix J.
Approval	Approval means any environment or Cultural Heritage related, permit, authority, license, self-assessable code, statutory exemption with conditions, protocol or other statutory instrument with conditions.
Average Reoccurrence Interval (ARI)	The average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. It is implicit in this definition that the periods between exceedances are generally random.
Biosecurity Instrument Permit	An authority issued by Biosecurity Queensland under the *Biosecurity Act* 2014 for movement of a carrier of a regulated Biosecurity Matter under a biosecurity zone regulation to a place outside the zone or into an area subject of a movement control where the activity does not meet the regulatory provisions defined in the Queensland Biosecurity Manual.
Biosecurity Matter	Biosecurity matters as defined in the *Biosecurity Act* 2014 including Biosecurity Matters listed by Local, State and Commonwealth Governments. Biosecurity matters include but are not limited to prohibited and restricted invasive plants (weeds) and animals.
CHMA	Cultural Heritage Management Agreement
CHMP	Cultural Heritage Management Plan
Complaint	A verbal or written complaint from a member of the pubic regarding the Works under the Contract and the impact upon their person or property.

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Term	Definition
Compliance Management Plan (CMP)	A CMP is a statutory approval under TIA by the department in relation to specific legislative requirement(s) and replaces the requirement for compliance or approval under another Act provided compliance with the CMP achieved.
Compliance Testing	Compliance Testing to determine whether a product, system, or action complies with the requirements of a Technical Specification, Contract or regulation or legislation or a combination of any or all.
Contaminated Sites	An area of land where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact.
Critical Facility, Infrastructure and Utility	In relation to impacts from noise and vibration, a Critical Facility, Infrastructure or Utility is defined in accordance with the *Transport Noise Management Code of Practice*: Volume 2 *Construction Noise and Vibration* as: • Critical facilities include medical / health buildings, educational / research facilities, courts of law and community buildings. The latter three are only considered critical when in use. Critical facilities are usually sensitive to both construction noise and vibration. • Critical infrastructure and utilities include dams, electrical and telecommunications facilities (including railway signalling systems), oil and gas pipelines and other petrochemical installations and utilities such as water mains and sewers. Critical infrastructure and utilities are typically sensitive to construction vibration. • Other facilities, infrastructure or utilities (for example bridges) which may be deemed to be of critical importance on a project-specific basis.
Cultural Heritage	Cultural Heritage includes artefacts, Sites, items, areas or places of known or potential Cultural Heritage significance (both indigenous and non-indigenous).
Cultural Heritage Personnel	Persons nominated by the Indigenous Party's including but not limited to monitors, survey staff, and elders.
Discharge	The movement of Site stormwater: a) into a Waterway within the Site b) into a Waterway adjacent to the Site, and c) beyond the boundary of the Site where it could reasonably enter a Waterway.
DO	Dissolved Oxygen
EC	Electrical Conductivity
EMP(C)	Environmental Management Plan (Construction)
Environment and Cultural Heritage Incident	An environment and Cultural Heritage incident is the occurrence of a reportable breach of legislation, an event that causes or has the potential to cause material or serious Environmental Harm, or unauthorised harm to Cultural Heritage. For the purpose of this Technical Specification, events listed in Clause 7.7.1 are also Environmental and Cultural Heritage Incidents.
Environmental Harm	As defined by the *Environmental Protection Act* 1994, Section 14.
Environmental Management	The protection of existing environment and Cultural Heritage from Environmental Harm associated with the Works under the Contract.
Environmental Nuisance	As defined by the *Environmental Protection Act* 1994, Section 15.
ESCP	Erosion and Sediment Control Plan

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Term	Definition
Exclusion Zone	An area not to be entered by a person or machine for the duration of the Contract or otherwise designated period of time or restricted access for authorised persons.
IECA	International Erosion Control Association Australasia
Indigenous Party(s)	The signatory party to the Principal's Cultural Heritage Management Agreement or Cultural Heritage Management Plan.
ITP	Inspection and Test Plan
Permanent Environmental Infrastructure	Environmental Management measures that consist of a structure or other hard engineering feature that forms part of the network beyond the duration of the Contract. Permanent Environmental Infrastructure includes structural components for fish or other fauna passage, sediment basins, glider poles, fauna underpasses, overpasses, permanent exclusion fencing, ladders, artificial nesting resources or any other infrastructure specified by the Administering Authority or the Principal in Clause 13.1 of Annexure MRTS51.1.
Limits of Clearing	The Limits of Clearing are defined as the outside boundary of areas specified within the Contract for clearing and ground disturbance, specifically: • areas for clearing and grubbing (under Clause 7.2 of MRTS04) • side tracks (Clause 3.8 of Annexure MRTS02.1) • noise barriers (Clause 7.2 of MRTS15) • fencing (Clause 11.4 of MRTS14) • borrow areas and associated access tracks (Clause 17 of MRTS04) • water point access tracks (Clause 12 of Annexure MRTS51.1) • stockpile locations (Clause 2.2 of Annexure MRTS04.1) • areas available for disposal of excess and unsuitable material on Site (Clause 6 of Annexure MRTS04.1) • marketable timber (Clause 7.2.3 of MRTS04) • clear zones (Clause 1.4 of MRTS04.1), and • other areas identified by the Principal within the Contract.
Management Measure(s)	A Management Measure is purpose-built structure or strategy employed by the Contractor and documented in the EMP(C) to prevent or minimise Environmental Harm or provide an environmental benefit.
Material Environmental Harm	As defined in the *Environmental Protection Act* 1994, Section 16.
QDAF	Queensland Department of Agriculture and Fisheries
Queensland Waterway for Waterway Barrier Works	The Queensland Waterway for Waterway Barrier Works is a spatial data set, which defines waterways by colour based on their risk of adverse impact from instream barriers on fish movement.
Recycled Materials and Products	Recycled Materials and Products refers to a construction material or product that contains a proportion of re-processed waste material.
RPEQ	Registered Professional Engineer of Queensland

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Term	Definition
Sensitive Receiver(s) (air quality)	As defined by the department's *Road Traffic Air Quality Management Manual*, Glossary, as any of the following: • a dwelling (detached and attached), reformatory institution, caravan park or retirement village • a library, child care centre, kindergarten, school, school playgrounds, college, university, museum, art gallery or other educational institution • a hotel, motel or other premises which provides accommodation for the public • a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest under the *Nature Conservation Act* 1992, or • a public park or gardens that is open to the public (whether or not on payment of a fee) for use other than for sport or organised entertainment (passive recreation only).
Sensitive Receptor(s) (for noise and vibration)	Defined in accordance with the *Transport Noise Management Code of Practice*: Volume 2 *Construction Noise and Vibration* as: • a dwelling (detached or attached) including house, townhouse, unit, reformatory institution, caravan park or retirement village • a library, child care centre, kindergarten, school, school playground, college, university, museum, art gallery or other educational institution, hospital, respite care facility, nursing home, aged care facility, surgery or other medical centre • a community building including a place of public worship • a court of law • a hotel, motel or other premises which provides accommodation for the public • a commercial (office) or retail facility • a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest under the *Nature Conservation Act* 1992, or • an outdoor recreational area (such as public park or gardens open to the public, whether or not on payment of a fee, for passive recreation other than for sport or organised entertainment) or a private open space.
Serious Environmental Harm	As defined in the *Environmental Protection Act* 1994, Section 17.
Significant Vegetation	Significant Vegetation is an individual plant or vegetation community, which are protected under either State or Commonwealth legislation, or have been identified under the Clause 9 of Annexure MRTS51.1 as being of significance.
Site	Means the lands and other places upon described in Item 7A of General Conditions of Contract and any other lands and places made available to the Contractor by the Principal for the purpose of the Contract.
Spotter Catcher (fauna)	A person authorised under a current rehabilitation permit to take and/or keep a protected animal whose habitat is about to be destroyed by human activity in accordance with the Nature Conservation (Administration) Regulation 2017.

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Term	Definition
Suitably Qualified and Experienced Person (fauna)	A person with formal qualifications and/or experience in identification of native animals and wildlife ecology. A person is considered to be suitably qualified and experienced if they meet one or more of the following criteria: 1. an ecological consultant with experience in conducting surveys for native animal breeding places 2. a person who possesses a degree in natural science or similar with experience in conducting surveys for native animal breeding places, or 3. a person who is authorised as a Spotter Catcher under a rehabilitation permit issued under the *Nature Conservation Act* 1992.
TIA	*Transport Infrastructure Act*
TSS	Total Suspended Solids
Waste	As defined by the *Environmental Protection Act*, Section 13.
Water Quality Investigation Criteria	The Water Quality Investigation Criteria outlined in Table 8.2.2 of this Technical Specification sets the criteria for impacts to water quality. Non-conformance with Water Quality Investigation Criteria trigger investigations as to the cause of the non-conformance and whether the non-conformance represents an Environmental Incident.
Waterway	As defined as a watercourse under the Environmental Protection Regulation 2008 and including naturally occurring surface waters as defined in the Environmental Protection Regulation 2008.
Weekly Site Inspections	Weekly Site Inspections undertaken by the Contractor's Environmental Representative or other person deemed suitable by the Administrator, and are documented visual inspections of environmental Management Measures to assess presence, functionality and adequacy of measures prescribed in the EMP(C).
Work under the Contract	The work which the Contractor is or may be required to execute under the Contract and includes variations, remedial work, Construction Plant and Temporary Works

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
Aboriginal Cultural Heritage Act 2003	*Aboriginal Cultural Heritage Act* 2003*,* Queensland
AS 1940	AS 1940:2017 – *The storage and handling of flammable and combustible liquids*
AS 2187.2	AS 2187.2:2006 – *Explosives – Storage and use – Part 2: Use of explosives*
AS 3833	AS 3833:2007 – *The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers*
AS 4970	AS 4970:2009 – *Protection of trees on development sites*
Biosecurity Act 2014	*Biosecurity Act* 2014*,* Queensland
Contractor's Monthly Environmental Reporting Template	MRTS51 Appendix *A Contractor's Monthly Environmental Report*, Transport and Main Roads, Queensland Department of Transport and Main Roads, Technical Publications

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Reference	Title
DES Procedural Guides	*Procedural Guide, Summary sheets: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland*, Department of Environment & Science, Queensland
Departmental Cultural Heritage Induction	*Cultural Heritage Induction*, Transport and Main Roads, Queensland
Environmental Protection Act 1994	*Environmental Protection Act* 1994, Queensland
Environment Protection and Biodiversity Conservation Act 1999	*Environment Protection and Biodiversity Conservation Act* 1999, Commonwealth
Exemption Requirements for constructing authorities for the taking of water without entitlement (WSS/2013/666)	*Exemption Requirements for constructing authorities for the taking of water without entitlement (*WSS/ 2013/666), Department of Natural Resources and Mines, Version 3.06, July 2020
IECA Best Practice Erosion and Sediment Control Appendix B – Sediment Basin Design and Operation	*International Erosion and Sediment Control (Australasia), Best Practice Erosion and Sediment Control, Appendix B – Sediment Basin Design and Operation*, Major Update – June 2018
Monitoring and Sampling Manual	*Monitoring and Sampling Manual* 2018, Environmental Protection (Water) Policy 2009, February 2018, Queensland Department of Environment and Science
MRTS01	*Introduction to Technical Specifications*
MRTS02	*Provision for Traffic*
MRTS04	*General Earthworks*
MRTS14	*Road Furniture*
MRTS15	*Noise Fences*
MRTS16	*Landscape and Revegetation Works*
MRTS28	*Contractor's Site Facilities and Camp*
MRTS50	*Specific Quality System Requirements*
MRTS52	*Erosion and Sediment Control*
MRTS96	*Management and Removal of Asbestos*
Nature Conservation Act 1992	Nature Conservation Act 1992, Queensland
National Environment Protection (Assessment of Site Contamination) Measure, 1999	*National Environment Protection (Assessment of Site Contamination) Measure*,1999, Commonwealth National Environment Protection Council
QDAF Accepted development requirements for operational work that is constructing or raising waterway barrier works	*Accepted development requirements for operational work that is constructing or raising waterway barrier works*, Department of Agriculture and Fisheries, Queensland
QDAF Vehicle and machinery cleandown procedures	*Vehicle and machinery cleandown procedures*, Department of Agriculture and Fisheries, Queensland

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Reference	Title
Queensland Heritage Act 1992	*Queensland Heritage Act* 1992, Queensland
Queensland Waterways for Waterway Barrier Works	*Queensland Waterways for Waterway Barrier Works*, Queensland Department of Agriculture and Fisheries
Road Planning and Design Manual	*Road Planning and Design Manual*, 2nd Edition, 2013, Queensland Department of Transport and Main Roads
Road Traffic Air Quality Management Manual	*Road Traffic Air Quality Management Manual*, Queensland Department of Transport and Main Roads, June 2014
SMP-low risk	*Transport and Main Roads Species Management Program for tampering with animal breeding places – low risk of impacts – least concern animals (excluding special least concern or colonial breeders),* issued by the Department of Environment and Science, May 2019
TN03	TN03 *Measurement of Ground Vibrations and Airblast*, Queensland Department of Transport and Main Roads
Torres Strait Islander Cultural Heritage Act 2003	*Torres Strait Islander Cultural Heritage Act* 2003*,* Queensland
Transport Noise Management Code of Practice: Volume 2	*Transport Noise Management Code of Practice*, Volume 2 – *Construction Noise and Vibration*, Transport and Main Roads (2016)

4 Standard test methods

Unless stated elsewhere herein, Compliance Testing shall be carried out in accordance with the relevant Australian Standard. Where no Australian Standard exists for the test, acceptable best practice methodology shall be employed based on State or Federal Administering Authority publications.

4.1 Compliance testing

Where stipulated in this Technical Specification, the Contractor is responsible for performing Compliance Testing as specified to ensure that the Environmental Management performance complies with the standards and requirements of the Contract and statutory legislation. However, the Contractor's Compliance Testing program shall be such that the frequencies and number of Compliance Tests are not less than those specified in Annexure MRTS51.1.

5 Quality system requirements

5.1 Hold Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications* and Clause 8.3 of MRTS50 *Specific Quality System Requirements*.

The Hold Points and Milestones applicable to this Technical Specification are summarised below in Table 5.1. There are no Witness Points defined.

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Table 5.1 – Hold Points and Milestones

Clause	Hold Point	Witness Point	Milestone
6.3	1. EMP(C) is assessed for suitability by Administrator		Submission of EMP(C)
6.4	2. Amendments to EMP(C) are assessed for suitability by Administrator		Submission of EMP(C) amendments
7.8	3. Environmental Records received by Administrator prior to issue of certificate of Practical Completion		Submission of Environmental Records

5.2 Non-conformances with this Technical Specification

Non-conformances identified under this Technical Specification shall be recorded, reported and managed under the Contractor's Quality Plan. This includes Monitoring non-conformances, Compliance Testing non-conformances and non-conformances raised by Contractor or Principal's audits.

Non-conformances that are also Environmental and Cultural Heritage Incidents, shall in addition be notified, managed and reported in accordance with Clause 7.8 of this Technical Specification.

6 Environmental management

6.1 General requirements

At all times, the Contractor shall be responsible for identifying and undertaking reasonable and practicable Management Measures appropriate to the Work under the Contract, in order to:

a) avoid causing Environmental Harm, and

b) comply with legislative requirements.

6.2 Contract-specific requirements

Contract-specific requirements are given in the Annexure MRTS51.1. The Contractor shall take notice of and must comply with these requirements as well as the requirements listed in this Technical Specification.

6.3 Environmental Management Plan (Construction)

For the duration of the Contract, the Contractor shall develop, implement and maintain an Environmental Management Plan – Construction (EMP(C)) that meets the requirements of the Contract. Works under the Contract shall be completed in accordance with the most current version of the EMP(C) deemed suitable by the Administrator. The Contractor may, with the Administrator's deemed suitability, substitute environmental Management Measures included in this Technical Specification with other environmental Management Measures which achieve the same, or better, environmental outcomes. These Management Measures shall be documented in the EMP(C).

The Contractor's Environmental Management Plan (Construction) (EMP(C)) shall address:

a) administrative requirements (Clause 7 of this Technical Specification), and

b) operational requirements identified for each environmental element (Clause 8 of this Technical Specification).

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Submission of the EMP(C) shall be in accordance with the General Conditions of Contract.
Hold Point 1 **Milestone**

The EMP(C) shall be accessible on Site at all times during Work under the Contract.

The Administrator shall be provided with an electronic copy of the most current and complete version of the EMP(C) at all times.

6.4 EMP(C) updates

The Contractor shall develop and document a process of periodically reviewing the EMP(C). The process shall focus on identifying opportunities for continual improvement of processes and practices to ensure that the EMP(C) is relevant to the Work under the Contract. The process shall address how legislative changes and Environment and Cultural Heritage Incidents corrective actions will be addressed via an update to the EMP(C). The Contractor shall establish and implement document version control.

Updates to the EMP(C) shall be undertaken by the Contractor to address changes on Site, Works under the Contract and to address corrective actions following non-conformances or Environment and Cultural Heritage Incidents. Where undertaken, updates to the EMP(C) shall be submitted to the Administrator as part of the Contractor's Monthly Environmental Report, for deemed suitability.
Hold Point 2 **Milestone**

7 EMP(C) Administrative requirements

7.1 Weekly Site Inspections

The Contractor's Environmental Representative shall undertake and document Weekly Site Inspections for the purpose of:

- verifying Management Measures prescribed in the EMP(C) are present, functional and adequate[1]
- observe the Site for actual or potential Environmental Harm or Environmental Nuisance
- identify maintenance requirements for implemented Management Measures, and
- verifying preparedness for adverse weather conditions where weather forecast.

The Contractor shall undertake corrective actions to rectify issues identified by the Weekly Site Inspections.

The procedure for Weekly Site Inspections shall be documented within the EMP(C). The Weekly Site Inspection records shall be made available to the Administrator within 48 hours of a request for a specific Weekly Site Inspection Report.

7.2 Notification of visits by Administering Authorities

The Contractor shall notify the Administrator of correspondence, meetings with or visits from representatives of any Administering Authority within 24 hours of the Contractor becoming aware of the event. The Administrator may nominate a representative to attend the planned meeting or visit on the Site as an observer.

[1] Adequate refers to whether the Management Measures employed on Site are reasonable and practicable to manage the risk of Environmental Harm occurring as a result of the Works under the Contract.

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7.3 Complaint management

In addition to Clause 15.6.2 of the General Conditions of Contract, the EMP(C) shall contain the Contractor's procedures for notification, investigation, and assessment for legislative triggers, management and reporting of environmental and Cultural Heritage-related complaints. The Contractor shall manage complaints in accordance with their procedure. For contracts specified as medium or high noise or vibration risk, complaints shall be managed in accordance with the *Transport Noise Management Code of Practice*: Volume 2 including undertaking complaint assessment where required.

7.4 Principal's surveillance and audits

The Administrator or their representative(s) may undertake inspections and audits of the EMP(C) implementation as part of the Contract Plan. The Administrator shall provide at least five business days' notice of a planned audit or inspection. The Administrator may, at their discretion, undertake unplanned audits in response to non-conformances, Environment or Cultural Heritage Incidents, or upon receiving complaints regarding the Site.

7.5 Environmental monitoring

The Contractor shall undertake Monitoring as specified in this Technical Specification, in the Annexure MRTS51.1 and where required as a condition of an Approval. The EMP(C) shall contain procedure(s) for undertaking the various types of Monitoring including specific location(s), method, timing, frequency, duration, parameter to be monitored, and objective / criteria measured against.

Where Monitoring identifies a non-conforming result with the legislative or Contractual criteria or objective, this non-conformance shall be reported in the Contractor's monthly environmental reporting (Clause 7.6 of this Technical Specification) and Clause 7.8 of this Technical Specification.

7.6 Monthly environmental reporting

The Contractor shall complete and submit exception reporting to the Administrator in the form of a monthly environmental report. The monthly environmental report shall be submitted to the Administrator within five business days of the end of each month[2]. The monthly environmental report shall include exception reporting and statements actively addressing[3] but not limited to the following that occurred during the reporting month:

a) Contractor's updates to EMP(C) and Erosion and Sediment Control Plan (ESCP).

b) Weekly Site Inspections – number of inspections completed, and summary of corrective actions undertaken.

c) Monitoring Reporting – summary of Monitoring and whether non-conforming results were obtained including submission of animal breeding place registers maintained in accordance with a Species Management Program.

d) Compliance Testing reporting if applicable – summary of Compliance Testing and whether non-conforming results obtained.

[2] If laboratory test results are not available at the time of monthly reporting it shall be included in the following month's report.

[3] Actively addressing means that where there is nothing to report, the Contractor shall report "nil" rather than omission of any response.

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e) Register of current and completed non-conformance reports, environment-related complaints and Environmental and Cultural Heritage Incidents raised by the Contractor as part of their Quality System in relation to this Technical Specification and a record of the current status.

f) Positive environmental outcomes achieved and opportunities identified by the Contractor, and

g) Where the Contractor has developed a Compliance Management Plan, Compliance Reporting under the Compliance Management Plan.

A template for the Contractor's Monthly Environmental Report is provided in Appendix A of MRTS51. The Contractor may nominate to utilise their own reporting template if deemed suitable by the Administrator.

Where exception reporting demonstrates repeated or multiple (three or more) non-conformances of the same issue, the Administrator may instruct the Contractor to undertake a review of the adequacy of Management Measures outlined in the EMP(C) and provide response back to the Administrator within five business days either confirming and justifying the suitability of the existing EMP(C) or notifying of updates to the EMP(C) and the justification.

7.7 Notification and management of environmental incidents

The EMP(C) shall contain the Contractor's procedures for notification and management of Environmental Incidents in accordance with relevant legislation, Approval conditions and this Technical Specification.

7.7.1 Notification

The Contractor shall report to the Administering Authority in accordance with the Approval conditions and relevant legislation where a breach of Approval condition(s), reportable legislative breach, or actual or potential material or serious Environmental Harm (as defined in the *Environmental Protection Act* 1994) is identified.

In addition, the Contractor shall notify the Administrator as soon as practicable upon becoming aware of any of the following:

a) actual or potential material or serious Environmental Harm as defined in the *Environmental Protection Act* 1994

b) reportable breach of legislation

c) breach of an Approval condition(s)

d) non-conformances from Water Quality Investigation Criteria recorded during Monitoring as specified in this Technical Specification (Table 8.2.2)

e) injury or death of native fauna other than least concern species, potentially caused by Work under the Contract, including the occurrence of a fish kill on Site or in Waterways receiving Discharge from Site

f) tampering with a native animal breeding place(s) other than in accordance with an applicable Species Management Program

g) ground disturbance or vegetation clearing beyond the Contractual Limits of Clearing or areas otherwise deemed suitable by the Administrator

h) damage to known or potential Cultural Heritage

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i) ground disturbance or vegetation clearing beyond the boundary of the Contract's Cultural Heritage Management Agreement or Plan otherwise deemed suitable by the Administrator

j) movement or relocation of Cultural Heritage without approval of the Indigenous Party(s)

k) clearing of a protected plant under State or Commonwealth legislation other than authorised under an Environmental Approval

l) identification of a new Biosecurity prohibited matter or restricted matter (Category 1 or 2) on Site or breach of a condition of a biosecurity zone, and

m) discovery of a Contaminated Site (including unexploded ordinance) or land contamination occurred on the Site during the Work under the Contract.

Unless justified otherwise and deemed suitable by the Administrator, the above events shall be reported and managed by the Contractor as Environmental Incidents under the Contract.

7.7.2 Management

The Contractor shall undertake immediate remedial actions to mitigate Environmental Harm or further impacts. Immediate response actions shall not be delayed by the need for notification to Administrator or Administrating Authority.

Once the immediate risk from the Environmental and Cultural Heritage Incident is alleviated, the Contractor shall investigate the cause of the breach and/or potential Environmental Harm, identify, and implement corrective actions as soon as practicable. The Contractor shall provide an Environment and Heritage Incident Report to the Administrator within 40 business days of the Environmental and Cultural Heritage Incident detailing:

a) the nature of the incident

b) what Management Measures were in place to prevent an incident occurring

c) probable cause of the incident, and

d) what corrective actions have been undertaken to prevent incidents reoccurring.

Appendix B of MRTS51 provides an Environmental and Cultural Heritage Incident Report template. The Contractor may utilise the template or utilise their own Environment and Cultural Heritage Incident Report template where the information provided is the same, where deemed suitable by the Administrator.

The Administrator may at their discretion, instruct the Contractor to make additional corrective actions.

Should the Works under the Contract result in Environmental Nuisance or Environmental Harm, the Contractor shall be responsible for remediation works to make good the Environmental Nuisance and/or Environmental Harm to the Administrating Authority and Administrator' satisfaction. Where penalties or offsets are payable for Environmental Nuisance or Environmental Harm, they will be at the Contractor's expense.

7.8 Records and registers

Environmental records are to be included in the Quality Records under the Contract. Table 7.8 of this Technical Specification identifies environmental record requirements. Records and registers shall be made available to the Administrator upon request. **Hold Point 3** **Milestone**

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The environmental records listed in Table 7.8 shall be submitted to the Administrator (electronically unless agreed to by the Contract Administrator) prior to Practical Completion.

Table 7.8 – Environmental record requirements and requirements for submission to Administrator

Record Requirement	Submit to Administrator at Practical Completion
Environment and Cultural Heritage induction attendance registers	☒
Environmental and Cultural Heritage Incident reports, non-conformances and complaints register and associated corrective actions taken	☒
Weekly Site Inspection checklists and diary entries	
Monitoring results	☒
Compliance Testing results	☒
Contractor environment audit reports and subsequent corrective actions taken	
Meeting minutes with Administrating Authorities and interested parties relating to the Management Measures	☒
Formal letters from Administering Authorities	☒
Biosecurity Matter certificates, Biosecurity Instrument Permits and Biosecurity management documentation	☒
Complete registers kept under Species Management Program of animal breeding place(s) tampered with, relocated and injury(s) or death(s) to native fauna	☒
Records to demonstrate and document compliance with Environmental Approvals held by Principal and Contractor	☒
As constructed drawings and maintenance plans for any permanent environmental management infrastructure constructed (i.e. sediment basins, fauna management infrastructure)	☒
Details regarding ongoing management, monitoring or reporting requirements related to Environmental Approvals held by Principal or Contractor	☒
Quantities of water and quarry materials extracted from non-commercial sources under the Contract by source Site	☒
Electronic copy of a completed Waste Register in accordance with the Department's Waste Estimation and Reporting tool (https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Project-waste-reporting) submitted to both Administrator and emailed to projectwasteregister@tmr.qld.gov.au	☒
Cultural Heritage personnel daily timesheets	☒
Any other record identified within the Contractor's EMP(C)	
Any other record required by Annexure MRTS51.1	☒

7.9 Environmental roles and responsibilities of personnel

The Contractor's EMP(C) shall document all environmental-specific roles and responsibilities of personnel.

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7.10 Selection and management of sub-contractors

The Contractor shall include a requirement to comply with the EMP(C) in all Contractual arrangements with sub-contractors.

7.11 Approvals

The Contractor shall be responsible for identifying statutory requirements and obtaining all Approvals that are required for the construction activities. The EMP(C) shall include a list of all Approvals relevant to the Contract. Details shall include:

a) name, type and reference number of Approval

b) Administering Authority

c) commencement and expiry date, and

d) conditions of Approvals.

Where Environmental Approvals contain or are likely to contain conditions that will extend beyond the period of the Contract, the Contractor shall seek advice from the Principal regarding the acceptance of the Environmental Approval condition prior to formalising the Approval.

Clause 1 of Annexure MRTS51.1 details Approvals that the Principal has obtained for the works and associated conditions and requirements. Copies of all Approvals submitted and obtained by the Contractor shall be made available to the Administrator on request.

The Contractor shall comply with the relevant conditions of Approvals obtained by the Contractor as well as those obtained by the Principal (where stipulated in Clause 1 of Annexure MRTS51.1). The Contractor shall retain records required to demonstrate compliance with all Approvals in accordance with Clause 7.9 of this Technical Specification.

Where the conditions contained in Approvals listed in Clause 1 of Annexure MRTS51.1 contain a reporting requirement or supply of data or other documentation, the Contractor will supply the necessary documentation to the Principal no later than 20 business days prior to the dates specified in the Approvals for the Principal's approval. Reports shall not be released or published without the written approval of the Principal. On the discretion of the Principal, any inadequacies or inaccuracies in the documentation will be addressed to the satisfaction of the Principal at the Contractors expense.

At practical completion the Contractor shall provide documentation of the successful surrender of Approvals held by the Contractor that relate to the Contract. Where surrender is not feasible, and where deemed suitable by the Administrator, the Contractor shall apply to transfer the Approvals to the Principal prior to the defect's liability period concluding. The Contractor shall be responsible for providing all relevant documentation regarding the transfer to the Principal.

7.12 Site induction

Prior to commencing ground disturbing activities, the Contractor shall ensure that all staff involved in, or supervising, these activities, have attended an Environmental Site Induction. This includes, as a minimum, all Site management staff, employees and subcontractors working on activities which disturb the natural ground surface.

The Contractor shall prepare and deliver a Contract Specific Site Induction for to all persons upon entering the Site. The Contractor shall maintain a register signed by those inducted. The register shall

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contain but not be limited to the name of inductees, dates inducted, and the name of the induction facilitator.

A copy of the Contractor's Environmental induction shall be included in the Contractor's EMP(C).

The induction shall include, but not be limited to:

a) basic roles and responsibilities for environmental management including general environmental duty and duty to notify under the *Environmental Protection Act* 1994

b) specific locations within the Site of environmental and Cultural Heritage significance or risks, including exclusions zones and details of prohibited and restricted Biosecurity Matters on Site with photos of the matter

c) the scope and conditions of Approvals applicable to the Contract

d) locations of ancillary activities deemed suitable by the Administrator (including but not limited to stockpile Sites, turnaround points, construction water and material sources)

e) the Limit of Clearing and the boundary of the Cultural Heritage Management Agreement or Cultural Heritage Management Plan where applicable

f) environmental Management Measures stipulated in the Contractor's EMP(C)

g) procedures for notifying of potential Environmental and Cultural Heritage Incidents, and

h) contingency plans for unplanned events.

Cultural Heritage Induction

Prior to commencing ground disturbing activities, the Contractor shall ensure that all staff involved in, or supervising, these activities, have attended the Principal's Cultural Heritage Induction or an alternative Cultural Heritage Induction course deemed suitable by the Administrator. This includes, as a minimum, all Site management staff, employees and subcontractors working on activities which disturb the natural ground surface. The Principal's Cultural Heritage Induction shall be arranged through the Administrator.

8 EMP(C) specific element requirements

8.1 General

Environmental elements included in the EMP(C) shall include, but not be limited to those defined in the following sections.

The EMP(C) shall encompass the Environmental Management of the Works under the Contract including Temporary Works and ancillary activities including sourcing water, gravel, side tracks, stockpile Sites, Contractor's Site facilities and camps, and turnaround points.

The Contractor shall select Management Measures which are reasonable and practicable for the environmental impacts they are managing. A brief justification of the suitability of the Management Measures based on the risk assessed shall be provided in the EMP(C) for environmental elements.

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8.2 Water quality

8.2.1 General

The Contractor shall be responsible for the management of water quality to meet Contractual and legislative requirements, and not cause Environmental Harm or Environmental Nuisance to Waterways within the Site or adjacent waterways into which the Site Discharges.

Water quality management pertaining to sediment is managed under MRTS52 *Erosion and Sediment Control*.

8.2.2 Performance requirements

The Contractor shall at all times undertake reasonable and practicable Management Measures to avoid Environmental Harm or Environmental Nuisance within the Site and to waterways into which the Site Discharges. Specifically, the Contractor shall comply with the *Environmental Protection Act* 1994, Section 440ZG.

Water quality Management Measures shall be designed to achieve Discharge from Site compliant with the Water Quality Investigation Criteria (Discharge) outlined in Table 8.2.2 of this Technical Specification.

The Project Manager and/or Environmental Officer is encouraged to develop Site specific discharge criteria relevant to the receiving environment / catchment Site based on the risks to the receiving environment and Site specific information available. In particular it is recommended that Site specific criteria be developed for:

- naturally occurring acid environments and ecosystems such as wallum streams, and
- projects located in western catchments such as Murray-Darling and desert channel area.

Consideration may need to be given to the analysis of water for Electrical Conductivity particularly if using a coagulant or flocculant which increases EC and water being discharged into a low salinity low flow stream.

The Contractor shall develop and undertake a water quality Monitoring Plan that is reasonable and practicable in accordance with the requirements stipulated in Clause 8.2.3 of this Technical Specification.

Table 8.2.2 – Water quality investigation criteria

Contract Water Quality Risk	Parameter	Discharge	Dewatering to Land[4]	Waterway	
				Level	Change (Upstream-Downstream)
Low water quality risk	Turbidity	No visual evidence of sediment accumulating at point of Discharge.	N/A	No visible change from upstream	-
	Waste	No waste or litter visible	No waste or litter	No waste or litter	-

[4] Deliberate releases to land such as dewatering to land (does not apply to overland flow).

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Contract Water Quality Risk	Parameter	Discharge	Dewatering to Land[4]	Waterway	
				Level	Change (Upstream-Downstream)
	Hydrocarbons tannins, paint	No visible trace	No visible trace	No visible change from upstream	-
Medium and high water quality risk	Suspended Solids	Discharges shall be < 50 mg/L TSS or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit. Where specified, an alternative discharge criteria identified in Annexure MRTS52.1.	N/A	< 50 mg/L TSS or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit	5 mg/L or 10% increase (whichever is greatest)
	pH	Stable pH reading; and General Sites: 6.5 – 8.5, or Wallum/Acidic Ecosystems: 5.0 – 7.0	Stable pH reading, and General Sites: 6.5 – 8.5, or Wallum/ Acidic Ecosystem: 5.0 – 7.0	General Sites: 6.5 - 8.5 Wallum/Acid ecosystems: 5.0 - 7.0	1.0 pH unit change
	Hydrocarbons tannins, paint	No visible trace	No visible trace	No visible change from upstream	-
	Waste	No Waste or litter	No Waste or litter	No Waste or litter	-
	Dissolved Oxygen	90% Saturation (lower limit)[5]	N/A	> 85% saturation for flowing waters DO > 5 mg/L	10% decrease

NOTE: For medium and high water quality risk projects, the Contractor shall ensure that water temperature (°C) is recorded for each monitoring record on the water quality monitoring spreadsheet.

8.2.2.1 Flocculation

NOTE: The use of flocculants for erosion and sediment control is prescribed in MRTS52, however the use and discharge of chemical flocculants are also a water quality consideration.

Where flocculation is undertaken on Site, the Contractor shall select, store, apply and monitor the use of flocculants in accordance with *IECA Best Practice Erosion and Sediment Control Appendix B – Sediment Basin Design and Operation*, Step 17 to ensure that the flocculant does not cause Environmental Harm on the surrounding land and water. If Monitoring by the Contractor or Administrator indicates Environmental Harm may be occurring, flocculation shall cease until changes are made to the flocculation process to prevent the Environmental Harm.

Management of sediment basin sludge where flocculant has been used shall be in accordance with the chemical supplier's advice and documented within the EMP(C).

[5] Derived from the *DEHP Queensland Water Quality Guidelines* 2009, July 2013

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8.2.2.2 Stormwater reuse

The reuse of stormwater (including stormwater captured in sediment basins) for dust suppression, roadworks or landscaping is preferred over Discharge. Where water is to be reused for landscaping it shall be compliant with Clause 7.9 of MRTS16 *Landscape and Revegetation Works* quality requirements.

Where captured stormwater is to be reused on roadworks the Contractor shall address requirements in MRTS04 *General Earthworks*.

8.2.3 Monitoring

The Contractor shall develop and undertake a water quality monitoring plan to verify the effective management of water quality risks from Site. Applicable Water Quality Investigation Criteria consists of three criteria: Discharge, Waterways and Land.

1. Discharge criteria – criteria applicable to stormwater flows moving into Waterways within the Site, Waterways adjacent to the Site and beyond the boundary of the Site where it could reasonably enter a Waterway such as in defined drainage lines (Discharges). Discharges criteria also applies to Discharges from sediment basin(s) prior to dewatering. Discharge criteria does not extend to overland flows.
2. Waterway(s) criteria – criteria for Waterway(s) are applicable to Waterways within a Site or receiving Waterways adjacent to Site. Purpose of the criteria is to compare water quality parameters of the Waterway upstream of the Site to downstream of the Site to identify potential water quality impacts from the Works under the Contract. The Contractor shall nominate representative locations, not more than 100 m upstream and 100 m downstream of the works on all Waterways where stormwater is Discharged.
3. Land criteria – the land criteria applies where sediment basins or other impoundment of water is purposefully dewatered over areas of land for the purpose of evaporation and infiltration. The water quality shall comply with the criteria in Table 8.2.2. Active Monitoring of land criteria will only be required where stipulated in Clause 2 of Annexure MRTS51.1 or as requested by Administrator.

Monitoring results shall be recorded on a monitoring spreadsheet and evaluated by the Contractor against the Water Quality Investigation Criteria to verify compliance. For each Monitoring result that does not conform with the Water Quality Investigation Criteria (Discharge or Waterway) the Contractor shall:

a) Report the non-conformance to the Administrator and Administering Authority in accordance with Clause 7 of this Technical Specification. Including the size of the rainfall event ARI[6], duration of the rainfall event (where applicable), the water quality parameter that exceeded the criteria and level that was recorded from within the Site and downstream of the Site.

[6] The Contractor shall use the most recently available IFD (Intensity – Frequency- Duration) data available through the Bureau of Meteorology (www.bom.gov.au). Alternatively the Contractor may utilise data from a calibrated Site based rainfall intensity gauge and Bureau of Meteorology data. The rainfall event shall be expressed as Annual Recurrence Interval (ARI).

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FOI 26-292 - Document 21

b) Undertake an investigation in accordance with the processes outlined in the Administrating Authority's *Procedural Guide*, Summary Sheet[7], and

c) Develop and implement corrective actions such as improved work procedures or Management Measures to improve water quality and prevent re-occurrence of Monitoring non-conformances.

NOTE: The Monitoring non-conformance will be a Contractual non-conformance unless the Contractor can be demonstrated the following:

- for Total Suspended Solids, the rainfall event that caused Discharge was greater than the specified design event (Table 8.2.2).
- reasonable and practicable measures were in place, functional and maintained, or
- non-conformance was caused by factors external to Site activities / practices (for example, an upstream third-party polluter).

8.2.3.1 Low risk contracts – Visual Monitoring of Discharge and Waterways

For contracts specified as low water quality risk in Clause 2.1 of Annexure MRTS51.1 Monitoring of Discharges and Waterways shall consist of visual Monitoring. Discharge and Waterway Monitoring shall be undertaken by the Contractor in accordance with Table 8.2.3.1 of this Technical Specification unless otherwise specified in Clause 2.2 of Annexure MRTS51.1.

Table 8.2.3.1 – Water quality Monitoring locations and frequency

Monitoring	Locations	Frequency / Trigger	
		Weekly[8]	15 mm Rainfall in 2 hours[9]
Discharge	At representative locations where concentrated-flows of stormwater Discharges from Site.		✓
Waterways	At representative locations upstream and downstream of the Site on Waterways within the Site and where Discharges enter from the Site. Where possible, the upstream and downstream Monitoring location should be no more than 100 m from the Works.	✓	✓

Visual Monitoring will be documented in the form of spreadsheets and photographs of the Monitoring locations. Photographs must include a time and date stamp. Rainfall data from the Bureau of Meteorology may be used for any comparison with Monitoring where required.

Where Monitoring observes Discharges or Waterways to be:

a) visually contaminated

[7] Note the *DES Procedural Guide* requirements pertaining to sediment basins shall only be applied where appropriate for medium and high risk projects.
[8] Weekly during Works where potential impact to a Waterway or Waterbody with water present (for example from earthworks, stockpiling of pre-coated aggregate, concrete curing within a Waterway, clearing and grubbing).
[9] Transport and Main Roads calculated this, the contractor is able to adopt a higher standard to manage risk where appropriate.

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b) there is a visible accumulation of sediment or other contaminant within a Waterway at the point of Discharge, or

c) a complaint is received

the Contractor shall undertake investigations, assess whether reasonable and practicable measures are implemented, and whether corrective actions are required. The outcome of the investigation shall be recorded and reported to the Administrator in accordance with Clause 7 of this Technical Specification.

The Administrator may at their discretion, instruct the Contractor to undertake further investigations and/or undertake water quality monitoring in accordance with Clause 8.2.3.2 of this Technical Specification.

8.2.3.2 Medium and high water quality risk contracts

For projects specified as medium or high water quality risk in Clause 2.1 of Annexure MRTS51.1, the Contractor shall be responsible for developing, undertaking and recording a Water Quality Monitoring Program as part of the EMP(C). The Contractor's Water Quality Monitoring Program shall be developed in accordance with the *Monitoring and Sampling Manual* 2018. The Contractor's Water Quality Monitoring Program shall be reasonable and practicable considering risks from Works under the Contract and the sensitivity of the receiving Waterways.

8.2.3.2.1 Site rainfall

In order to obtain accurate rainfall data, the Contractor shall install a proprietary rain gauge and/or proprietary meteorological station and keep a record of the rainfall depth (mm) of each rainfall event, and where possible duration of the rainfall event. In instances of continuous rainfall greater than 24 hours, daily records and total duration shall be recorded when the Site is still open for operation. For geographically diverse Sites where rainfall is likely to differ significantly across the Site the Contractor shall install a rain gauge at locations representative of each climatic zone.

8.2.4 EMP(C) requirement for water quality

The EMP(C) shall include descriptions and/or diagrams of:

a) Waterbodies and Waterways within 50 m of the Site boundaries that the Site Discharged to.

b) List Works under the Contract (including ancillary activities and temporary works) in locations at risk of impacting water quality other than erosion and sediment control risks, including:

   i. the potential contaminants

   ii. locations of Works in relation to waterbodies and Waterways, and

   iii. flow paths to waterbodies and Waterways within and adjacent to Site.

c) Water Quality Management Measures, other than erosion and sediment controls which are addressed in the Erosion and Sediment Control Plan in accordance with MRTS52.

d) The Contractor's Water Quality Monitoring Plan:

   i. Low risk – The plan shall nominate Monitoring locations, frequency and methodology, or

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ii. For medium and high water quality risk – the Contractor's Monitoring program in accordance with the *Monitoring and Sampling Manual* 2018 that shall document as a minimum:

- sampling scope – objectives of sampling, spatial boundaries, duration and frequency
- sampling design – what, where, when and how to sample including quality control requirements, and
- the spreadsheet template for analysis of results against Water Quality Investigation Criteria (Table 8.2.2 of this Technical Specification) and rainfall data.

e) Contingency plans for Environmental Harm to water quality.

8.3 Erosion and sedimentation

Requirements relating to Erosion and Sediment Control are contained within MRTS52 *Erosion and Sediment Control*. The Erosion and Sediment Control Plan forms part of the Environmental Management Plan (Construction) (EMP(C)).

8.4 Cultural Heritage

8.4.1 General

The Contractor shall be responsible for the management (including protection) of Indigenous and non-Indigenous Cultural Heritage within and adjacent to the Site to avoid harm to Cultural Heritage.

Contract-specific management requirements are stipulated in Clause 3.1 - 3.6 of Annexure MRTS51.1.

Where stated in Clause 3.4 of Annexure MRTS51.1, the Department has entered into an agreement with Indigenous parties for the management of Cultural Heritage located within and adjacent to the Site.

8.4.2 Performance requirements

The Contractor shall undertake Work under the Contract in compliance with the *Aboriginal Cultural Heritage Act* 2003, *Torres Strait Islander Cultural Heritage Act* 2003, and Queensland Heritage Act 1992 and the *Environment Protection and Biodiversity Conservation Act* 1999.

The Contractor shall at all times take reasonable and practicable Management Measures to avoid harm to Cultural Heritage from Works under the Contract. Where a Cultural Heritage Management Plan (CHMP) or Cultural Heritage Management Agreement (CHMA) is specified in Clause 3 of Annexure MRTS51.1, the Contactor shall operate in accordance with the conditions.

The Contractor shall comply with the contract specific requirements in Clause 3.1 - 3.6 of Annexure MRTS51.1.

8.4.2.1 Indigenous Heritage

Where disturbance or clearing is required outside the area covered by the CHMA or CHMP, the Contractor shall notify the Administrator. Works will not commence beyond the area covered by CHMA or CHMP, until deemed suitable by the Administrator.

Where, during the Contract, items of potential Indigenous Cultural Heritage are discovered when Cultural Heritage Personnel are present, activities shall only proceed in accordance with the

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procedures outlined in the CHMP or CHMA. If Cultural Heritage Personnel are not present at the time of a discovery, refer to Clause 8.4.2.3 of this Technical Specification for management requirements.

8.4.2.2 Non-Indigenous heritage

The Contractor shall comply with any Approval conditions as stated in Clause 1 of Annexure MRTS51.1. Unless otherwise stated in Clause 1 of Annexure MRTS51.1, the Contractor shall obtain all Approvals required for impacting heritage listed places within and adjacent to the Site as per the applicable legislation.

8.4.2.3 Unexpected discovery / find

Where items of potential Cultural Heritage significance (Indigenous or Non-Indigenous) are discovered (and when no Cultural Heritage Personnel are present for Indigenous heritage), the Contractor will follow the Find – Stop – Notify – Manage procedure:

a) FIND: An item of potential Cultural Heritage is found.

b) STOP: All work at the Find location shall cease. The item shall not be removed or disturbed.

c) NOTIFY: The Contractor shall immediately notify the Administrator. The Administrator will promptly notify the Principal's Cultural Heritage Officer, and

d) MANAGE: Principal's Cultural Heritage Officer will arrange for the potential Cultural Heritage to be inspected and assessed for significance. Principal's Cultural Heritage Officers shall provide the temporary management recommendations. This may include securing the find by erecting an exclusion zone for a period of time and precluding access to that area. The Contractor shall notify all Site personnel of the object and/or area and proposed treatment of the object and/or area as soon as possible, but prior to commencing work on the next working day.

8.4.3 Monitoring

NOTE: This section relates to Monitoring activities generally and is not exclusively related to Monitoring of Works by Cultural Heritage Personnel.

Where stipulated in Clause 3 of Annexure MRTS51.1, Monitoring is required of specific areas within the Site. Where Monitoring is required, it shall be undertaken and reported in accordance with Clause 7 of this Technical Specification.

Where stipulated in the CHMA or CHMP, Monitoring by Cultural Heritage personnel is required in addition to the Contractor's Monitoring activities. In accordance with the CHMA or CHMP, the Contractor shall be responsible for ensuring that the Cultural Heritage Personnel are on Site during ground disturbance activities identified in the CHMA or CHMP. If activities requiring Monitoring by Cultural Heritage Personnel are occurring and Cultural Heritage Personnel are not present, the Contractor is to advise the Administrator immediately. The Contractor may only proceed in accordance with the conditions of the CHMP or CHMA.

Whilst on Site, the Cultural Heritage personnel(s) shall be supervised and coordinated by the Contractor. The Contractor shall ensure that the Cultural Heritage personnel are appropriately inducted, as required by Workplace Health and Safety Regulations. The Contractor shall ensure that the Cultural Heritage personnel comply with the relevant Codes of Conduct and workplace regulations that apply to the construction Site. Cultural Heritage personnel(s) shall be employed and paid by the Principal.

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The Contractor's Work Supervisor shall verify and sign the Cultural Heritage personnel including monitor(s) signed and completed daily Monitoring Report and timesheet daily. (A copy of the report / timesheet proforma shall be provided by the Principal). The Contractor shall retain a copy of timesheets store and submit to the Administrator on a weekly basis.

8.4.4 EMP(C) requirements for Cultural Heritage

The EMP(C) shall include documents and/or diagrams indicating the following:

a) the Principal's Cultural Heritage Officer contact details

b) location of known Cultural Heritage significance within and adjacent to the Work Site

c) Work under the Contract likely to occur in proximity to Cultural Heritage

d) Cultural Heritage Management Measures, and

e) a Monitoring Plan for cultural heritage including Works under the Contract that Cultural Heritage Personnel are required to monitor.

8.5 Noise

8.5.1 General

The Contractor is responsible for the management of construction noise generated from Work under the Contract. The requirements of this Technical Specification do not include management of noise in relation to noise exposure within the Workplace (occupational noise). This Technical Specification does not address noise impacts on native fauna unless specified in the Annexure MRTS51.1.

In addition to the Sensitive Receptors and Critical Facilities, Infrastructure and Utilities identified by the Principal in Clause 4 of Annexure MRTS51.1, the Contractor shall be responsible for identifying Sensitive Receptors and Critical Facilities, Infrastructure and Utilities likely to be affected by construction noise through the application of the performance requirements in Clause 8.5.2.

8.5.2 Performance requirements

The Contractor shall at all times take reasonable and practicable Management Measures to avoid and mitigate Environmental Harm or Environmental Nuisance from noise associated with Work under the Contract.

The documentation, assessment and mitigation requirements are set by the Contract's noise risk level, as defined in Clause 4.1 of Annexure MRTS51.1.

For all Contracts, the Contractor shall review the Noise Management Plan or EMP(C), update and implement additional Management Measures where:

- directed by the Administrator
- in response to a justifiable complaint caused by the Work under the Contract, or
- when changes in the equipment / work method, intensity, location, duration or timing of impacts that are expected to increase noise impacts are foreseen.

8.5.2.1 Low noise risk

For Contracts specified as low noise risk in Clause 4.1 of Annexure MRTS51.1, the *Transport Noise Management Code of Practice:* Volume 2 is not applicable.

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8.5.2.2 Medium or high noise risk

For Contracts identified in Clause 4.1 of Annexure MRTS51.1 as medium or high risk for noise, the Contractor shall comply with the *Transport Noise Management Code of Practice*: Volume 2. Specifically, the Contractor shall be responsible for preparing, undertaking, submitting and maintaining the following:

a) Where specified in Clause 4.3 of Annexure MRTS51.1 that the Principal has not completed a preconstruction assessment, the Contractor shall undertake a Noise Assessment Report in accordance with Section 4 of the *Transport Noise Management Code of Practice*: Volume 2, to identify noise generating activities on Site, Sensitive Receptors likely to be impacted by Construction noise, and undertake assessment of likely noise impacts. The Noise Assessment Report will identify Sensitive Receptors to be included within the Noise Management Plan and shall be carried out prior to the commencement of construction. The Noise Assessment Report shall be signed off by an RPEQ with relevant qualifications and experience, and submitted to the Administrator for deemed suitability.

   If the Principal has provided a Noise Assessment Report that considers construction noise, the Contractor shall review the Noise Assessment Report and comply with the requirements. If the Contractor cannot comply with or has differing construction methods to those documented within the existing Noise Assessment Report, then the Contractor shall advise the Administrator and prepare an update to the Noise Assessment Report.

b) Development of a stand-alone Noise Management Plan in accordance with the requirements of the *Transport Noise Management Code of Practice*: Volume 2. The Noise Management Plan shall be based on the information and outcomes of the RPEQ-signed Noise Assessment Report.

c) Planned and trial Noise Assessment Report (including Monitoring) shall be undertaken by the Contractor where stipulated in the Noise Management Plan.

8.5.3 Monitoring

For medium and high noise risk Contracts, the Contractor shall undertake noise assessment (referred to as construction stage assessment in the *Transport Noise Management Code of Practice*: Volume 2 where required by the Contractor's Noise Management Plan.

8.5.4 EMP(C) requirements for noise

For low noise risk contracts

The EMP(C) requirements and documentation shall be as follows:

a) location of any Sensitive Receptors and Critical Facilitates, Infrastructure and Utilities in proximity to the project

b) noise (including air blasting overpressure) generating activities, their locations, work periods[10] (standard hours, non-standard hours (day / evening), nonstandard hours (night time))

c) evaluation outcome of whether Sensitive Receptors will likely be impacted by construction noise

[10] Work periods are as defined in the *Transport Noise Management Code of Practice:* Volume 2 Table 3.1.3.

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d) noise Management Measures to avoid or minimise noise impacts, and

e) contingency plan for Environmental Harm associated with noise impacts.

For medium or high noise risk contracts

The Contractor's Noise Management Plan shall be prepared, maintained and implemented in accordance with the *Transport Noise Management Code of Practice*: Volume 2. The Noise Management Plan shall be prepared as a stand-alone document. The Noise Management Plan and supporting Noise Assessment Report will form part of the overall EMP(C).

8.6 Vibration

8.6.1 General

The Contractor is responsible for managing Work under the Contract to avoid Environmental Harm or Environmental Nuisance to Sensitive Receptors and Critical Facilities, Infrastructure or Utilities. For the purpose of this Technical Specification potential vibration impacts are categorised in two forms:

1. Human comfort vibration management relates to managing vibration to avoid nuisance to public, residents or people utilising the area in the vicinity of the Site, and
2. Building / Structural vibration management relates to managing vibration to avoid structural damage to buildings and structures within and beyond the Site. This also includes to managing impacts on building contents and surrounding utilities and services.

This Technical Specification does not address vibration impacts to native fauna unless specified in Clause 5 of Annexure MRTS51.1.

In addition to the Sensitive Receptors and Critical Facilities, Infrastructure and Utilities identified by the Principal in Clause 5 of Annexure MRTS51.1, the Contractor shall be responsible for identifying Sensitive Receptors and Critical Facilities, Infrastructure and Utilities likely to be affected by Construction vibration through the application of the performance requirements in Clause 8.6.2.

8.6.2 Performance requirements

The Contractor shall at all times take reasonable and practicable Management Measures to mitigate:

1. Vibration impacts associated with Work under the Contract so as not to cause Environmental Harm and Environmental Nuisance in accordance with *Environmental Protection Act* 1994 (Human comfort Vibration), and
2. Environmental Harm to structures, premises, services and buildings within or beyond the boundary of the Site as a result of Work under the Contract. (Building / Structural Vibration).

The Contractor shall document the reasonable and practicable Management Measures either in a standalone Vibration Management Plan or the EMP(C). The Contractor shall review the Vibration Management Plan and update and implement additional Management Measures where:

a) directed by the Administrator

b) in response to a justifiable complaint caused by the Work under the Contract

c) in the event of structural / building damage caused by the Work under the Contract, or

d) when changes in the equipment / work method, intensity, location, duration or timing of impacts that are expected to increase vibration impacts are foreseen.

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FOI 26-292 - Document 21

The performance requirements of the Contract are dependent on the vibration risk level specified in Clause 5.1 of Annexure MRTS51.1.

8.6.2.1 Vibration (building / structural)

In managing vibration effects in nearby buildings and structures, for all contacts the Contractor shall comply with the following:

a) Vibration limits given within the *Transport Noise Management Code of Practice*: Volume 2 (for medium or high Vibration Risk Projects only).

b) Air Blast Overpressure and ground vibration from blasting limits given in *Environmental Protection Act* 1994 Section 440ZB[11].

c) Ground vibration values in TN03 *Measurement of Ground Vibrations and Airblast* unless otherwise set by Vibration Assessment Report, and

d) Vibration Monitoring requirements stated in Clause 5.4 of Annexure MRTS51.1.

Where the vibration criteria cannot be achieved, the Contractor shall notify the Administrator and advise the owner of the premise, building, service or structure affected of the predicted particle velocity and what reasonable and practicable Management Measures shall be employed to minimise impacts. The Administrator shall assess the application for suitability prior to the Contractor proceeding.

8.6.2.2 Low vibration risk contracts

For contracts specified as low vibration risk in Clause 5.1 of Annexure MRTS51.1, the *Transport Noise Management Code of Practice:* Volume 2 is not applicable. The Contractor shall nominate reasonable and practicable Management Measures to prevent Environmental Harm and Environmental Nuisance.

8.6.2.3 Medium or high vibration risk contracts

For contracts identified in Clause 5.1 of Annexure MRTS51.1 as medium or high risk for vibration, the Contractor shall comply with the *Transport Noise Management Code of Practice*: Volume 2. Specifically, the Contractor shall be responsible for undertaking, submitting to the Administrator, implementing and maintaining the following:

a) Where specified in Clause 5.2 of Annexure MRTS51.1, that the Principal has not completed a Preconstruction Assessment, the Contractor shall prepare and undertake a Vibration Assessment Report identifying Sensitive Receptors and Critical Facilities, Infrastructure and Utilities in accordance with the *Transport Noise Management Code of Practice*: Volume 2. The Vibration Assessment Report will identify Sensitive Receptors to be included within the Vibration Management Plan and shall be carried out prior to the commencement of vibration-generating Works. The Vibration Assessment Report shall be signed off by an RPEQ

[11] A person must not conduct blasting if:

(a) the air blast overpressure is more than 115dB Z Peak for four out of any five consecutive blasts, or

(b) the air blast overpressure is more than 120dB Z Peak for any blast; or (c) the ground vibration is:

(i) for vibrations of more than 35Hz-more than 25 mm a second ground vibration, peak particle velocity, or

(ii) for vibrations of no more than 35Hz-more than 10 mm a second ground vibration, peak particle velocity.

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with relevant qualifications and experience, as required by the *Transport Noise Management Code of Practice*: Volume 2 and submitted to the Administrator for deemed suitability.

b) Where the Principal has provided a Vibration Assessment Report that considers construction Vibration, the Contractor shall review the Principal's Vibration Assessment Report and comply with the requirements. If the Contractor cannot comply with the Principal's Vibration Assessment Report, then the Contractor shall advise the Administrator and prepare an update to the Vibration Assessment Report prior to commencement of vibration-generating Works.

c) Where required by Vibration Assessment Report or Clause 5.5 of Annexure MRTS51.1, a condition survey of buildings and structures as "at risk" of damage. The condition survey shall be undertaken prior to commencing vibration generating Works. In addition, condition surveys shall be carried out on those structures and buildings listed in Clause 5.4 of Annexure MRTS51.1, prior to the commencement of Works unless the Vibration Assessment Report determines the structures / buildings are not at risk of damage. The survey shall assess the current structural and architectural condition of buildings and structures and shall record all existing cracks and other defect. Photographs shall support the condition survey. Unless stated in Clause 5.6 of Annexure MRTS51.1 a registered structural engineer (RPEQ) shall carry out the condition survey. The survey is to be carried out with the consent and in the presence of the owner or owner's representative. A copy of the condition survey shall be given to the Administrator five working days before any Works that cause vibration start.

d) A standalone Vibration Management Plan that includes details as required by the *Transport Noise Management Code of Practice*: Volume 2. The Vibration Management Plan shall be based on the information and outcomes of the RPEQ signed Vibration Assessment Report.

e) Undertake post-construction condition surveys at buildings and structures subsequent to completion of the works. Post-construction condition survey reports detailing the results of the inspections shall be submitted to the Administrator following completion of the relevant activity.

f) Undertake other investigations such as building contents investigations and infrastructure, services and utility investigations as determined in the Vibration Assessment Report.

Where the Contractor's Vibration Assessment Report identifies a department's structure(s) are at risk of impact from vibration, the Contractor shall advise the Administrator. At their discretion, the Administrator may advise the Contractor of vibration criteria for the specific structure(s) potentially impacted.

8.6.3 Monitoring

Where stipulated in Clause 5.3 of Annexure MRTS51.1 or by the Contractor's Vibration Management Plan or vibration section of the EMP(C), the Contractor shall undertake assessment for vibration (human comfort) and/or Vibration (structural / building) during Works under the contract identified as having potential risk of impact.

In accordance with Section 4.3 of the *Transport Noise Management Code of Practice*: Volume 2, in the event of vibration-related complaints the Contractor shall investigate Management Measures and possible impacts from vibration. Upon direction from the Administrator, the Contractor shall undertake a complaint-triggered vibration assessment.

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Contract records shall include all vibration assessment results are documented, investigated and managed in accordance with the *Transport Noise Management Code of Practice*: Volume 2 and Clause 7 of this Technical Specification.

8.6.4 EMP(C) requirements for vibration

For low vibration risk contracts, the EMP(C) shall include documents and/or diagrams indicating the following:

a) the type of Vibration Sensitive Receptors and Critical Facilities, Infrastructure and Utilities potentially impacted by Works under the Contract the location in relation to Site

b) location of significant Vibration and Air Blasting Overpressure generating Works within the Site

c) applicable construction vibration criteria for assessment

d) evaluation outcome of which Sensitive Receptors, structures and/or buildings will likely be impacted by construction vibration and Air Blast Overpressure and from what Works

e) vibration Management Measures and strategies to avoid or minimise Environmental Harm of vibration (human comfort) and vibration (structural / building), and

f) contingency plan for observed damage to structures (private, public or departmental-owned).

For medium or high vibration risk contracts, the Contractors Vibration Management Plan shall be prepared, maintained and implemented in accordance with the *Transport Noise Management Code of Practice*: Volume 2. The Vibration Management Plan shall be prepared as a stand-alone document. The Vibration Management Plan and supporting Vibration Assessment Report will form part of the overall EMP(C).

NOTE: Where vibration and noise risk levels are both medium and high, the Assessment Report and Management Plans may be combined in accordance with the Transport Noise Management Code of Practice: Volume 2*.*

8.7 Air quality

8.7.1 General

The Contractor shall be responsible for managing work under the Contract to avoid and minimise Environmental Harm on air quality including from dust, smoke and offensive odours and other air pollutants.

8.7.2 Performance requirements

The Contractor shall at all times take reasonable and practicable Management Measures to avoid causing Environmental Harm and Environmental Nuisance.

Where specified in Clause 6.3 of Annexure MRTS51.1, the Contractor shall assess and manage construction related air quality in accordance with Chapter 6 of the *Road Traffic Air Quality Management Manual*. Construction related air quality complaints shall be managed in accordance with Chapter 7 of the *Road Traffic Air Quality Management Manual*.

Burning of material shall not be permitted unless specifically allowed by Clause 6.1 of Annexure MRTS51.1. If burning is permitted, the Contractor shall:

a) obtain approval from the Administering Authority prior to burning

b) notify adjacent landowners

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c) comply with additional conditions specified in Clause 6.2 of Annexure MRTS51.1, and

d) not burn regulated waste that shall create toxic or nuisance emissions.

8.7.3 Monitoring

Where stipulated in Clause 6.3 of Annexure MRTS51.1, the Contractor shall undertake air quality Monitoring. Air quality Monitoring shall be undertaken in accordance with the current Australia Standard measurement techniques. Contract records shall include all air quality Monitoring results, schedule and all instrument calibrations. Reporting of air quality Monitoring shall be in accordance with Clause 7 of this Technical Specification.

Weekly Site Inspections shall include observations of the Site for visual evidence of dust or emissions travelling beyond the boundary of the Site and evidence of dust fallout from the Works on adjacent vegetation or buildings.

8.7.4 EMP(C) requirements for air quality

The EMP(C) shall include documents and/or diagrams indicating the following:

a) Location of Air Quality Sensitive Receivers to the Site.

b) Works likely to cause Environmental Harm or Environmental Nuisance in relation to air quality and location of these works on Site (for example, blasting, excavation, crushing, screening and earth moving plant, compressors and pumps, fabrication areas, lead paint removal, workshops, concrete batching and mixing plant, and all other construction plant and equipment).

c) Prevailing wind direction and speeds (wind rose) generally expected for the Site location (available from Bureau of Meteorology).

d) Evaluation outcome of which air quality sensitive receivers will likely experience Environmental Nuisance or Environmental Harm in relation to air quality (unless Monitoring specified in Annexure MRTS51.1 this is qualitative evaluation).

e) Management Measures and strategies for mitigating Environmental Nuisance and Environmental Harm to air quality. Works that may result in air quality emissions of a substance harmful to health, shall be identified and additional specific management practices and controls prescribed.

f) Where Monitoring is stipulated in Clause 6.3 of Annexure MRTS51.1, air quality Monitoring methodology, equipment used, frequency, duration, location of equipment and details of the person undertaking the Monitoring Assessment.

g) Where Air Quality Compliance Testing is stipulated in Clause 6.3 of Annexure MRTS51.1, Air Quality Compliance Testing methodology, equipment used, frequency, duration, location and details of the person undertaking the Compliance Testing Assessment, and

h) Contingency Plan for observations of emissions exceeding criteria.

8.8 Acid sulfate soils

The Contractor shall be responsible for the management of actual or potential acid sulfate soils within the Site. The Contractor's EMP(C) shall address the requirements of MRTS04 *General Earthworks* including the requirements concerning the management of actual and potential acid sulfate soils.

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8.9 Contaminated Sites

8.9.1 General

The Contractor shall be responsible for managing Work under the Contract in order to mitigate risks of Environmental Harm from Contaminated Sites within the Site (for example, contaminated soil, Waste dumps, unexploded ordnances). In addition to the requirements in this Technical Specification, the Contractor shall comply with the requirements of Clause 11 of MRTS04 *General Earthworks* in relation to use of or disposal of surplus and unsuitable material and MRTS96 *Management and Removal of Asbestos*.

Known locations of Contaminated Sites are stated in Clause 7.1 of Annexure MRTS51.1.

Where an Administrating Authority-accepted Site Management Plan exists, this is identified in Clause 7.2 of Annexure MRTS51.1.

8.9.2 Performance requirements

The Contractor shall at all times take reasonable and practicable Management Measures to manage known Contaminated Sites in order to avoid and prevent the spread of contaminants either within the Site or beyond the boundary of the Site. Management shall be in accordance with the Administrating Authority-approved Site Management Plan where it exists. Where the contract requires disturbance of known Contaminated Sites, Management Measures will extend to the active containment and, where stipulated in Annexure MRTS51.1, treatment of contaminated material. Management must be in accordance with statutory requirements under the *Environmental Protection Act* 1994. Where disposal is required off Site, a disposal permit shall be obtained by the Contractor unless otherwise stated in Clause 1 of Annexure MRTS51.1.

Where stipulated in Clause 7.3 of Annexure MRTS51.1, the Contractor shall develop and implement a Contaminated Site investigation by a suitably qualified person, management and Compliance Testing Plan in accordance with *Environmental Protection Act* 1994, Chapter 7, Part 8 Contaminated Land.

If an additional Contaminated Site is identified during Work under the Contract, the Contractor shall:

a) notify the Administrator in accordance with Clause 7 of this Technical Specification

b) notify the Administrating Authority in accordance with the requirements of the *Environmental Protection Act* 1994 (for unexploded ordnances (UXO) notify Department of Defence)

c) prevent spread of contamination

d) manage the Contaminated Site in accordance with statutory requirements

e) where instructed by the Administrator, the Contractor will develop a Site Management Plan in accordance with statutory requirements, submit to the Administrator for suitability, submit to the Administrating Authority for acceptance, and carry out remediation of Contaminated Site in accordance with the Site Management Plan, and

f) provide the Administrating Authority-accepted Site Management Plan to Administrator for records.

The Principal may at their discretion elect to undertake the investigation and management of additional Contaminated Site by its own agents. The Contractor shall facilitate the investigation.

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FOI 26-292 - Document 21

8.9.3 Monitoring

Where stipulated in Clause 7.2 of Annexure MRTS51.1, the Contractor shall develop and undertake a reasonable and practicable Monitoring Plan submitted for deemed suitability with the EMP(C).

In addition to the requirements of Clause 7 of this Technical Specification, Weekly Site Inspections shall incorporate observations for evidence of contaminates or contaminated material being transported from the Contaminated Site without appropriate management.

8.9.4 Compliance testing

Where stipulated in Clause 7.3 of Annexure MRTS51.1, the Contractor shall undertake Compliance Testing in accordance with the Contractor's (or pre-existing) Contaminated Site Management Plan and the requirements stipulated in the *National Environment Protection (Assessment of Site Contamination) Measure*, 1999. Compliance Testing shall be required of material treated for remediation as part of this Contract. The Contractor shall provide Inspection and Test Plans (ITP's) for Contaminated Site Compliance Testing as part of the Quality Plan.

8.9.5 EMP(C) requirements for Contaminated Sites

The EMP(C) shall include documents and/or diagrams indicating the following:

a) location of known Contaminated Sites and known insitu contaminants

b) Management Measures and Monitoring requirements applicable to each Contaminated Site

c) where stipulated by Clause 7.3 of Annexure MRTS51.1, the EMP(C) shall document the Contractor's Contaminated Site Management Plan including methods of assessment, remediation and Compliance Testing, and

d) contingency plan for the event of contaminants leaving Site or being discovered on Site.

8.10 Native fauna

8.10.1 General

The Contractor shall be responsible for managing potential Environmental Harm to native fauna, their breeding places and their habitat within the Site and adjacent to the Site.

The Contractor shall be responsible for the assessment, management and compliance of temporary Waterway Barrier Works undertaken as part of this Contract unless otherwise stipulated in Clause 1 of Annexure MRTS51.1. Principal identified *Queensland Waterways for Waterway Barrier Works*, as mapped by ADMINISTRATING AUTHORITY[12], are identified in Clause 8.1 of Annexure MRTS51.1.

NOTE: This Technical Specification does not address permanent fauna sensitive road design requirements as these shall be included in Contract design drawings.

8.10.2 Performance requirements

The Contractor shall take reasonable and practicable Management Measures to avoid Environmental Harm and Environmental Nuisance to native fauna, and to known fauna habitat and breeding places. Where Environmental Harm cannot be avoided, the Contractor shall comply with the provisions of both State and Commonwealth legislation pertaining to native fauna. Where impacts to native fauna, known

[12] https://www.data.qld.gov.au/dataset/queensland-waterways-for-waterway-barrier-works

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habitat and breeding places cannot be avoided, the Contractor shall operate in accordance with legislative requirements.

Where the Principal has identified native fauna habitat, breeding places(s), the locations and specific management requirements of the Principal are stipulated in Clause 8.2 of Annexure MRTS51.1. The Contractor shall incorporate the Management Measures stipulated in Clause 8.2 of Annexure MRTS51.1 in the fauna management section of the EMP(C). The Principal has obtained State-wide Environmental Approvals for Tampering with Animal Breeding Places of Least Concern Species[13] (SMP-low risk). Where the Works under the Contract will result in a requirement to tamper with a breeding place covered by the scope of the Principal's State-wide SMP-low risk, the Contractor shall be responsible for:

a) Tampering with any least concern breeding places in accordance with Table 1 of the SMP-low risk including the engagement of Suitably Qualified and Experienced Person (fauna) as required.

b) Providing the details of Clause 8.2 of Annexure MRTS51.1 to the Contractor's Suitably Qualified and Experienced Person (fauna) for compliance as part of their management program.

c) Complete the Register of Tampering with an Animal Breeding Place[14] in accordance with the department's Technical Note completing a SMP Register, to record any breeding places known to have been tampered with and whether native fauna have been injured or killed. If no animal breeding places are identified "Nil" shall be entered into the register. Report fauna-related Monitoring and submit the SMP Register with the Monthly Environmental Report (Clause 7 of this Technical Specification), and

d) Submit the final completed Register to Administrator at Practical Completion in accordance with Clause 7.8 of this Technical Specification.

If required by legislation, the Contractor shall obtain other necessary Approvals unless otherwise Principal-supplied in Clause 1 of Annexure MRTS51.1.

Any unauthorised death of fauna or tampering with a breeding place not in accordance with an Approval will be reported in accordance with Clause 7 of this Technical Specification.

In the event that native fauna species is injured or killed on Site, the Contractor shall undertake an investigation into the Environmental Incident and determine whether the injury / death was related to Works under the Contract and whether reasonable and practicable measures were in place and determine if corrective actions are warranted to prevent a similar incident re-occurring. The Contractor shall submit the results of their investigation in accordance with Clause 7 of this Technical Specification. The Administrator may at its discretion elect to undertake their own investigation.

Where stipulated in Clause 8.2 of Annexure MRTS51.1, the Contractor shall implement measures to facilitate the safe movement of fauna across the Site. Where temporary fencing is required in Clause 8.3 of Annexure MRTS51.1, the Contractor shall plan for fauna movement as part of the fencing installation.

[13] https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Animal-Breeding
[14] https://environment.des.qld.gov.au/licences-permits/plants-animals/documents/fm-wl-register-animal-breeding-place.xlsx

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8.10.2.1 Waterway barrier works

Principal-identified Queensland Waterways for Waterway Barrier Works within the Site are identified in Clause 8.4 of Annexure MRTS51.1. Where waterway barrier works Approvals (Development Approval or Self Assessable Code) apply to permanent structures, the Contractor shall undertake works in accordance with the applicable Approval. If temporary waterway barrier works are to be constructed, raised or modified as part of this Contract, the Contractor shall ensure compliance with QDAF's *Accepted development requirements for operational work that is constructing or raising waterway barrier works* (Acceptable Development Requirements).

Where compliance with the Accepted Development Requirements is not practicable, the Contractor is obligated to obtain an applicable Development Approval and comply with Approval conditions.

If the Contractor requires access over or works within a waterway mapped under the *Queensland Waterways for Waterway Barrier Works* not within the Site, the Contractor is required to undertake an assessment of applicable fish passage requirements. The Contractor shall obtain the necessary Approvals.

The Contractor shall be responsible for completing and submitting pre and post works notifications for all waterway barrier (permanent and temporary) works under the Contract.

8.10.3 Monitoring

Contract-specific requirements for Monitoring are outlined in Clause 8.4 of Annexure MRTS51.1 or Clause 1 of Annexure MRTS51.1 under the Environmental Approval.

When operating under the State-wide SMP-low risk, the Contractor shall engage a Suitably Qualified and Experienced Person (Fauna) to undertake pre-clearing inspections of vegetation and potential breeding places and Monitor for native fauna and breeding places when undertaking Works that are known or likely to impact animal breeding places or native fauna.

The Suitably Qualified and Experienced Person (fauna) inspections are to verify the absence or presence of native fauna and breeding places and, where active breeding places exist, the absence or presence of eggs or young. The Suitably Qualified and Experienced Person (Fauna) shall advise the Contractor of the outcomes of the inspections and whether the SMP-low risk is applicable. Where the State-wide SMP-low risk applies, the Contractor shall, based on the advice of the Suitably Qualified and Experienced Person (Fauna), undertake:

a) measures to avoid tampering with breeding places, death or injury to animals

b) where avoidance is not possible, engage the Suitably Qualified and Experienced Person (fauna) to undertake Management Measures to relocate and preserve breeding places and animals if appropriate

c) where avoidance and relocation is not practicable, engage the Suitably Qualified and Experienced Person (fauna) to destroy breeding places and remove eggs and young for rehabilitation, and

d) as a last resort, engage the Suitably Qualified and Experienced Person (fauna) to destroy eggs, young under an appropriate Damage Mitigation Permit.

The Contractor shall record Monitoring and tampering data in the Register for tampering with animal breeding places.

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8.10.4 EMP(C) requirements for native fauna

The EMP(C) shall include documents and/or diagrams indicating the following:

a) location of native fauna habitat and breeding places within the Site and relative to the Limits of Clearing

b) identification of activities that are likely to impact fauna, habitat or animal breeding places and the nature of impacts

c) identification of mapped *Queensland Waterways for Waterway Barrier Works* impacted by the Work under the Contract and location of any temporary Waterway Barrier Works

d) Management Measures and strategies for native fauna, breeding places, habitat and fish passage, including details of any Suitably Qualified and Experienced Person (fauna) to be utilised for fauna management

e) contingency plan including procedures for fauna rescue and release including treatment of fauna injured by Work under the Contract, and

f) contact details for emergency wildlife care shall be included on the Site's emergency contact list and within the fauna management plan.

8.11 Vegetation

8.11.1 General

NOTE: This Vegetation section of MRTS51 is for the management of potential impacts upon Significant Vegetation and to minimise the Environmental Harm of the Works under the Contract on vegetation that is to be retained. Clearing & Grubbing activities under the contract are covered in MRTS04.

The Contractor shall be responsible for managing Work under the Contract in order to avoid Environmental Harm on Significant Vegetation within the Site, minimise the disturbance area on Site, and undertake progressive vegetation clearing and rehabilitation where reasonable and practicable.

Significant Vegetation known to occur within the Site and associated management requirements are stated in Clause 9 of Annexure MRTS51.1.

Details of revegetation, ground preparation and planting media are outlined in MRTS16 *Landscape and Revegetation Works* Specification and the Annexure MRTS16.1.

Management of vegetative waste is detailed in Clause 8.13 Waste.

8.11.2 Performance requirements

The Contractor shall adhere to the Contractual Limits of Clearing as defined in Table 2 of this Technical Specification. The Contractor shall take reasonable and practicable Management Measures to avoid disturbance to vegetation or ground surface outside of the Limits of Clearing and to minimise disturbance areas within the Limits of Clearing where practicable. The Contractor shall install identification markers along the Limits of Clearing boundary prior to commencing vegetation clearing and ground disturbance. Identification markers shall be maintained for the duration of the Contract or at least until Works are complete in the adjacent area.

Where the Contractor identifies the requirement for additional areas of vegetation or ground to be disturbed outside the specified Limits of Clearing, the Contractor shall submit a request to the

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Administrator. If the Administrator deems the additional areas suitable for clearing, the Contractor shall amend the Limits of Clearing and erosion and sediment controls managing the Site before proceeding. The Contractor will be responsible for determining whether Approval(s) are required, obtaining the Approval(s) and complying with conditions. Delays incurred as a result of obtaining Approvals shall be the Contractor's responsibility.

Where Significant Vegetation is identified within the Limits of Clearing, the Contractor shall comply with Principal obtained Approvals listed in Clause 1 of Annexure MRTS51.1. If the Contractor cannot comply with the Approval, the Contractor shall advise the Administrator and be responsible for obtaining an alternative Approval for the relevant vegetation clearing.

The Contractor shall clearly identify areas of Significant Vegetation or habitat by identification markers that are visibly different to the limits of clearing markers and deemed suitable by the Administrator. Staff will be made aware of these areas through Site Induction, training and tool box talks prior to vegetation clearing or grubbing commencing.

Any vegetation clearing beyond the Limits of Clearing or not otherwise deemed suitable by the Administrator, shall be reported to the Administrator in accordance with Clause 7 of this Technical Specification. The Contractor shall provide details on the area (metre squared), the location, a description of the vegetation cleared and other issues that might relate to the clearing (such as clearing outside the Cultural Heritage Management Agreement area).

Where disturbance has occurred beyond the Limits of Clearing, the Administrator may at their discretion, order the Contractor to stop Works which pertain to the activity where the unauthorised disturbance occurred. The Administrator will then promptly arrange for the Site to be inspected and the extent and impact of the additional clearing assessed. The Administrator may choose to declare the area an Exclusion Zone for any period of time until the Administrator is satisfied that the additional clearing has been investigated, remediated and measures have been implemented to prevent additional unauthorised clearing from reoccurring. Remediation of unauthorised cleared areas beyond the Limits of Clearing deemed suitable by the Administrator will be at the Contractor's expense.

Where the Administrator has declared an area excluded from Works, the Contractor will organise for relevant exclusion devices to be erected to ensure that access to the area by the Contractor's staff or others is prevented. The Contractor shall notify all Site personnel of the exclusion area as soon as possible, but prior to commencing work on the next working day. The Contractor will be responsible for ensuring that access to an excluded area remains restricted until informed otherwise by the Administrator.

Where Works encroach on individual trees or vegetation to be retained, ground disturbance or other Works, including material stockpiling, shall not encroach within the dripline of the tree (below canopy of tree) unless otherwise deemed suitable by the Administrator. For contracts within an urban context, the Contractor shall comply with AS 4970:2009 *Protection of trees on development Sites* for the protection of vegetation to be retained.

Clear zone clearing shall be undertaken in accordance with the departmental *Road Planning and Design Manual*, Supplements to Volume 3, Part 6 Roadside Design, Safety and Barriers or otherwise stated in Annexure MRTS04.1. Specifically, clearing for clear zone shall be the selective removal of infrangible vegetation.

Any other requirements are stated in Clause 9 of Annexure MRTS51.1.

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8.11.3 Monitoring

Where specified in Clause 9 of Annexure MRTS51.1, the Contractor shall undertake Monitoring of specific areas of Significant Vegetation or areas of Site as specified.

Weekly Site Inspections shall inspect and verify the adherence to the Limits of Clearing for the duration of the Contract. The Monitoring shall assess whether identification markers are present, functional and adequate, and any maintenance requirements for the markers. The Weekly Site Inspections shall also assess whether any clearing or disturbance has occurred beyond the Limits of Clearing without Administrator deemed suitability.

8.11.4 EMP(C) requirements for vegetation management

The EMP(C) shall include documents and/or diagrams indicating the following:

a) A drawing depicting the following:
   i. location and dimensions of Contractual Limits of Clearing (as specified in Clause 8.11.1 of this Technical Specification)
   ii. limits of Contractor's intended vegetation clearing (demonstrating minimised clearing area)
   iii. restrictions to clearing in waterways (as specified in Clause 7.2.2 of MRTS04)
   iv. any areas required for clearing additional to the Contractual Limit of Clearing
   v. locations of Significant Vegetation and any specific trees identified in Clause 9 of Annexure MRTS51.1 or Annexure MRTS04.1 to be retained on Site, and
   vi. a program of clearing operations demonstrating progressive clearing stages where practicable.

b) Identification method for the Limit of Clearing and method of identifying Significant Vegetation.

c) Management Measures and strategies to minimise the area of vegetation clearing, and

d) Where required Environmental Approval for additional clearing.

8.12 Biosecurity

8.12.1 General

The Contractor shall be responsible for managing Work under the Contract in order to mitigate the spread of Biosecurity Matters.

8.12.2 Performance requirements

The Contractor shall comply with the *Biosecurity Act* 2014. The Contractor shall fulfil their General Biosecurity Obligations to mitigate Biosecurity risk from prohibited and restricted Biosecurity Matters (including but not limited to invasive animals and plants) within the Site by preventing their spread into the Site, within the Site and out of the Site. The Contractor shall manage movement of Biosecurity Matter carriers across biosecurity management zone boundaries as part of Work under the Contract. Biosecurity matters known to occur within the worksite and associated management requirements are stated in Clause 10.1 - 10.2 of Annexure MRTS51.1.

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The Contractor shall undertake the following:

a) Obtain biosecurity certificates certifying that all imported topsoils and mulches are free of prohibited or restricted biosecurity matters.

b) Ensure construction plant and vehicles undergo a documented cleaned down prior to entry to Site.

c) Ensure construction plant and vehicles operating in biosecurity-contaminated areas undergo a clean down in accordance with *QDAF Vehicle and machinery cleandown procedures* prior to movement out of the biosecurity-contaminated area.

d) Where specified in Clause 1 of Annexure MRTS51.1, comply with the departmental Biosecurity Instrument Permit requirements.

e) Obtain and comply with a Biosecurity Instrument Permit for applicable Work under the Contract not covered by Principal's Biosecurity Instrument Permit.

f) Where previously unidentified suspected prohibited or restricted Biosecurity Matter is identified on or adjacent to the Site, the Contractor shall isolate the infestation and implement Management Measures to prevent the spread or transmission of the Biosecurity Matter out of the identified infestation area within the Site. The Contractor shall notify the Administrator and, where applicable Biosecurity Queensland, in accordance with Clause 7 of this Technical Specification, and

g) Ensure use of pesticides is undertaken by appropriately licenced contractors and in accordance with the label including the requirements of Clause 7.3 and 8.3 of MRTS16 *Landscape and Revegetation Works* and retain records of spray activities.

Where temporary clean-down bays are used, the Contractor shall document:

- Maintenance requirements and procedures.
- Management Measures implemented to contain wastewater and restrict movement of Biosecurity Matters particularly to Waterways and drainage lines.
- Management Measures to contain biosecurity matter, sediments, oils and greases, and
- Prevention of vehicle recontamination.

8.12.3 Monitoring

Where stipulated in Clause 10.1 of Annexure MRTS51.1 or a condition of an Environmental Approval (Clause 1 of Annexure MRTS51.1), the Contractor shall undertake Monitoring of the Site for new infestations of Biosecurity Matters. The Contractor shall submit a Biosecurity Monitoring Plan as part of the EMP(C) for deemed suitability.

8.12.4 EMP(C) requirements for biosecurity

The EMP(C) shall include documents and/or diagrams indicating the following:

a) Details of the Biosecurity Matter including photo, location of Biosecurity Matter infestations, the Biosecurity Matter category and respective Management Measures.

b) Location of applicable biosecurity management zone boundaries in relation to Work under the Contract (including ancillary activities such as water source, stockpile sites, gravel sources, spoil locations).

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c) Identify movement of Biosecurity Matter carriers across biosecurity zone boundaries and Biosecurity Instrument Permit details pertaining to these movements.

d) Management Measures for preventing the spread of Biosecurity Matters within Site and out of the Site.

e) Measures to exclude access to known areas of Biosecurity Matter infestation such as flagging.

f) Location of clean-down facility (if temporary clean down bay is to be constructed on Site, specify design and maintenance requirements).

g) Specific Monitoring procedures for biosecurity matters (method, timing, frequency, duration, parameter to be monitored, criteria / outcome measured against).

h) Pesticide treatment schedule addressing method of control, chemicals, locations, timing of works, and

i) Biosecurity Matter Commercial Operator's Licence.

8.13 Waste

8.13.1 General

The Contractor shall be responsible for management of Wastes generated from Work under the Contract in accordance with the *Environmental Protection Act* 1994. This shall include Wastes generated at Site Camp and facilities under MRTS28.

Where illegally dumped waste and litter is discovered during the Work under the Contract, the Principal may instruct the Contractor to undertake appropriate management, removal and disposal of Waste and litter.

8.13.2 Performance requirements

The Contractor shall adopt the Waste management hierarchy of avoidance, reuse recycling, energy recovery and disposal of Wastes generated under the Contract.

No Waste, including vegetative Waste, or litter shall be burnt on Site unless allowed as specified in Clause 8.7.2.

Upon completion of Works, the Contractor shall ensure that all Wastes have been removed from Site or otherwise lawfully disposed of on Site. No Waste shall be buried on Site unless deemed suitable by the Administrator and the Administering Authority.

The Contractor shall provide bins at common areas at all times. Bins shall be fitted with lids and serviced prior to being filled to capacity. During construction, the Contractor shall maintain the Site free of litter.

Vegetation Waste from clearing and grubbing, that is free from Biosecurity Matter, may be used in conjunction with soil erosion and sediment measures such as brush matting or mulch or for appropriate fauna logs in accordance with Clause 7.2.5 of MRTS04. Clause 11.1 of Annexure MRTS51.1 specifies the method of management of vegetation Waste from clearing and grubbing activities.

Mulch stockpiles shall be separated from drainage lines and Waterways by distance or Management Measure to inhibit Discharge. Mulch stockpiles shall be a maximum of 2.5 m in height where air temperature is < 30° and humidity < 70%. Where Site climate conditions exceed this, mulch stockpiles

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should be reduced to a maximum height of 1.5 m and Monitored regularly for excess leachate and heat. Where the volume of mulch generated by the Works exceeds the volume of mulch required for the Work under Contract, the Contractor shall be responsible for removal from Site and reuse of the mulch.

The Contractor shall record Wastes generated[15], disposed[16], recycled[17] and reused[18] and Recycled Materials and Products utilised by the Work under the Contract in the department's Waste Estimation and Reporting Template available at https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Project-waste-reporting. The Contractor shall retain copies of all documents issued in relation to Trackable Waste[19] transportation and disposal processes. The Contractor shall complete the departments Waste Estimation and Reporting Template[20] and shall submit to the Administrator and emailed to projectwasteregister@tmr.qld.gov.au prior to Practical Completion. Further information is available in the Project Waste Reporting Guideline[20].

Where surplus or unsuitable material shall be used or disposed of off-site in accordance with Clause 11 of MRTS04 *General Earthworks*, the Contractor shall provide the following details to the Administrator as part of the EMP(C) or EMP(C) updates, prior to commencing the spoil activity off-site:

a) GPS coordinates of the boundary corners of the spoil location

b) evidence of an agreement with the landowner for receiving the spoil, the location of the spoil and the condition of the spoil

c) details of the materials to be spoiled off-site

d) deed of indemnity from the landowner for the Principal for the long-term management of the spoil, and

e) details as to the measures to be undertaken by the Contractor to ensure the spoil is stable and not posing any environmental or safety concerns in future.

8.13.3 EMP(C) requirements for Waste management

The EMP(C) shall include documents and/or diagrams indicating the following:

a) Estimates of type and quantity of Waste expected to be generated and their source. Waste shall be categorised as per the waste streams stipulated the Department's Waste Estimation and Reporting Tool.

b) Waste management strategies (avoidance, reuse, recycling, energy, recovery, disposal).

c) Waste containment locations.

d) All mulch stockpiles shall be identified on plans, and

e) The procedure for measuring and recording Waste generated, reused, recycled and disposed and Recycled Materials and Products utilised of under the Contract.

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[15] Generated – The total quantity of material or products that enters a waste stream before it is recycled, reused, recovered or disposed to landfill.
[16] Disposed - Quantity of discarded or discharged waste material that has been disposed of at landfill facilities in accordance to prescribed legislation.
[17] Recycled - Quantity of waste material that is recovered and used as an input or resource product.
[18] Reused – Quantity of waste material that is used again (on or off Site) without modification or processing.
[19] Trackable waste as defined under the Schedule 2E of Environmental Protection Regulation 2008.
[20] https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Project-waste-reporting

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8.14 Chemicals and fuels

8.14.1 General

The Contractor shall be responsible for the management of all chemicals and fuels within the Site so as not to cause Environmental Nuisance or Environmental Harm.

8.14.2 Performance requirements

In addition to satisfying the requirements of *Environmental Protection (Water) Policy* 2009, management of hazardous substances or dangerous goods (flammable and combustible liquid storage) shall comply with AS 1940 and AS 3833, including minor storages in accordance with Section 2 of the Standards.

Where Work under the Contract shall trigger an Approval in relation to chemical storage, the Contractor shall be responsible for obtaining and complying with relevant Approval(s).

The Contractor shall ensure spill response equipment is available on the Site for use in an emergency. Spill response equipment shall be commensurate with the Site location, topographical features, type and quantity of chemicals and fuels being stored on Site and the time of year the contract is undertaken. All Staff on Site shall be trained in the use of spill response equipment.

The Contractor shall, promptly remediate any contamination resulting from spills, leaks and Discharges to a condition similar to that existing before the contamination and to the Administrator's satisfaction.

Refuelling of machinery shall conform to the following requirements:

a) occur away from Waterways unless for tracked machinery and contingency plan Management Measures are available in the immediate area

b) fuelling activity to be supervised at all times, and

c) hoses to be fitted with a stop valve at the nozzle end.

Machinery shall be maintained to minimise the leakage of oil, fuel, hydraulic and other fluids. During the servicing of machinery, the Contractor shall use Management Measures to capture and contain oils, fuels, hydraulic and other fluids so as to minimise contamination of the servicing area.

Surface coating treatments will be undertaken in a manner that avoids or minimises release of chemical to the environment and contact with the public.

Unless otherwise stated in the contract, no pre-coating of aggregates shall be conducted on Site.

8.14.3 EMP(C) requirements for management of chemicals and fuels

The EMP(C) shall include documents and/or diagrams indicating the following:

a) list chemical and fuels stored on Site in volumes greater than 250 L, the maximum quantity to be stored at any one time, storage location

b) type and number / size of spill response equipment stored on site

c) Management Measures, including containment, for avoiding contamination or discharge to land or water from fuels and chemicals

d) details of any approvals held in relation to fuel and chemical storage or use, and

e) contingency plan in the event of a contamination or discharge.

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FOI 26-292 - Document 21

8.15 Sourcing of construction materials (non-commercial sources)

NOTE: This clause applies to sourcing construction material from non-commercial sources and sourcing of water from non-potable water.

8.15.1 General

Construction materials such as gravel, embankment material, and water are often sourced from non-commercial sources without existing infrastructure, management procedures and Approvals.

The sourcing of construction materials from non-commercial sources[21] requires that the material source, the activity (the "take") and any associated Site activities such as clearing vegetation, construction of access tracks potentially including Waterway Barriers Works, be planned and managed by the Contractor to ensure operations comply with legislation and avoid causing Environmental Harm.

8.15.2 Performance requirement

Where Approvals have not been obtained by the Principal, the Contractor is responsible for identifying, assessing, obtaining Environmental Approvals for relevant material sources including construction water and gravel resources or sourcing from suitably licensed Suppliers. The materials supplied by the Contractor shall be from sources compliant with relevant environmental legislation and managed in accordance with Environmental Approval conditions.

Where specified in Clause 1 of Annexure MRTS51.1, the Principal has obtained Approvals pertaining to the material source and activity. The Contractor shall ensure that Works under the Contract are in accordance with the conditions of the Approvals, recording and documenting compliance as required by the Approval. The Contractor shall plan and undertake Management Measures in accordance with the Approval Conditions and include in the EMP(C).

The Contractor shall maintain volumetric and photographic records of material sourced and supplied under the contract from each source as well as other records required for compliance with Approvals. The records shall be reported in accordance with Clause 7 of this Technical Specification.

Progressive rehabilitation of source Sites and access tracks approved by the Administrator shall be undertaken by the Contractor as sources are exhausted or supply requirements are fulfilled. Rehabilitation shall be in accordance with the relevant approvals and Technical Specifications in MRTS16 *Landscape and Revegetation Works* and the Annexure MRTS16.1.

For all material sourcing, unless stated otherwise in Clause 12.1 of Annexure MRTS51.1 the Contractor shall complete all pre-works notifications, record keeping and reporting under the applicable Approvals.

Weekly Site Inspections shall include inspection of any material sources outside of the Site in accordance with the Weekly Site Inspections specified throughout MRTS51 or otherwise stated in Approvals.

8.15.3 Monitoring

For construction water sources, the Contractor's shall undertake Monitoring of the water source to ensure compliance with the *Exemption Requirements for constructing authorities for the taking of*

[21] Non-commercial sources are sources where either Principal or Contractor hold relevant approvals and material sourcing operations are undertaken by the Contractor or its sub-contractor.

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FOI 26-292 - Document 21

water without entitlement (WSS/2013/666) or other applicable Approval. This shall require Monitoring of water levels in a non-flowing source against a depth gauge or suitable alternative and recording percentage (%) of full capacity. For flowing sources, Monitoring shall be of the flow rate and whether flows cease during Works under the Contract.

For construction gravel, fill and sand material sources, the Contractor shall undertake Monitoring of the material source Site against Approval and EMP(C) requirements specified in Clause 12.1 of Annexure MRTS51.1. In accordance with Clause 7 of this Technical Specification, if Monitoring finds variances from the Approval criteria and conditions, this shall be raised as a Non-Conformance and further investigated.

8.15.4 EMP(C) requirements for material sourcing

The EMP(C) shall include documents and/or diagrams indicating the following:

Water sourcing

a) Key water consumption activities under the contract, the estimated volumes of water, the identified construction water source(s) and proposed volume of take, legislative requirements, applicable conditions for take and whether notification to other users has been undertaken.

b) Water efficiency strategies to be utilised under the Contract.

c) Procedures for Monitoring against requirements of any applicable Environmental Approval (exemption) (i.e. capacity level of non-flowing source).

Construction material

d) Identified gravel, fill or sand sources, distance to Site, access track requirements, stockpile areas, associated approvals and conditions, proposed volume of take and progressive rehabilitation processes.

e) Activity based management plan for extraction Sites.

f) Soil Management Plan – Construction in accordance with Clause 5.2.1 of MRTS16 where applicable, and

Other

g) Other construction material requirements identified sources and Management Measures.

9 Permanent environmental infrastructure

Where the design drawings or Environmental Approvals require the construction of Permanent Environmental Infrastructure such as sediment basins or fauna management infrastructure, the Contractor shall develop documentation on the operational and maintenance requirements for the infrastructure. Further in accordance with MRTS50 the Contractor shall develop and submit to the Principal, As-Constructed drawings of the Permanent Environmental Infrastructure.

The list of Principal identified Permanent Environmental Infrastructure requiring operational and maintenance plans is provided in Clause 13.1 of Annexure MRTS51.1.

10 Supplementary requirements

The requirements of MRTS51 *Environmental Management* are varied by the supplementary requirements given in Clause 14 of Annexure MRTS51.1.

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FOI 26-292 - Document 21

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Technical Specification

Transport and Main Roads Specifications MRTS52 Erosion and Sediment Control

July 2018

Queensland Government

FOI 26-292 - Document 21

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Contents

1 Introduction 1
1.1 Relationship to other documentation 1
1.2 Departure from standards 1
1.3 Project risk 2
1.4 Erosion and sediment control principles 3
2 Definition of terms 4
3 Referenced documents 5
4 Standard test methods 6
5 Quality system requirements 7
5.1 Hold Points, Witness Points and Milestones 7
6 Erosion and Sediment Control Plan 7
6.1 General 7
6.2 Plan requirements 8
6.3 Personnel – Plan development 9
6.4 Implementation and revision of plan 10
7 Erosion and Sediment Control Management – General requirements 10
7.1 Installation 10
7.2 Operation and maintenance 11
7.3 Decommissioning and removal 11
8 Erosion and Sediment Control Management – Performance requirements 11
8.1 Performance requirements 11
9 Administrative requirements 12
9.1 Independent audits 12
10 Design and technical standards 12
10.1 Technical standards 12
10.2 Design requirements 13
10.2.1 Sediment Basin embankments 13
10.2.2 Catch drains 13
11 Supplementary requirements 13

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FOI 26-292 - Document 21

1 Introduction

This Technical Specification applies to the control of erosion and sediment during investigation for and construction of transport infrastructure projects

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS51 *Environmental Management*, MRTS16 *Landscape and Revegetation Works* and other Technical Specifications as appropriate. This also forms part of the Principal's Specifications. This Technical Specification has not been designed to be used for marine or boating infrastructure projects.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

The Department of Transport and Main Roads encourages the early installation of permanent drainage controls for use as construction erosion and sediment controls where appropriate. Where permanent controls are to be used the relevant project drawings and Technical Specification shall take precedence over the design requirements within this Technical Specification, however the performance requirements and intent of this Technical Specification must be adhered to.

1.1 Relationship to other documentation

Where other contractual or statutory requirements applicable to the project demand higher standards of environmental management, the higher standards shall be adopted, where applicable.

This includes but is not limited to:

- Conditions of any environmental approvals or licences obtained by Principal or Contractor for this Contract.
- Department of Environment and Heritage Protection (DEHP) Procedural Guide - *Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland*, and
- *State Planning Policy* and *State Development Assessment Provisions* July 2013.

Clause 1 of Annexure MRTS51 provides information on environmental approvals and/or licences obtained by the Principal that may have erosion and sediment control conditions. The Contractor shall be responsible for identifying and obtaining any other licences and permits that are required.

1.2 Departure from standards

This Technical Specification utilises the International Erosion Control Association (IECA) *Best Practice Erosion and Sediment Control Manual* (2008) as the prescribed standard for erosion and sediment control. The requirements and recommendations set out in this Technical Specification should not be inferred to preclude innovative or alternative solutions that provide improved value for money or environmental outcomes that meet the intent and principles of this Technical Specification.

Where departures are proposed from either this Technical Specification, the standards established in the IECA Manual, or a higher standard prescribed under other contractual or statutory requirements (due to an approved innovation proposal or due to other restrictions) the Contractor must clearly state the departures from standards within the tender submission. This departure must have prior agreement from the Principal.

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For significant departures the contractor is encouraged to use the Guided Tender Alternative method and obtain in principal agreement prior to submission of tender. All departmental Transport Infrastructure Contracts (TIC) require that deviations agreed prior to contract award are recorded within the Schedule of Deviations.

It must be noted that insufficient space within the road reserve or challenging topographic conditions is not in itself a reason for departures from the standard. With appropriate staging areas within the Works footprint can be used for temporary controls, sediment basin sizes can be reduced through the use of high efficiency sediment basins, or adjacent land can be obtained through rent or other prior agreement. The Contractor is responsible for obtaining any necessary areas. In some instances the Principal may have pre-negotiated areas for use for sediment and erosion control. Details of these areas and requirements are given in Clause 1 of Annexure MRTS52. The Contractor must be aware of and abide by the Notification of Entry requirements contained within General Conditions of Contract.

The Contractor is responsible for temporary erosion and sediment control and for ensuring that controls are adequately designed, installed, adapted, maintained and decommissioned.

1.3 Project risk

For the purposes of the management requirements required to be employed under this Technical Specification, the project is deemed to have the Erosion Risk identified in Table 1.3 unless otherwise nominated in Clause 2 of Annexure MRTS52.

Table 1.3 - Erosion risk level

Erosion Risk	Characteristics of risk level
Low	• < 2500 m² disturbed surface area open at any one time OR < 10 t/ha/year soil loss predicted (using RUSLE), and • Controls installed and maintained in accordance with prescriptive standard (e.g. Standard Drawings).
Medium	• All projects not meeting the characteristics above or below.
High	Projects with two or more of the following characteristics: • project duration > 6 months • project working within or discharging to sensitive environment such as marine parks, wetlands or waterway • soils with high to very high erodibility rating (i.e. dispersive soils) • projects which have > 1 hectare of land exposed during months with monthly rainfall erosivity (R factor) is greater than 285 • topography factor (LS) is greater than 2 or modal slopes on project are steeper than 15% (6.6 degrees).

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While Table 1.3 above has been prepared as indicative of likely erosion risk level there are many factors that impact on the actual environmental risk. With the breadth of infrastructure projects delivered by the department including location, duration, season, type and receiving environments it is difficult to develop a simple table that will account for every scenario.

Departmental project managers in consultation with design consultants and environmental officers are encouraged to state the risk level that is appropriate for their project in Clause 2 of Annexure MRTS52.

Factors that should be taken into account when determining the project risk level include soil type, location and timing (rainfall volume, intensity and likelihood), landform (including the ability to install sediment basins or other erosion and sediment controls).

For projects in locations with highly seasonal rainfall, a project over a long duration may warrant different erosion risks at different times of year. This may be specified in Clause 2 of Annexure MRTS52. A date should be set for the change of risk level and a project-specific hold point be specified in the annexure that the modified ESCP shall be submitted, accepted and implemented on site prior to this designated date.

1.4 Erosion and sediment control principles

The primary purpose in installing sediment and erosion controls is to not cause environmental harm nor deposit prescribed water contaminants in waterways as per the *Environmental Protection Act* 1994.

In addition appropriate erosion control can have the benefit of decreasing soil degradation hence improving asset protection and decreasing maintenance costs during and post construction.

Erosion and Sediment Control for all projects shall be designed, installed, maintained and decommissioned in accordance with the following principles:

a) Erosion and sediment controls are integrated with construction planning.

b) Effective and flexible erosion and sediment control plans are developed based on soil, weather, construction conditions and the receiving environment.

c) The extent and duration of soil exposure is minimised.

d) Water movement through the Site is controlled - in particular clean water is diverted around the Site.

e) Soil erosion is minimised.

f) Disturbed areas are promptly stabilised.

g) Sediment retention on Site is maximised.

h) Controls are maintained in proper working order at all times, and

i) The Site is monitored and erosion and sediment control practices adjusted to maintain the required performance standard.

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FOI 26-292 - Document 21

2 Definition of terms

The terms in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*.

Additional terms used in this Technical Specification shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
AEP	Annual Exceedance Probability The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.
Appropriately qualified person (AQP)	**Appropriately qualified person(s)** is as defined by the administering authority of the *Environmental Protection Act.* The definition at time of publication of this Technical Specification relevant to temporary sediment and erosion control is: A person or persons who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature. The appropriately qualified person(s) should have, or collectively have, all the following capabilities: a) A detailed understanding of relevant sections of the following guidelines and legislation: i. *Environmental Protection Act* and Environmental Protection Regulation ii. *Environmental Protection (Water) Policy* iii. *Environment and Heritage Protection Urban Stormwater Planning Guidelines* iv. *Queensland Urban Drainage Manual* v. *IECA Best Practice Erosion and Sediment Control Manual.* b) An understanding of hydrology and hydraulics, including the ability to size and determine stabilisation requirements of drainage structures and treatment devices. c) An understanding of soil as it relates to revegetation and erosion. Specifically the ability to conduct an effective soil sampling program, interpret results and design management strategies to address problem soils (pH, sodic, dispersive, and saline). d) An understanding of appropriate use of the revised universal soil loss equation (RUSLE) to estimate soil loss. e) An understanding of the erosion, drainage and sediment controls considered best practice in Australia, and knowledge on the correct installation, operation and maintenance of these controls. f) Ability to prepare erosion and sediment control plans of a standard that is suitable for construction. g) Has experience in erosion and sediment control and a suitable environmental or engineering degree from a recognised institution.
CPESC	Certified Professional in Erosion and Sediment Control. A CPESC is an example of a person likely to be appropriately qualified.
DEHP	Department of Environment and Heritage Protection (Queensland)

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Term	Definition
EMP(C)	Environmental Management Plan (Construction)
Environmental harm	As defined by the EP Act, including nuisance, serious and material environmental harm.
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
EY	Exceedances per year
IFD	Intensity Frequency Duration
Rainfall erosivity	The ability of rainfall to cause erosion. Rainfall erosivity can be determined using the formula Annual Average erosivity $R = 164.74 (1.1177)^{S} \times S^{0.64444}$ where S = 2 year ARI, 6 hour rainfall event (mm/h). The average monthly erosivity is the annual average erosivity x % rainfall that falls in that month. Alternatively rainfall erosivity risk ratings for various towns are provided in Table 4.4.4 of IECA Manual.
RUSLE	Revised Universal Soil Loss Equation (RUSLE) Predictor of erosion risk based on the estimated annual soil loss. A = R x K x LS x C x P A = annual soil loss due to erosion (t/ha/year) R = rainfall erosivity factor K = soil erodibility factor LS = topographic factor based on slope length and gradient C = cover and management factor P = erosion control practice factor Refer to IECA Manual, Appendix E for further information.
RPEQ	Registered Professional Engineer, Queensland
Type 1, Type 2 and Type 3 controls	As defined by IECA Manual 'Sediment Control Classification System' design guide

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Unless otherwise specified a reference to a statute includes its delegated legislation and a reference to a statute or delegated legislation or a provision of either includes consolidations, amendments, re-enactments and replacements.

Table 3 - Referenced documents

Reference	Title
ARR	Australian Rainfall and Runoff, Engineers Australia
DEHP Standard Work Method	Procedural Guide - Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland (Department of Environment and Heritage)
EP Act	*Environmental Protection Act* including subordinate legislation and regulations

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Reference	Title
Monitoring and Sampling Manual	*Monitoring and Sampling Manual* 2018*, Environmental Protection (Water) Policy* 2009, (February 2018)
IECA Manual	*International Erosion Control Association Australasia* "Best Practice Erosion and Sediment Control"
South East Queensland (SEQ)	As defined by Sustainable Planning Regulation or subsequent legislation. Includes areas of: Brisbane City Council Gold Coast City Council Ipswich City Council Lockyer Valley Regional Council Logan City Council Moreton Bay Regional Council Toowoomba Regional Council (part of) Redland City Council Scenic Rim Regional Council Somerset Regional Council Sunshine Coast Regional Council Noosa Shire Council
Geotechnical Design Standard	*Transport and Main Roads Geotechnical Design Standard*
MRTS03	*Drainage, Retaining Structures and Protective Treatments*
MRTS04	*General Earthworks*
MRTS16	*Landscape and Revegetation Works*
MRTS27	*Geotextiles (Separation and Filtration)*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*
Water and Wastewater Sampling Guidelines	EPA Guidelines*, Regulatory Monitoring and Testing, Water and Wastewater Sampling* (South Australian Environment Protection Agency, 2007)

4 Standard test methods

Unless stated elsewhere herein, testing shall be carried out in accordance with the relevant Australian Standard. All laboratory analyses required under this Technical Specification must be carried out by a laboratory that has National Association of Testing Authorities (NATA) certification, or an equivalent certification, for such analyses.

Soil testing for erosion and sediment control should occur with consideration of, and where practicable in coordination with, the requirements of MRTS16 and MRTS04. This includes the requirements for a Soil Management Plan – Construction (SMP-C), and for topsoil, subsoil, and acid sulfate soil (pH) testing.

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5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points applicable to this Technical Specification are summarised in Table 5.1. There are no Witness Points or Milestones defined in this Technical Specification.

Table 5.1 – Hold Points

Clause	Hold Point	Witness Point	Milestone
6.1	1. Assessment of suitability of Erosion and Sediment Control Plan for each stage and/or section of the Works where required		
7.1	2. Installation of appropriate erosion and sediment controls in each section of the Works		

The number of hold points relating to Erosion and Sediment Control will be dependent on the risk associated with the project.

- For low risk projects there are likely to be two Hold Points on the project – the first being no Works to occur prior to the assessment of suitability of the ESCP, the second being no earthworks (other than Works necessary to install devices) until erosion and sediment control devices have been installed.
- For high risk projects there is likely to be many Hold Points throughout the project as the assessment of suitability of the plan and assessment of installation of controls shall be required for each section or stage of the Works.

6 Erosion and Sediment Control Plan

6.1 General

Before the natural surface is disturbed on a section of the Works, the Contractor shall submit an Erosion and Sediment Control Plan (ESCP) for that section.

An ESCP is required to be prepared for all areas prior to use or disturbance including auxiliary areas under the control of the contractor such as stockpile and storage areas, access and haulage tracks, temporary waterway crossing, borrow areas, compound areas and material processing areas.

Clearing and grubbing (or the use of the area for stockpiles) for that section shall not start until the ESCP for that section is assessed as suitable by the Administrator. **Hold Point 1**

For high risk projects multiple erosion and sediment control plans will be required for sections that have significant cut and fill (e.g. a plan for clearing, a plan for commencement of bulk earthworks and a plan for completion of earthworks). Prior to significant changes to drainage flow or sediment treatment locations, an updated erosion and sediment control plan shall be developed and submitted by the Contractor and assessed as suitable by the Administrator. Each ESCP shall clearly detail the

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area and work that it is valid for. It is acceptable to have a primary 'over-arching' ESCP supplemented by numerous progressive ESCP on a project.

Timelines for assessment of suitability of ESCP shall be as per Conditions of Contract for the assessment of EMP(C).

6.2 Plan requirements

The Erosion and Sediment Control Plan (ESCP) shall be developed in accordance with the principles in Clause 1.4 of this Technical Specification and taking into account:

- seasonal conditions
- soil types, particularly dispersive, sodic, saline soils and acid sulfate soils
- topography, particularly areas with natural, during construction or final slope > 10%
- local hydrology and drainage affecting the worksite including temporary and overland flow paths
- specific project issues including no go zones, protected flora and fauna, private property boundaries, contaminated land; and
- specific project issues and requirements listed in Clause 3 of Annexure MRTS52.

The ESCP shall consist of the following:

a) The Works and area that the plan is valid for.

b) The location of major features of the Site, such as waterways, limitations of disturbance areas, property boundaries and other special features (including sensitive environments, contaminated land, dispersive soils).

c) Contour lines or flow direction arrows sufficient to show direction of waterflow.

d) The type and location of all erosion and sediment control measures, including but not limited to:

   i. proposed erosion control measures including soil treatment and batter stabilisation methods such as soil binders, geofabric, hydromulching and/or early revegetation

   ii. clean and dirty water drainage paths

   iii. sediment controls such as sediment basins for all areas greater than one hectare on medium and high risk sites, and Type 2 and Type 3 controls for other areas

   iv. location of nominated discharge points, and

   v. Site exit points and controls.

e) The installation sequence and timing of controls including timing of installation of any permanent Works being relied upon as drainage control during construction.

f) List of any deviations from IECA Manual with regard to the installation, construction and maintenance of all erosion and sediment control measures (in particular any deviation from Book 4 – Design Fact Sheets and Book 6- Standard Drawings) and justification for such deviations.

g) The response strategy for managing significant rain events, and

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h) The person/s responsible for development of the ESCP including their experience and qualifications for determination by the Administrator as to whether Appropriately Qualified.

For medium risk sites the ESC Plan shall include the above (a to h) and:

i) Design calculations for all drainage and sediment control measures, including sediment basins, earth banks high flow / spillways, outlet structures and drainage lines.

The administrator may also request to view the calculations for low risk sites.

For high risk sites the ESC Plan shall include the above (a to i) and:

j) The qualifications and experience of the independent verifier (refer to Clause 6.3 below) and a statement from the independent verifier that the ESCP if implemented correctly will meet the requirements of this Technical Specification, and

k) the proposed frequency and timing of independent audits (refer to Clause 9.1.2)

l) the monitoring and maintenance requirements for the project Site, erosion and sediment controls and receiving environment.

The ESCP for all projects undertaken in South-East Queensland shall comply with *Procedural Guide - Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland* (Department of Environment and Heritage).

The number and complexity of the Erosion and Sediment Control Plans will vary depending on the size and complexity of the project.

For low risk projects, the above Technical Specification could be met by one Standard Drawing or diagram that includes notes on timing of installation of controls.

For high risk and large scale medium projects the ESCP is likely to consist of multiple sets of drawings for various areas, and various stages of each area. One option for major projects is for an overarching ESCP to be developed containing key methods, procedures and features which is then supplemented by numerous progressive ESCP. A report detailing assumptions and calculations for drainage, erosion and sediment controls will also be required.

Note that the response strategy for managing significant rain events may be contained within the Severe Weather Management Plan or other document.

6.3 Personnel – Plan development

The Erosion and Sediment Control Plan shall be prepared and updated by personnel who have the requisite level of training and experience outlined in Table 6.3, or as modified by Clause 5 of Annexure MRTS52.

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Table 6.3 - Erosion and Sediment Control Plan – Personnel minimum requirements

Erosion Risk Level (as per clause 1.3)	Minimum requirements for plan development and verification
Low	ESCP to be prepared by a person who has undertaken environmental representative training and has at least 5 years' experience in relevant construction type (for example, roadwork construction).
Medium	• ESCP to be prepared by Appropriately Qualified Person/s (see definitions) with experience in relevant construction type (for example general road projects). • Drawings and design for any items that are Prescribed Engineering Service (PES) shall be certified by an RPEQ.
High	• ESCP to be prepared by Appropriately Qualified Person/s (see definitions) with experience in relevant construction type (for example major road projects). • Drawings and design for any items that are Prescribed Engineering Service (PES) shall be certified by an RPEQ. ESCP to be reviewed and deemed suitable by an independent verifier who is an Appropriately Qualified Person.

The Contractor must submit details of the person preparing the ESCP and the verifier to the Administrator with the ESCP for determination of suitability by Administrator. The Contractor may submit details prior to engagement of said person/s.

6.4 Implementation and revision of plan

The Contractor shall:

a) implement the Erosion and Sediment Control Plan

b) monitor the continued effectiveness of the ESC during the contract

c) update the ESCP where necessary.

The plans shall be updated in accordance with Clause 5.1 of this Technical Specification, and updated such that all major drainage paths and Type 1 sediment treatment devices are shown correctly. The updates shall be undertaken by personnel approved as suitable by the Administrator (that is, who has the requisite level of training and experience outlined in Table 6.3, or as modified by Clause 4 of Annexure MRTS52.

7 Erosion and Sediment Control Management – General requirements

7.1 Installation

As soon as practicable and prior to initial earthworks operations (clearing and grubbing) for any stage or section of the Works, the Contractor must install erosion and sediment controls (including sediment traps, catch banks and diversion drains) associated with drainage paths flowing through the Works area. The completion of these activities will be a **Hold Point 2** for any further earthworks.

Where clearing is required in order to construct or install the erosion and sediment controls this shall be discussed and approved by the Administrator.

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7.2 Operation and maintenance

The Contractor shall maintain all erosion and sediment controls in effective working order including reconfiguring drainage lines as required during the construction process to ensure dirty water is directed into sediment controls at all times.

Reuse of the water collected in sediment ponds or basins for dust suppression and roadworks is preferred over release into the environment. Where water is being stored for dust suppression the required design capacity of the basins shall be available.

Sediment basins and other sediment controls shall be operated and maintained in a manner that minimises the risk of environmental harm. The design capacity of the upper settling volume shall be made available within 120 hours of the most recent rainfall event which causes runoff.

The sediment storage zone shall be maintained at all times with the accumulated sediment removed in a manner that does not allow the sediment to be conveyed into a watercourse or offsite.

Where coagulants or flocculants are used to treat stormwater, they must not cause harm to the receiving waters or environment. A jar test or streaming current detector (SCV) must be undertaken to estimate volumes of the coagulant or flocculant required and to reduce the risk of overdosing. Coagulants or flocculants containing aluminium (including alum and PAC) shall not be used when water is being discharged to an acidic environment where natural pH is less than 6.0 (such as wallum stream or wetland).

> The greatest environmental risk from coagulants / flocculants exists when overdosing has occurred. This risk can be mitigated by discharging water from sediment basin that has been flocced into a drainage channel rather than directly into a waterway. For projects using coagulants other than gypsum this practice is recommended.

7.3 Decommissioning and removal

The Contractor shall remove temporary controls when permanent measures are in place and/or Site stabilisation has occurred. This should occur prior to the end of the Defects Liability Period or the end of the Landscape and Revegetation Works Monitoring Period whichever is the later. The Contractor will not receive a Final Certificate until these temporary controls have been removed from the Site.

Any areas used for erosion and sediment control shall be rehabilitated to the satisfaction of Administrator.

8 Erosion and Sediment Control Management – Performance requirements

8.1 Performance requirements

There shall be no erosion resulting from construction practices unless there are provisions within the worksite to manage resultant sediment.

Releases from site must not cause scour at the area of discharge. Water must only be released at the discharge point nominated within the ESCP and as deemed acceptable by the Administrator. Any modification to discharge point must be agreed by the Administrator.

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The Contractor's erosion and sediment controls shall be sufficient to achieve the water quality investigation criteria for Discharge, land and Waterways in accordance with Clause 8.2.2 of MRTS51 Technical Specification.

9 Administrative requirements

The ESCP is an annexure to the EMP(C) defined in MRTS51 *Environmental Management*. Unless specified otherwise in this Technical Specification, all requirements defined in Clause 6 and 7 of MRTS51 *Environmental Management* will apply to MRTS52.

9.1 Independent audits

In addition to MRTS51 administrative requirements, for sites determined to have a high erosion risk (assessed against the criteria of Table 1.3 of this Technical Specification and as nominated in Clause 2 of Annexure MRTS52) the Contractor shall engage an independent Appropriately Qualified Person (AQP). The AQP shall assess the compliance of ESC measures against:

- this Technical Specification
- the accepted ESCP
- ESCP principles (as defined in Section 1.4), and
- discharge limits.

The Contractor shall submit the independent review report to the Administrator with proposed and completed actions undertaken to address the identified issues not more than seven days following the audit.

Unless modified by Clause 5.1 of Annexure MRTS52 the Contractor shall allow for a minimum of three independent audits for each stage of the project for example: one audit immediately following clearing and grubbing and one audit during cut and fill and one audit at end of major earthworks.

Management and reporting of non-conformances and incidents relating to erosion and sediment control shall be as per requirements for environmental non-conformances and incidents (Clause 5.2 of MRTS51). Notification to the Administrator or the Principal does not in any way negate the requirements on the Contractor to notify DEHP, other regulatory authorities and landowners under the Environmental Protection or other Acts.

The Administrator reserves the right to seek costs against the Contractor for incidents that cause environmental harm. The costs shall correspond to the cost for additional administration of the contract (which may include investigation of the incident, internal and external reporting of incident, meetings and correspondence). The costs shall be recovered based on the hourly rate listed in Clause 6 of MRTS52 Annexure.

> Transport and Main Roads may elect to nominate a greater frequency such as monthly if desired, or nominate high frequency for areas around sensitive environments.

10 Design and technical standards

10.1 Technical standards

The Contractor shall ensure sediment and erosion controls are designed, installed and maintained in accordance with the IECA Manual (particularly Book 4 – Design Fact Sheets and Book 6 – Standard

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FOI 26-292 - Document 21

Drawings) and manufacturers specifications except as modified by design requirements in Clause 10.2 below.

Where controls will become permanent, the relevant Technical Specification shall have precedence, for example:

- MRTS03 *Drainage, Retaining Structures and Protective Treatments* shall apply for drainage controls that become permanent including sheet or strip filter drains.
- MRTS16 *Landscape and Revegetation Works* shall apply for permanent revegetation (including Technical Specifications for cover crop to be included within permanent seed mixes), and
- MRTS27 *Geotextiles (Separation and Filtration)* shall apply for geotextiles that are part of the permanent Works.

10.2 Design requirements

Controls shall be designed to have the capacity and structural strength specified in Table 10.2.

Table 10.2 - Design requirements

Item	Disturbed area open for:		
	0 – 12 months	**12 – 24 months**	**> 24 months**
Drainage controls • Diversion drains • Channels • Batter chutes	39.3 % AEP (2 year ARI)	18.13% AEP (5 year ARI)	~ 10% AEP (10 year ARI)
Sediment basins	80th percentile 5 day rain event Projects adjacent to sensitive receiving waters: 85th percentile, five day rain event		
Sediment basin inlet	18.13% AEP (5 year ARI)	~ 10% AEP (10 year ARI)	10% AEP (~10 year ARI)
Sediment basin – Emergency outlet, embankments	5% AEP (~20 year ARI)	5% AEP (~20 year ARI)	2% AEP (~50 year ARI)

10.2.1 Sediment Basin embankments

Fill materials used for the construction of sediment basin embankment shall be in accordance with Clause 14.2.6 of MRTS04. The material shall be compacted to not less than 97% in accordance with requirements stipulated in Table 15.3(b) of MRTS04. The stability requirements shall be as per Section 2 of Geotechnical Design Standard.

10.2.2 Catch drains

Triangular V drains (Type B catch drains as shown in IECA Standard Drawing CD-01: Catch Drains) shall not be installed in areas with dispersive soil.

11 Supplementary requirements

The requirements of MRTS52 *Sediment and Erosion Control* are varied by the additional requirements specified in Clause 7 of Annexure MRTS52.

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Technical Specification

Transport and Main Roads Specifications
MRTS96 Management and Removal of Asbestos

July 2017

Queensland Government

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Contents

1 Introduction 1
2 Definition of terms 1
3 Referenced documents 2
4 Quality system requirements 3
4.1 Hold Points, Witness Points and Milestones 3
5 Information about the presence of asbestos 3
6 Investigation and testing for identification of asbestos 4
7 Management of asbestos 5
8 Asbestos removal 5
8.1 General 5
8.2 Licensed asbestos removal contractor 6
8.3 Asbestos removal work 6
8.4 Tools and equipment prohibited on asbestos 6
8.5 Decontamination 7
9 Transport and disposal of asbestos waste 7
10 Clearance inspection, clearance certificate and site validation report 7

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1 Introduction

This Technical Specification applies to the management and safe removal of asbestos from existing transport infrastructure including:

- bridges (for example, rehabilitation works including widening, strengthening and damage due to vehicle impact)
- electrical conduits and pits
- water mains, sewer mains, drainage pipes and pits
- miscellaneous products, packing.

This Technical Specification shall be read in conjunction with the requirements of the *Environmental Protection Act* 1994 and Environmental Protection Regulation 2008, MRTS01 *Introduction to Technical Specifications,* MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are as defined in Table 2.

The following terms are used in this Technical Specification and their definitions are in accordance with Work Health and Safety Regulation 2011*, How to safely remove asbestos – Code of Practice* 2011*, How to manage and control asbestos in the workplace – Code of Practice* 2011 and the Transport and Main Roads Asbestos Management Framework.

Terms used in this Technical Specification relating to the *Environmental Protection Act* 1994 and Environmental Protection Regulation 2008 are defined in accordance with the regulation.

Table 2 – Definition of terms

Term	Definition
Airborne asbestos	Airborne asbestos means any fibres of asbestos small enough to be made airborne. For the purposes of monitoring airborne asbestos fibres, only respirable fibres are counted.
Asbestos	Asbestos means the asbestos form varieties of mineral silicates belonging to the serpentine or amphibole groups of rock forming minerals, including actinolite asbestos, grunerite (or amosite) asbestos (brown), anthophyllite asbestos, chrysotile asbestos (white), crocidolite asbestos (blue) and tremolite asbestos or a mixture of one or more of these minerals.
Asbestos Coordinator	Transport and Main Roads' nominated persons who undertake the function of entering and extracting data from the Central Asbestos Register, coordinating Asbestos Services as required and any other functions within their allocated area of responsibility as outlined in branch specific Implementation Guides. A full description of the Asbestos Coordinator role and responsibilities is provided in the Framework.

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Term	Definition
Central Asbestos Register	Central repository of information relating to the presence, suspected presence or the confirmed absence of asbestos and asbestos containing material in the department owned assets.
Competent person	In relation to identifying asbestos, Asbestos Containing Material (ACM) or Naturally Occurring Asbestos (NOA) at the workplace and/or conducting asbestos risk assessments means a person who: • Has acquired through training or experience the knowledge to identify suspected asbestos, ACM or NOA and holds an occupational hygienists license, or • Has a statement of attainment in the unit of competency for the identification of asbestos or ACM.
Competent Person-Clearance inspection	In relation to carrying out clearance inspections under the Work Health and Safety (WHS) Regulation 2011, Section 473 means a person who has acquired through training or experience the knowledge and skills of relevant asbestos removal industry practice and holds a certification in relation to the specified Vocational Education and Training course for asbestos assessor work or a tertiary qualification in occupational health and safety, occupational hygiene, science, building, construction or environmental health.
Friable asbestos	Friable asbestos means material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos.
Non-friable asbestos	Non-friable asbestos means material containing asbestos that is not friable asbestos, including material containing asbestos fibres reinforced with a bonding compound. (e.g. Asbestos cement in sheeting or piping).
Respirable asbestos	Respirable asbestos means an asbestos fibre that: 1. is less than 3 micrometres (µm) wide 2. more than 5 micrometres (µm) long, and 3. has a length to width ratio of more than 3:1.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
Asbestos Removal – COP	*How to Safely Remove Asbestos - Code of Practice* 2011
Design criteria for Bridges and Other Structures	*Bridge Design and Assessment Criteria: Design Criteria for Bridges and Other Structures*
Implementation Guideline	Engineering and Technology Implementation Guideline for the Asbestos Management Framework Program Delivery & Operations Implementation Guide RoadTek Implementation Guide
Manage and Control Asbestos COP	*How to Manage and Control Asbestos in the Workplace – Code of Practice* 2011
MRTS01	*Introduction to Technical Specifications*
MRTS50	*Specific Quality System Requirements*
MRTS51	*Environmental Management*

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Reference	Title
TMR Framework	Asbestos Management Framework
WHS Regulation	Work Health and Safety Regulation 2011
-	Asbestos Management Policy for its Assets
-	*Environmental Protection Act* 1994
-	Environmental Protection Regulation 2008

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications.*

The Hold Points and Witness Points applicable to this Technical Specification are summarised in Table 4.1. There are no Milestones defined.

Table 4.1 – Hold Points, Witness Points and Milestone

Clause	Hold Point	Witness Point	Milestone
8.2	1. Acceptance of the Asbestos Removal Plan 2. Acceptance of a revised Asbestos Removal Control Plan	1. Submission of Asbestos removal control plan 2. Submission of a revised Asbestos Removal Control Plan	
10	3. Receipt of Clearance certificate		

5 Information about the presence of asbestos

The Central Asbestos Register must be consulted as part of the planning for rehabilitation projects and absolutely prior to the commencement of any works, testing etc., to obtain information about the presence or suspected presence of asbestos, where relevant. The Central Asbestos Register can be accessed in consultation with the nominated departmental Asbestos Coordinator.

The location of known contaminated sites, including those subject to asbestos manufacture or disposal, are identified in Annexure MRTS51.1 *Environmental Management*. Contaminated sites containing asbestos must be managed in accordance with MRTS51 *Environmental Management,* this Technical Specification, and the Environmental Protection Regulation 2008.

Where asbestos is known to be present, the following documentation must be considered as part of any planning for works and incorporated in planning documentation, procurement documentation, and information provided to contractors or subcontractors:

- Site specific information for the Central Asbestos Register, and
- The Asbestos Management Plan.

The documentation can be obtained by the Asbestos Coordinator from the Central Asbestos Register.

If there is uncertainty as to whether asbestos is present in any part of a structure or plant, the person with management or control of the workplace can either assume asbestos is present and treat it with appropriate caution based on the level of risk or have a sample analysed.

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6 Investigation and testing for identification of asbestos

The preferred option is for investigation and testing to identify the presence of asbestos in existing structures for rehabilitation projects shall be carried out during the design phase. However, in some circumstances such as damage due to vehicle impact on a bridge, this will not be possible. In this instance work should be carried out according to the relevant Implementation Guideline and the WHS Regulation.

Refer to the department's *Design Criteria for Bridges and Other Structures,* the relevant Implementation Guideline and the relevant WHS Regulation for requirements of identification and testing of asbestos.

Asbestos can occur in the following locations in existing transport infrastructure:

- bridges with permanent formwork for insitu deck slabs with girders including separated deck units
- drainage pipes, water mains, sewer mains, pits
- cast in services (e.g. Conduits and drainage fittings)
- buried services including ducts and pits
- electrical and communication pits
- miscellaneous packing and sealing products.

The department will not allow work involving asbestos to commence unless a competent person has assessed the risks, implemented controls and identified safe work practices. To limit worker exposure to asbestos the department will not perform licensed asbestos removal work but will contract this work to a qualified and licensed specialist. Please refer to the relevant Implementation Guideline.

Before work commences on site, the Contractor shall carry out an investigation to confirm the information on the asbestos register and the Central Asbestos Register. The Contractor shall be aware that ACM may exist at locations in addition to those included on the asbestos register and take all necessary precautions.

Where a new incidence of ACM is discovered, or suspected, the Contractor shall immediately stop work and notify the Administrator. The Administrator will promptly arrange for the site to be inspected and assessed by a competent person. The Administrator may declare an exclusion zone for a period of time. The Contractor shall erect exclusion zones as directed by the Administrator and preclude access to those areas.

If asbestos is identified, a written asbestos management plan shall be developed by a qualified person in accordance with the WHS Regulation.

The Asbestos Coordinator should be advised and record all details, photos etc., of any newly identified ACM in the Central Asbestos Register. Where ACM is not disturbed as a result of design details, it shall remain insitu to the extent permitted and be identified and protected appropriately as per guideline provided in the Manage and Control Asbestos Code of practice (COP).

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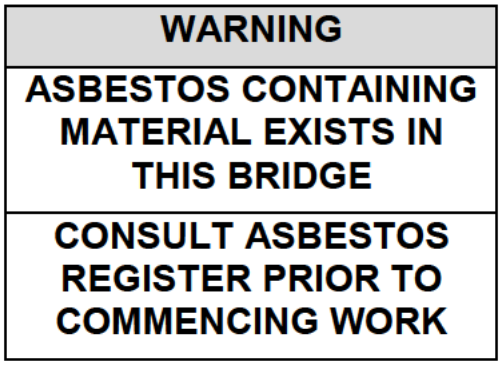
7 Management of asbestos

Management of asbestos should align to the procedures within the relevant Implementation Guideline. This includes managing asbestos risk in transport infrastructure. In addition to the Implementation Guideline, management of asbestos as a regulated and trackable waste should occur in accordance with MRTS51 *Environmental Management,* this Technical Specification, and the Environmental Protection Regulation 2008.

Where the Contract includes requirements for managing ACM on the site, the Contractor shall strictly comply with requirements outlined in the relevant Implementation Guideline and the WHS Regulation.

The department shall erect signs in prominent locations warning of the presence of ACM and shall display a copy of the Asbestos Register. An example of a typical warning sign is shown in Figure 7. All required information shall be included in all safety inductions and meetings.

Figure 7 - Example of a typical warning sign



Where the site has ACM that is not to be disturbed, the department shall ensure that the ACM is adequately signed and delineated to ensure that it is not disturbed.

The Contractor shall ensure all asbestos-related work activities are carried out in accordance with the WHS Regulation.

8 Asbestos removal

8.1 General

Where removal of ACM is included in the Contract, removal shall be undertaken as specified in the contract and paid in accordance with MRS96. When removal of ACM is outside the Contract, the Administrator shall undertake the work in accordance with this Technical Specification, Manage and Control Asbestos – COP and the relevant Implementation Guide.

Where ACM requires removal, the appointed Licensed Asbestos Removal Contractor must notify the Regulator, using the approved form, at least five days prior to starting work, unless there is a sudden unexpected event or breakdown of essential services requiring work to be done immediately. In the latter case the Regulator must be notified immediately or within 24 hours after notice is provided. Asbestos removal must only be done with specific care to minimise asbestos fibres becoming airborne. The following WHSQ legislation shall be followed:

- Work Health and Safety Regulation 2011
- *How to Safely Remove Asbestos – Code of Practice* 2011
- *How to Manage and Control Asbestos in the Workplace – Code of Practice* 2011.

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8.2 Licensed asbestos removal contractor

Asbestos removal shall be carried out by an appropriately licensed asbestos removal contractor unless exempted by the WHS Regulation for the size and class of the proposed asbestos removal work. The type of license required shall be in accordance with WHS Regulation 2011 and Asbestos Removal Control Plan.

The licensed asbestos removal contractor shall prepare an Asbestos Removal Control Plan (ARCP) and submit it to the Administrator at least 21 days prior to the start of asbestos removal works. Refer to the *Asbestos Removal Code of Practice* 2011 and the Implementation Guide for guidance. **Witness Point 1** The proposed asbestos waste disposal site shall be shown in the ARCP. Asbestos removal shall not be commenced until the Administrator has issued written confirmation of the acceptance of the ARCP. **Hold Point 1**

The ARCP shall outline the specific control measures to control airborne asbestos. An assessment of air monitoring requirements shall be carried out by the Asbestos removalist in accordance with the Asbestos Removal – COP to ensure the effectiveness of control measures.

If requirements for additional measures are identified during the ACM removal work, the ACM removal shall stop immediately and the Administrator notified. The Administrator will promptly arrange for the site to be inspected and assessed. The Administrator may declare an exclusion zone for a period of time. The Contractor shall erect exclusion zone as directed by the Administrator and preclude access to those areas. The contractor shall revise the ARCP and submit it to the Administrator at least 14 days before the commencement of the Asbestos removal. **Witness Point 2** Asbestos removal shall not be commenced until the Administrator has issued written confirmation of the acceptance of the revised plan **Hold Point 2**

8.3 Asbestos removal work

Asbestos removal may require the asbestos removal area to be enclosed. Large scale asbestos removal (friable or non-friable) is of longer duration and there is higher risk of generating a significant amount of airborne asbestos.

The licensed asbestos removalist shall carry out a risk assessment to determine the requirements for the asbestos removal area to be enclosed to eliminate or minimise the release of airborne asbestos. If it is not reasonably practicable to enclose the area, adequate alternative control measures shall be included in the ARCP. The ARCP shall be submitted to the Administrator for approval in accordance with Clause 8.23

Design, assessment and testing of the enclosure shall be carried out in accordance with the Asbestos Removal – Code of Practice.

8.4 Tools and equipment prohibited on asbestos

In accordance with the Asbestos Removal – COP, tools and equipment that generate dust must not be used on ACM. Prohibited tools and equipment's include:

- high-speed abrasive power and pneumatic tools, for example angle grinders, sanders, saws and high-speed drills
- brooms and brushes (unless brushes are used for sealing)

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- high-pressure water spray, jets, power or similar tools and instruments on asbestos in the workplace, and
- compressed air.

The use of tools and equipment that cause the release of asbestos, including power tools and brooms shall not be used on asbestos unless they are enclosed and/or designed to capture or suppress asbestos fibres and/or the equipment is used in such a way that is designed to capture or suppress asbestos fibres safely.

The wet spray method shall be used for asbestos removal and any dry method is not permitted because of greater potential for airborne asbestos fibres to be generated.

The level of airborne asbestos shall be monitored during asbestos removal. If the level of airborne asbestos is higher than the fibre levels specified in the Asbestos Removal – COP, asbestos removal works shall stop and the Administrator notified for action as stated in Clause 7.3 and the WHS Regulation. The ARCP shall be revised with additional control measures as stated in Clause 7.3.

8.5 Decontamination

Contaminated items, tools, equipment and clothing including PPE and RPE must not be removed from the asbestos removal work area unless they have been decontaminated or contained. Personal decontamination shall also be undertaken each time an asbestos removal worker leaves the ACM removal work area. Decontamination should be undertaken as per the guidelines provided in Asbestos Removal – COP.

9 Transport and disposal of asbestos waste

Asbestos waste must be contained and labelled before the asbestos waste is removed from the asbestos removal area. The transport and disposal of asbestos shall be in accordance with the requirements of the Environmental Protection Regulation 2008. The Contractor shall manage as a regulated waste including waste tracking obligations.

Transport and disposal of asbestos waste shall be in accordance with the guidelines provided in the Asbestos Removal COP.

10 Clearance inspection, clearance certificate and site validation report

On completion of the asbestos removal works, a clearance inspection of the area shall be carried out and a clearance certificate shall be issued by an independent licensed asbestos assessor for friable licensed asbestos removal work or an independent competent person for non-friable licensed asbestos removal work to verify that it is safe for normal use in accordance with WHSQ Regulations 2011 and the Asbestos Removal – COP.

The requirements of the independent asbestos assessor and independent competent person for clearance inspection to issue clearance certificate shall be in accordance with the Asbestos Removal – COP. If required within MRTS51, a site validation report shall be completed in accordance with sections 389 and 390 of the *Environmental Protection Act* 1994.

The Contractor shall submit this clearance certificate to the Administrator and shall not allow unauthorised persons to access the asbestos effected area until the Administrator has acknowledged receipt of the clearance certificate. **Hold Point 3** The asbestos hazard signs shall be maintained until the **Hold Point 3** has been released.

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Within 10 days of completion of the clearance inspection for all work associated with the removal of ACM or any audit/inspection program, the Contractor shall forward to the Administrator all related asbestos documentation, including clearance certificate, photographs, waste disposal certificate, sample results etc., to show the extent of ACM that was removed or identified. The department shall update the Central Asbestos Register and update the Hazard Field in the Bridge Information System if applicable.

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Technical Specification

MRTS170 Public Utilities in Road Projects Site Works

March 2021

Queensland Government

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Contents

1 Introduction 1
2 Definitions of terms 1
3 Referenced documents 3
4 Standard test methods 4
5 Materials 4
6 Site Works 6
6.1 General 6
6.2 Flowable (liquid) Fill / Grout 6
6.3 Depth of Cover, Orientation and Proximity to Structures 6
6.4 Longitudinal services 6
6.5 Boring, jacking and microtunnelling 7
6.6 Trenching 7
6.7 Backfill of trenches 7
6.8 Longitudinal installation 7
6.9 Reinstatement of pavement and surfacing 7
6.10 Attachment to existing bridge structures and culverts 7

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FOI 26-292 - Document 21

1 Introduction

This Technical Specification defines or applies to the installation and/or protection of Public Utility Plant (PUP) within the State Controlled Road (SCR) including busways and cycle lanes. It is suitable for use with all Transport and Main Roads contract types. It does not apply to local government owned stormwater assets or other third party assets that are not PUP.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS171 *Public Utilities in Road Projects Principal Contractor Responsibilities*, TN163 *Third Party Utility Infrastructure Installation in State Controlled Roads Technical Guidelines* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

Utility Authorities specify testing methods and technical requirements for their assets in their own technical standards or adopt Australian Standards requirements, as identified in Table 2. Requirements, such as minimum spacing requirements between each utility asset, are not provided as this will depend on Utility Authority standards, asset specifications and engineering judgement.

This Technical Specification therefore does not identifying the technical requirements for the actual Utility Asset. Instead, it focusses on requirements to ensure the management of departmental infrastructure projects and the state-controlled road corridor are not compromised.

2 Definitions of terms

The terms defined in Clause 2 of MRTS01 *Introduction to Technical Specifications* apply to this Technical Specification. Additional terminology relevant to this Technical Specification is defined in Table 2 below.

Table 2 – Definitions of terms

Term	Definition
Act	An Act is a statute or law passed by both Houses of Parliament that has received Royal Assent. On Royal Assent, Acts are given a year and number. Once an Act is formally enacted it can generally only be amended or repealed by another Act. When an Act changes, a compilation of the Act is prepared to show the Act as amended. Acts are also known as primary legislation.
Alignment Approval	Utility Assets are permitted within the road corridor however the Utility Owner must obtain an alignment approval from the road authority. The alignment approval confirms the location for the utility asset (generally an offset from the property boundary or kerb). Failure to obtain an alignment approval can result in the asset being removed at the Utility Owner's cost. This approval may be supplied through contractual or other agreement processes.
Approved Supplier / Materials	Utility Owners have identified particular products (pipe types, valve types, pits, and so on) or manufactures that can be used on their infrastructure. Generally, the prequalified Utility Owner contractor or the road construction contractor is responsible for purchasing materials from approved suppliers however the details will be taken from the design drawings.
Assets	An item of property owned by a person or company, regarded as having value.

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Term	Definition
Civil works	Separate works which are undertaken by a construction company in order to facilitate work by an Infrastructure Utility Owner. This may be installation of conduits and pits, access roads, excavations.
Contestable Works	Works on Utility Infrastructure that can be undertaken or managed by an organisation / contactor who is not the utility infrastructure owner. Contractors who undertake the works generally require prequalification (approved supplier status) from the Utility Infrastructure owner.
Contractor	A company engaged to undertake the works
Council assets	Council assets may include land, sewerage pipelines, water pipelines, pumping stations, drainage channels, and so on.
Design	Design of the electrical network, water pipeline, gas pipeline, sewerage pipeline and related infrastructure.
DBYD	Dial Before You Dig. Data supplied from DBYD is only valid for 60 days.
Distribution network	The network of pipes (water, gas) or electrical lines that supply the utility service to the end user. Property service connections are feed from the distribution network.
Fees	Some Infrastructure Utility Owners charge fees for example design lodgement fee, field audit fee, inspection fee, switching fee.
High voltage power	Includes 11 kV, 33 kV, 66 kV, 110 kV and 275 kV power (electrical) lines.
IFC	Issued for Construction.
Investigation	A detailed investigation of an Infrastructure Utility assets, used to determine the location, depth and extent of the asset. The quality of the information is categorised in accordance with AS5488.
LGA	Local Government Authority, also referred to as “council”.
Local authority approval	Include any approvals from a local authority in relation to the works.
Local Laws	Some councils have a register of local laws and subordinate local laws.
Low voltage power	a power (electrical) line conducting electricity in the range from 50 to 1000 V.
MoU	Memorandum of Understanding – a non-legally binding agreement between two organisations.
Non-Contestable Works	Works on Utility Infrastructure that can only be undertaken (or managed) by the Utility Infrastructure owner.
Permits	LGA may require contractors to obtain a permission to work in their road corridor. This permission is provided as a road corridor works permit.
Prequalified Supplier	In some cases, the Infrastructure Utility Owner has a list of approved companies and individuals that are authorised to undertake, manage and/or coordinate works on their assets.
PUP	Public Utility Plant means plant permitted under another Act or a Commonwealth Act to be on a road. This can also be referred to as Utility Infrastructure or utility assets.

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Term	Definition
Public Utility/ Public Utility Provider	An entity that owns public utility plant. An organisation that has a right, under federal, state or local legislation, to undertake Works in the road corridor. These are entities empowered by legislation to own and operate infrastructure for the purpose of providing essential services to the community. This covers electricity entities (generation, transmission and distribution), gas suppliers/pipeline licence holders (distribution and transmission), telecommunications carriers (excluding mobile towers which are considered commercial assets), retail-distributors or council water suppliers (water / wastewater / recycled water / sewage delivery but not bulk water).
QUU	Queensland Urban Utilities.
RCP	Transport and Main Roads Road Corridor Permit.
SCR	State Controlled Road.
Utility Owner/ Authority	Includes electric power distribution or transmission company owned by the Government of Queensland (e.g. Energex, Ergon, Powerlink), statutory authority of the Government of Queensland (e.g. Urban Utilities) private company (e.g. APA Group, Optus, Telstra), corporation owned by the Australian government (e.g. NBN Co). Also known as a public utility provider in the *Transport Infrastructure Act* 1994 (Section 105N).
URMP	Utility Relocation Management Plan.

3 Referenced documents

The requirements of the referenced documents listed in Table 3 below apply to this Technical Specification and specifies the technical requirements associated with Utility Assets. This list is not complete as it is the designer's obligation to confirm all technical requirements associated with a particular Utility Asset are specified in the issue for construction (IFC) design and comply with the Utility Authorities and Transport and Main Road's requirements. Where there are inconsistencies between this Technical Specification and the referenced documents, the requirements specified in this Technical Specification shall take precedence.

Table 3 – Referenced documents

Reference	Title
American Petroleum Institute recommended practice, API RP1102	*Steel Pipelines Crossing Railroads and Highways*
AS 2885.1	*Pipelines – Gas and Liquid Petroleum, Part 1: Design and Construction*
AS 2885.2	*Pipelines – Gas and Liquid Petroleum, Part 2: Welding*
AS 2943	*Plastics pipes and fittings for gas reticulation - Polyamide compounds*
AS 4645	*Gas Distribution Networks*
AS 4799	*Installation of underground utility services and pipelines within railway boundaries*
AS 4853	*Electrical Hazards on metallic pipelines*
AS 5100.2	*Bridge Design – Design loads*
AS 5488	*Classification of Subsurface Utility Information*

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Reference	Title
AS/NZS 2566.1	*Buried Flexible Pipelines, Part 1: Structural Design*
AS/NZS 3725	*Design for Installation of Buried Concrete Pipes*
AS/NZS 4680	*Hot-dip Galvanized (zinc) Coatings on Fabricated Ferrous Articles*
BS 5228-2:2009	*Code of practice for noise and vibration control on construction and open sites*
DIN 4150-3:1999	*Vibration on Buildings - Part 3: Effects on Structures*
MRTS01	*Introduction to Technical Specifications*
MRTS50	*Specific Quality System Requirements*
MRTS56	*Construction Surveying*
MRTS70	*Concrete*
MRTS140	*Horizontal Directional Drilling*
MRTS141	*Microtunnelling and Pipe Jacking*
MRTS142	*Thrust Boring and Auger Drilling*
MRTS171	*Public Utilities in Road Projects Principal Contractor Responsibilities*
SEQ Code	*South East Queensland Water Supply and Sewerage Design and Construction Code*
TN163	*Third Party Utility Infrastructure Installation in State Controlled Roads Technical Guidelines*
WSA	*Water Services Association - Water Supply code of Australia*
-	*Transport Noise Management Code of Practice, Volume 2*

4 Standard test methods

This Technical Specification does not identify the technical requirements or testing requirements associated with an actual Utility Asset.

For departmental testing methods associated with Utility installation / protection, therefore focus on backfill of trenches (within the pavement and the verge), pavement reconstruction, concrete, line marking and installation methods that may impact on departmental infrastructure such as directional drilling. Refer to Clause 5 below for details.

5 Materials

Utility Authorities specify acceptable materials and products for their assets – often listing an Approved Supplier. It is the obligation of the designer to confirm all materials specified in an issue for construction (IFC) design comply with the Utility Authority's material and product requirements. Consequently, this Technical Specification does not identify Utility Authority material or product requirements.

Transport and Main Roads' material requirements associated with backfilling trenches, asphalt, and so on are specified in the Technical Specifications documents identified in Table 5.

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Table 5 – Technical Specification testing requirements

Reference	Title
MRTS03	*Drainage, Retaining Structures and Protective Treatments*
MRTS04	*General Earthworks*
MRTS05	*Unbound Pavements*
MRTS08	*Plant mixed heavily bound (cemented) pavements*
MRTS10	*Plant mixed lightly bound pavements*
MRTS11	*Sprayed Bituminous Treatments (excluding emulsion)*
MRTS12	*Sprayed Bituminous Emulsion Surfacing*
MRTS13	*Bituminous Slurry Surfacing*
MRTS14	*Road Furniture*
MRTS17	*Bitumen and Multigrade Bitumen*
MRTS18	*Polymer Modified Binder (including Crumb Rubber)*
MRTS19	*Cutter and Flux Oils*
MRTS20	*Cutback Bitumen*
MRTS21	*Bituminous Emulsion*
MRTS24	*Manufacture of Precast Concrete Culverts*
MRTS25	*Manufacture of Precast Concrete Pipes*
MRTS26	*Manufacture of Fibre Reinforced Concrete Drainage Pipes*
MRTS27	*Geotextiles (separation and Filtration)*
MRTS30	*Asphalt Pavements*
MRTS32	*High Modulus Asphalt (EME2)*
MRTS35	*Recycled Material Blends for Pavements*
MRTS39	*Lean Mix Concrete Sub-Base for Pavements*
MRTS45	*Road Surface Delineation*
MRTS56	*Construction Surveying*
MRTS70	*Concrete*
MRTS96	*Removal and Removal of Asbestos*
MRTS101	*Aggregates for Asphalt*
MRTS102	*Reclaimed Asphalt Pavement Material*
MRTS103	*Fillers for Asphalt*
MRTS140	*Horizontal Directional Drilling*
MRTS141	*Microtunnelling and Pipe Jacking*
MRTS142	*Thrust Boring and Auger Drilling*

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6 Site Works

6.1 General

The purpose of Utility relocation management during the Contract period is to provide for the co-ordination and/or completion of protection and relocation of affected Utility Infrastructure as identified on the "Public Utility Plan Layout" drawings for the impacted utility assets by the adoption of an appropriate Utility Relocation Management Plan (URMP).

During the site works there are required standards that must be met by the Public Utility and Transport and Main Roads. Where there is no standard specifically identified the TN163 *Third Party Utility Infrastructure Installation in State Controlled Roads Technical Guidelines* shall apply or the relevant departmental standards.

6.2 Flowable (liquid) Fill / Grout

Refer to MRTS70 *Concrete* for information on Flowable Fill and TN163 for guidance on how it applies in utility works.

All work shall be carried out in accordance with the provisions of the contract documents and to the satisfaction of the Utility Authorities and the Transport and Main Roads Representative / Administrator.

6.3 Depth of Cover, Orientation and Proximity to Structures

Technical note TN163 specifies departmental requirements associated with the depth of cover, orientation and proximity to structures for Utility Assets. It is the designer's obligation to ensure all depth, orientation and proximity to structures requirements are specified in the issue for construction (IFC) design and comply with the Transport and Main Roads and Utility Authority requirements.

Further, where utility assets are in the vicinity of project works, utility asset owners should be consulted to determine their specific requirements in relation to vibration exposure. In the absence of third party advice, guidance may be taken from British Standard BS 5228-2:2009 or German Standard DIN 4150-3:1999 which provide information on the vulnerability of ground-related services and structures to vibration (Refer to the *Transport Noise Management Code of Practice Volume 2* for more information).

6.4 Longitudinal services

Technical note TN163 details requirements associated with utility assets installed longitudinally in the state-controlled road corridor.

It is the designer's obligation to ensure longitudinal installations specified in the issue for construction (IFC) design comply with Transport and Main Roads requirements as well as Utility Authority requirements.

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6.5 Boring, jacking and microtunnelling

Transport and Main Roads requirements associated with boring, jacking and microtunnelling must adhere to the requirements specified in the following documents:

- TN163 *Third Party Utility Infrastructure Installation in State Controlled Roads Technical Guideline*
- MRTS140 *Horizontal Directional Drilling*
- MRTS141 *Microtunnelling and Pipe Jacking*
- MRTS142 *Thrust Boring and Auger Drilling*

6.6 Trenching

Trenching is generally considered as the installation method to be employed for installations within areas of the road corridor that are not developed for traffic (i.e. verge) or where structural pavements have not been constructed/ completed.

While minimum depths of cover have been identified in TN163 *Third Party Utility Infrastructure Installation in State Controlled Roads Technical Guideline*, it is the designer's obligation to ensure that load bearing requirements are addressed for any road crossing. IFC drawings must therefore address all drainage, verge reinstatement works, load bearing requirements, pavement reinstatement works and relevant departmental Technical Specifications.

Trenches must not be left open overnight. Trenches are to be back filled, covered with a steel plate lid or be protected by a barrier perimeter approved by the Administrator.

Conduits must be bedded in accordance with the relevant Australian Standard or Service Authority Standard and maintain minimum horizontal and vertical clearances to other utility services as specified by Australian Standards, Service Authority Standards, Legislation or as detailed in the IFC drawings.

6.7 Backfill of trenches

Unless specified elsewhere in the IFC drawings and contract documents, the back fill of trenches shall be as detailed in TN163.

6.8 Longitudinal installation

Lean mix and or flowable fill must not be used for services installed longitudinally in or adjacent to the pavement due to the potential to trap water within the pavement.

6.9 Reinstatement of pavement and surfacing

Unless specified elsewhere in the IFC drawings and contract documents, the reinstatement of pavement and surfacing shall be as detailed in TN163.

6.10 Attachment to existing bridge structures and culverts

Unless specified elsewhere in the IFC drawings and contract documents, that reinstatement of pavement and surfacing shall be as detailed in TN163.

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Specification (Measurement)

Transport and Main Roads Specifications
MRS01 Introduction to Specifications

July 2019

Queensland Government

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Schedule of Rates contract 1

2.1.1 Standard method of measurement 1
2.1.2 Standard work description methodology 2
2.1.3 Standard Work Items 2
2.1.4 Supplementary Work Items 4
2.1.5 Work Operations 4
2.1.6 Parameters in work item descriptions 5
2.1.7 Provisional quantities and provisional items 5
2.1.8 Non-Standard Work Items (90000 Series Items) 6
2.1.9 Recycled materials 7

2.2 Lump Sum Contracts 7

2.3 Measurement of quantities 8

3 Definition of terms 8

3.1 Standard definitions 8

3.2 Definitions in other documents 9

3.3 Priority of definitions 9

4 Referenced documents 9

5 Application of concession provisions for below standard work 10

6 Application of bonus provisions for above standard work 10

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1 Introduction

This Specification serves as an introduction to Specifications.

This Specification shall be read in conjunction with the other Specifications.

The requirements of this Specification apply to all Specifications including Supplementary Specifications incorporated into the Contract.

Reference to clause numbers shall be taken to mean reference to the clauses of that number within that Specification unless stated otherwise.

This Specification forms part of the Transport and Main Roads Specifications Manual. All Specifications forming the Transport and Main Roads Specifications Manual detail the technical requirements for work related to departmental projects.

Others may use these documents for non-departmental projects at their own risk. In some cases, a particular Technical Specification may be based on the assumption that a standard departmental contract is in place (that is, references to “contract” means a reference to a specific standard contract). A consistency check should be undertaken if the contract is not a departmental standard.

These Specifications do not specifically cover non-technical issues associated with undertaking departmental works, for example Workplace Health and Safety, or environmental. Such issues are generally covered by legislative or other requirements and are generally beyond the scope of these Specifications.

Technical Specifications set out the requirements for the standard of work to be carried out for the department under all forms of contract. Specifications set out additional requirements for particular forms of contract. Each Specification includes the associated Technical Specification. For example, MRS02 consists of MRS02 plus MRTS02.

2 Measurement of work

2.1 Schedule of Rates contract

2.1.1 Standard method of measurement

The Schedule of Rates contains a set of items with estimated quantities for various elements of work to be carried out under the Contract.

Item numbering and descriptions generally conform to the provisions of the standard work description methodology set out in Clause 2.1.2.

Unless marked provisional in accordance with Clause 2.1.7, the estimated quantities included in the Schedule of Rates have been measured:

a) where a specific “Calculation of Quantities” clause is included in the relevant Specification, in accordance with that clause, or

b) in other cases, from the dimensions shown on the drawings.

The estimated quantities have been rounded (up or down as required) to the nearest unit or decimal part of a unit as specified in Table 2.1.1.

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Table 2.1.1 – Rounding values for quantities

Unit of Measurement	Rounding Value
cubic metre	0.1
each	1
hour	0.1
kilolitre	0.001
litre	1
metre	1
square metre	1
tonne	0.01

In valuing completed work for the purposes of the Conditions of Contract, the Administrator will measure the completed work in accordance with the method of measurement described in Clause 2.1. In the case of a variation approved or directed by the Administrator under the Conditions of Contract, the Administrator will measure the completed work in accordance with the method of measurement described in the variation, but if no method is so described, then the method of measurement described in Clause 2.1 will be used. Quantities will be rounded (up or down as required) as stated above.

Where the Unit of Measure is square metre, it shall be measured using the surface area unless specified elsewhere in the Work Operations.

2.1.2 Standard work description methodology

The work required to be carried out under a Schedule of Rates contract is described in terms of the Standard Work Items (Clause 2.1.3), Supplementary Work Items (Clause 2.1.4), and/or Non-Standard Work Items (Clause 2.1.8). Standard Work Items, Supplementary Work Items and Non-Standard Work Items are collectively referred to as “Work Items”.

Work Items are defined by an item number, description and unit of measurement. The work represented by a Work Item is described in terms of Work Operations referred to in Clause 2.1.5.

The complete set of Standard Work Items in all Specifications plus any Supplementary or Non-Standard Work Items included in the Schedule of Rates are referred to as the Measurement Set for the Contract and are deemed to fully describe the work under the Contract. Notwithstanding the requirements of the Conditions of Contract, any work under the Contract which is not specifically mentioned in the Work Items in the Measurement Set or in the Work Operations associated with those Work Items shall nevertheless be deemed to be included in the Work Items in the Measurement Set.

However, not all of the Standard Work Items will necessarily be applicable to work under the Contract and will not be shown in the Schedule of Rates.

2.1.3 Standard Work Items

Relevant Standard Work Items are listed in Clause 2 of individual Specifications.

Some Specifications contain no Standard Work Items (e.g. material supply or component manufacturing Specifications). In such a case however, provision for the elements of work described in those Specifications is included in a companion construction or erection Specification.

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Work Items in the Schedule of Rates are numbered using the relevant Standard Item Number followed by a decimal point and a one or two digit counter. The counter will normally be incremented for each additional Work Item based on that Standard Work Item. As an example, using new 5 digit number, the first Work Item based on Standard Work Item 40001 Type 1 (HSG) Base, unbound pavement [location], would be numbered 40001.1 or 40001.01. An example using 4 digit number, the first Work Item based on Standard Work Item 4101 Base, unbound pavement, Type 1, Subtype [subtype], [location], would be numbered 4101.1 or 4101.01.

Where text in a Specification or the description of a Work Item contains a reference to a Standard Item Number, that reference shall be taken as a reference to all Work Items based on the Standard Work Item with that Standard Item Number.

Descriptions of some Standard Work Items contain parameters as defined in Clause 2.1.6.

The addition to the description of any Work Item of a parameter for the location of the specific work being measured shall not affect the provisions of Clause 2.1.

Where there are a number of tasks to be performed under a Work Item (e.g. sprayed bituminous surfacing) and each of the tasks are different or have different parameters, the requirements of specific Work Items included in the Schedule of Rates are specified in the Annexure to the relevant Specification.

Minor differences between the description of a Work Item in the Schedule of Rates and the description of the Standard Work Item on which that Work Item is based shall not materially affect the provisions of Clause 2.1.

As at 1 August 2017 Standard Work Items are grouped as set out in Table 2.1.3(a) using 5 digits while Standard Work Items pre-1 August 2017 were grouped as set out in Table 2.1.3(b) using 4 digits.

Table 2.1.3(a) – 5 digit Standard Work Item groups effective 1 August 2017

Standard Item Number Group	Description of Work	Standard Item Number Group	Description of Work
10000 – 19999	Principal	50000 – 59999	Road Furniture and Surface Delineation
20000 – 29999	Overarching Specifications	60000 – 69999	Electrical and ITS
30000 – 39999	Earthworks, Drainage, Culverts and Geotechnical	70000 – 79999	Bridges, Marine and Structures
40000 – 49999	Pavements and Surfacing	80000 – 89999	Others (Rail and TransLink)

Table 2.1.3(b) – 4 digit Standard Work Item groups used pre-1 August 2017

Standard Item Number Group	Description of Work	Standard Item Number Group	Description of Work
1000 – 1999	Site establishment, Provision for traffic, Environmental management	5000 – 5999	Surfacing
2000 – 2999	Drainage, Retaining structures, Protective treatment	6000 – 6999	Road furniture, Pavement marking, Electrical

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Standard Item Number Group	Description of Work	Standard Item Number Group	Description of Work
3000 – 3999	Earthworks, Landscape works	7000 – 7999	Bridge substructure
4000 – 4999	Pavement	8000 – 8999	Bridge substructure

2.1.4 Supplementary Work Items

From time to time, certain work circumstances demand the existing Standard Work Item description be altered to better address a situation. Once altered, such Work Items do not hold the identity of a "Standard Work Item". Users are required to convert such Standard Work Items into Supplementary Work Items.

In such cases the Supplementary Work Item may be represented by an item number which is based on a Standard Item Number, followed by a suffix "S". The Supplementary Work Item:

a) will be described by its item description which may be different to the description of the Standard Work Item on which it is based in that the description may contain additional information to fully describe the location and/or extent of the work required

b) shall include at least the Work Operations described for the corresponding Standard Work Item, and

c) usually be described further in a Supplementary Specification or the "Supplementary requirements" section in the relevant Technical Specification Annexure.

Some Supplementary Specifications may not include Supplementary Work Items, in which case the work described by that Supplementary Specification shall be deemed to be included in the Work Items which are included in the Schedule of Rates.

Supplementary Work Items may include parameters as described in Clause 2.1.6.

2.1.5 Work Operations

The Work Operations applicable to a Work Item include those tasks listed below in Clause 2.1.5, those tasks listed in the relevant Specification and / or Supplementary Specification as being directly applicable to the Work Item, and any other tasks which could reasonably be inferred to be applicable to the Work Item having regard to the description of the Work Item, the context in which it is used in the relevant Specification or the Schedule of Rates and the tasks necessary to complete the work in accordance with the Contract.

The listed Work Operations do not necessarily comprise a complete description of the Work Items or the work under the Contract, but provide a guide to the work required and highlight significant operations.

The Work Operations which describe any specific Work Item in the Schedule of Rates shall be those applicable to the Standard Work Item on which the Work Item is based.

The following Work Operations are common to all Work Items and are deemed to be included in the Work Items shown in the Schedule of Rates:

a) establishment and disestablishment including cleaning up and making good, except to the extent that establishment and disestablishment are the subject of a separate specific Work Item in the Schedule of Rates

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b) provision of all site facilities, except to the extent that the provision of any site facilities is the subject of a separate specific Work Item in the Schedule of Rates

c) provision of all labour, plant and equipment

d) supply, delivery, handling and storage of all materials except for materials supplied by the Principal and except to the extent that supply, delivery, handling and storage of any materials is the subject of a separate specific Work Item in the Schedule of Rates

e) provision of all supervisory and support staff

f) all costs associated with the operation of the Contractor's Workplace Health and Safety obligations, Quality System, environmental management obligations, traffic management obligations, community liaison obligations, Public Utility Plant obligations, works programming, road maintenance obligations and all other supervisory and coordination functions, except to the extent that such obligations and functions are the subject of separate specific Work Items in the Schedule of Rates

g) all costs incurred by the Contractor in complying with Commonwealth and State legislation and Local Government By-laws

h) all testing, except to the extent that testing is the subject of a separate specific Work Item in the Schedule of Rates

i) all costs associated with the work with respect to security, interest, fees, charges, taxes, royalties, insurance and compensation

j) all costs associated with the provision of workshop drawings, bar bending schedules and materials lists

k) any design for work required to be designed by the Contractor, except to the extent that such design is the subject of a separate specific Work Item in the Schedule of Rates

l) all overheads and profit, and

m) all other expenses associated with the work not specifically listed above.

2.1.6 Parameters in work item descriptions

Where they occur in descriptions of Work Items, parameters are place markers for additional information (dimensions, location, material type, application rates, etc.). When Work Items with parameters appear in the Schedule of Rates, the parameters are replaced with the additional specific information.

Parameters are shown in the item description in italics and in square brackets [diameter].

2.1.7 Provisional quantities and provisional items

Where a Work Item Number contains a suffix "P," that Work Item shall be deemed to be Provisional and it shall be treated as specified below.

At the time of tendering, the Principal was unable to determine an estimated quantity for such items in the manner mentioned in Clause 2.1.1.

In practice, any Work Item can be shown in the Schedule of Rates as Provisional (by the addition of a suffix "P" to the Work Item Number) whether or not that Work Item is so designated in the Specifications or Supplementary Specifications.

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Where a Work Item Number contains a suffix “P” and the words “Provisional Quantity” appear in the description of the item, the Contractor shall be entitled to be paid for that work with the applicable limits of accuracy for the quantities of plus 50% minus 50%.

Where a Work Item Number contains a suffix “P” and the words “Provisional Quantity, as directed” appear in the description of the item, the Contractor shall be entitled to be paid for that work with the applicable limits of accuracy for the quantities of plus 50% minus 50%. The Administrator will direct or mark out the extent of the work. The Contractor shall not proceed until the extent of the work is agreed.

Where a Work Item Number contains a suffix “P” and the words “Provisional Quantity, if ordered” appear in the description of the item, the Contractor shall only be entitled to be paid for that work if the Administrator has directed the Contractor in writing to undertake that work. The applicable limits of accuracy for the quantities for an item marked as “Provisional Quantity, if ordered” shall be plus 100% minus 100%.

Where a Work Item Number contains a suffix “P” and the words “Provisional Item, if ordered” appear in the description of the item, the Contractor shall only be entitled to be paid for that work if the Administrator has directed the Contractor in writing to undertake that work. It shall be understood that the work represented by that Work Item may not be required under the Contract. Limits of accuracy do not apply to these Work Items.

2.1.8 Non-Standard Work Items (90000 Series Items)

From time to time, users are required to capture discrete and project specific work elements in a contract schedule to address an issue that is unique to the circumstances of a project. Such work elements are not covered by any other Standard Work Item description or Technical Specification. This category of work elements is known as Non-Standard Work Items for which the end-users are required to develop Specifications and define a unit of measure to how it should be delivered.

From September 2018, the Non-Standard Work Items (previously known as 9000 series items) have been expanded to 90000 series. Non-Standard Work Items are organised into pre-defined ranges, with each range allocated a specific unit of measure. For example, the Non-Standard Work Item Number range 90101 to 90499 is allocated for any user defined work element with unit of measure as “Lump Sum”.

Table 2.1.8 below provides the complete set of Non-Standard Work Items:

Table 2.1.8 - Non-Standard Work Item Numbers and Units of Measurement

Non-Standard Work Item Number Series	Unit of Measurement	Range
90100	lump sum	90101 to 90499
90500	each	90501 to 90999
91000	m	91001 to 91499
91500	km	91501 to 91999
92000	m²	92001 to 92499
92500	m³	92501 to 92999
93000	kg	93001 to 93499
93500	tonne	93501 to 93999
94000	litre	94001 to 94199

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Non-Standard Work Item Number Series	Unit of Measurement	Range
94200	kilolitre	94201 to 94399
94400	dollars	94401 to 94599
94600	hr	94601 to 94799
94800	day	94801 to 94999
95000	week	95001 to 95199
95200	month	95201 to 95399
95400	year	95401 to 95599
95600	per set	95601 to 95799
95800	fixed fee	95801 to 95999
96000	fixed rate	96001 to 96199
96200	Ha	96201 to 96399
96400	loose m³	96401 to 96599
96600	Provisional Sum (Dollars)	96601 to 96899

2.1.9 Recycled materials

Where a Work Item Number contains a suffix “R”.

a) Recycled materials for this Work Item Number shall be manufactured from recycled materials and Works shall be completed in accordance with the requirements of MRS35, and

b) Where in the Tender Schedule there is a pair of Work Item Numbers where one has a suffix "R" and the other has no suffix, and each of these paired Work Item Numbers has the same quantity:

   i. the Work Item Number with no suffix refers to the parent Specification as defined in MRS35

   ii. the Tenderer may submit a tender for either one or both of the Work Item Numbers

   iii. the Contract will be awarded on the basis of only one of the Work Item Numbers, and

   iv. the Contractor shall complete the Works using either, but not both, of the Work Item Numbers as ordered by the Principal.

2.2 Lump Sum Contracts

In general, quantities will not be measured by the Principal nor provided to the Contractor under a Lump Sum Contract.

Any Clause titled “Measurement of Work” in a Specification (generally Clause 2), shall not apply to a Lump Sum Contract.

Items included in a Schedule of Prices have been allocated specifically for the Contract without reference to any standard methodology. Under no circumstances shall items included in a Schedule of Prices be interpreted as being described by the method of measurement for Schedule of Rates contracts specified in Clause 2.1.

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Where there is a high probability that the work required might differ from that shown on the Drawings (e.g. length of piles or rock quantities), items may be included in a Schedule of Rates for Variations. If such a change actually occurs during the Contract, reimbursement shall be made for the quantities actually carried out at the rates included in the Schedule of Rates for Variations in the Contractor's tender.

2.3 Measurement of quantities

The Conformance Report for each lot shall include measured quantities for all scheduled items associated with the lot.

3 Definition of terms

3.1 Standard definitions

The terms used in Specifications shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications.*

Additional terms used in Specifications shall be as defined in Table 3.1.

Table 3.1 – Definition of terms

Term	Definition
corrective action request	A written communication from the Administrator to the Contractor identifying a nonconformance and includes a direction for the Contractor to issue a nonconformance report
CQR	Abbreviation for Contractor's Quality Representative who is the Contractor's employee responsible for the Contractor's quality system for the Contract
defect	Any single nonconformance of the product or process with the relevant standards and requirements of the Contract
measurement set	The set of Work Items containing all Standard Work Items in all Specifications plus any Supplementary Work Items included in the Schedule of Rates
Standard Work Item Number	A unique number assigned to a Standard Work Item as shown in a Specification
Specification	Any document published by the department as a Specification forming part of the Transport and Main Roads Specifications Manual
Standard Work Items	A unique description of a discrete element of work specified in a Specification used for measurement and payment purposes in a Schedule of Rates contract
Supplementary Work Item Number	A unique number assigned to a Supplementary Work Item as shown in a Supplementary Specification or Technical Specification Annexure (refer Clause 2.1.4)
Supplementary Specification	Any Specification included in the Contract which is not a Standard Specification
Supplementary Work Items	Similar to Standard Work Items, but represented by a suffix "S" in a Supplementary Specification or Technical Specification Annexure, used for measurement and payment purposes in a Schedule of Rates contract
Non-Standard Work Item Number	A unique number assigned to a Non-Standard Work Item as shown in a Supplementary Specification (90000 series)

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Term	Definition
Non-Standard Work Items	A unique and discrete element of work not specified or covered under the Standard Work Items. Is specified in a Supplementary Specification used for measurement and payment in a Schedule of Rates contract
Technical Specification	Any document published by the department as a Technical Specification forming part of the Transport and Main Roads Specifications Manual
utilisation of a rejected lot for a reduced level of service	Concession, as defined by ISO AS/NZS 9000
Work Operation	One of a set of tasks which together generally describe the work represented by a Work Item
Work Item	A Standard Work Item or a Supplementary Work Item
Work Item Number	A Standard Item Number or a Supplementary Item Number. The meanings of suffixes attached to the Work Item Number, are as described within the Specification to which the Work Item Number relates

3.2 Definitions in other documents

Further relevant definitions are contained in the following documents:

a) a particular Supplementary Specification

b) a particular Specification, and

c) as stated in MRTS01 *Introduction to Technical Specifications.*

3.3 Priority of definitions

In the event of conflict in definition, priority shall be assigned in the order that the documents are listed below:

a) the relevant Supplementary Specification

b) the relevant Specification, and

c) as stated in MRTS01 *Introduction to Technical Specifications*.

4 Referenced documents

Requirements for referenced documents are given in MRTS01 *Introduction to Technical Specifications.*

Table 4 lists documents referenced in this Specification.

Table 4 – Referenced documents

Reference	Title
AS/NZS ISO 9000	*Quality management systems – Fundamentals and vocabulary*

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5 Application of concession provisions for below standard work

A rejected lot may be considered by the Administrator for use for a reduced level of service provided that a specific *Utilisation of a Rejected Lot for a Reduced level of Service* Clause is included in the relevant Technical Specification.

The Administrator may consider the lot for a reduced level of service based on the Administrator's assessment of the consequences of the deficiencies on the performance of the work and provided that the Contractor takes the necessary action to prevent recurrence of the non-compliance and states, on the nonconformance report, what action is to be taken.

If the Administrator does not reject the lot but allows its use for a reduced level of service, payment will be made at the reduced value as calculated from the specific *Utilisation of a Rejected Lot for a Reduced Level of Service* Clause. Where there is no specific clause, the reduction in value will be determined by the Administrator.

The non-rejection of and payment for a lot utilised for a reduced level of service shall be on the basis of the minimisation of losses to both the Principal and the Contractor due to the failure by the Contractor to present the minimum standard of work required by the Contract.

6 Application of bonus provisions for above standard work

A lot may be considered by the Administrator for bonus payment for above standard work provided that:

a) a specific *Additional Payment for A Higher Standard of Product* clause is included in the relevant Technical Specification, and

b) the inclusion of the provisions of that clause in the Contract is indicated in the Annexure to that Technical Specification.

The bonus payment as detailed in the contract is based on the Principal's assessment of the additional benefit to the Principal.

Payment will be made at the increased value as calculated from the specific Additional Payment for A Higher Standard of Product clause.

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Specification (Measurement)

Transport and Main Roads
MRS02 Provision for Traffic

July 2020

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 1

2.3 Calculation of quantities 5

2.4 Provision of temporary barriers 5

2.5 Provision of temporary barrier end treatments 6

2.6 Provision of anti-gawking screens 6

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the control of traffic during the construction of roadworks.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No	Description	Unit of Measurement
Provision for Traffic		
20002	Travel Time Surveys	lump sum
20003	Construction and removal of side track	m²
20004	Supply of temporary barriers	m
20005	Installation of temporary barriers	m
20006	Supply of temporary barrier end treatments	each
20007	Installation of temporary barrier end treatments	each
20008P	Supply of anti gawking screens (Provisional Quantity, if ordered)	m
20012P	Installation of anti gawking screens (Provisional Quantity, if ordered)	m
20016	Traffic management inspections	lump sum
20017	Planning of temporary traffic management (TMP)	lump sum
20018	Design of temporary traffic management (TGS)	lump sum
20019	Implementation, maintenance and removal of temporary traffic management	lump sum
20020	Administration of temporary traffic management	lump sum

2.2 Work Operations

Item 20002 Travel Time Surveys

Work operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) undertaking travel time surveys

c) recording data, and

d) provision of records.

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FOI 26-292 - Document 21

Item 20003 Construction and removal of side track

Work operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) design of side track

c) provision of all materials for construction of side track

d) construction and maintenance of side track, and

e) removal of side track.

Item 20004 Supply of Temporary Barriers

Work operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of barrier, and

c) delivery to the Site.

Item 20005 Installation of Temporary Barriers

Work operations incorporated in the above item include:

a) Work operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) maintenance and repair of barrier

c) supply of erection angle connectors, reinforced connector assemblies and connector tie bars, as necessary

d) trimming and/or levelling surface

e) erection of barrier, including water filling where required

f) dismantling and relocation of barriers, and

g) dismantling and removal of barrier from the Site.

Item 20006 Supply of temporary barrier end treatments

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials, and

c) delivery to the Site.

Item 20007 Installation of temporary barrier end treatments

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of end treatment

c) removal of end treatment for reuse or storage as necessary, and

d) maintenance of end treatment.

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FOI 26-292 - Document 21

Item 20008P Supply of anti gawking screens (Provisional Quantity, if ordered)

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 I*ntroduction to Specifications*

b) supply of materials

c) fabrication of anti-gawking screens, and

d) delivery to the Site.

Item 20012P Installation of anti gawking screens (Provisional Quantity, if ordered)

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of screens

c) maintenance of screens, and

d) removal of screens on completion.

Item 20016 Traffic management inspections

Work operations incorporated in the above items include:

a) traffic management inspections as per Clause 7.4 of MRTS02.

Item 20017 Planning of temporary traffic management (TMP)

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) all work associated with the preparation, submission and revision (where necessary) of the Traffic Management Plan, and

c) all other operations associated with the planning of temporary traffic management as required by the *Manual of Uniform Traffic Control Devices* (MUTCD) Part 3, MUTCD Part 3 Supplement, and any other contractual and legislative requirements.

Item 20018 Design of temporary traffic management (TGS)

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specification*s

b) all work associated with the preparation, submission and revision (where necessary) of the Traffic Guidance Scheme(s), and

c) all other operations associated with the design of temporary traffic management as required by the MUTCD Part 3, MUTCD Part 3 Supplement, and any other contractual and legislative requirements.

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Item 20019 Implementation, maintenance and removal of temporary traffic management

Work operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specification*

b) provision and placement of the prescribed traffic control devices for the warning, guidance and protection of the traffic and the protection of workers, construction plant and other property on or adjacent to the Works

c) provision of police control, as necessary

d) provision of Traffic Controllers, as necessary

e) construction, maintenance and removal of temporary access along or across the Site for pedestrians, cyclists and agricultural machinery, as necessary

f) relocation of any bus stops affected by changes in traffic arrangements

g) covering and uncovering new signs, as necessary

h) covering or removal of traffic control devices when not in use

i) maintenance of emergency vehicle access at all times

j) relocation of all existing signage and any modifications required thereto to ensure that the standard of signage is consistent with that existing prior to the Contractor commencing work and that it is consistent with the requirements of the Traffic Guidance Schemes

k) supply and installation of Site access signs and all other traffic control signage as detailed in the traffic Guidance Schemes

l) supply and operation of traffic control devices

m) supply and installation of temporary delineation of trafficked corridors

n) supply, installation and operation of temporary traffic signals

o) supply and installation of temporary delineation where access to streets and side roads has been altered

p) provision for the detouring of traffic

q) dust control

r) maintenance of entrances and construction of alternative entrances (as necessary) to private properties

s) maintenance of trafficable surfaces, where specified

t) implementation and monitoring of the Traffic Management Plan when such is specified

u) supply of all materials, plant and equipment for temporary road lighting

v) installation and maintenance of temporary road lighting equipment, and removal of temporary road lighting equipment after permanent road lighting is installed or as directed by the Administrator.

w) provision of all other facilities for the safe passage of vehicular traffic through and around the Works

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x) removal of all temporary works and control devices used in the provisions for traffic

y) design and construction of side-tracks where no separate item is provided for this work in the schedule

z) supply, installation, maintenance and removal of temporary barriers other than those nominated Clause 1 of Annexure MRS02.1

aa) supply, installation, maintenance and removal of temporary barrier end treatments other than those nominated in Clause 2 of Annexure MRS02.1

bb) supply, installation, maintenance and removal of anti-gawking screens other than those nominated in Clause 3 of Annexure MRS02.1, and

cc) all other operations associated with the implementation, maintenance, and removal of temporary traffic management as required by the MUTCD Part 3, MUTCD Part 3 Supplement, and any other contractual and legislative requirements.

Item 20020 Administration of temporary traffic management

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specification*

b) ensuring that any delays to the passage of traffic are not greater than that specified in MRTS02

c) provision of any information required for public notices

d) provision of out-of-hours representatives

e) recording of all work site signing and delineation, keeping of records, and provision of records, and

f) all other operations associated with the contractor's administration of temporary traffic management as required by the MUTCD Part 3, MUTCD Part 3 Supplement, and any other contractual and legislative requirements.

2.3 Calculation of quantities

Calculation of quantities for the supply of temporary measures for the provision of traffic shall be based on the quantity provided by the Contractor in accordance with the Contract.

Calculation of quantities for the installation of temporary measures for the provision of traffic shall be based on the quantity installed by the Contractor in accordance with the Contract with each installation measured separately.

2.4 Provision of temporary barriers

The Principal will pay separately for the supply and/or installation of barriers only where such barriers are specifically referred to in Clause 1 of Annexure MRS02.1.

The Contractor shall be deemed to have made due allowance in Work Item 20019 Implementation, maintenance and removal of temporary traffic management for the supply and installation of temporary barriers other than those referred to in Clause 1 of Annexure MRS02.1.

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2.5 Provision of temporary barrier end treatments

The Principal will pay separately for the supply and/or installation of temporary barrier end treatments only where such end treatments are specifically referred to in Clause 2 of Annexure MRS02.1.

The Contractor shall be deemed to have made due allowance in Work Item 20019 Implementation, maintenance and removal of temporary traffic management for the supply and installation of temporary barrier end treatments other than those referred to in Clause 2 of Annexure MRS02.1.

2.6 Provision of anti-gawking screens

The Principal will pay separately for the supply and/or installation of anti-gawking screens only where such screens are specifically referred to in Clause 3 of Annexure MRS02.1.

The Contractor shall be deemed to have made due allowance in Work Item 20019 Implementation, maintenance and removal of temporary traffic management for the supply and installation of anti-gawking screens other than those referred to in Clause 3 of Annexure MRS02.1.

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Specification (Measurement)

Transport and Main Roads Specifications
MRS03 Drainage, Retaining Structures and Protective Treatments

January 2019

Queensland Government

FOI 26-292 - Document 21

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FOI 26-292 - Document 21

Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 6

2.2.1 General 6
2.2.2 Removal or demolition of culverts and culvert end structures 6
2.2.3 Removal/demolition of kerbs and channels and concrete slabs 7
2.2.4 Removal / demolition of gullies and access chambers 7
2.2.5 Supply of precast and preformed culvert and drainage trough components 7
2.2.6 Installation of precast and preformed culvert components 8
2.2.7 Installation of precast and preformed drainage trough components 9
2.2.8 Installation of precast pipe culvert components using jacking methods 9
2.2.9 Supply and installation of precast and preformed culvert and drainage trough components 10
2.2.10 Concrete end plugs for existing culverts 11
2.2.11 Insitu concrete culvert components 11
2.2.12 End structures to culverts 12
2.2.13 Precast concrete end structures to culverts 12
2.2.14 Cast-in-place concrete kerb, channel and kerb and channel 13
2.2.15 Precast concrete kerb, channel and kerb and channel blocks 13
2.2.16 Shoulder dykes 13
2.2.17 Concrete gullies 14
2.2.18 Concrete access chambers 14
2.2.19 Precast concrete access chambers 15
2.2.20 Precast concrete side inlet gullies 15
2.2.21 Subsoil drains 16
2.2.22 Sheet or strip filter drains 17
2.2.23 Vertical Drains 17
2.2.24 Stone Columns 17
2.2.25 Concrete paved inverts in corrugated culverts 18
2.2.26 Linings in drains and channels 18
2.2.27 Berm drains 19
2.2.28 Concrete margins and batters 19
2.2.29 Concrete rail track crossings and machinery crossings 19
2.2.30 Hand placed concrete paving 20
2.2.31 Sprayed concrete paving 20
2.2.32 Block paving 20
2.2.33 Rock masonry 21
2.2.34 Grouted rock pitching 21
2.2.35 Rock protection 22
2.2.36 Steel-wire gabion protection work 22
2.2.37 Steel-wire mattress protection work 22
2.2.38 Fabric encased concrete batter protection 23
2.2.39 Bridge abutment protection Type 1 – rock spill through 23
2.2.40 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough 23
2.2.41 Bridge abutment protection Type 4 – rockwork over earth spillthrough 23
2.2.42 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough 24
2.2.43 Shotcreting 24
2.2.44 Bridge abutment protection Type 7 – Rock-filled gabion protection 25
2.2.45 Concrete retaining walls 25
2.2.46 Concrete masonry retaining walls 26
2.2.47 Crib walls 26
2.2.48 Boulder retaining walls 27
2.2.49 Soil nailing 27
2.2.50 Passive rock dowels 28
2.2.51 Active rock bolts 28

Released under the Freedom of Information Act 1982 by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts

FOI 26-292 - Document 21

2.2.52 Surveying requirements 28
2.3 Measurement 29
2.3.1 Measurement of removal/demolition 29
2.3.2 Measurement of excavation and backfilling 29
2.3.3 Measurement of precast culverts 29
2.4 Calculation of quantities 30
2.4.1 General 30
2.4.2 Precast culverts 30

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the construction of drainage structures, retaining structures and protective treatments in roadworks.

The requirements for reinforced soil retaining structures are specified in MRS06 *Reinforced Soil Structures*.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of measurement
Drainage removal / demolition		
30001	Removal or demolition of culverts, complete	lump sum
30002	Removal or demolition of culvert end structures	lump sum
30003	Removal or demolition of culverts, excluding end structures	lump sum
30004	Removal or demolition of concrete kerb including kerb crossings	m
30005	Removal or demolition of concrete channel	m
30006	Removal or demolition of concrete kerb and channel including kerb crossings	m
30007	Removal or demolition of concrete slabs	m²
30008	Removal or demolition of gullies	each
30009	Removal or demolition of access chambers	each
Supply of culverts		
30051	Supply of steel-reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter, [*environment*] environment	m
30052	Supply of fibre reinforced concrete pipe culverts, Class [*class*], [*diameter*] mm diameter	m
30053	Supply of concrete box culvert components, [*size*]	m
30054	Supply of concrete spanning slabs, [*size*]	m
30055	Supply of helical lock-seam corrugated steel pipe culvert components, [*size*]	m
30056	Supply of helical lock-seam corrugated aluminium pipe culvert components, [*size*]	m

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Standard Item No.	Description	Unit of measurement
30057	Supply of nestable corrugated steel pipe culvert components, [*size*]	m
30058	Supply of multiple plate corrugated steel pipe culvert components, [*size*]	m
30059	Supply of multiple plate corrugated steel pipe-arch culvert components, [*size*]	m
30060	Supply of multiple plate corrugated steel arch culvert components, [*size*]	m
30061	Supply of concrete pipe drainage trough components, [*size*]	m
30062	Supply of concrete box trough components, [*size*]	m
30063	Supply of nestable corrugated steel pipe drainage trough components, [*size*]	m
Installation of culverts		
30151	Installation of concrete pipe culvert components, [*diameter*] mm diameter	m
30152	Installation of fibre reinforced concrete pipe culvert components, [*diameter*] mm diameter	m
30153	Installation of concrete box culvert components, [*size*]	m
30154	Installation of concrete spanning slabs, [*size*]	m
30155	Installation of helical lock-seam corrugated steel pipe culvert components, [*size*]	m
30156	Installation of helical lock-seam corrugated aluminium pipe culvert components, [*size*]	m
30157	Installation of nestable corrugated steel pipe culvert components, [*size*]	m
30158	Installation of multiple plate corrugated steel pipe culvert components, [*size*]	m
30159	Installation of multiple plate corrugated steel pipe-arch culvert components, [*size*]	m
30160	Installation of multiple plate corrugated steel arch culvert components, [*size*]	m
30161	Installation of concrete pipe drainage trough components, [*size*]	m
30162	Installation of concrete box trough components, [*size*]	m
30163	Installation of nestable corrugated steel pipe drainage trough components, [*size*]	m
30164	Installation of pipe culvert components using jacking methods, [*diameter*] mm diameter	m
Supply and installation of culverts		
30251	Supply and installation of steel-reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter, [*environment*] environment	m

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Standard Item No.	Description	Unit of measurement
30252	Supply and installation of fibre reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter	m
30253	Supply and installation of concrete box culvert components, [*size*]	m
30254	Supply and installation of concrete spanning slabs, [*size*]	m
30255	Supply and installation of helical lock-seam corrugated steel pipe culvert components, [*size*]	m
30256	Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, [*size*]	m
30257	Supply and installation of nestable corrugated steel pipe culvert components, [*size*]	m
30258	Supply and installation of multiple plate corrugated steel pipe culvert components, [*size*]	m
30259	Supply and installation of multiple plate corrugated steel pipe-arch culvert components, [*size*]	m
30260	Supply and installation of multiple plate corrugated steel arch culvert components, [*size*]	m
30261	Supply and installation of concrete pipe drainage trough components, [*size*]	m
30262	Supply and installation of concrete box trough components, [*size*]	m
30263	Supply and installation of nestable corrugated steel pipe drainage trough components, [*size*]	m
30264	Supply and installation of pipe culvert components using jacking methods, Class [*class*], [*dia*meter] mm diameter	m
Concrete in culverts and end structures		
30351	Concrete end plugs for culverts	m^3
30352	Concrete bases in culverts	m^3
30353	Concrete footings in culverts	m^3
30354	Concrete infill floors in culverts	m^3
30355	Concrete abutments and piers in culverts	m^3
30356	Concrete slab decks and kerbs in culverts	m^3
30357	Concrete unitary box culverts	m^3
30358	End structures to culverts, reinforced concrete	m^3
30359	End structures to culverts, unreinforced concrete	m^3
30360	End structures to culverts, rock masonry	m^3
30361	End structures to culverts, concrete masonry	m^3
30362	Aprons to culverts, reinforced concrete	m^3
30363	Aprons to culverts, unreinforced concrete	m^3
30364	Aprons to culverts, grouted rock pitching	m^3
30365	Aprons to culverts, steel wire mattresses	m^3

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Standard Item No.	Description	Unit of measurement
30366	Precast concrete end structures to culverts, [*size*]	each
Pavement drainage		
30451	Concrete kerb, [*type*]	m
30452	Concrete kerb crossings, [*type*]	m
30453	Concrete channel, [*type*]	m
30454	Concrete kerb and channel, [*type*]	m
30455	Concrete kerb and channel crossings, [*type*]	m
30456	Precast concrete kerb blocks, [*type*]	m
30457	Precast concrete channel blocks, [*type*]	m
30458	Precast concrete kerb and channel blocks, [*type*]	m
30459	Shoulder dykes, concrete	m
30460	Shoulder dykes, asphalt	m
30461	Shoulder dykes, precast concrete blocks	m
30462	Concrete gullies, [*size* | *description*]	each
30463	Concrete access chambers, [*size* | *description*]	each
30464	Precast concrete access chambers, [*size* | *description*]	each
30465	Precast concrete side inlet gullies with precast shaft, [*size* | *description*]	each
30466	Precast concrete side inlet gullies with cast-in-place pit, [*size* | *description*]	each
Subsurface drainage		
30551	Subsoil drains, Type B, [*size*] mm diameter	m
30552	Subsoil drains, Type D	m
30553	Subsoil drain outlet connection, [*size*] mm diameter, [*type*]	each
30554	Subsoil drain clean-out, [*size*] mm diameter, [*type*]	each
30555	Sheet filter drains	m^2
30556	Strip filter drains	m
30557	Sheet or strip filter drain outlet connection, [*type*]	each
30558	Vertical wick filter drains, plastic core	m
30559	Vertical sand drains	m
30560	Granular working platform for stone columns	m^3
30561	Supply and installation of reinforcement geosynthetic material for stone columns	m^2
30562	Supply and installation of geotexile, Strength Class [*strength class*], Filtration Class [*filtration class*]	m^2
30563	Stone columns	m

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Standard Item No.	Description	Unit of measurement
Protective treatments		
30651	Concrete paved inverts in corrugated steel/aluminium culverts, [*size*]	m
30652	Linings in drains and channels, unreinforced concrete	m^3
30653	Linings in drains and channels, reinforced concrete	m^3
30654	Linings in drains and channels, grouted rock pitching	m^2
30655	Linings in drains and channels, steel wire mattresses	m^3
30656	Berm drain, [*width*] mm wide	m
30657	Concrete margins	m^3
30658	Concrete batters	m^3
30659	Concrete rail track crossings	m^3
30660	Concrete machinery crossings	m^3
30661	Hand placed concrete paving, [*thickness*] mm thick	m^2
30662	Sprayed concrete paving, [*thickness*] mm thick	m^2
30663	Block paving, [*thickness*] mm thick	m^2
30664	Rock masonry	m^3
30665	Grouted rock pitching	m^2
30666	Rock protection	m^3
30667	Steel wire gabion protection work	m^3
30668	Steel wire mattress protection work	m^2
30669	Fabric encased concrete batter protection on batter faces	m^2
30670	Fabric encased concrete batter protection in cut-off walls	m^2
30671	Bridge abutment protection Type 1 – rock spillthrough, [*location*] abutment	each
30672	Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [*location*] abutment	each
30673	Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [*location*] abutment	each
30674	Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [*location*] abutment	each
30675	Shotcreting	m^3
30676	Bridge abutment protection Type 7 – Rock-filled gabion protection over road embankment, [*location*] abutment	each
Retaining walls		
30801	Concrete retaining wall, concrete in footing, [*wall location* | *wall number*]	m^3
30802	Concrete retaining wall, concrete in wall, [*wall location* | *wall number*]	m^3
30803	Concrete retaining wall, steel reinforcing bar, [*wall location* | *wall number*]	tonne

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Standard Item No.	Description	Unit of measurement
30804	Concrete masonry retaining wall, concrete in footing, [*wall location* | *wall number*]	m^3
30805	Concrete masonry retaining wall, masonry in wall, [*wall location* | *wall number*]	m^2
30806	Concrete masonry retaining wall, steel reinforcing bar, [*wall location* | *wall number*]	tonne
30807	Crib walls	m^2
30808	Boulder retaining wall	m^3
30809	Soil nailing	m
30810	Passive rock dowels	m
30811	Active rock bolts	m
Surveying requirements		
30901	Conformance and As Constructed survey for culverts	each
30902	Conformance and As Constructed survey for gullies	each
30903	Conformance and As Constructed for insitu concrete access chambers	each
30904	Conformance and As Constructed for precast concrete access chambers	each
30905	Conformance and As Constructed for concrete retaining wall footings	each
30906	Survey information for existing underground assets	lump sum

2.2 Work Operations

2.2.1 General

The listed work operations for the Standard Work Items are given below.

2.2.2 Removal or demolition of culverts and culvert end structures

Item 30001 Removal or demolition of culverts, complete

Item 30002 Removal or demolition of culvert end structures

Item 30003 Removal or demolition of culverts, excluding end structures

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out any necessary excavations

c) removing or demolishing complete culverts or end structures or culvert units as relevant

d) utilising or disposing of excavated and removed or demolished materials

e) stacking removed culvert or end structure components

f) backfilling resulting excavations, and

g) transport of culverts or end structures selected for salvage to the nominated storage site.

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2.2.3 Removal/demolition of kerbs and channels and concrete slabs

Item 30004 Removal or demolition of concrete kerb including kerb crossings

Item 30005 Removal or demolition of concrete channel

Item 30006 Removal or demolition of concrete kerb and channel including kerb crossings

Item 30007 Removal or demolition of concrete slabs

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) removing or demolishing concrete kerbs, channels and slabs

c) utilising or disposing of excavated and removed or demolished material, and

d) backfilling resulting excavations.

2.2.4 Removal / demolition of gullies and access chambers

Item 30008 Removal or demolition of gullies

Item 30009 Removal or demolition of access chambers

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out any necessary excavations

c) removing or demolishing concrete gullies and access chambers

d) utilising or disposing of excavated and demolished material, and

e) backfilling resulting excavations.

2.2.5 Supply of precast and preformed culvert and drainage trough components

Item 30051 Supply of steel-reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter, [environment**] environment**

Item 30052 Supply of fibre reinforced concrete pipe culverts, Class [*class*], [*diameter*] mm diameter

Item 30053 Supply of concrete box culvert components, [*size*]

Item 30054 Supply of concrete spanning slabs, [*size*]

Item 30055 Supply of helical lock-seam corrugated steel pipe culvert components, [*size*]

Item 30056 Supply of helical lock-seam corrugated aluminium pipe culvert components, [*size*]

Item 30057 Supply of nestable corrugated steel pipe culvert components, [*size*]

Item 30058 Supply of multiple plate corrugated steel pipe culvert components, [*size*]

Item 30059 Supply of multiple plate corrugated steel pipe-arch culvert components, [*size*]

Item 30060 Supply of multiple plate corrugated steel arch culvert components, [*size*]

Item 30061 Supply of concrete pipe drainage trough components, [*size*]

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Item 30062 Supply of concrete box trough components, [*size*]

Item 30063 Supply of nestable corrugated steel pipe drainage trough components, [*size*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) delivery to the site, and

d) storage on the site.

2.2.6 Installation of precast and preformed culvert components

Item 30151 Installation of concrete pipe culvert components, [*diameter*] mm diameter

Item 30152 Installation of fibre reinforced concrete pipe culvert components, [*diameter*] mm diameter

Item 30153 Installation of concrete box culvert components, [*size*]

Item 30154 Installation of concrete spanning slabs, [*size*]

Item 30155 Installation of helical lock-seam corrugated steel pipe culvert components, [*size*]

Item 30156 Installation of helical lock-seam corrugated aluminium pipe culvert components, [*size*]

Item 30157 Installation of nestable corrugated steel pipe culvert components, [*size*]

Item 30158 Installation of multiple plate corrugated steel pipe culvert components, [*size*]

Item 30159 Installation of multiple plate corrugated steel pipe-arch culvert components, [*size*]

Item 30160 Installation of multiple plate corrugated steel arch culvert components, [*size*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials excluding culvert components

c) carrying out excavations (†)

d) utilising or disposing of excavated material (†)

e) placing and compacting foundation bedding material and haunch zone material (†)

f) cartage of culvert components from the storage site

g) laying and jointing or placing and assembling culvert components

h) cutting culvert components where necessary

i) installing dowel bars and holding down anchors

j) constructing concrete end blocks

k) placing and compacting concrete infill material

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l) constructing thrust blocks and ring beams

m) finishing and curing concrete

n) supply, placing and compacting backfill material (including side zone and overlay zones) (†), and

o) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.7 Installation of precast and preformed drainage trough components

Item 30161 Installation of concrete pipe drainage trough components, [*size*]

Item 30162 Installation of concrete box trough components, [*size*]

Item 30163 Installation of nestable corrugated steel pipe drainage trough components, [*size*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials, excluding drainage trough components

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing and compacting foundation bedding material

f) cartage of drainage trough components from the storage site

g) laying and jointing or placing and assembling culvert components

h) cutting culvert components where necessary

i) installing holding down anchors

j) supply, placing and compacting backfill material, and

k) labelling drainage structures.

2.2.8 Installation of precast pipe culvert components using jacking methods

Item 30164 Installation of pipe culvert components using jacking methods, [*diameter*] mm diameter

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials excluding culvert components

c) establishment of excavating and jacking equipment on the site

d) carrying out all excavations including jacking and receiving pits where necessary

e) utilising or disposing of excavated material

f) cartage of culvert components from the storage site

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g) jacking culvert components

h) cutting culvert components where necessary

i) filling pipe joints with mortar

j) supply, placing and compacting backfill material, and

k) labelling drainage structures.

2.2.9 Supply and installation of precast and preformed culvert and drainage trough components

Item 30251 **Supply and installation of steel-reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter, [*environment*] environment**

Item 30252 **Supply and installation of fibre reinforced concrete pipe culvert components, Class [*class*], [*diameter*] mm diameter**

Item 30253 **Supply and installation of concrete box culvert components, [*size*]**

Item 30254 **Supply and installation of concrete spanning slabs, [*size*]**

Item 30255 **Supply and installation of helical lock-seam corrugated steel pipe culvert components, [*size*]**

Item 30256 **Supply and installation of helical lock-seam corrugated aluminium pipe culvert components, [*size*]**

Item 30257 **Supply and installation of nestable corrugated steel pipe culvert components, [*size*]**

Item 30258 **Supply and installation of multiple plate corrugated steel pipe culvert components, [*size*]**

Item 30259 **Supply and installation of multiple plate corrugated steel pipe-arch culvert components, [*size*]**

Item 30260 **Supply and installation of multiple plate corrugated steel arch culvert components, [*size*]**

Item 30261 **Supply and installation of concrete pipe drainage trough components, [*size*]**

Item 30262 **Supply and installation of concrete box trough components, [*size*]**

Item 30263 **Supply and installation of nestable corrugated steel pipe drainage trough components, [*size*]**

Item 30264 **Supply and installation of pipe culvert components using jacking methods, Class [*class*], [*diameter*] mm diameter**

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) carrying out excavations (†)

d) utilising or disposing of excavated material (†)

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e) placing and compacting foundation bedding material and haunch zone material (†)

f) cartage of culvert components from the storage site

g) laying and jointing or placing and assembling culvert components

h) jacking culvert components where appropriate

i) cutting culvert components where necessary

j) installing dowel bars and holding down anchors

k) constructing concrete end blocks

l) placing and compacting concrete infill material

m) constructing thrust blocks and ring beams

n) finishing and curing concrete

o) supply, placing and compacting backfill material (including side zone and overlay zones) (†), and

p) labelling drainage structures.

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.10 Concrete end plugs for existing culverts

Item 30351 Concrete end plugs for culverts

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) placing and compacting concrete, and

d) finishing and curing concrete.

2.2.11 Insitu concrete culvert components

Item 30352 Concrete bases in culverts

Item 30353 Concrete footings in culverts

Item 30354 Concrete infill floors in culverts

Item 30355 Concrete abutments and piers in culverts

Item 30356 Concrete slab decks and kerbs in culverts

Item 30357 Concrete unitary box culverts

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations (†)

d) utilising or disposing of excavated material (†)

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e) fabricating and placing steel reinforcement

f) placing and compacting concrete

g) supplying and placing embedded dowel bars and galvanised arch channels

h) finishing and curing concrete, and

i) supply, placing and compacting backfill material (†).

Work operations marked with a (†) above apply unless excavation and backfilling is measured separately in accordance with Clause 2.3 of MRS04 *General Earthworks*.

2.2.12 End structures to culverts

Item 30358 End structures to culverts, reinforced concrete

Item 30359 End structures to culverts, unreinforced concrete

Item 30360 End structures to culverts, rock masonry

Item 30361 End structures to culverts, concrete masonry

Item 30362 Aprons to culverts, reinforced concrete

Item 30363 Aprons to culverts, unreinforced concrete

Item 30364 Aprons to culverts, grouted rock pitching

Item 30365 Aprons to culverts, steel wire mattresses

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing end structures

f) constructing aprons

g) laying and jointing masonry units

h) installing dowel bars, and

i) finishing and curing concrete work.

2.2.13 Precast concrete end structures to culverts

Item 30366 Precast concrete end structures to culverts, [*size*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all material

c) carrying out excavations

d) utilising or disposing of excavated material

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e) placing and compacting foundation bedding material, and

f) placing and jointing end structures.

2.2.14 Cast-in-place concrete kerb, channel and kerb and channel

Item 30451 Concrete kerb, [*type*]

Item 30452 Concrete kerb crossings, [*type*]

Item 30453 Concrete channel, [*type*]

Item 30454 Concrete kerb and channel, [*type*]

Item 30455 Concrete kerb and channel crossings, [*type*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing and compacting concrete

f) forming expansion and contraction joints, and

g) finishing and curing concrete.

2.2.15 Precast concrete kerb, channel and kerb and channel blocks

Item 30456 Precast concrete kerb blocks, [*type*]

Item 30457 Precast concrete channel blocks, [*type*]

Item 30458 Precast concrete kerb and channel blocks, [*type*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing and compacting bedding material

f) installing precast concrete kerb blocks, and

g) installing precast concrete channel blocks.

2.2.16 Shoulder dykes

Item 30459 Shoulder dykes, concrete

Item 30460 Shoulder dykes, asphalt

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FOI 26-292 - Document 21

Item 30461 Shoulder dykes, precast concrete blocks

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) placing and compacting concrete, asphalt or concrete blocks, and

d) finishing and curing concrete.

2.2.17 Concrete gullies

Item 30462 Concrete gullies, [*size* | *description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at bottom of excavations

f) fabricating and placing steel reinforcement

g) placing and compacting concrete

h) finishing and curing concrete

i) placing cement mortar

j) placing and compacting backfilling material

k) fabricating, coating and installing grates and frames, and

l) installing precast concrete back-units.

2.2.18 Concrete access chambers

Item 30463 Concrete access chambers, [*size* | *description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) fabricating and placing steel reinforcement

g) placing and compacting concrete

h) finishing and curing concrete

i) placing cement mortar

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j) placing and compacting backfilling material

k) shaping concrete benching, and

l) installing step irons.

2.2.19 Precast concrete access chambers

Item 30464 Precast concrete access chambers, [*size* | *description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) placing and compacting backfilling material

g) installing precast concrete access chambers

h) placing cement mortar, and

i) shaping concrete benching.

2.2.20 Precast concrete side inlet gullies

Item 30465 Precast concrete side inlet gullies with precast shaft, [*size* | *description*]

Item 30466 Precast concrete side inlet gullies with cast-in-place pit, [*size* | *description*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) placing and compacting foundation bedding material

g) placing and compacting concrete

h) finishing and curing concrete

i) installing precast concrete side inlet gully components

j) placing cement mortar

k) placing and compacting backfilling material, and

l) shaping concrete benching.

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FOI 26-292 - Document 21

2.2.21 Subsoil drains

Item 30551 Subsoil drains, Type B, [*size*] mm diameter

Item 30552 Subsoil drains, Type D

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing concrete cradles

f) placing, jointing and fixing geotextiles and textile sleeves

g) installing, jointing and fixing prefabricated strip filter drains

h) installing drainage pipes

i) placing and compacting backfilling material, and

j) installing marker maintenance posts.

Item 30553 Subsoil drain outlet connection, [*size*] mm diameter, [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) constructing outlet ends

d) installing maintenance marker post, and

e) installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

Item 30554 Subsoil drain clean-out, [*size*] mm diameter, [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) installing pipe and fittings

d) installing concrete surrounds, and

e) installing maintenance marker post.

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FOI 26-292 - Document 21

2.2.22 Sheet or strip filter drains

Item 30555 Sheet filter drains

Item 30556 Strip filter drains

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) installing, combining, joining and fixing prefabricated sheet filter and strip filter drains

f) installing collector pipes including all fittings, slitting of pipes and provision of filling around pipes, and

g) supplying and installing marker maintenance posts.

Item 30557 Sheet or strip filter drain outlet connection, [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) constructing outlet ends

c) supplying and installing maintenance marker post, and

d) supplying and installing galvanised chicken-wire cones/pest-proof flaps to the outlets of drainage pipes.

2.2.23 Vertical Drains

Item 30558 Vertical wick filter drains, plastic core

Item 30559 Vertical sand drains

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing and fixing vertical wick filter drains, and

f) placing and compacting and monitoring sand drains.

2.2.24 Stone Columns

Item 30560 Granular working platform for stone columns

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of the existing surface

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c) supply of granular material, and

d) construction of the granular working platform.

Item 30561 Supply and installation of reinforcement geosynthetic material for stone columns

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and installation of reinforcement geosynthetic material.

Item 30562 Supply and installation of geotexile, Strength Class [*strength class*], Filtration Class [*filtration class*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and installation of geotextile.

Item 30563 Stone columns

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) installation of stone columns

d) clearing the Site of spoil, mud and sedimentation ponds, and

e) reinstatement of disturbed areas.

2.2.25 Concrete paved inverts in corrugated culverts

Item 30651 Concrete paved inverts in corrugated steel/aluminium culverts, [*size*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) preparing the surfaces on which paved inverts are to be constructed, and

d) constructing paved inverts.

2.2.26 Linings in drains and channels

Item 30652 Linings in drains and channels, unreinforced concrete

Item 30653 Linings in drains and channels, reinforced concrete

Item 30654 Linings in drains and channels, grouted rock pitching

Item 30655 Linings in drains and channels, steel wire mattresses

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

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c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material below surfaces to be lined, and

f) constructing lining.

2.2.27 Berm drains

Item 30656 Berm drain, [*width*] mm wide

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material below surfaces to be lined, and

f) constructing concrete lining.

2.2.28 Concrete margins and batters

Item 30657 Concrete margins

Item 30658 Concrete batters

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material below surfaces covered by margins and batters

f) constructing margins (including cut-off walls)

g) constructing batters (including cut-off walls)

h) supplying and installing steel sleeves, and

i) providing weepholes.

2.2.29 Concrete rail track crossings and machinery crossings

Item 30659 Concrete rail track crossings

Item 30660 Concrete machinery crossings

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

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d) utilising or disposing of excavated material

e) compacting material at bottom of excavations

f) placing and compacting foundation bedding material, and

g) constructing concrete crossings.

2.2.30 Hand placed concrete paving

Item 30661 Hand placed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) fabricating and placing steel reinforcement

g) placing and compacting concrete

h) placing compressible packing, and

i) finishing and curing concrete.

2.2.31 Sprayed concrete paving

Item 30662 Sprayed concrete paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) fabricating and placing steel reinforcement

g) spraying concrete

h) placing compressible packing, and

i) finishing and curing concrete.

2.2.32 Block paving

Item 30663 Block paving, [*thickness*] mm thick

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

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c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at the bottom of excavations

f) placing bedding material

g) placing paving blocks

h) compaction of blocks and bedding

i) cutting paving blocks, and

j) filling gaps between blocks and edge restraints.

2.2.33 Rock masonry

Item 30664 Rock masonry

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing cement mortar

f) placing compressible filler

g) placing rock

h) placing tightly packed rock behind the pile and between blocks of rock masonry, and

i) placing geotexile, sheet and strip filter drain.

2.2.34 Grouted rock pitching

Item 30665 Grouted rock pitching

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) placing foundation bedding material

f) placing rock, and

g) placing cement mortar.

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2.2.35 Rock protection

Item 30666 Rock protection

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material, and

e) dumping or otherwise placing rock.

2.2.36 Steel-wire gabion protection work

Item 30667 Steel wire gabion protection work

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) assembling, positioning and joining gabions

f) forming shapes

g) placing rock filling, and

h) closing gabions.

2.2.37 Steel-wire mattress protection work

Item 30668 Steel wire mattress protection work

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) installing anchor plates, anchor bolts and anchor pickets

f) assembling, positioning and joining mattresses

g) forming shapes

h) placing rock filling, and

i) closing mattresses.

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2.2.38 Fabric encased concrete batter protection

Item 30669 Fabric encased concrete batter protection on batter faces

Item 30670 Fabric encased concrete batter protection in cut-off walls

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations, and

d) utilising or disposing of excavated material.

2.2.39 Bridge abutment protection Type 1 – rock spill through

Item 30671 Bridge abutment protection Type 1 – rock spillthrough, [*location*] abutment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) construction of rock masonry toe wall

f) constructing rockfill, and

g) constructing hand-packed rock face and grouting with cement mortar.

2.2.40 Bridge abutment protection Type 2 – reinforced concrete over earth spillthrough

Item 30672 Bridge abutment protection Type 2 – reinforced concrete over road embankment spillthrough, [*location*] abutment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing concrete toe walls, edge walls and capping

f) constructing reinforced concrete slabs, and

g) provision of joints, where required.

2.2.41 Bridge abutment protection Type 4 – rockwork over earth spillthrough

Item 30673 Bridge abutment protection Type 4 – rockwork over road embankment spillthrough, [*location*] abutment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing rock masonry toe wall

f) constructing rockwork layer, and

g) constructing hand-packed rock face and grouting with cement mortar.

2.2.42 Bridge abutment protection Type 6 – interlocking blockwork over earth spillthrough

Item 30674 Bridge abutment protection Type 6 – interlocking blockwork over road embankment spillthrough, [*location*] abutment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing cement stabilised sand

f) placing PVC-slotted pipe

g) placing granular fill

h) placing, jointing and fixing geotextile

i) constructing concrete toe walls, edge walls, mid walls and capping, and

j) installing interlocking blocks.

2.2.43 Shotcreting

Item 30675 Shotcreting

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of fixing pins

d) hot-dipped galvanising of steelwork

e) fabricating and placing steel reinforcement

f) provision of weep holes

g) spraying shotcrete, and

h) provision of joints where required.

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2.2.44 Bridge abutment protection Type 7 – Rock-filled gabion protection

Item 30676 Bridge abutment protection Type 7 - Rock-filled gabion protection over road embankment, [*location*] abutment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials except eyebolts for safety harness. Note eyebolts are included in Item 7314 of MRS62 *Bridge Substructure*

c) carrying out excavations

d) utilising or disposing of excavated material

e) constructing subsoil drainage, applicable to gabion toe only

f) installing geotextile layer

g) constructing gabion toe or mass concrete toe

h) constructing cement stabilised sand layer, rock armour and rock-filled mattress toe protection

i) constructing rock-filled gabion protection,

j) installing medium impact polythene sheet separator for capping construction,

k) constructing concrete capping, and

l) Dewatering and cofferdam where required.

2.2.45 Concrete retaining walls

Item 30801 Concrete retaining wall, concrete in footing, [*wall location* | *wall number*]

Item 30802 Concrete retaining wall, concrete in wall, [*wall location* | *wall number*]

Item 30803 Concrete retaining wall, steel reinforcing bar, [*wall location* | *wall number*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at bottom of excavations

f) fabricating and placing steel reinforcing

g) placing and compacting concrete

h) finishing and curing of concrete

i) fabricating and placing inserts

j) installation of expansion and contraction joints

k) installing weep holes

l) installing drainage behind retailing wall, and

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m) backfilling behind retaining wall where required.

2.2.46 Concrete masonry retaining walls

Item 30804 Concrete masonry retaining wall, concrete in footing, [*wall location* | *wall number*]

Item 30805 Concrete masonry retaining wall, masonry in wall, [*wall location* | *wall number*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials, excluding reinforcing

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at bottom of excavations

f) constructing concrete footings

g) finishing and curing of concrete

h) laying and jointing masonry units

i) placing and compacting concrete infill

j) fabricating and placing inserts

k) installation of expansion and contraction joints

l) installing weep holes

m) constructing capping walls

n) installing drainage behind retailing wall, and

o) backfilling behind retaining wall where required.

Item 30806 Concrete masonry retaining wall, steel reinforcing bar, [*wall location* | *wall number*]

Work Operations incorporated in the above item include:

a) Work Operations incorporated in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials, and

c) fabricating and placing steel reinforcements.

2.2.47 Crib walls

Item 30807 Crib walls

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

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e) compacting material at bottom of excavations

f) constructing concrete footings

g) installing crib units, and

h) placing and compacting backfilling material.

2.2.48 Boulder retaining walls

Item 30808 Boulder retaining wall

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carrying out excavations

d) utilising or disposing of excavated material

e) compacting material at bottom of excavations

f) placing boulders/rockfill

g) installing drainage blanket behind boulder retaining wall

h) installing seepage drains

i) backfilling behind boulder retaining wall

j) compacting backfill behind or adjacent to boulder retaining wall/drainage bracket

k) filing voids between boulders with slurry concrete, and

l) inspections by RPEQ Geotechnical Engineer.

2.2.49 Soil nailing

Item 30809 Soil nailing

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of soil nails

d) hot-dipped galvanising of steelwork

e) drilling holes for soil nails

f) installation of nails

g) grouting soil nails, and

h) acceptance testing.

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2.2.50 Passive rock dowels

Item 30810 Passive rock dowels

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of dowels

d) hot-dipped galvanising of dowels

e) encapsulating dowels in HDPE sheath

f) drilling holes for dowels

g) installing dowels

h) grouting dowels, and

i) acceptance testing.

2.2.51 Active rock bolts

Item 30811 Active rock bolts

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of rock bolts

d) hot-dipped galvanising of steelwork

e) drilling holes for rock bolts

f) installing rock bolts

g) grouting rock bolts

h) stressing the rock bolts, and

i) acceptance testing.

2.2.52 Surveying requirements

Item 30901 Conformance and As Constructed survey for culverts

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 59 of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

Item 30902 Conformance and As Constructed for gullies

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 59 Surveying requirements of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

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FOI 26-292 - Document 21

Item 30903 Conformance and As Constructed for insitu concrete access chambers

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 59 of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

Item 30904 Conformance and As Constructed survey for precast concrete access chambers

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 59 of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

Item 30905 Conformance and As Constructed for concrete retaining wall footings

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 59 of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

Item 30906 Survey information for existing underground assets

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 60 of MRTS03 *Drainage, Retaining Structures and Protective Treatments.*

2.3 Measurement

2.3.1 Measurement of removal/demolition

Where any of Items 2104–2109 are not scheduled separately, demolition and/or removal of existing infrastructure shall be included in Item 3101 in MRS04 *General Earthworks*.

2.3.2 Measurement of excavation and backfilling

In general, any excavation and backfilling required to be carried out in order to construct the work described by this Specification shall not be measured separately. Payment for excavation and backfilling shall be deemed to be included in the rate for the appropriate Standard Work Item for the particular work.

However, where specifically provided for under Clause 2.3 of MRS04 *General Earthworks*, excavation and backfilling for particular components of the work under the Contract may be measured separately. Where this is the case, appropriate Standard Work Items from MRS04 *General Earthworks* shall be included in the Schedule of Rates.

2.3.3 Measurement of precast culverts

This Specification provides Standard Work Items for:

a) supply only

b) installation only, and

c) supply and installation

of precast culvert components.

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Any combination of Standard Work Items relating to these methods of measurement may be used in the Schedule of Rates. However, where a Standard Work Item for supply and installation of a particular culvert structure is included in the Schedule of Rates, no supply only nor installation only Standard Work Item shall also apply to that structure.

2.4 Calculation of quantities

2.4.1 General

Unless specified otherwise in Clause 2.4, quantities shall be calculated in accordance with the provisions of Clause 2.1.1 of MRS01 *Introduction to Specifications*.

2.4.2 Precast culverts

Where precast culvert components are supplied only under the Contract (i.e., not installed), the quantity shall be the exact length supplied and quantities shall not be rounded in accordance with Clause 2.1.1 of MRS01 *Introduction to Specifications*.

Where precast culvert components are installed only or are supplied and installed under the Contract, the quantity shall be measured in accordance with the remainder of this Clause and normal rounding of the final quantity shall apply.

Where culverts are installed by other than jacking methods:

a) Single cell culverts

   The quantity shall be the invert length along the centreline of the cell as shown on or calculated from the Drawings, or

b) Multiple cell culverts

   Where the cells are of equal length, the quantity shall be the invert length along the centreline of one cell only as shown on or calculated from the Drawings.

   Where the cells are of variable length, the quantity shall be the average of the invert lengths along the centreline of all cells as shown on or calculated from the Drawings.

Where culverts are installed using jacking methods:

a) Whole length of culvert is installed as a jacking operation

   The quantity shall be the invert length along the centreline of the culvert for the complete installation as shown on or calculated from the Drawings, or

b) Part of the length of culvert only is jacked

   The quantity shall be the invert length along the centreline of that section of culvert which is actually required to be jacked as shown on or calculated from the Drawings, plus an allowance of 2.4 m for end stubs. The remainder of the culvert shall be measured as for installation other than using jacking methods.

2.4.2.1 Stone columns

The quantity of stone columns shall be the length of stone column in place and shall be the sum of the individual lengths of each column, calculated as the difference between the height of the ground surface and the founding level as shown on the Drawings or otherwise accepted by the Superintendent.

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The quantity of the working platform shall be the volume calculated from the dimensions shown on the Drawings.

Embankment fill above stone columns shall be measured in accordance with the relevant Standard Work Items in MRS04 *General Earthworks*.

2.4.2.2 Soil nails, passive rock dowels and active rock bolts

The quantity of soil nails, passive rock dowels and active rock bolts shall be calculated as the sum of the lengths of soil nails, passive rock dowels or active rock bolts installed, grouted, stressed (where applicable) and load tested successfully.

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Specification (Measurement)

Transport and Main Roads Specifications
MRS04 General Earthworks

November 2020

Queensland Government

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 5

2.2.1 Clearing and grubbing 5
2.2.2 Stripping of Topsoil 6
2.2.3 Acid Sulphate Soils 6
2.2.4 Ground surface treatment 6
2.2.5 Excavation 8
2.2.6 Embankments 10
2.2.7 Existing subgrade testing 11
2.2.8 Subgrade treatments 12
2.2.9 Backfill 15
2.2.10 Turnouts, entrances and stopping places 16
2.2.11 Widening of existing formation to Subgrade Level 16

2.3 Measurement of excavation and backfilling of trenches and structures 17

2.4 Borrow, Spoil, hauling, stockpiling and multiple handling 18

2.5 Calculation of quantities 18

3 Measurement and payment 19

3.1 Unsuitable Material 19

3.2 Acid Sulphate Soils 20

3.2.1 Disposal in areas on the site 20

3.3 Non-rippable material 21

3.3.1 General 21
3.3.2 Road Excavation 21
3.3.3 Confined Excavations 21
3.3.4 Blasting 22

3.4 All excavations 22

3.5 Conditions applicable to additional payment for excavation in non-rippable material 22

3.6 Special requirements for cuttings 23

3.6.1 Bottom of excavation 23
3.6.2 Unsuitable Material below the bottom of excavation 23

3.7 Unsuitable Material in Confined Excavations 23

3.8 Special Embankment materials 23

3.9 Geotextile at changes in material type 23

3.10 Borrow operations 23

3.11 Backfill zones to concrete pipe culverts 24

4 Existing ground level survey 24

5 Supplementary requirements 24

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1 Introduction

This Specification applies to the construction of general earthworks in roadworks and bridgeworks.

The requirements of this Specification apply to excavation and filling operations for all work under the Contract, except for excavation for:

a) cast-in-place piles which is specifically covered by MRS63 *Cast-In-Place Piles*, and

b) footings for poles which is specifically covered by MRS92 *Traffic Signal and Road Lighting Footings*.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications,* MRS50 *Specific Quality System Requirements* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1.

Figure 2.1(a) to Figure 2.1(c), are schematic representations of the application of some of the Standard Work Items for preparation, excavation, Embankment, Subgrade and Backfill.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Preparation		
32001	Clearing and grubbing	m²
32002	Bridge site preparation	m²
32003P	Stripping of Topsoil (Provisional Quantity, as directed)	m³
32007	Ground surface treatment under Embankment, standard	m²
32008	Ground surface treatment, special (square metres)	m²
32009	Ground surface treatment, special (cubic metres)	m³
32010P	Ground surface treatment, insitu treatment of Acid Sulphate Soils with lime (Provisional Quantity, if ordered)	m³
32014P	Excavation and disposal of Unsuitable Material with individual excavation ≤ 10 m³ (Provisional Quantity, as directed)	m³
32018P	Excavation and disposal of Unsuitable Material with individual excavation > 10 m³ (Provisional Quantity, as directed)	m³
32022P	Supply and storage of agricultural lime (Provisional Quantity, as directed)	tonne
32026P	Quantitative laboratory testing of actual or potential Acid Sulphate Soils (Provisional Quantity, if ordered)	set of tests
32030P	Treatment of water contaminated by Acid Sulphate Soils (Provisional Quantity if ordered)	kL

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Standard Item No.	Description	Unit of Measurement
Excavation		
32101	Excavation, all materials	m³
32102	Excavation to clear waterways at bridge abutments, all materials	m³
32103	Excavation for culvert, pipe and conduit trenches, all materials [*description*]	m³
32104	Excavation for structures, all materials [*description*]	m³
32105	Excavation for diversion channels, all materials	m³
32106	Excavation for diversion drains, all materials	m³
32107	Excavation for catch drains, all materials	m³
32108	Special excavation, all materials [*description*]	m³
32109P	Excavation of non-rippable material in Road Excavation, rate additional to rate for Standard Work Item 32101 (Provisional Quantity)	m³
32113P	Excavation of non-rippable material in Confined Excavation, rate additional to rates for Standard Work Items 32103 to 32107 inclusive (Provisional Quantity)	m³
32117	Pre-splitting batters of rock cuttings	m²
32118P	Excavation and disposal of Unsuitable Material in and below Confined Excavations (Provisional Quantity, as directed)	m³
32122P	Excavation and disposal of Unsuitable Material within lines of excavation, rate additional to rate for Standard Work Item 32101 (Provisional Quantity, as directed)	m³
32126	Blinding concrete, [*thickness*] mm nominal thickness	m²
Embankment		
32201	Embankment	m³
32202	Levees, catch banks and diversion blocks using earthfill material (Class A1, Class B) from all sources	m³
32203	Special Embankment [*description*] from all sources	m³
32204	Supply and installation of geotextile, strength class [*strength class*], filtration class [*filtration class*]	m²
32206P	Addition of lime to Embankment materials to neutralise Acid Sulphate Soils, rate additional to rates for Standard Work Items 32201 to 32203 (Provisional Quantity, as directed)	m³
32210	Verge fill	m³
Existing Subgrade Testing and Treatments		
32301	Existing Subgrade testing	lump sum
32302P	Existing Subgrade testing (Provisional Quantity, if ordered)	set of tests
32306P	Subgrade treatment Type A (Provisional Quantity, if ordered)	m²
32310P	Subgrade treatment Type B, replace with Subgrade Fill Material, (Provisional Quantity, if ordered)	m³

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Standard Item No.	Description	Unit of Measurement
32314P	Subgrade treatment Type C, replace with unbound granular material (Provisional Quantity, if ordered)	m³
32318P	Subgrade treatment Type D, insitu stabilise existing (Provisional Quantity if ordered)	m³
32322P	Subgrade treatment Type E, replace with plant-mixed stabilised material (Provisional Quantity, if ordered)	m³
32326P	Subgrade treatment Type F1, replace with plant-mixed stabilised and unbound drainage layers (Provisional Quantity, if ordered)	m³
32330P	Subgrade treatment Type F2, replace with plant-mixed stabilised and high-permeability drainage layers (Provisional Quantity, if ordered)	m³
32334P	Subgrade treatment Type G, replace with insitu stabilised Drainage Layer (Provisional Quantity, if ordered)	m³
32338P	Subgrade treatment Type H, replace with plant-mixed stabilised Drainage Layer (Provisional Quantity, if ordered)	m³
32342P	Subgrade treatment Type I, replace with high-permeability Drainage Layer (Provisional Quantity, if ordered)	m³
32346P	Subgrade treatment Type J, bridging layer (Provisional Quantity, if ordered)	m³
32350P	Subgrade treatment Type K [*description*], (Provisional Quantity, if ordered)	m³
32354P	Excavation of non-rippable material in Subgrade treatments, rate additional to rate for Standard Work Items 32322, 32326, 32330, 32334, 32338 and 32342 (Provisional Quantity)	m³
32358P	Supply of insitu stabilising agent, lime (Provisional Quantity, as directed)	tonne
32362P	Supply of insitu stabilising agent, Type GB cement (Provisional Quantity, as directed)	tonne
Backfill		
32401	Backfill with earth Backfill material [*description*]	m³
32402	Backfill with Select Backfill Material to [*description*]	m³
32403	Backfill with Free-Draining Granular Material to [*description*]	m³
32404	Backfill with Sand to [*description*]	m³
32405	Backfill with cement stabilised granular material to [*description*]	m³
32406	Backfill with Stabilised Sand to [*description*]	m³
32407	Backfill with Lean Mix Concrete to [*description*]	m³
32408	Backfill with Rock Fill to [*description*]	m³
32409	Backfill with material for steel culverts to [*description*]	m³
32410	Bedding of [*description*]	m³
32411	Haunch Zone for [*description*]	m³
32412	Side Zone for [*description*]	m³
32413	Overlay Zone for [*description*]	m³

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Standard Item No.	Description	Unit of Measurement
32414P	Addition of lime to Backfill material in Acid Sulphate Soils areas (Provisional Quantity, as directed)	m^3
Turnouts, Entrances and Stopping Places		
32503	Stopping places	Lump Sum
32504	Turnouts	Lump Sum
32505	Entrances to private property	Lump Sum
Widening		
32601	Widening of the existing formation (metres)	m
32602	Widening of the existing formation (square metres)	m^2

Figure 2.1(a) – Excavation

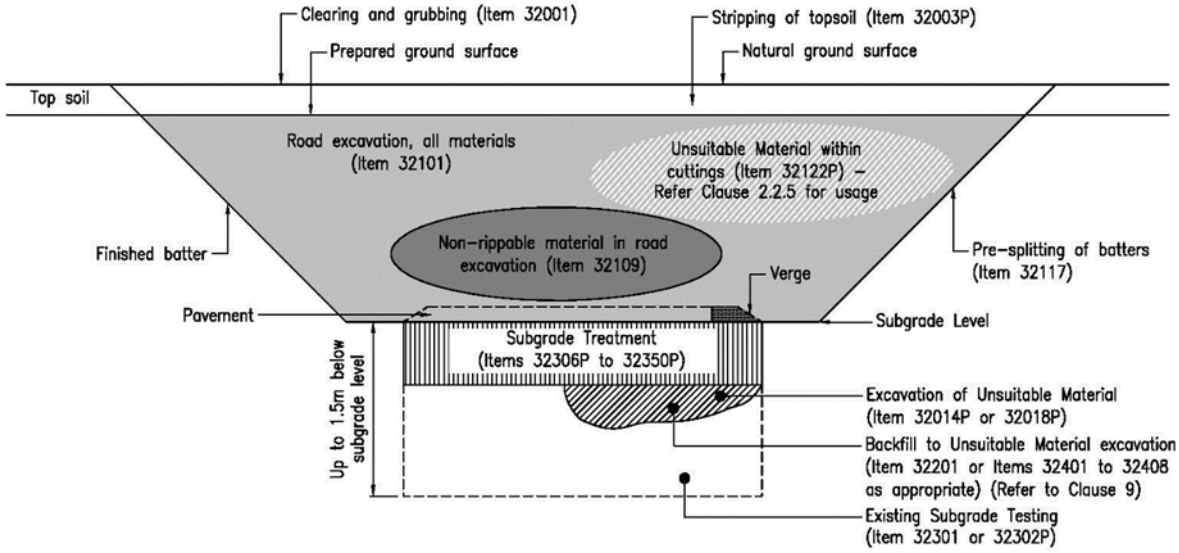
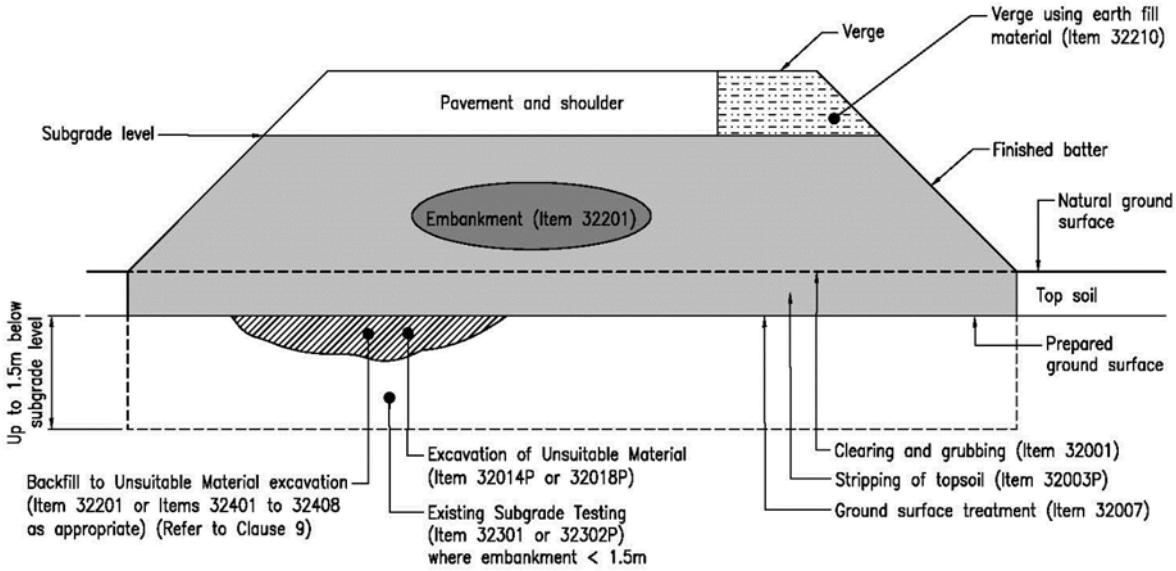
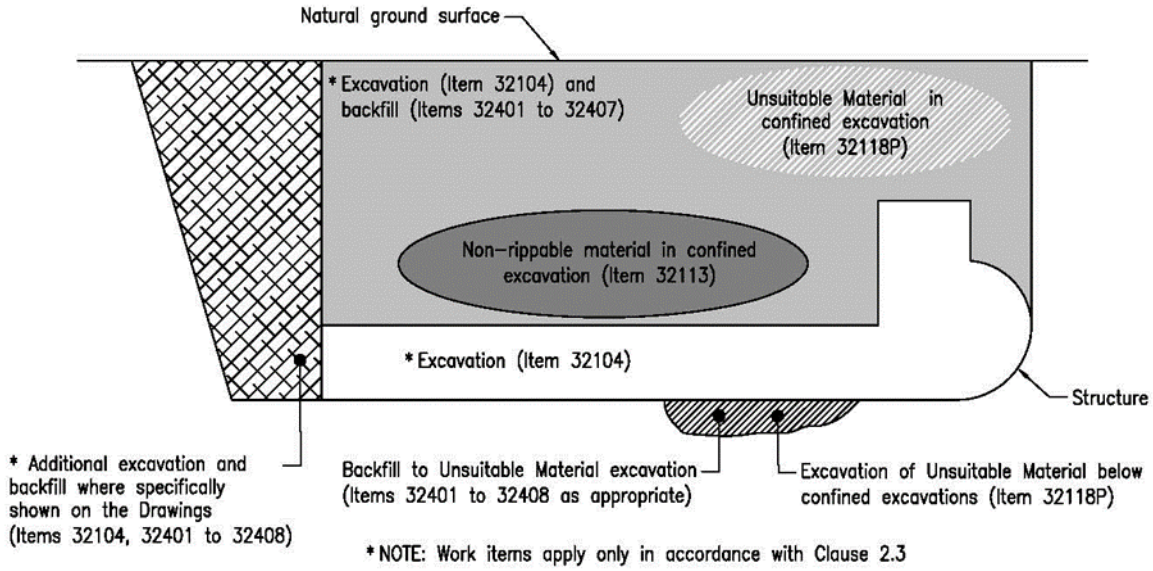


Figure 2.1(b) – Embankment



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Figure 2.1(c) – Excavation and Embankment to structures



2.2 Work Operations

Work Operations included in the Standard Work Items are specified in the relevant clause adjacent to each Standard Work Item listed in Table 2.1.

2.2.1 Clearing and grubbing

Item 32001 Clearing and grubbing

Item 32002 Bridge site preparation

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) removing trees, shrubs and overhanging branches

c) setting aside marketable timber

d) setting aside vegetative material suitable for processing to produce organic mulch

e) placing fallen logs and branches suitable for fauna habitat clear of construction activities

f) removing stumps and roots (including any subsequent regrowth) to a depth not less than 300 mm below ground surface

g) removing noxious weeds, crops and other vegetable matter from the ground surface (including any subsequent regrowth)

h) removing rocks, buildings and artificial obstructions from the ground surface

i) removing and/or demolishing existing drainage infrastructure and roadside furniture including barriers where not scheduled separately

j) removing abandoned Public Utility Plant to a depth not less than 300 mm below Natural Ground Surface

k) disposing of all cleared and grubbed materials which are not to be reused, and

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l) trimming and lightly compacting area within the limits of the clearing and grubbing outside the limits of earthworks operations.

2.2.2 Stripping of Topsoil

Item 32003P Stripping of Topsoil (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) stripping existing Topsoil from the Site

c) identification of material suitable for use as Planting Media

d) stockpiling of material considered suitable for use as Planting Media, and

e) use of or disposal of surplus material and material unsuitable for use as planting medium.

2.2.3 Acid Sulphate Soils

Item 32022P Supply and storage of agricultural lime (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and storage of lime.

Item 32026P Quantitative laboratory testing of actual or potential Acid Sulphate Soils (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) collection of sample, appropriate packaging, transport to laboratory, testing and reporting of result.

Item 32030P Treatment of water contaminated by Acid Sulphate Soils (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) temporary retention of contaminated water

c) testing and analysis of contaminated water

d) mixing of lime slurry and incorporation into contaminated water, and

e) discharge of, or disposal of, treated water and contaminated products.

2.2.4 Ground surface treatment

Item 32007 Ground surface treatment under Embankment, standard

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying, placing and compacting Fill Material in holes and localised depressions

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c) adjusting the moisture content of insitu material below the existing ground surface, and

d) compacting material below the Prepared Ground Surface.

Item 32008 Ground surface treatment, special (square metres)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) all work specified in Clause 12.2.2 of Technical Specification MRTS04 *General Earthworks*.

Item 32009 Ground surface treatment, special (cubic metres)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) all work specified in Clause 12.2.2 of Technical Specification MRTS04 *General Earthworks*.

Item 32010P Ground surface treatment, insitu treatment of Acid Sulphate Soils with lime (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) visual and field testing of materials for acid sulphate potential

c) identification of areas requiring treatment and level of treatment required

d) loosening and excavation of materials as directed by the Administrator

e) spreading and mixing of lime into excavated material at a rate required to neutralise acid production, and

f) moisture conditioning and re-compaction of material into excavation.

Item 32014P Excavation and disposal of Unsuitable Material with individual excavation ≤ 10 m³ (Provisional Quantity, as directed)

Item 32018P Excavation and disposal of Unsuitable Material with individual excavation > 10 m³ (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) identification of Unsuitable Material including testing and survey where required

c) loosening insitu material

d) excavating loading and hauling loosened material to stable slopes as directed by the Administrator

e) disposal of Unsuitable Material, and

f) compaction of base of excavation.

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2.2.5 Excavation

Item 32101 Excavation, all materials

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) identification of material classes and Unsuitable Material including testing and survey where required

c) loosening insitu material

d) excavating, loading, hauling and unloading loosened material

e) any additional stockpiling, reloading, hauling and unloading of excavated material as required to deliver the material to its final point of placement

f) disposing or otherwise using excavated material

g) lightly tyning areas specified, and

h) finishing batters.

Item 32102 Excavation to clear waterways at bridge abutments, all materials

Item 32103 Excavation for culvert, pipe and conduit trenches, all materials [*description*]

Item 32104 Excavation for structures, all materials [*description*]

Item 32105 Excavation for diversion channels, all materials

Item 32106 Excavation for diversion drains, all materials

Item 32107 Excavation for catch drains, all materials

Item 32108 Special excavation, all materials [*description*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) identification of material classes and Unsuitable Material including testing and survey where required

c) loosening insitu material

d) excavating, loading, hauling and unloading loosened material

e) any additional stockpiling, reloading, hauling and unloading of excavated material as required to deliver the material to its final point of placement

f) disposing or otherwise using excavated material

g) compacting material at the bottom of excavations, and

h) finishing batters.

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Item 32109P Excavation of non-rippable material in Road Excavation, rate additional to rate for Standard Work Item 32101 (Provisional Quantity)

Item 32113P Excavation of non-rippable material in Confined Excavation, rate additional to rates for Standard Work Items 32103 to 32107 inclusive (Provisional Quantity)

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) work associated with the excavation of non-rippable material in addition to that required for Road Excavation or Confined Excavation, as appropriate, in all materials.

Item 32117 Pre-splitting batters of rock cuttings

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) Pre-splitting of face of batter with explosives.

Item 32118P Excavation and disposal of Unsuitable Material in and below Confined Excavations (Provisional Quantity, as directed)

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) identification of Unsuitable Material including testing and survey where required

c) loosening insitu material

d) excavating to stable slopes and to extent of Unsuitable Material as directed by the Administrator, loading and hauling loosened material

e) use of or disposal of Unsuitable Material, and

f) compaction of base of excavation.

Item 32122P Excavation and disposal of Unsuitable Material within lines of excavation, rate additional to rate for Standard Work Item 32101 (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) identification of Unsuitable Material including testing and survey where required

c) use of or disposal of Unsuitable Material, and

d) supply of additional Fill Material, to supplement construction of embankments and other fills.

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If there is an excess of excavation over proposed Embankment, the tender schedule allows for the disposal of the excess material under Standard Work Item 32101 and the unsuitable material also has to be selected and disposed of under Standard Work Item 32101 and no additional payment is made.

If there is a deficiency of excavation over proposed Embankment, and the excavated unsuitable material has to be disposed of and Fill Material up to the amount of unsuitable material to be imported, payment is made under Standard Work Item 32122P.

Item 32126 Blinding concrete, [*thickness*] mm nominal thickness

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of concrete

c) transport of concrete

d) placing and compacting concrete, and

e) finishing concrete.

2.2.6 Embankments

Item 32201 Embankment

Item 32202 Levees, catch banks and diversion blocks using earthfill material (Class A1, Class B) from all sources

Item 32203 Special Embankment [*description*] from all sources

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) loosening insitu material

c) stepping the ground surface

d) supplying and placing Fill Material from stockpiles or Borrow Areas on or off the Site or general excavation on the Site as required

e) separation of Embankment Fill Material into Embankment zones where specified

f) installing Embankment geotextile at changes in fill type

g) spreading Fill Material

h) compacting Fill Material

i) sampling and testing

j) finishing batters, and

k) trimming of Subgrade to tolerance.

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Item 32204 Supply and installation of geotextile, strength class [*strength class*], filtration class [*filtration class*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply, delivery and handling of geotextile including allowance for lapping, and

c) installation of geotextile, including lapping / joining.

Item 32206P Addition of lime to Embankment materials to neutralise Acid Sulphate Soils, rate additional to rates for Standard Work Items 32201 to 32203 (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) visual assessment and field testing of materials for acid sulphate potential

c) identification of materials requiring treatment and level of treatment required, and

d) mixing of lime into excavated material at rate required to neutralise acid production (excluding supply of lime).

Item 32210 Verge fill

Work Item Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) loosening insitu material

c) stepping the ground surface

d) supplying and placing verge material from stockpiles and Borrow Areas on or off the Site as required

e) spreading verge material

f) compacting verge material

g) sampling and testing, and

h) trimming and finishing batters.

2.2.7 Existing subgrade testing

Item 32301 Existing Subgrade testing

Item 32302P Existing Subgrade testing (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) sampling and testing of existing Subgrade as required by Appendix B of Technical Specification MRTS04 *General Earthworks*, and

c) reporting of test results to the Administrator.

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Testing of fill materials used in Subgrade is included in Standard Work Item 32201 or the respective Subgrade treatment. Standard Work Items 32301 and 32302P do not cover testing of fill materials.

Standard Work Item 32301 is intended to be applied where the Contractor is responsible for undertaking existing Subgrade testing throughout the site (that is, if the 'yes' box is selected in Clause 12.5 of Annexure MRTS04.1 to the Technical Specification MRTS04 *General Earthworks*).

Standard Work Item 32302P is intended to be applied where specified testing of existing Subgrade is directed by the Administrator (that is, if the 'as directed' box is selected in Clause 12.5 of Annexure MRTS04.1 to the Technical Specification MRTS04 *General Earthworks*).

2.2.8 Subgrade treatments

Item 32306P Subgrade treatment Type A (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) ripping and/or tyning to specified treatment depth

c) adjustment of moisture content, where necessary

d) compaction of material

e) sampling and testing, and

f) trimming of Subgrade to tolerance.

Item 32310P Subgrade treatment Type B, replace with Subgrade Fill Material, (Provisional Quantity, if ordered)

Item 32314P Subgrade treatment Type C, replace with unbound granular material (Provisional Quantity, if ordered)

Item 32342P Subgrade treatment Type I, replace with high-permeability Drainage Layer, (Provisional Quantity, if ordered)

Item 32346P Subgrade treatment Type J, bridging layer (Provisional Quantity, if ordered)

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and delivery of all materials (excluding geotextile and/or high-strength geosynthetic reinforcement, where required)

c) excavation of existing Subgrade in accordance with the Work Operations of Standard Work Item 32101 in Clause 2.2.5, where required

d) placement of appropriate Fill Material

e) compaction

f) sampling and testing, and

g) trimming of Subgrade to tolerance.

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Item 32318P Subgrade treatment Type D, insitu stabilise existing (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and delivery of all materials excluding stabilising agent

c) testing insitu material and undertaking mix design to determine lime or cement application rate, as required

d) scarifying and/or pulverising the material to be stabilised

e) spreading the stabilising agent

f) incorporation of water and stabilising agent into the material

g) compaction

h) trimming of Subgrade to tolerance

i) sampling and testing, and

j) moist curing until Subgrade is covered.

Item 32322P Subgrade treatment Type E, replace with plant-mixed stabilised material (Provisional Quantity, if ordered)

Item 32338P Subgrade treatment Type H, replace with plant-mixed stabilised Drainage Layer (Provisional Quantity, if ordered)

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and delivery of all materials including stabilising agent

c) excavation of existing Subgrade in accordance with the Work Operations of Standard Work Item 32101 in Clause 2.2.5, where required

d) undertaking mix design to determine lime or cement application rate, as required

e) storing, metering and mixing of all components of plant-mixed material

f) placing of plant-mixed material

g) compaction

h) trimming of Subgrade to tolerance

i) moist curing until Subgrade is covered

j) sampling and testing, and

k) provide free-draining surface as per Clause 18.3.3.1 of Technical Specification MRTS04 *General Earthworks*.

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Item 32326P Subgrade treatment Type F1, replace with plant-mixed stabilised and unbound drainage layers (Provisional Quantity, if ordered)

Item 32330P Subgrade treatment Type F2, replace with plant-mixed stabilised and high-permeability drainage layers (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and delivery of all materials including stabilising agent

c) excavation of existing Subgrade in accordance with the Work Operations of Standard Work Item 32101 in Clause 2.2.5, where required

d) undertaking mix design to determine lime or cement application rate, as required

e) storing, metering and mixing of all components of plant-mixed material

f) placing of unbound or rockfill material

g) placing of plant-mixed material

h) compaction

i) trimming of Subgrade to tolerance

j) sampling and testing

k) moist curing until Subgrade is covered, and

l) provide free-draining surface as per Clause 18.3.3.1 of Technical Specification MRTS04 *General Earthworks*.

Item 32334P Subgrade treatment Type G, replace with insitu stabilised Drainage Layer (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and delivery of all materials, excluding stabilising agent

c) excavation of existing Subgrade in accordance with the Work Operations of Standard Work Item 32101 in Clause 2.2.5, where required

d) undertaking mix design to determine lime or cement application rate, as required

e) placing the unbound material

f) spreading the stabilising agent

g) incorporation of water and stabilising agent into the material

h) compaction

i) trimming of Subgrade to tolerance

j) sampling and testing

k) moist curing until Subgrade is covered, and

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l) provide free-draining surface as per Clause 18.3.3.1 of Technical Specification MRTS04 *General Earthworks*.

Item 32350P Subgrade treatment Type K [*description*], (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) all Work Operations required to supply and construct the particular Subgrade treatment described, and

c) sampling and testing

Item 32354P Excavation of non-rippable material in Subgrade treatments, rate additional to rate for Standard Work Items 32322, 32326, 32330, 32334, 32338 and 32342 (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) work associated with excavation of non-rippable material in addition to that required for excavation of rippable material.

Item 32358P Supply of insitu stabilising agent, lime (Provisional Quantity, as directed)

Item 32362P Supply of insitu stabilising agent, Type GB cement (Provisional Quantity, as directed)

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply, delivery and storage of stabilising agent.

> For plant-mixed stabilised materials, the supply of stabilising agent is part of the Subgrade treatment Standard Work Item. For these materials, the Contractor is responsible for nominating the stabilising agent type and quantity (through the mix design process) to achieve the specified Unconfined Compressive Strength (UCS) requirements.

2.2.9 Backfill

Item 32401 Backfill with earth Backfill material to [*description*]

Item 32402 Backfill with Select Backfill Material to [*description*]

Item 32403 Backfill with Free-Draining Granular Material to [*description*]

Item 32404 Backfill with Sand to [*description*]

Item 32405 Backfill with cement stabilised granular material to [*description*]

Item 32406 Backfill with Stabilised Sand to [*description*]

Item 32407 Backfill with Lean Mix Concrete to [*description*]

Item 32408 Backfill with Rock Fill to [*description*]

Item 32409 Backfill with material for steel culverts to [*description*]

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FOI 26-292 - Document 21

Item 32410 Bedding of [*description*]

Item 32411 Haunch Zone for [*description*]

Item 32412 Side Zone for [*description*]

Item 32413 Overlay Zone for [*description*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) undertaking mix design to determine lime or cement application rate as required

d) mixing all materials where applicable

e) placing and compacting material in trenches or against structures,

f) sampling and testing, and

g) finishing surfaces of Backfill.

Item 32414P Addition of lime to Backfill material in Acid Sulphate Soils areas (Provisional Quantity, as directed)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) mixing of lime into Backfill material at the rate required to neutralise potential acid production (excluding supply of lime).

2.2.10 Turnouts, entrances and stopping places

Item 32503 Stopping places

Item 32504 Turnouts

Item 32505 Entrances to private property

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) clearing and grubbing, Topsoil stripping and ground surface treatment standard

c) constructing road Cutting excavations

d) constructing road embankments

e) constructing Subgrade in general Fill Material, and

f) sampling and testing.

2.2.11 Widening of existing formation to Subgrade Level

Item 32601 Widening of the existing formation (metres)

Item 32602 Widening of the existing formation (square metres)

Work Operations incorporated in the above item include all requirements for Work Item Numbers:

a) 32001 Clearing and grubbing

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FOI 26-292 - Document 21

b) 32003P Stripping of Topsoil

c) 32007 Ground surface treatment under Embankment, standard

d) 32101 Excavation, all materials

e) 32106 Excavation for diversion drains, all materials

f) 32107 Excavation for catch drains, all materials

g) 32201 Embankment, and

h) 32306P Subgrade treatment Type A.

2.3 Measurement of excavation and backfilling of trenches and structures

Excavation and backfilling for construction or installation of the following elements shall not be measured separately:

a) pipes less than 1200 mm nominal diameter

b) box culverts less than 1200 mm nominal height

c) conduits and cables

d) pits, access chambers, gullies and sumps

e) culvert end structures and aprons

f) kerbs and channels

g) subsoil drains of any description

h) batter, Embankment and channel protection of any description

i) sundry paving for footpaths, bikeways, rail and machinery crossings, relieving slabs and median and verge infill paving

j) retaining walls

k) road furniture

l) landscape works, and

m) traffic signal and road lighting footings.

Excavation and backfilling for construction or installation of the following elements shall not be measured separately unless specifically stated otherwise in Clause 1 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks* or in the relevant Specification or Supplementary Specification:

a) pipe culverts greater than or equal to 1200 mm nominal diameter

b) culverts greater than or equal to 1200 mm nominal height

c) inlets and outlets to culverts

d) structures, and

e) cast-in-place piles.

Where not measured separately, payment for excavation and backfilling for any of the above mentioned elements shall be deemed to be included in the rate for an appropriate Standard Work Item

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(provided in another Specification or Supplementary Specification) for construction or installation of that particular element.

2.4 Borrow, Spoil, hauling, stockpiling and multiple handling

No separate Standard Work Item shall apply to and no separate payment shall be made for borrowing, spoiling, hauling, stockpiling and/or multiple handling of materials forming the earthworks described by this Specification and/or the Drawings. Full payment for such activities shall be deemed to be included in the rates for the Standard Work Items included in the Schedule of Rates.

2.5 Calculation of quantities

In Clause 2.5, the term “top of excavation” shall mean:

a) in a Cutting – Subgrade Level, or

b) elsewhere – Prepared Ground Surface. For the purpose of calculating quantities, the Prepared Ground Surface shall be taken as the Natural Ground Surface less the depth of Topsoil to be excavated measured before the placement of any Embankment Material and exclude any subsequent settlement following the placement of Embankment Material unless specifically provided for elsewhere in the Contract document

The following methods of measurement shall apply to the quantities of earthworks measured under the Contract:

a) excavation (except as stated otherwise in Clause 2.5) – the volume determined from the three-dimensional shape bounded by the Prepared Ground Surface and the finished shapes and dimensions to Subgrade Level as shown on the Drawings or otherwise nominated in the Contract

b) stripping of Topsoil, ground surface treatments and clearing and grubbing – for stripping of Topsoil and ground surface treatments, the volume calculated using the plan view areas and average depths specified; for clearing and grubbing, the area calculated using the plan view areas

c) excavation of Unsuitable Material – the volume determined by a method approved by the Administrator, which may require surveys to be carried out before and after excavation of the material

d) excavation for culverts (where excavation for culverts is to be measured separately in accordance with Clause 2.3) – the volume determined from the three-dimensional shape bounded by the top of excavation, the minimum depth determined from the dimensions shown on Standard Drawing 1359 *Culverts – Installation, bedding and filling / backfilling against / over culverts*, the vertical planes representing the minimum width of excavation at the centre of the culvert as shown on Standard Drawing 1359 and the actual length of the culvert at top of excavation

e) excavation for structures (where excavation for structures is to be measured separately in accordance with Clause 2.3) – the volume determined from the three-dimensional shape bounded by the top of excavation, the underside of structure (excluding any blinding concrete) and the vertical planes containing the plan shape of the structure plus any defined Backfill zones as shown on the Drawings

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f) excavation in non-rippable material (where excavation in non-rippable material is to be measured separately in accordance with Clause 13.3.1 of Technical Specification MRTS04 *General Earthworks*) – the actual volume of non-rippable material excavated, provided the provisions of Clause 3.5 are followed

g) pre-splitting of batters in cuttings – the area defined by the plane of the inclined rock face shown on the Drawings

h) embankments – the volume determined from the three-dimensional shape bounded by Subgrade Level, the Prepared Ground Surface and, the finished shapes and dimensions as shown on the Drawings or otherwise nominated in the Contract; the unit cost provided by the Contractor shall include allowance for the following (no additional payment shall be claimed):

   i. elastic settlement of the subsoil and the Embankment fill, and

   ii. any wastage due to handling and so on

i) Backfill of Unsuitable Material excavations – the volume equal to that described in subparagraph (c) above

j) Backfill for culverts – total Backfill for each zone as appropriate (where Backfill to culverts is to be measured separately in accordance with Clause 2.3) – the volume equal to that described in subparagraph (d) above, less the actual volume of the culvert except that:

   i. for a trench installation as shown on Standard Drawing 1359, the Backfill above the Overlay Zone will be measured as Overlay Zone material, and

   ii. for an Embankment installation, the volume of Backfill above the Prepared Ground Surface shall be calculated to the lines shown on Standard Drawing 1359

k) Backfill for structures (where Backfill to structures is to be measured separately in accordance with Clause 2.3) – the volume equal to that described in subparagraph (e) above, less the actual volume of the structure

l) blinding concrete – the area covered by the footprint of concrete footing or slab as shown on the Drawings

m) Subgrade treatment Type A – the area at Subgrade Level, and

n) geotextile – the unit of measurement is the plan square metre of the geotextile placed.

Excavation quantities shall make no allowance for any additional excavation required to place Planting Media and other landscape treatments to the specified thicknesses and finished levels shown on the Drawings. No additional payment shall be made for such excavation under the Contract. Embankment quantities shall make no allowance for any reduction of Embankment dimensions required to place Planting Media and other landscape treatments to the specified thicknesses and finished levels shown on the Drawings.

3 Measurement and payment

3.1 Unsuitable Material

Payment for backfilling of excavations of Unsuitable Material shall be made under Standard Work Items 32401 to 32408 as appropriate; however, where, in the opinion of the Administrator, backfilling is required to be carried out in an area which does not allow the use of earthmoving plant of the size

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and capacity employed by the Contractor in constructing embankments on the Site, payment shall be made under Standard Work Item 32401. The Administrator may order Backfill in alternative materials in accordance with Standard Work Items 32402 to 32408 inclusive.

The Contractor shall carry out surveys, before and after treatment of any Unsuitable Material, to determine the quantity of Unsuitable Material for payment purposes and the cost of such surveys shall be deemed to be included in the Contractor's rates for treatment of Unsuitable Material.

In the interests of expediency, the Contractor may elect to remove Unsuitable Material and replace it with other material without reference to the Administrator. In such a case, the Principal will not be bound to make any additional payment.

In general, no additional payment will be made to the Contractor for Unsuitable Material within cuttings / excavations where there is excavated material which is surplus to the project requirements.

If there is an excess of excavation over proposed Embankment, the tender schedule allows for the disposal of the excess material under Standard Work Item 32101 and the Unsuitable Material also has to be selected and disposed of under Standard Work Item 32101 and no additional payment is made.

If there is a deficiency of excavation over proposed Embankment, and the excavated Unsuitable Material has to be disposed of and Fill Material up to the amount of Unsuitable Material to be imported, payment is made under Standard Work Item 32122P.

3.2 Acid Sulphate Soils

The costs of visual and field testing for Acid Sulphate Soils shall be borne by the Contractor. The Administrator will authorise payment for ordered quantitative laboratory testing under Standard Work Item 32026P.

The cost of water treatment where required will be borne by the Principal under Standard Work Item 32030P where the contaminated water is:

a) groundwater from excavations which are essential to the construction of the Works, or

b) runoff from stockpiles which have been created as essential steps in the management of Acid Sulphate Soils on the Site

but only where, in the opinion of the Administrator, the Contractor:

a) has taken all reasonable steps to avoid contamination, and

b) is constructing the Works in accordance with its construction program.

In all other circumstances, the cost of water treatment shall be borne by the Contractor.

3.2.1 Disposal in areas on the site

No additional payment shall be made for shaping, draining, topsoiling and revegetation of Spoil sites.

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3.3 Non-rippable material

3.3.1 General

For the purpose of Clause 3.3, 'production rate' means the rate at which material can be ripped only, without regard to stockpiling, loading or carting.

3.3.2 Road Excavation

Non-rippable material in Road Excavation shall be material which cannot be ripped at a production rate exceeding the rate specified in Table 3.3.2 for the classes of crawler tractor nominated in Clause 2.1 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks*.

Where no class of crawler tractor is nominated in the Annexure MRS04.1 to this Specification, MRS04 *General Earthworks*, this requirement shall be assessed against any class of crawler tractor in Table 3.3.2.

The crawler tractor shall be equipped with a heavy-duty, single-tine, parallelogram ripper approved by the manufacturer of the crawler tractor for use with the particular model of crawler tractor.

Table 3.3.2 – Road Excavation – production rate limit for non-rippable material

Class of crawler tractor [1,2]	Operating mass (kg)[3]	Classifying power (kW)	Production rate (m³/h)
150C	≥ 20,000 < 29,000	≥ 150 < 200	50
200C	≥ 29,000 < 44,000	≥ 200 < 300	75
300C	≥ 44,000 < 58,000	≥ 300 < 400	90
400C	≥ 58,000 < 73,000	≥ 400 < 500	105
500C	≥ 73,000 < 90,000	≥ 500 < 600	120
600C	≥ 90,000	≥ 600	135

Notes

1. 'C' in class number designates a crawler tractor.
2. Class number shall be the number, or the lower of the two numbers for which the machine would be classified separately by classifying power and by operating mass.
3. Operating mass also includes hydraulic controls and fluids, straight bulldozer blade, operator's protective structure.

3.3.3 Confined Excavations

Non-rippable material in Confined Excavation shall be material which cannot be ripped at a production rate exceeding the rate specified in Table 3.3.3 for the classes of crawler excavator nominated in Clause 2.2 of Annexure MRS04.1 to this Specification MRS *General Earthworks*. Where no class of crawler tractor is nominated in the Annexure MRS04.1 to this Specification MRS *General Earthworks*, this requirement shall be assessed against any class of crawler tractor in Table 3.3.3. The crawler excavator shall be equipped with a heavy-duty bucket or rock bucket (approved by the manufacturer of the crawler excavator for use with the particular model of crawler excavator for excavation in rock) of width not greater than that stated in Table 3.3.3. The bucket teeth shall be fitted with high-penetration boots.

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Table 3.3.3 – Confined Excavation – production rate limit for non-rippable material and classification of excavators and shovel loaders

Class number of crawler excavator[1]	Operating mass (kg)[2]	Net engine power (kW)	Maximum bucket width (mm)	Production rate (m^3/h)
55	≥ 12 500 < 15 000	≥ 55 < 65	450	1.5
85	≥ 19 000 < 23 000	≥ 85 < 100	600	3
115	≥ 27 000 < 31 000	≥ 115 < 135	750	4.5
155	≥ 38 000 < 44 000	≥ 155 < 175	900	7
200	≥ 50 000 < 60 000	≥ 200 < 235	1050	10

Notes

1. Class number shall be the number or the lower of the two numbers, for which the machine would be classified separately by net engine power and by operating mass.
2. Operating mass shall also include standard attachments, for example, one-piece boom standard stick, small bucket, standard undercarriage.

3.3.4 Blasting

In general, no additional payment shall be made to the Contractor for blasting operations in any excavation. The Contractor shall be deemed to have made due allowance in its tendered rates for the cost of all blasting operations.

3.4 All excavations

Except where other specific Standard Work Items are included in the Schedule of Rates, all excavations shall be measured under Standard Work Item 32101.

In general, no additional payment shall be made to the Contractor for excavation in non-rippable material in any excavation. The Contractor shall be deemed to have made its own assessment of the extent and nature of the material to be excavated and to have made due allowance in its tendered rates for the cost of excavation in all materials.

However, where so stated in Clause 2.3 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks*, the Contract shall provide for additional payment to be made to the Contractor for excavation of non-rippable material in Road Excavation and, where so stated in Clause 2.4 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks*, the Contract shall provide for additional payment to be made to the Contractor for excavation of non-rippable material in Confined Excavation. Where the Contract provides for additional payment for excavation in non-rippable material, the provisions of Clause 3.5 shall apply.

Irrespective of whether material is rippable or non-rippable, the Contractor may carry out excavations using any equipment and any safe techniques.

3.5 Conditions applicable to additional payment for excavation in non-rippable material

Where the Contract provides for additional payment for excavation in non-rippable material in accordance with Clause 3.4, the following provisions shall apply:

a) the Schedule of Rates will contain an appropriate Standard Work Item for the work associated with excavation in non-rippable material

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b) proving material to be non-rippable shall be the Contractor's responsibility

c) proving material to be non-rippable shall be a **Hold Point** as specified in MRTS50 *Quality System Requirements* to be released by the Administrator

d) equipment shall be in good working condition and the Administrator may require the Contractor to demonstrate that the equipment has been regularly and properly serviced

e) the Administrator shall have the right to nominate the operator (whether a Contractor's employee or not) and the type, manufacturer and/or size of excavating machine and to direct the operations of the machine during the proving operation

f) unless the Contractor has proved material to be non-rippable and the Administrator has agreed that the material is non-rippable prior to excavation of that material, the Principal shall not be bound to make any additional payment for that material on account of its non-rippability

g) at the discretion of the Administrator, measurement of quantities of non-rippable material may require surveys, before and after excavation, and such surveys shall be carried out by the Contractor and the cost thereof shall be deemed to be included in the Contractor's rates for excavation in non-rippable material, and

h) in particular, any additional payment to be made to the Contractor for excavation of non-rippable material for Subgrade treatments shall be made strictly in accordance with these provisions.

3.6 Special requirements for cuttings

3.6.1 Bottom of excavation

All excavation down to Subgrade Level shall be measured under Standard Work Item 32101.

3.6.2 Unsuitable Material below the bottom of excavation

The quantity of excavation of Unsuitable Material below the finished lines and levels of bottom of excavation shall be measured separately under Standard Work Item 32014P or 32018P as appropriate – refer to Figure 2.1(a).

3.7 Unsuitable Material in Confined Excavations

Where excavation for the relevant trench or structure is to be measured separately in accordance with Clause 2.3, the quantity of excavation of Unsuitable Material shall be measured separately under Standard Work Item 32118P.

3.8 Special Embankment materials

Where special Embankment materials are required to be used, they are included in the Schedule of Rates under Standard Work Item 32203.

3.9 Geotextile at changes in material type

No additional payment shall be made for supply or installation of the geotextile at the interface at changes in material type in embankments.

3.10 Borrow operations

No separate payment shall be made for establishing Borrow Areas or for sourcing material from Borrow Areas.

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3.11 Backfill zones to concrete pipe culverts

Overlay Zone material not actually in a trench shall be measured as Embankment material under Standard Work Item 32201.

4 Existing ground level survey

The Principal has provided survey data as stated in Clause 3 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks*. If the Contractor accepts these data, they shall become the basis for calculation of all quantities.

If the Contractor does not agree with the survey data provided, the Contractor shall notify the Administrator prior to the Natural Ground Surface being disturbed. The Contractor shall also provide validation of the survey control information to the Administrator.

If the Administrator deems it necessary, the Administrator shall determine the sample of set of points and survey methodology for the Contractor to undertake this survey. This survey information shall be provided to the Administrator, showing the differences from the Principal's original survey.

No additional payment shall be made by the Principal for this sample survey.

If the Administrator accepts that the survey indicates inaccuracies in the Principal's original survey sufficient to require an additional independent ground survey of the disputed areas, it shall be carried out as directed by the Administrator to meet the surveying requirements as specified in the *Transport and Main Roads Surveying Standards*.

This independent survey shall be arranged, programmed and organised by the Contractor and the survey shall be conducted by a qualified surveyor mutually agreed between the Contractor and Administrator, working to an agreed program and quoted price. Payment for the survey will be made as a variation.

No additional payment shall be made by the Principal other than for the above independent survey and no extension to time shall be granted as a result.

> To assess the requirements of this Clause, Administrators should consult with the Principal Surveyor of the Transport and Main Roads' Region / District. If a Region or District does not have a Principal Surveyor, then all enquiries to the Principal Surveyor shall be made through TMR_Spatial_Enquiry@tmr.qld.gov.au

5 Supplementary requirements

The requirements of this Specification MRS04 *General Earthworks* are varied by the supplementary requirements given in Clause 4 of Annexure MRS04.1 to this Specification MRS04 *General Earthworks*.

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Specification (Measurement)

Transport and Main Roads Specifications MRS05 Unbound Pavements

March 2022

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 1

3 Utilisation of a rejected lot for a reduced level of service 2

3.1 General 2

3.2 Determination of the reduced value 3

3.2.1 Unbound pavement material 3

3.2.2 Compaction standard 4

3.2.3 Road roughness (surface evenness) 4

3.2.4 Intelligent Construction (IC) Roller Coverage 5

4 Additional payment for a higher standard of surface evenness 5

4.1 General 5

4.2 Payment 5

4.3 Quantity of pavement to which the additional payment applies 6

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the construction of road pavements using unbound material.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
40001	Type 1 (HSG) Base, unbound pavement, [*location*]	m³
40002	Subtype 2.1, Unbound pavement, [*layer / location*]	m³
40003	Subtype 2.2, Unbound pavement, [*layer / location*]	m³
40004	Subtype 2.3, Unbound pavement, [*layer / location*]	m³
40005	Subtype 2.4, Unbound pavement, [*layer / location*]	m³
40006	Subtype 2.5, Unbound pavement, [*layer / location*]	m³
40007	Type 3 Base, Subtype [*subtype*], Unbound pavement, [*location*]	m³
40008	Type 3 Subbase, Subtype [*subtype*], Unbound pavement, [*location*]	m³
40009	Type 4 Base, Subtype [*subtype*], Unbound pavement, [*location*]	m³
40010	Type 4 Subbase, Subtype [*subtype*], Unbound pavement, [*location*]	m³

2.2 Work Operations

Item 40001 Type 1 (HSG) Base, unbound pavement, [*location*]

Item 40002 Subtype 2.1, Unbound pavement, [*layer / location*]

Item 40003 Subtype 2.2, Unbound pavement, [*layer / location*]

Item 40004 Subtype 2.3, Unbound pavement, [*layer / location*]

Item 40005 Subtype 2.4, Unbound pavement, [*layer / location*]

Item 40006 Subtype 2.5, Unbound pavement, [*layer / location*]

Item 40007 Type 3 Base, Subtype [*subtype*], Unbound pavement, [*location*]

Item 40008 Type 3 Subbase, Subtype [*subtype*], Unbound pavement, [*location*]

Item 40009 Type 4 Base, Subtype [*subtype*], Unbound pavement, [*location*]

Item 40010 Type 4 Subbase, Subtype [*subtype*], Unbound pavement, [*location*]

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Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) winning and processing of materials

c) stockpiling

d) supply, transport and delivery of all material

e) spreading and placement of material

f) supply and incorporation of water

g) compacting and trimming

h) preparation of joints, including removal and disposal of cutback material

i) preparation of surfaces

j) additional work to achieve higher tolerances

k) sampling and compliance testing to demonstrate conformance with the relevant Technical Specifications, and

l) maintenance of the subgrade and/or pavement courses.

Where the use of Intelligent Construction (IC) Rollers is specified in Annexure MRTS05.1, the Contractor shall allow for these costs as part of the relevant unbound pavement payment item.

3 Utilisation of a rejected lot for a reduced level of service

3.1 General

Pre-determined acceptance criteria in the form of payment reductions, as provided in this Specification, may be applied to nonconformances for the properties given in Table 3.1.

Table 3.1 – Properties and limits for acceptance at a reduced level of service

Property	Limit for Acceptance at a Reduced Level of Service
Unbound Pavement Material	Maximum of – a) 5 defects for any individual sample, or b) an average of 3 defects in one lot. (Refer to Clause 3.2.1 for determination of number of defects)
Compaction Standard	2% below the specified limit
Road Roughness (Surface Evenness)	0.7 m/km above the specified limit
Intelligent Construction (IC) Roller Coverage	N/A

For unbound pavement material, compaction standard and IC roller coverage nonconformances, the payment reduction (%) shall apply to the scheduled rate for the entire lot of unbound pavement material represented by the tests, for the total thickness of the layer.

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For road roughness nonconformances, the payment reduction (%) shall apply to the scheduled rate for the quantity of the lightly bound pavement material represented by:

a) the area of the lot represented by the road roughness test results, and

b) the depth of material which is the lesser of:

   i. the full depth of the unbound pavement base course, or

   ii. 150 mm.

Where nonconformances are accepted for more than one of these properties, the total payment reduction (%) to be applied to the scheduled rate shall be determined by adding together the individual payment reduction (%) calculated for each property in accordance with Clauses 3.2.

Unless otherwise approved by the Administrator, a lot shall not be utilised for a reduced level of service if:

a) the actual value of any property or requirement not listed in Table 3.1 has failed to meet the specified limit or requirement

b) the actual value for any property listed in Table 3.1 has exceeded the limit stated in Table 3.1

c) the actual value for any property given in Table 3.1 has exceeded the specified limit (not the limit stated in Table 3.1) for the same property in the immediately preceding lot, or

d) the actual value for any property given in Table 3.1 has exceeded the specified limit (not the limit states in Table 3.1) for the same property in more than three lots of any preceding work.

The pre-determined acceptance criteria set out in this Specification form the basis for lots to be accepted at a reduced level of service.

Where nonconformance fall outside of the limits nominated, the defective works shall be assessed in accordance with the requirements of the Contract. Where appropriate, the Administrator may agree to accept lots outside of the limits nominated. In doing so, the reduction in value shall be determined by the Administrator in accordance with the requirements of Clause 3 of MRS50 *Specific Quality System Requirements*.

3.2 Determination of the reduced value

3.2.1 Unbound pavement material

The following payment reduction (%) will be applied to accepted nonconformances in unbound pavement material.

$$\text{Payment reduction (\%)} = N_{av} \times 3$$

where:

N_{av} = the average number of defects in one lot.

The average number of defects in one lot shall be determined by calculating the total number of individual defects, if any, for each and every sample taken from the lot and dividing the total number of defects for the lot by the number of samples.

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The number of individual defects for each sample shall be calculated in accordance with Table 3.2.1.

Table 3.2.1 – Determination of defect in unbound pavement materials

Property	Magnitude of Incremental Departure Outside the Specified Limits which is Considered as 'One Defect'
Percentage passing: • AS 2.36 mm sieve and greater	For each sieve size - each 2% (absolute, or part thereof)
Percentage passing: • AS 0.425 mm sieve • AS 0.075 mm sieve	For each sieve size - each 1% (absolute, or part thereof)
Fines ratio	Up to 0.05 increase or decrease Each 0.02 (or part thereof) increase or decrease beyond that in 'a)' above
Liquid limit	Each 2% absolute (or part thereof) increase
Linear shrinkage	Each 0.2% absolute (or part thereof) increase
Weighted linear shrinkage	Each 2.5 units (or part thereof) increase

3.2.2 Compaction standard

The following payment reduction (%) will be applied to accepted nonconformances in compaction standard.

$$\text{Payment reduction (\%)} = (C_s - C_a) \times 4$$

where:

C_a = the actual minimum characteristic value of compaction, and

C_s = the specified value of compaction (refer Clause 8.4.3 or MRTS05).

3.2.3 Road roughness (surface evenness)

The following payment reduction (%) will be applied to accepted nonconformances in road roughness.

$$\text{Payment reduction (\%)} = 26.49 \times (R_a - R_s)$$

where:

R_a = the actual road roughness value, and

R_s = the specified road roughness value (refer Clause 8.4.6 of MRTS05).

Calculation of surface roughness should accurately represent the ride quality of the complete pavement. It is generally accepted that the inclusion of other road features within the pavement are likely to reduce ride quality.

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In accordance with the test method adopted, these features are required to be noted during roughness testing. However in accordance with Clause 9.4.9 of MRTS05, the following features are allowed to be excluded from the ride quality assessment:

- roundabouts
- railway lines
- bridge joints, and
- inspection pit covers (for example, drainage manholes).

The Contractor should nominate a methodology and provide calculations on ride quality for the Administrators acceptance, showing how each feature has been excluded from the assessment and the subsequent lot structure.

Under no circumstances should pavement features (including joints) or signalised / unsignalised intersections (other than roundabouts) be excluded from the ride quality assessment without the express agreement of the Administrator.

3.2.4 Intelligent Construction (IC) Roller Coverage

The payment reduction for nonconformances in IC roller coverage shall be in accordance with Table 3.2.4.

Table 3.2.4 – Payment Reduction for Nonconformances in IC Roller Coverage

Coverage	Payment Reduction
80% – 89%	5%
70% – 89%	10%
< 70%	20%

4 Additional payment for a higher standard of surface evenness

4.1 General

Where specifically stated in Clause 1 of Annexure MRS05.1, an additional payment above the scheduled rate will be made if a higher standard of surface evenness is achieved when measured as a reduction in road roughness below the maximum specified limit.

4.2 Payment

The value of any additional payment will be determined as follows:

Additional payment ($) = R x Q x P

where:

R = scheduled rate for the Work Item for the base course

Q = compacted quantity of pavement material in the lot that is eligible for payment (refer Clause 4.3), and

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P = the additional payment factor for a higher standard of surface evenness, calculated as

$$P = \left(\frac{Rs - Ra}{9.4}\right) - 0.02$$

where:

R_a = the actual road roughness value, and

R_s = the specified road roughness value (refer Clause 8.4.6 of MRTS05).

Notwithstanding the above requirements, the maximum value of P shall be 0.04.

4.3 Quantity of pavement to which the additional payment applies

Any additional payment will apply to the quantity of the unbound pavement material represented by:

a) the area of the lot represented by the road roughness test results, and

b) the depth of material which is the lesser of:

   i. the full depth of the unbound pavement base course, or

   ii. 150 mm.

Additional payment shall only apply where all construction compliance test results are conforming in accordance with the requirements of Clause 9 of MRTS05.

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Specification (Measurement)

Transport and Main Roads Specifications
MRS14 Road Furniture

March 2022

Queensland Government

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 2

2.3 Method of measurement 10

2.3.1 Supply of regulatory, warning and hazard signs 10
2.3.2 Installation of regulatory, warning and hazard Signs 10
2.3.3 Supply of direction and information signs 10
2.3.4 Installation of direction and information signs 11
2.3.5 Grids 11

2.4 Project signs 11

2.4.1 Items supplied by the Principal 11
2.4.2 Incidental materials 11
2.4.3 Payment 11

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the demolition and re-erection of and the supply and construction of road edge guide posts, fencing, gates road signs, grids, steel beam guardrail, tensioned wire rope barrier systems, steel traffic barriers and concrete traffic barriers.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications*, MRTS50 *Specific Quality System Requirements* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
50001	Demolition of road furniture, as listed in Clause 3 of Annexure MRTS14.1	lump sum
50002	Removal and salvage of road furniture, as listed in Clause 1.1 of Annexure MRTS14.1	lump sum
50003	Removal and re-erection of road furniture, as listed in Clause 4 of Annexure MRTS14.1	lump sum
Guidance and information systems		
50051	Road edge guide posts	each
50052	Supply of regulatory, warning and hazard sign faces, as listed in Clause 1.3 of Annexure MRS14.1	lump sum
50053	Supply of regulatory, warning and hazard sign faces, [*sign type*]	each
50054	Supply of direction and information sign faces, as listed in Clause 2.3 of Annexure MRS14.1	lump sum
50055	Supply of direction and information sign faces, as listed in Clause 2.3 of Annexure MRS14.1	m²
50056	Installation of regulatory, warning and hazard signs, as listed in Clause 1.3 of Annexure MRS14.1	lump sum
50057	Installation of regulatory, warning and hazard signs, [*number of posts*]	each
50058	Installation of direction and information signs, as listed in Clause 2.3 of Annexure MRS14.1	lump sum
50059	Installation of direction and information signs, [*sign number*]	each
50060	Installation of direction and information signs, [*sign size*]	each
50061	Supply, erection and removal of project signs	lump sum
50062	Supply and install sight board as listed in Clause 1.3 of Annexure MRS14.1	lump sum

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Standard Item No.	Description	Unit of Measurement
Roadside structures		
50151	Grid [*type*]	each
50152	Grid with vermin and dog fencing [*type*]	each
50153	Concrete traffic barrier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]	m
50154	Concrete traffic barrier at wall or pier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]	m
50155	Concrete traffic barrier median terminal, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]	each
50156	Galvanised cover assembly at opening for light pole	each
50157	Galvanised cover assembly at opening for cable pit, number [*pit number* | *type*]	each
50158	Split carriageway concrete traffic barrier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]	m
50159	Precast concrete barrier	m
50160	Steel beam guardrail, w beam	m
50161	Steel beam guardrail, thrie beam	m
50162	Steel beam guardrail, terminal type [*number*]	each
50163	Steel beam guardrail, transition type [*number*]	each
50164	Installation of tensioned wire rope barrier system including all necessary intermediate anchors	m
50165	Tensioned wire rope barrier system terminal anchors	each
50166	Barrier end treatment	each
50167	Fencing, [*height*] mm high, [*type*]	m
50168	Gates, [*height*] mm high, [*width*] mm wide, [*type*]	each
50169	Steel traffic barriers	m
Tactile Ground Surface Indicators (TGSI)		
50201	Supply and install [*discrete* | *integrated*] [*directional* | *warning*] [*material*] TGSI	m²
50202	Removal of existing TGSI	lump sum

2.2 Work Operations

Item 50001 Demolition of road furniture, as listed in Clause 3 of Annexure MRTS14.1

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out excavation where necessary

c) demolishing existing road furniture as listed

d) utilising or disposing of excavated and demolished material, and

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e) backfilling and finishing resulting excavations.

Item 50002 Removal and salvage of road furniture, as listed in Clause 1.1 of Annexure MRTS14.1

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out excavation where necessary

c) careful dismantling and removal of existing road furniture as listed

d) demolition of any agreed non-salvageable part of the existing installation

e) utilising or disposing of excavated and demolished material

f) transporting salvaged material to storage site

g) safe storage of salvaged material at storage site, and

h) backfilling and finishing resulting excavations.

Item 50003 Removal and re-erection of road furniture, as listed in Clause 4 of Annexure MRTS14.1

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out excavation where necessary

c) careful dismantling and removal of existing road furniture as listed

d) demolition of any agreed non-salvageable part of the existing installation

e) utilising or disposing of excavated and demolished material

f) backfilling and finishing resulting excavations

g) safe storage of salvaged material until required for re-erection

h) supply of new materials necessary for re-erection, and

i) re-erection of salvaged material.

Item 50051 Road edge guide posts

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of guide posts

d) application of all coatings

e) affixing delineators, and

f) installation of posts.

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Item 50052 Supply of regulatory, warning and hazard sign faces, as listed in Clause 1.3 of Annexure MRS14.1

Item 50053 Supply of regulatory, warning and hazard sign faces, [*sign type*]

Item 50054 Supply of direction and information sign faces, as listed in Clause 2.3 of Annexure MRS14.1

Item 50055 Supply of direction and information sign faces, as listed in Clause 2.3 of Annexure MRS14.1

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of the sign panels

d) attachment of stiffeners, where applicable

e) application of protective coatings, colour coatings, reflective coatings and messages

f) reference marking of signs, and

g) delivery to the site.

Item 50056 Installation of regulatory, warning and hazard signs, as listed in Clause 1.3 of Annexure MRS14.1

Item 50057 Installation of regulatory, warning and hazard signs, [*number of posts*]

Item 50058 Installation of direction and information signs, as listed in Clause 2.3 of Annexure MRS14.1

Item 50059 Installation of direction and information signs, [*sign number*]

Item 50060 Installation of direction and information signs, [*sign size*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of posts

c) supply of brackets, saddles and fixings

d) supply and fabrication of sign frames, where applicable

e) installation of the posts

f) installation of frames, where applicable, and

g) installation of the sign faces to posts or frames.

Item 50061 Supply, erection and removal of project signs

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials except those materials supplied by the Principal

c) transport of signs and supports

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d) installation of posts

e) installation of the sign faces to posts or frames

f) maintenance of project signs, and

g) removal of project signs and cleaning up.

Item 50062 Supply and install sight board as listed in Clause 1.3 of Annexure MRS 14.1

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials except those materials supplied by the Principal

c) transport of signs and supports

d) installation of posts, and

e) installation of the sign faces to posts or frames.

Item 50151 Grid [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out excavations

c) utilisation or disposal of the excavated material

d) supply of all materials

e) fabrication and galvanising of grid frames

f) construction of concrete abutments

g) backfilling behind abutments

h) construction of concrete slab

i) installation of grid frames

j) construction of grouted stone pitching at abutment wings

k) installation of four guide posts and width marker, where necessary

l) installation of two 2400 mm wide, 1650 mm high fence strainer panels and fencing between strainer panel and guide posts, and

m) reinstatement of any pavement, pavement surfacing, fencing and road furniture.

Item 50152 Grid with vermin and dog fencing [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) carrying out excavations

c) utilisation or disposal of the excavated material

d) supply of all materials

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e) fabrication and galvanising of grid frames

f) construction of concrete abutments and wing walls

g) backfilling behind abutments and wing walls

h) construction of concrete slab

i) installation of grid frames

j) installation of four guide posts and width marker, where necessary

k) installation of 66 metres of 1950 mm high vermin and dog fencing including 10 strainer panels

l) installation of two 2500 mm wide, 1950 mm high gates, and

m) reinstatement of any pavement, pavement surfacing, fencing and road furniture.

Item 50153 Concrete traffic barrier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]

Item 50154 Concrete traffic barrier at wall or pier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]

Item 50155 Concrete traffic barrier median terminal, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of surface

c) supply of all materials

d) installation of electrical conduit and cable pits, where applicable

e) installation of dowels, where applicable

f) installation of steel reinforcing

g) erection of formwork

h) installation of guardrail anchor bolts

i) placement of concrete

j) installation of expansion joint, and

k) installation of delineators.

Item 50156 Galvanised cover assembly at opening for light pole

Item 50157 Galvanised cover assembly at opening for cable pit, number [*pit number* | *type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of cover assembly

d) installation of fixing angles

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e) installation of cement mortar infill over conduit, and

f) installation of cover plates.

Item 50158 Split carriageway concrete traffic barrier, [*type*], [*with* | *without conduit*], [*with* | *without dowels*]

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of surface

c) supply of all materials

d) installation of electrical conduit and cable pits, where applicable

e) installation of dowels, where applicable

f) installation of steel reinforcing

g) extruding or forming and casting of fibre reinforced concrete traffic barrier

h) installation of compressible filler, where required

i) installation of expansion joints and contraction joints, and

j) installation of delineators.

Item 50159 Precast concrete barrier

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of surface

c) supply of all materials

d) supply and transport of precast concrete barrier

e) installation of barrier including permanent connectors as specified, and

f) fill stanchion holes.

Item 50160 Steel beam guardrail, w beam

Item 50161 Steel beam guardrail, thrie beam

Work Operations incorporated in the above items include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of components

d) galvanising of components

e) installation of posts, and

f) erection of guard-rail.

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Item 50162 Steel beam guardrail, terminal type [*number*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of components

d) galvanising of components

e) installation of posts

f) installation of anchor cable assembly

g) erection of guardrail, and

h) supply and installation of TC 1151 signs.

Item 50163 Steel beam guardrail, transition type [*number*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of components

d) galvanising of components

e) installation of connector brackets

f) installation of posts, and

g) erection of guardrail.

Item 50164 Installation of tensioned wire rope barrier system including all necessary intermediate anchors

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) fabrication of all components

d) application of all protective coatings

e) installation of barrier system, and

f) installation of delineators.

Item 50165 Tensioned wire rope barrier system terminal anchors

Work operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of components

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d) application of all protective coatings, and

e) installation of terminal anchor complete.

Item 50166 Barrier end treatment

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of site

c) supply of all materials, and

d) installation of proprietary barrier end treatment.

Item 50167 Fencing, [*height*] mm high, [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) localised clearing

c) supply of all materials

d) installation of posts, pickets and stays

e) running, fixing and straining fencing wire, and

f) installation of chainwire, wire netting and/or welded mesh.

Item 50168 Gates, [*height*] mm high, [*width*] mm wide, [*type*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of all materials

c) fabrication of gates, and

d) installation of the gates.

Item 50169 Steel traffic barriers

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of Site

c) supply of all Materials, and

d) installation of steel traffic barrier system.

Item 50201 Supply and install [*discrete* | *integrated*] [*directional* | *warning*] [*material*] TGSI

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) all activities and materials for the supply and placement of the TGSI in line with the manufacturer's recommendation

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c) preparation of installation location

d) installation of TGSI in accordance with design requirements and manufacturer's recommendation, and

e) quality documentation submitted.

Item 50202 Removal of existing TGSI

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) all work necessary to carefully dismantle and remove the existing TGSI

c) demolition of any agreed non-salvageable part of the existing installation, and

d) disposing of excavated and demolished material.

2.3 Method of measurement

2.3.1 Supply of regulatory, warning and hazard signs

The supply of regulatory, warning and hazard signs shall be measured by either Method A or Method B as stated as Clause 1.1 of Annexure MRS14.1.

Where Method A applies, the supply of all regulatory, warning and hazard signs shall be included in a single Work Item measured as a lump sum. The signs included in the lump sum Work Item shall be as listed in Clause 1.3 of Annexure MRS14.1.

Where Method B applies, the supply of regulatory, warning and hazard signs shall be assigned individual Work Items on the basis of sign type and measured as each sign.

2.3.2 Installation of regulatory, warning and hazard Signs

The installation of regulatory, warning and hazard signs shall be measured by either Method A or Method B as stated in Clause 1.2 of Annexure MRS14.1.

Where Method A applies, the installation of all regulatory, warning and hazard signs shall be included in a single Work Item measured as a lump sum. The signs included in the lump sum Work Item shall be as listed in Clause 1.3 of Annexure MRS14.1.

Where Method B applies, the installation of regulatory, warning and hazard signs be assigned several Work Items on the basis of the number of support posts, and measured as each sign.

2.3.3 Supply of direction and information signs

The supply of direction and information signs shall be measured by either Method A or Method B as stated in Clause 2.1 of Annexure MRS14.1.

Where Method A applies, the supply of all direction and information sign faces shall be included in a single Work Item measured as a lump sum. The signs included in the lump sum Work Item shall be as listed in Clause 2.3 of Annexure MRS14.1.

Where Method B applies, the supply of direction and information sign faces shall be included in a single Work Item and measured as square metres of sign face. The signs included in the lump sum work Item shall be as listed in Clause 2.2 of Annexure MRS14.1.

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2.3.4 Installation of direction and information signs

The installation of direction and information signs shall be measured by either Method A, Method B or Method C as stated in Clause 2.2 of Annexure MRS14.1.

Where Method A applies, the installation of all direction and information signs shall be included in a single Work Item measured as a lump sum. The signs included in the lump sum Work Item shall be as listed in Clause 2.3 of Annexure MRS14.1.

Where Method B applies, the installation of direction and information signs shall be assigned individual Work Items on the basis of the sign number, and measured as each sign.

Where Method C applies, the installation of direction and information signs shall be assigned several Work Items on the basis of sign size, and measured as each sign.

2.3.5 Grids

Specific Item Numbers for grids used in the Schedule of Rates shall be deemed to represent the work associated with the particular reference locations stated in Clause 3 of Annexure MRS14.1.

2.4 Project signs

2.4.1 Items supplied by the Principal

Any project signs and support posts which are to be supplied by the Principal are shown on the Principal Supplied Material List (Form C7827). Such items will be supplied free on truck at the location listed on the Principal Supplied Material List.

2.4.2 Incidental materials

All materials not specifically included on the Principal Supplied Material List, but necessary for the assembly, erection and maintenance of Principal-supplied items, including saddles, fixings or other erection hardware, shall be supplied by the Contractor.

2.4.3 Payment

Sixty percent of any lump sum item included in the Schedule of Rates for project signs shall be paid following the erection of the signs. The balance of such lump sum item shall be paid following dismantling, reinstating footing holes and returning posts, and signs to the nominated location.

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Specification (Measurement)

Transport and Main Roads Specifications MRS16 Landscape and Revegetation Works

July 2017

Queensland Government

FOI 26-292 - Document 21

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 3

2.2.1 Landscape and Revegetation – Sampling and Testing 3
2.2.2 Landscape and Revegetation – Site Won Materials 5
2.2.3 Landscape and Revegetation – Imported Materials 6
2.2.4 Landscape and Revegetation – Weed Control 7
2.2.5 Landscape and Revegetation – Ground Preparation 8
2.2.6 Landscape and Revegetation – Seeding 9
2.2.7 Landscape and Revegetation – Turfing 11
2.2.8 Landscape and Revegetation – Planting 12
2.2.9 Landscape and Revegetation – Hardscape 12
2.2.10 Landscape and Revegetation – Establishment and Monitoring 13

3 Payment 13

3.1 Management of stockpiles of site and imported topsoil 13

3.2 Installation of topsoil 13

3.3 Seed supply proposal and seed harvesting proposal 14

3.4 Plant supply proposal and plant harvesting proposal 14

3.5 Non-potable water management plan and associated testing 14

3.6 Replacing installed works damaged by herbicide overspray 14

3.7 Replacing installed works damaged by construction works 14

3.8 Payment for Establishment Period 14

3.9 Payment for Establishment Period Watering 14

3.10 Payment for Monitoring Period 15

3.11 Payment for Monitoring Period Watering 15

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1 Introduction

This Specification applies to the construction of landscape and revegetation treatments in roadworks. This Specification shall be read in conjunction with MRS01 *Introduction to Specifications*, and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Landscape and Revegetation – Sampling and Testing		
50601	Preparation of a Soil Management Plan – Construction – Form A	lump sum
50602P	Topsoil sampling and testing – Form C (Provisional Quantity)	set of tests
50606P	Manufactured site topsoil sampling and testing – Form D (Provisional Quantity)	set of tests
50610P	Subsoil sampling and testing – Form E (Provisional Quantity)	set of tests
50614P	Drainage basin soil sampling and testing – Form F (Provisional Quantity)	set of tests
Landscape and Revegetation – Site Won Materials		
50651P	Manufactured site topsoil (Provisional Quantity, if ordered)	m^3
50655P	Manufactured site mulch (Provisional Quantity, if ordered)	m^3
50659	Harvesting of site seed material [*description*]	lump sum
50660	Harvesting of site plant material [*description*]	lump sum
Landscape and Revegetation – Imported Materials		
50701P	Amelioration agent – agricultural lime, dolomite and / or gypsum (Provisional Quantity, if ordered) [agricultural lime, agricultural dolomite, agricultural gypsum]	tonne
50705P	Amelioration agent – organic soil conditioner (Provisional Quantity, if ordered)	m^3
50709P	Imported topsoil (Provisional Quantity, if ordered)	m^3
50713P	Imported mulch (Provisional Quantity, if ordered) [*description*]	m^3
Landscape and Revegetation – Weed Control		
50751P	Application of knock-down herbicide (Provisional Quantity)	m^2
50755P	Manual removal of weeds (Provisional Quantity, if ordered) [*description*]	lump sum
50759P	Application of target herbicide (Provisional Quantity, if ordered) [*description*]	m^2

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Standard Item No.	Description	Unit of Measurement
Landscape and Revegetation – Ground Preparation		
50801	Installation of ameliorants to subsoil	m²
50802	Ripping, cultivation, roughening	m²
50803	Installation of topsoil [*depth*]	m²
Landscape and Revegetation – Seeding		
50851	Seed Mix – Grassland Mix [*mix name*]	kg
50852	Seed Mix – Woodland / Forest Mix [*mix name*]	kg
50853	Installation of drill seeding [*mix name*]	m²
50854	Installation of broadcast seeding [*mix name*]	m²
50855	Installation of hydromulch – standard [*mix name*]	m²
50856	Installation of hydromulch - bonded fibre matrix [*mix name*]	m²
50858	Installation of hydro-compost [*mix name*]	m²
50859	Installation of straw mulching [*mix name*]	m²
50860	Installation of organics blanket [*mix name*]	m²
50861	Installation of seeded organic mesh and emulsion [*mix name*]	m²
Landscape and Revegetation Works - Turfing		
50901	Installation of turf [*description*]	m²
Landscape and Revegetation Works - Planting		
50951	Installation of planting [*description*]	container
Landscape and Revegetation - Hardscape		
51001	Installation of concrete planting bed edging	m
51002	Installation of irrigation system	lump sum
Landscape and Revegetation – Establishment and Monitoring		
51051	Establishment Period	lump sum
51052P	Establishment Period Watering (Provisional Quantity)	lump sum
51056	Monitoring Period [*duration*]	lump sum
51057P	Monitoring Period Watering (Provisional Quantity)	lump sum

Standard Work Items common to all landscape and revegetation treatments (seeding, turfing and planting) should be nominated in the Schedule of Rates:

50601	Preparation of a Soil Management Plan – Construction – Form A
50602P	Topsoil sampling and testing – Form C (Provisional Quantity)
50606P	Manufactured site topsoil sampling and testing – Form D (Provisional Quantity)
50610P	Subsoil sampling and testing – Form E (Provisional Quantity)
50751P	Application of knock-down herbicide (Provisional Quantity)

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50701P	Amelioration agent – agricultural lime, dolomite and / or gypsum (Provisional Quantity, if ordered)
50705P	Amelioration agent – organic soil conditioner (Provisional Quantity, if ordered)
50651P	Manufactured site topsoil (Provisional Quantity, if ordered)
50709P	Imported topsoil (Provisional Quantity, if ordered)
50801	Installation of amelioration agents to subsoil
50802	Ripping, cultivation, roughening
50803	Installation of topsoil
51051	Establishment Period
51052P	Establishment Period Watering (Provisional Quantity)
51056	Monitoring Period
51057P	Monitoring Period Watering (Provisional Quantity)

2.2 Work Operations

2.2.1 Landscape and Revegetation – Sampling and Testing

Item 50601 Preparation of a Soil Management Plan – Construction – Form A

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) preparation and updating of the Soil Management Plan - Construction in accordance with Clause 5.2.1 of MRTS16 *Landscape and Revegetation Works*.

Item 50602P Topsoil sampling and testing – Form C (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) sampling in accordance with Clause 8.1.2.1 of MRTS16 *Landscape and Revegetation Works*

c) testing in accordance with Clause 8.1.2.2 of MRTS16 *Landscape and Revegetation Works*

d) completion of *Form C – Topsoil Testing*

e) analysis of test results and determination of recommendations, and

f) preparation of *Form B – Soil Assessment Report*.

A quantity allowance should be based on the minimum required testing frequency of two tests per 500 m^3 of topsoil.

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Item 50606P Manufactured site topsoil sampling and testing – Form D (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) sampling in accordance with Clause 8.1.2.1 of MRTS16 *Landscape and Revegetation Works*

c) testing in accordance with Clause 8.1.2.2 of MRTS16 *Landscape and Revegetation Works*

d) completion of *Form D – Manufactured Site Topsoil Compliance Testing*

e) analysis of test results and determination of recommendations, and

f) preparation of *Form B – Soil Assessment Report.*

A quantity allowance should be based on the minimum required testing frequency of two tests per 500 m^3 of stockpiled stripped site topsoil.

Item 50610P Subsoil sampling and testing – Form E (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) sampling in accordance with Clause 8.1.1.1 of MRTS16 *Landscape and Revegetation Works*

c) testing in accordance with Clause 8.1.1.2 of MRTS16 *Landscape and Revegetation Works*

d) completion of *Form E – Subsoil Testing*

e) analysis of test results and determination of recommendations, and

f) preparation of *Form B – Soil Assessment Report.*

A quantity allowance should be based on two tests per 500 m length of roadway.

A higher quantity allowance should be considered on sites with large and / or multiple hills, ridges, cuts / fill batters and water courses.

A lower quantity allowance should be considered on sites with a consistently flat, landform.

Item 50614P Drainage basin soil sampling and testing – Form F (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) sampling in accordance with Clause 8.1.1.1 of MRTS16 *Landscape and Revegetation Works*

c) testing in accordance with Clause 8.1.1.2 of MRTS16 *Landscape and Revegetation Works*

d) completion of *Form F – Drainage Basin Soil Testing*

e) analysis of test results and determination of recommendations, and

f) preparation of *Form B – Soil Assessment Report.*

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A quantity allowance should be based on one test per drainage basin to be vegetated.

2.2.2 Landscape and Revegetation – Site Won Materials

Item 50651P Manufactured site topsoil (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) amelioration and screening stockpiled site topsoil in accordance with Clause 8.2.1 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for stripping, stockpiling, sampling and testing, and supply of amelioration agents is included under separate Standard Work Items.

Where it is intended site won topsoil is to be used, ensure Standard Work Item 32003P Stripping of topsoil (Provisional Quantity as directed) is scheduled.

When Standard Work Item 50651P Manufactured site topsoil (Provisional Quantity, if ordered) is scheduled, the following interdependent Standard Work Items should be nominated in the Schedule of Rates:

a) testing:

50602P	Topsoil sampling and testing – Form C (Provisional Quantity)
50606P	Manufactured site topsoil sampling and testing – Form D (Provisional Quantity)

b) amelioration agents:

50701P	Amelioration agent – agricultural lime, dolomite and / or gypsum (Provisional Quantity, if ordered)
50705P	Amelioration agent – organic soil conditioner (Provisional Quantity, if ordered)

Item 50655P Manufactured site mulch (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) manufacture and stockpiling in accordance with Clause 8.2.2 of MRTS16 *Landscape and Revegetation Works*.

Where vegetation exists on site and it is intended to process for use as mulch in permanent landscape works or temporary erosion and sediment control works, ensure MRTS04 *General Earthworks* Annexure specifies the retention of adequate quantities of suitable material.

Material may be used for planting areas or for erosion and sediment control.

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Item 50659 Harvesting of site seed material [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) obtaining permits, where required in accordance with Clause 5.3.2 of MRTS16 *Landscape and Revegetation Works*, supply of all materials

c) preparation of a Seed Harvesting Proposal in accordance with Clause 5.3.2 of MRTS16 *Landscape and Revegetation Works*, and

d) activities in accordance with the Seed Harvesting Proposal and Clause 8.2.3.1 of MRTS16 Landscape and Revegetation Works.

Item 50660 Harvesting of site plant material [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) obtaining permits, where required in accordance with Clause 5.3.4 of MRTS16 *Landscape and Revegetation Works*, supply of all materials

c) preparation of a Plant Harvesting Proposal in accordance with Clause 5.3.4 of MRTS16 *Landscape and Revegetation Works*, and

d) activities in accordance with the Plant Harvesting Proposal and Clause 8.2.3.2 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for planting site harvested plant material is included under Standard Work Item 50951.

2.2.3 Landscape and Revegetation – Imported Materials

Item 50701P Amelioration agent – agricultural lime, dolomite and / or gypsum (Provisional Quantity, if ordered) [*agricultural lime, agricultural dolomite, agricultural gypsum*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and storage of amelioration agents:

   i. agricultural lime, and / or

   ii. agricultural dolomite, and / or

   iii. agricultural gypsum.

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A quantity allowance for the supply of amelioration agents (lime, dolomite, gypsum) should be:

- Subsoil
  - 1.5 kg of chemical amelioration agent per m^2 of areas to be treated with a vegetation treatment (1.5 kg / m^2)
- Topsoil
  - 5 kg of chemical amelioration agent per m^3 of stripped site topsoil (5 kg / m^3)

The actual type and quantity of amelioration agent to be applied is determined through sampling and testing the subsoil and topsoil.

Item 50705P Amelioration agent – organic soil conditioner (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and storage of organic soil conditioner.

A quantity allowance for the supply of organic soil conditioner to ameliorate topsoils should be:

- 0.1 m^3 of organic soil conditioner per m^3 of stripped site topsoil (0.1 m^3 / m^3).

The actual quantity of amelioration agent to be applied is determined through sampling and testing the topsoil.

Item 50709P Imported topsoil (Provisional Quantity, if ordered)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and storage of imported topsoil.

Item 50713P Imported mulch (Provisional Quantity, if ordered) [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) supply and storage of imported mulch.

2.2.4 Landscape and Revegetation – Weed Control

Item 50751P Application of knock-down herbicide (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) obtaining permits, where required in accordance with Clause 8.3 of MRTS16 *Landscape and Revegetation Works*, and

c) handling and application of knock-down herbicide as part of ground preparation in accordance with Clause 8.3 of MRTS16 *Landscape and Revegetation Works*.

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A quantity allowance should be based on 10% of the total area of vegetation treatments.

This quantity allowance generally relates to treatment at the edge of disturbed areas beyond the cut and fill batters. Newly constructed cut and fill batters are typically weed free.

Biosecurity weeds are managed under MRS51 *Environmental Management*.

Item 50755P Manual removal of weeds (Provisional Quantity, if ordered) [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) manual removal and disposal of weeds as part of ground preparation in accordance with Clause 8.3 of MRTS16 *Landscape and Revegetation Works*.

Item 50759P Application of target herbicide (Provisional Quantity, if ordered) [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) obtaining permits, where required in accordance with Clause 8.3 of MRTS16 *Landscape and Revegetation Works*, and

c) handling and application of specific target herbicide as part of ground preparation in accordance with Clause 8.3 of MRTS16 *Landscape and Revegetation Works*.

2.2.5 Landscape and Revegetation – Ground Preparation

Item 50801 Installation of ameliorants to subsoil

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) installation of amelioration agent on subsoil prior to ground preparation in accordance with Clause 8.4.1.1 of MRTS16 *Landscape and Revegetation Works*.

Item 50802 Ripping, cultivation, roughening

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) ripping and cultivation of compacted subsoil areas ≤ 1:4, in accordance with Clause 8.4.1.2 of MRTS16 *Landscape and Revegetation Works*

c) cultivation of subsoil in areas ≤ 1:4, in accordance with Clause 8.4.1.3 of MRTS16 *Landscape and Revegetation Works*, and

d) roughening of subsoil in areas > 1:4, in accordance with Clause 8.4.1.4 of MRTS16 *Landscape and Revegetation Works*.

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Item 50803 Installation of topsoil [*depth*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) installation of topsoil in accordance with Clause 8.4.2.1 of MRTS16 *Landscape and Revegetation Works*.

2.2.6 Landscape and Revegetation – Seeding

Item 50851 Seed Mix – Grassland Mix [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of a Seed Supply Proposal in accordance with Clause 5.3.1 of MRTS16 *Landscape and Revegetation Works*

c) supply of seed mix in accordance with Clause 7.4.9 and Clause 7.4.9.1 of MRTS16 *Landscape and Revegetation Works*, and

d) activities in accordance with the Seed Supply Proposal

Item 50852 Seed Mix – Woodland / Forest Mix [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of a Seed Supply Proposal in accordance with Clause 5.3.1 of MRTS16 *Landscape and Revegetation Works*

c) supply of seed mix in accordance with Clause 7.4.9 and Clause 7.4.9.2 of MRTS16 *Landscape and Revegetation Works*, and

d) activities in accordance with the Seed Supply Proposal.

Item 50853 Installation of drill seeding [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) installation in accordance with Clause 8.5.1.1 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

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Item 50854 Installation of broadcast seeding [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) installation in accordance with Clause 8.5.1.2 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

Item 50855 Installation of hydromulch – standard [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 of MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.3 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

Item 50856 Installation of hydromulch - bonded fibre matrix [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 of MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.4 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

Item 50858 Installation of hydro-compost [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 of MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.5 of MRTS16 *Landscape and Revegetation Works*.

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Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

Item 50859 Installation of straw mulching [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 or MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.6 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

Item 50860 Installation of organics blanket [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 of MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.7 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents), ground preparation (installation of amelioration agents to subsoil and ripping, cultivation, roughening), and supply of the seed mix is included under separate Standard Work Items.

Item 50861 Installation of seeded organic mesh and emulsion [*mix name*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) installation of a sample area in accordance with Clause 8.5.1 of MRTS16 *Landscape and Revegetation Works*, and

c) installation in accordance with Clause 8.5.1.8 of MRTS16 *Landscape and Revegetation Works.*

Payment Note: Payment for supply of materials (amelioration agents, topsoil), ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), and supply of the seed mix is included under separate Standard Work Items.

2.2.7 Landscape and Revegetation – Turfing

Item 50901 Installation of turf [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

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b) installation in accordance with Clause 8.5.2 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil) and ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), is included under separate Standard Work Items.

2.2.8 Landscape and Revegetation – Planting

Item 50951 Installation of planting [*description*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of a Plant Supply Proposal in accordance with Clause 5.3.3 of MRTS16 *Landscape and Revegetation Works*

c) activities in accordance with the Plant Supply Proposal

d) installation of planting containers < 25 L in accordance with Clause 8.5.3.1 or MRTS16 *Landscape and Revegetation Works*, and

e) installation of planting containers ≥ 25 L in accordance with Clause 8.5.3.2 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for supply of materials (amelioration agents, topsoil, mulch) and ground preparation (installation of amelioration agents to subsoil, ripping, cultivation, roughening and installation of topsoil), is included under separate Standard Work Items.

2.2.9 Landscape and Revegetation – Hardscape

Item 51001 Installation of concrete planting bed edging

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) installation in accordance with Clause 8.6.1 of MRTS16 *Landscape and Revegetation Works*.

Item 51002 Installation of irrigation system

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) design and documentation of the irrigation system in accordance with Clause 8.6.2.1 of MRTS16 *Landscape and Revegetation Works*

c) installation and commissioning in accordance with Clause 8.6.2.2 of MRTS16 *Landscape and Revegetation Works*

d) documentation and warranties in accordance with Clause 8.6.2.3 of MRTS16 *Landscape and Revegetation Works*, and

e) training the Principal's nominated representatives in the setup and operation of the system.

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FOI 26-292 - Document 21

2.2.10 Landscape and Revegetation – Establishment and Monitoring

Item 51051 Establishment Period

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) establishment period in accordance with Clause 9.1 of MRTS16 *Landscape and Revegetation Works*, and

c) establishment period operations in accordance with Clause 9.1.1 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for watering is included under Standard Work Item 51052P.

Item 51052P Establishment Period Watering (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) watering in accordance with Clause 9.1.1.1 of MRTS16 *Landscape and Revegetation Works*.

Item 51056 Monitoring Period [*duration*]

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) monitoring period in accordance with Clause 9.2 or MRTS16 *Landscape and Revegetation Works*, and

c) monitoring period operations in accordance with Clause 9.2.1 of MRTS16 *Landscape and Revegetation Works*.

Payment Note: Payment for watering is included under Standard Work Item 51057P.

Item 51057P Monitoring Period Watering (Provisional Quantity)

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) watering in accordance with Clause 9.2.1.1 of MRTS16 *Landscape and Revegetation Works*.

3 Payment

3.1 Management of stockpiles of site and imported topsoil

Payment for the management of stockpiles of site topsoil and imported topsoil is included under the Standard Work Item 32003P Stripping of Topsoil (Provisional Quantity, as directed) – MRTS04.

3.2 Installation of topsoil

Where topsoil has been installed and subsequently disturbed by the Contractor, the topsoil shall be restored to the specified depths and profiles at the Contractor's cost.

No additional payment shall be made for the corrective actions required to topsoil due to delay in the installation of vegetation treatments.

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3.3 Seed supply proposal and seed harvesting proposal

No separate payment shall be made for the preparation of proposals.

Payment for the preparation of proposals is included under the relevant Work Item.

3.4 Plant supply proposal and plant harvesting proposal

No separate payment shall be made for the preparation of proposals.

Payment for the preparation of proposals is included under the relevant Work Item.

3.5 Non-potable water management plan and associated testing

No separate payment shall be made for the preparation of the management plan or associated testing.

Payment for the preparation of the management plan and associated testing is included under the relevant Work Item.

3.6 Replacing installed works damaged by herbicide overspray

Where vegetation treatments are poisoned due to overspray with herbicides, the Contractor shall reinstall the area in accordance with this Specification.

No additional payment shall be made for replacement work for works damaged by herbicide overspray.

3.7 Replacing installed works damaged by construction works

Where landscape works are damaged by construction works, the Contractor shall reinstall the area in accordance with this Specification.

No additional payment shall be made for replacement work for works damaged by construction works.

3.8 Payment for Establishment Period

Provided the Contractor is fulfilling all their obligations, payment for Standard Work Item 51051 shall be:

a) the first two payments shall each comprise 40% of the tendered amount, and

b) the balance of monies owed to the Contractor for Standard Work Item 51051 is payable following the completion of the Establishment Period and issue of the Certificate of Completion of the Establishment Period for all Lots.

3.9 Payment for Establishment Period Watering

Provided the Contractor is fulfilling all their obligations, payment for Standard Work Item 51052P shall be:

a) the first two payments shall each comprise 40% of the tendered amount, and

b) the balance of monies owed to the Contractor for Work Item 51052P is payable following the completion of the Establishment Period and issue of the Certificate of Completion of the Establishment Period for all Lots.

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3.10 Payment for Monitoring Period

Provided that the Contractor is fulfilling all their obligations, payment for Work Item 51056 shall be as follows:

a) monthly pro-rata payments of the tendered amount until the total payments comprise 90% of the tendered amount, and

b) the balance of monies owed to the Contractor for Work Item 51056 is payable following the issue of the Certificate of Completion of the Monitoring Period.

3.11 Payment for Monitoring Period Watering

Provided that the Contractor is fulfilling all their obligations, payment for Work Item 51057P shall be as follows:

a) monthly pro-rata payments of the tendered amount until the total payments comprise 90% of the tendered amount, and

b) the balance of monies owed to the Contractor for Work Item 51057P is payable following the issue of the Certificate of Completion of the Monitoring Period.

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Specification (Measurement)

Transport and Main Roads Specifications MRS28 Contractor's Site Facilities and Camp

November 2019

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Contents

1 Introduction 1

2 Measurement of Work 1

2.1 Standard Work Items 1

2.2 Work Operations 1

2.3 Rate of payment for Site establishment and disestablishment and/or Camp 2

2.3.1 General 2

2.3.2 Establishment of Contractor's Site Facilities and/or Camp 2

2.3.3 Operation and maintenance of Contractor's Site Facilities and / or Camp 2

2.3.4 Disestablishment of Contractor's Site Facilities and / or Camp 3

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to establishment, maintenance and disestablishment of the Contractor's site facilities and establishment, operation, maintenance and disestablishment of the Contractor's camp, where required.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications*, MRS51 *Environmental Management* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of Work

2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS01 *Introduction to Specifications*, the Standard Work Items incorporated in this Specification are listed in Table 2.1.

Where either of these Standard Work Items is not included in the Schedule of Rates for the Contract, the Work Operations associated with that Work Item shall be deemed to be included in the other Work Items included in the Contract.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Contractor's Site Facilities and Camp		
20101	Contractor's site facilities	lump sum
20102	Contractor's camp	lump sum

2.2 Work Operations

Item 20101 Contractor's site facilities

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and transport of all personnel, plant, equipment and materials including buildings and structures, other than materials required for the construction of the Works or those covered by Item 20102, to and from the Site

c) hire or purchase of the Site for the Contractor's site facilities

d) preparation of the Site for the Contractor's Site facilities

e) all labour, plant, materials and hire associated with the establishment, maintenance and disestablishment of the Contractor's site facilities, including connection, operation and disconnection of communications, power, water, sewerage, garbage disposal and similar services except those covered by Item 20102 if this item is included in the Schedule of Rates for the Contract

f) obtaining all necessary licenses and permits under relevant legislation

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g) removal of all facilities upon completion of the Contract, and

h) cleaning up the Site following removal of all items.

Item 20102 Contractor's camp

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply and transport of all personnel, plant, equipment and materials including buildings and structures, other than materials required for the construction of the Works and those covered by Item 20101, to and from the Site

c) hire or purchase of the camp site, as relevant

d) preparation of the camp Site

e) all labour, plant, materials and hire associated with the establishment, operation and maintenance and disestablishment of a camp, including connection, operation and disconnection of communications, power, water, sewerage, garbage disposal and similar services

f) payment of wages for camp attendant(s), cook(s) and other staff employed for the operation of the camp

g) obtaining all necessary licenses and permits under relevant legislation

h) removal of all facilities upon completion of the Contract, and

i) cleaning up of the camp Site.

2.3 Rate of payment for Site establishment and disestablishment and/or Camp

2.3.1 General

Payment for Items 20101 and 20102 will be made by the Principal in three stages in accordance with the provisions of this clause.

2.3.2 Establishment of Contractor's Site Facilities and/or Camp

Provided that the Contractor is fulfilling all its obligations under the Contract and establishment has been completed, the Contractor shall be paid in the first Payment Certificate 25% of the lump sum amount for the item.

2.3.3 Operation and maintenance of Contractor's Site Facilities and / or Camp

Provided that the Contractor is fulfilling all its obligations under the Contract, each Payment Certificate shall include a percentage of the lump sum amount for the item until a total of 90% of the lump sum amount has been paid.

The cumulative percentage entitlement (including previous payments) shall be calculated as follows:

$$E = 25\% + 0.65 * P$$

E = aggregate percentage entitlement

P = Total achieved progress percentage (including approved Extension of Time)

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2.3.4 Disestablishment of Contractor's Site Facilities and / or Camp

The balance of the lump sum amount of 10% for the item will be paid in the Payment Certificate following the date of Practical Completion provided that the Contractor fulfils all its obligations under the Contract for Disestablishment.

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Specification (Measurement)

Transport and Main Roads Specifications MRS51 Environmental Management

July 2020

Queensland Government

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 2

2.3 Standard Work Items and Work Operations 2

2.3.1 Administration of Environmental Management Plan (Construction) 2

2.3.2 EMP(C) Specific Element Requirements 3

2.4 Payment 9

2.4.1 Weekly Environmental Inspections 9

2.4.2 Contaminated Sites 9

2.4.3 Environmental Nuisance and Environmental Harm 9

2.4.4 Payment for installation, maintenance and removal of Management Measures 9

2.4.5 Work Item 20208P Water Quality Monitoring (Provisional Quantity) 9

2.4.6 Work Item 20222P Condition Surveys (Provisional Quantity) 9

2.4.7 Work Item 20234P Air Quality Monitoring (Provisional Quantity, if ordered) 9

2.4.8 Work Item 20254P Complaint-related Noise Assessment and Management (Provisional Quantity, if ordered) 9

2.4.9 Work Item 20258P Complaint-related Vibration Assessment and Management (Provisional Quantity, if ordered) 9

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1 Introduction

This Specification describes Environmental and Cultural Heritage management requirements applicable to all activities relating to the Contract.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
20201	Weekly Environmental Inspections	lump sum
20202	Develop Environmental Management Plan (Construction)	lump sum
20203	Implement Environmental Management Plan (Construction)	lump sum
20204	Monthly Environmental Reporting	lump sum
20205	Environmental Records Management	lump sum
20206	Approvals	lump sum
20208P	Water Quality Monitoring (Provisional Quantity)	each
20211	Cultural Heritage Management	lump sum
20212	Noise Assessment Report	lump sum
20213	Develop Noise Management Plan	lump sum
20217	Implement Noise Management Plan	lump sum
20221	Vibration Assessment Report	lump sum
20222P	Condition Surveys (Provisional Quantity)	each
20226	Develop Vibration Management Plan	lump sum
20230	Implement Vibration Management Plan	lump sum
20234P	Air Quality Monitoring (Provisional Quantity, if ordered)	each
20238P	Management of Contaminated Sites, (Provisional Quantity, if ordered)	m^3
20242P	Fauna Management (Provisional Item, if ordered)	lump sum
20246	Biosecurity Matter Control	lump sum
20250P	Investigation of Contaminated Sites (Provisional Item, if ordered)	lump sum
20254P	Complaint-related Noise Assessment and Management (Provisional Quantity, if ordered)	each
20258P	Complaint-related Vibration Assessment and Management (Provisional Quantity, if ordered)	each

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2.2 Work Operations

Work Operations included in the Standard Work Items are specified in the relevant clause adjacent to each Standard Work Item listed in Table 2.1. All work items listed in this Specification are inclusive of Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*.

2.3 Standard Work Items and Work Operations

2.3.1 Administration of Environmental Management Plan (Construction)

The Standard Work Item applicable to Weekly Environmental Inspections is:

Item 20201 Weekly Environmental Inspections

Work Operations incorporated into the above item include the following:

a) Weekly Site Inspections to:

   i. verifying Management Measures prescribed in the EMP(C) are present, functional and adequate

   ii. observe the Site for Environmental Harm

   iii. identify maintenance requirements for implemented Management Measures, and

   iv. verifying preparedness for adverse weather conditions where weather forecast.

b) Undertake corrective actions to rectify identified omissions or non-conformances, and

c) Management and communication of Weekly Site Inspection results and records to all relevant parties.

> Adequate refers to whether the management measures employed on Site are reasonable and practicable to manage the risk of Environmental Harm occurring as a result of the Works under the Contract.

Item 20202 Develop Environmental Management Plan (Construction)

Work Operations incorporated in this item include the following:

a) site investigations and research in the development of the Environmental Management Plan (Construction)

b) documentation, submission and amendment (where necessary) of the Environmental Management Plan (Construction)

c) preparation of Noise section of the EMP(C) for low noise risk contracts

d) preparation of the vibration section of the EMP(C) for low vibration risk contracts, and

e) preparation of Monitoring plans for each environmental element under Clause 8 of the Specification where required.

Item 20203 Implement Environmental Management Plan (Construction)

Work Operations incorporated in this item include the following:

a) review and amend Environmental Management Plan (Construction)

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b) environmental inductions of staff

c) undertake all Management Measures described within the Environmental Management Plan (Construction), unless covered under a separate work item

d) maintain all Management Measures described within the Environmental Management Plan (Construction), and

e) removal of Management Measures prior to Practical Completion or as agreed with Administrator.

Item 20204 Monthly Environmental Reporting

Work Operations incorporated into the above item include the following:

a) preparation and submission to Administrator of the Contractor's Monthly Environmental Report in accordance with Clause 7.6.

Item 20205 Environmental Records Management

Work Operations incorporated into the above item include the following:

a) record and collate environmental records as required by the Specification and Approvals, and

b) submit to Administrator at practical completion the Contractor's Environmental records as per Clause 7.8 of MRTS51.

Item 20206 Approvals

Work Operations incorporated in this item include the following:

a) research, prepare, and consult Administrating Authorities regarding applications to obtain licences, permits and approvals

b) reimbursement of fees charged by Administering Authorities and other expenses associated with acquiring Approvals, and

c) notifications for applicable Self-Assessable Codes.

NOTE: Costs incurred in complying with the condition of Approvals are incurred in Work Item 20203.

2.3.2 EMP(C) Specific Element Requirements

Item 20208P Water Quality Monitoring (Provisional Quantity)

Work Operations incorporated in the above item include the following:

a) Undertake water quality monitoring as outlined in Clause 8.2.3 of MRTS51 and Clause 2 of Annexure MRTS51.1 based on water quality risk of the Contract:

   a) Low risk – visual monitoring.

   b) Medium and high risk including:

      i. undertake field water quality monitoring and sampling

      ii. testing in NATA laboratory (if required)

      iii. recording, reporting and analysing water quality monitoring results

      iv. undertake Monitoring in accordance with Clause 8.2.3 of MRTS51 of water discharged to land where applicable, and

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v. investigation of any results that exceed criteria outlined in Table 8.2.2 of MRTS51.

Item 20211 Cultural Heritage Management

Work Operations incorporated in this item include the following:

a) notifying the Administrator within agreed timeframes (unless otherwise agreed, seven days) prior to working in known areas of cultural heritage significance

b) carrying out site inductions for cultural heritage personnel

c) scheduling and co-ordinating cultural heritage management activities

d) unexpected finds management

e) cultural heritage induction of staff and contractors

f) compliance with cultural heritage approval conditions in accordance with Clause 1 of Annexure MRTS51.1

g) implementing contract specific cultural heritage requirements as outlined in Clause 3 of Annexure MRTS51.1, and

h) removal of Management Measures prior to Practical Completion or as agreed with Administrator.

For contracts where noise is identified as medium or high risk, the Noise Work Items are now Standard Work Items (that is they are not Provisional Items). These work items can be omitted from Contracts where noise is categorised as low risk. Noise is then managed under Work Items 20202 and 20203.

For Contracts where it is not certain whether a Noise Assessment Report or Noise Management Plan is required, these items (20212, 20213 and 20217) can be made Provisional on a contract-specific basis in accordance with MRS01 Clause 2.1.7.

Item 20212 Noise Assessment Report

Work Operations incorporated in this item include the following:

a) undertake noise assessment of potential impacts from construction prior to commencement of Works as outlined in Clause 8.5.2.2 of MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 - *Construction Noise and Vibration* and Clause 4.3 of Annexure MRTS51.1

b) preparation of Noise Assessment Report in accordance with Clause 8.5.2.2 MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 - *Construction Noise and Vibration*

c) review and acceptance of the Noise Assessment Report by a Registered Professional Engineer of Queensland with suitable qualifications and experience, and

d) submit to the Contract Administrator and obtain deemed suitability prior to commencing noise generating activities on Site.

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Item 20213 Develop Noise Management Plan

Applicable to medium and high-level noise risk contracts.

Work Operations incorporated in this item include the following:

a) development of a standalone Noise Management Plan prior to commencement of Works as outlined in Clause 4.3 of Annexure MRTS51.1 and in accordance with the *Transport Noise Management Code of Practice*: Volume 2 – *Construction Noise and Vibration*

b) submit to the Contract Administrator and obtain deemed suitability prior to commencing noise generating activities on Site, and

c) update the Noise Management Plan where required.

NOTE: Costs incurred in implementing the Noise Management Plan are incurred in Work Item 20217.

Item 20217 Implement Noise Management Plan

Work Operations incorporated in this item include the following:

a) Implementation of the management measures prescribed in the Contractor's Noise Management Plan.

b) Where required by the Noise Management Plan, the Contractor shall:

i. undertake planned and trial noise monitoring during the Work under the Contract in accordance with Clause 8.5.3 MRTS51 and Section 4.3 of the *Transport Noise Management Code of Practice*: Volume 2

ii. prepare Construction Stage Noise Assessment Report (for the trial and planned monitoring), and

iii. review and acceptance of the Vibration Assessment Report by a suitable Registered Professional Engineer of Queensland.

For contracts where vibration is identified as medium or high risk, the vibration work items are now Standard Work Items (that is they are not Provisional Items). These work items can be omitted from Contracts where vibration is categorised as low risk and vibration is managed under work items 20202 and 20203.

For Contracts where it is not certain whether a Vibration Assessment Report or Vibration Management Plan is required, these items (20221, 20222P and 20226) can be made provision on a contract-specific basis in accordance with MRS01 Clause 2.1.7.

Item 20222P Condition Surveys (Provisional Quantity)

Work Operations incorporated in this item include the following:

a) prior to commencing Work under the Contract, condition survey of premises, buildings and structures listed in Clause 5.5 of Annexure MRTS51.1

b) post construction condition survey undertaken, signed by RPEQ and submitted to Administrator

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c) building contents investigation where required as per *Transport Noise Management Code of Practice*: Volume 2 - *Construction Noise and Vibration*, and

d) undertake other investigations such as building contents investigations and infrastructure, services and utility investigations as determined in the Vibration Assessment Report.

Item 20221 Vibration Assessment Report

Work Operations incorporated in this item include the following:

a) undertake vibration assessment of potential impacts from construction prior to commencement of Works as outlined in Clause 8.6.2.3 of MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 - *Construction Noise and Vibration*

b) preparation of Vibration Assessment Report in in accordance with Clause 8.6.2.3 of MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 - *Construction Noise and Vibration*

c) review and acceptance of the Vibration Assessment Report by a Registered Professional Engineer of Queensland with suitable qualifications and experience, and

d) submit to the Contract Administrator and obtain deemed suitability prior to commencing noise generating activities on Site.

Item 20226 Develop Vibration Management Plan

Applicable to medium and high vibration risk contracts.

Work Operations incorporated in this item include the following:

a) development of a standalone Vibration Management Plan prior to commencement of Works as outlined in Clause 5.3 of Annexure MRTS51.1 and in accordance with *Transport Noise Management Code of Practice*: Volume 2 - Construction Noise and Vibration, and

b) submit to the Contract Administrator and obtain deemed suitability prior to commencing noise generating activities on Site, and

c) update the Vibration Management Plan where required.

NOTE: Costs incurred in implementing the Vibration Management Plan are incurred in Work Item 20230.

Item 20230 Implement Vibration Management Plan

Work Operations incorporated in this item include the following:

a) Implementation of the management measures prescribed in the Contractor's Vibration Management Plan.

b) Where required by the Vibration Management Plan, the Contractor shall:

   i. undertake planned or trial vibration monitoring during the Work under the Contract in accordance with Clause 8.6.3 of MRTS51 and Section 4.3 of the *Transport Noise Management Code of Practice*: Volume 2

   ii. prepare a Construction Stage Vibration Assessment Report (for the planned and/or trial monitoring), and

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iii. have the report reviewed and accepted by a suitable Registered Professional Engineer of Queensland.

Item 20234P Air Quality Monitoring (Provisional Quantity, if ordered)

Work Operations incorporated in this item include the following:

a) air quality monitoring as outlined in Clause 6.3 of Annexure MRTS51.1

b) where required by Clause 6.3 of Annexure MRTS51.1, air quality impact assessment in accordance with Chapter 6 of the Transport and Main Roads' *Road Traffic Air Quality Management Manual*, and

c) air quality monitoring in response to complaints received during Works under the Contract, completed in accordance with the Transport and Main Roads' *Road Traffic Air Quality Management Manual*.

Item 20238P Management of Contaminated Sites (Provisional Quantity, if ordered)

Work Operations incorporated in this item include the following:

a) preparation of Contaminated Site Management Plan where required in Clause 7.3 of Annexure MRTS51.1

b) consultation and negotiation with administrating authority to obtain endorsement from administrating authority for the Contaminated Site Management Plan in accordance with *Environmental Protect Act* 1994

c) treatment and/or encapsulation and/or removal and disposal of known contaminated material and backfilling in accordance with the approved Contaminated Site Management Plan

d) documentation of treatment, transport and/or disposal of the contaminated material in accordance with local and state government regulations, and

e) documentation, consultation and application to administrating authority to have contaminated site removed from the Environmental Management Register or Contaminated Land Register.

Item 20242P Fauna Management (Provisional Item, if ordered)

Work Operations incorporated in this item include the following:

a) pre-clearing inspections, monitoring, recovery and relocation of fauna undertaken by a spotter-catcher

b) management, removal, relocation or destruction of animal breeding place(s) undertaken by a spotter-catcher under an applicable Species Management Program

c) installation of temporary fauna fencing to design standard specified in Clause 8.3 of Annexure MRTS51.1, and

d) installation, maintenance, decommissioning and removal of temporary fauna fencing, and

e) fauna monitoring as stipulated in Clause 8.4 of Annexure MRTS51.1.

Item 20246 Biosecurity Matter Control

Work Operations incorporated in this item include the following:

a) management and control of biosecurity matters within the Site

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b) installation of clean down facility and clean down of vehicles and plant

c) management of biosecurity matter carrier movements across biosecurity management zones applicable to the contract, and

d) reporting of biosecurity matters and treatments.

Item 20250P Investigation of Contaminated Sites (Provisional Item, if ordered)

Work Operations incorporated in this item include the following:

a) in accordance with the requirements of Clause 7.3 of Annexure MRTS51.1, preparation of Contaminated Site Investigation Plan by a suitably qualified person in accordance with legislative requirements

b) implementation of the Contaminated Site Investigation Plan including laboratory analysis costs

c) where required, engagement of an independent auditor.

Item 20254P Complaint-related Noise Assessment and Management (Provisional Quantity, if ordered)

Work Operations incorporated in this item include the following:

a) manage and respond to noise complaints in accordance with Clause 7.3 of MRTS51, the Contractor's Noise & Vibration Management Plan, and *Transport Noise Management Code of Practice*: Volume 2 - Construction Noise and Vibration including undertaking Complaint Assessment

b) undertake complaint-related noise assessment during the Work under the Contract in accordance with Clause 7.3 of MRTS51 and Section 4.3 *Transport Noise Management Code of Practice*: Volume 2 - Construction Noise and Vibration, and

c) reporting of complaint-related noise assessments undertaken during Works under the Contract in accordance with Clause 7.3 of MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 -Construction Noise and Vibration.

Item 20258P Complaint-related Vibration Assessment and Management (Provisional Quantity, if ordered)

Work Operations incorporated in this item include the following:

a) manage and respond to vibration complaints in accordance with Clause 7.3 of MRTS51, the Contractor's Noise & Vibration Management Plan, and *Transport Noise Management Code of Practice*: Volume 2 - Construction Noise and Vibration including undertaking Complaint Assessment

b) undertake complaint-related vibration assessment during the Work under the Contract in accordance with Clause 7.3 of MRTS51 and Section 4.3 *Transport Noise Management Code of Practice*: Volume 2 - Construction Noise and Vibration, and

c) reporting of complaint-related vibration assessments undertaken during Works under the Contract in accordance with Clause 7.3 of MRTS51 and *Transport Noise Management Code of Practice*: Volume 2 -Construction Noise and Vibration.

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2.4 Payment

2.4.1 Weekly Environmental Inspections

Where an environmental or cultural heritage inspection demonstrates a non-conformance with the EMP(C), the Contractor shall be responsible for costs of further investigation and all associated remediation costs.

2.4.2 Contaminated Sites

Item 20238P relates to requirements to undertake remediation and management in accordance with *Environmental Protection Act* 1994. Investigation and management of additional contaminated sites discovered during the construction shall be undertaken as a variation to the contract unless the Contractor is found to be the cause of the contamination.

2.4.3 Environmental Nuisance and Environmental Harm

The Contractor shall pay all costs associated with remediation of Environmental Nuisance and Environmental Harm that results from Works under the Contract. This may include contamination resulting from spills and leaks of chemicals and fuels, ground disturbance and/or vegetation clearing beyond the Limits of Clearing, offsets payable due to Environmental Nuisance or Environmental Harm that occurred.

2.4.4 Payment for installation, maintenance and removal of Management Measures

Unless otherwise stated or negotiated, payment for Items 20203, 20217 and 20230 related to implementation of Management Plans shall be:

a) 80% of tendered amount on installation of prescribed Management Measures to appropriate standard, and

b) the balance of monies owed to the Contractor (20%) is payable on removal of the prescribed Management Measure and making good the area.

2.4.5 Work Item 20208P Water Quality Monitoring (Provisional Quantity)

Each is defined as each water quality location defined in the Contractor's Environmental Management Plan (Construction).

2.4.6 Work Item 20222P Condition Surveys (Provisional Quantity)

Each is defined as an individual premises, building or structure.

2.4.7 Work Item 20234P Air Quality Monitoring (Provisional Quantity, if ordered)

Each is defined as each air quality monitoring location defined in the Contractors Air Quality Monitoring Plan.

2.4.8 Work Item 20254P Complaint-related Noise Assessment and Management (Provisional Quantity, if ordered)

Each is defined as each compliant triggered-noise assessment location.

2.4.9 Work Item 20258P Complaint-related Vibration Assessment and Management (Provisional Quantity, if ordered)

Each is defined as each compliant triggered vibration assessment location.

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Specification (Measurement)

Transport and Main Roads Specifications MRS52 Erosion and Sediment Control

July 2018

Queensland Government

FOI 26-292 - Document 21

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Contents

1 Introduction 1

2 Measurement of work 1

2.1 Standard Work Items 1

2.2 Work Operations 3

3 Payment 11

3.1 Regular internal inspections and audits 11

3.2 Payment for installation, maintenance and removal of erosion and sediment control devices 11

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1 Introduction

This Specification applies to the provision of temporary sediment and erosion control for all activities relating to the Contract.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications*, MRS50 *Specific Quality System Requirements* and other specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

The cost and description of work items for permanent structures and vegetation are found in other Specifications such as:

- MRS03 *Drainage, Retaining Structures and Protective Treatments* applies to drainage controls that become permanent including sheet or strip filter drains.
- MRS16 *Landscape and Revegetation Works* applies to permanent revegetation (including specifications for cover crop to be included within permanent seed mixes).
- MRS27 *Geotextiles (Separation and Filtration)* applies to geotextiles that are part of permanent works.

Contractors are encouraged to install permanent controls as early as possible within the project.

2 Measurement of work

2.1 Standard Work Items

In accordance with the provisions of Clause 2.1.3 of MRS01 Introduction to Specifications, the Standard Work Items incorporated in this Specification are listed in Table 2.1

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
General		
20501	Erosion and Sediment Control Plan/s	lump sum
20502	Erosion and Sediment Control Devices (Non-Itemised)	lump sum
20503	Independent Verification and Auditing	lump sum
Drainage controls		
20551P	Catch drains [*material*] (Provisional Quantity)	m
20555P	Flow diversion bank / berm [*material*] (Provisional Quantity)	m
20559P	Batter chutes [*material*] (Provisional Quantity)	m
20563P	Check dams [*material*] (Provisional Quantity)	each
Erosion controls		
20601P	Geobinders (Provisional Quantity)	m²
20605P	Erosion Control Blanket (Provisional Quantity)	m²
20609P	Temporary Cover Crop (Provisional Quantity)	m²
20613P	Mulch (Provisional Quantity)	m²

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Standard Item No.	Description	Unit of Measurement
	Sediment controls	
20651P	Sediment Basin <100 m³ (Provisional Quantity)	each
20655P	Sediment Basin 100 – 200 m³ (Provisional Quantity)	each
20659P	Sediment Basin 200 – 500 m³ (Provisional Quantity)	each
20663P	Sediment Basin 500 – 1000 m³ (Provisional Quantity)	each
20667P	Sediment Basin 1000 – 2000 m³ (Provisional Quantity)	each
20671P	Sediment Basin 2000 – 5000 m³ (Provisional Quantity)	each
20675P	Sediment Basin >5000 m³ (Provisional Quantity)	each
20679P	Kerb Inlet Protection (Provisional Quantity)	each
20683P	Drop Inlet Protection (Provisional Quantity)	each
20687P	Silt / Sediment Fence (Provisional Quantity)	m
20691P	Site Exit Point – Shaker Ramp [*description*] (Provisional Quantity)	each
20695P	Site Exit Point – Wheel Wash (Provisional Quantity)	each
	In stream	
20751P	In-Stream Silt Curtain (Provisional Quantity)	m

The Contractor is responsible for designing, installing and maintaining temporary Erosion and Sediment Controls (ESC).

The purpose of development of a schedule of rates for erosion and sediment control items is to ensure that sufficient allowance has been made by the department in the cost estimate that ESC has been appropriately costed by all tenderers, and a level playing field is set during tender phase.

The following Work Items should be nominated in the Schedule of Rates for all construction projects:

20501 Erosion and Sediment Control Plan

20502 Erosion and Sediment Control Devices (Non-Itemised).

All high risk sites should also include:

20503 Independent Verification and Auditing, and

20502 Water quality monitoring [*location*].

It is recommended that the schedule of rates contain the standard work items for the main erosion and sediment control items (that is controls which will equate for a large majority of the costs). All other environmental work items missing from the schedule of rates are deemed to be included within Work Item 20502.

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For large projects this approach will involve inclusion of Work Items for all sediment basins plus potentially catch drains and batter chutes. It is recommended that on large size projects specific items such as sediment fences are not included as line items as the effort involved in measuring thousands of metres of fence is not warranted for the cost of the item.

For smaller projects (< 2500 m² disturbed) where controls are less, the major items may be flow diversion berm, check dams and sediment fence, and hence sediment fences would be specified as a line item.

2.2 Work Operations

Item 20501 Erosion and Sediment Control Plan/s

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*, and

b) preparation of the Erosion and Sediment Control Plans in accordance with Clause 6 of MRTS52

c) design of devices not in accordance with the *IECA Manual* Book 6 – Standard Drawing/s

d) review of plan/s by an independent appropriately qualified person where required and in accordance with Clause 6.3 of MRTS52

e) submission of plan/s to Superintendent and amendment (where necessary)

f) updating, submitting and amending the Erosion and Sediment Control Plan as needed throughout project.

Item 20502 Erosion and Sediment Control Devices (Non-Itemised)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) install, maintain and remove erosion and sediment control devices(other than those specified under other work items) as required by the Contractor's Erosion and Sediment Control Plan through Site investigations and in accordance with manufacturer's specifications and relevant *IECA Manual* Book 6 - Standard Drawing/s.

Item 20503 Independent Verification and Auditing

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications* and

b) auditing of erosion and sediment controls by independent appropriately qualified person including preparation and submission of report in accordance with Clause 9.1.2 of MRTS52.

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Drainage Controls

Standard work items have been specified for the main categories of temporary drainage controls.

The material used for controls will generally be a decision for the Contractor within the ESC plan. However in certain circumstances the Principal may elect to specify the particular material that control is to be constructed with in the tender schedule using square brackets [x] for example:

20551.01P Catch Drains [*grass lined*]

20551.02P Catch Drains [*rock lined*]

Standard work item numbers have not been created for items that are likely to be permanent, for example, cellular confinement systems. If needed these should be created using a 90000 series number within the tender schedule.

Item 20551P Catch drains [*material*] (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) design of catch drain in accordance with *IECA Manual* Book 4 - Design Fact Sheets

c) supplying all materials

d) clearing the location of the catch drain, including removal and disposal of trees, roots, stumps and other debris

e) grading or excavating the drain to the required slope and disposal of unsuitable material

f) constructing all works in accordance with *IECA Manual* Book 6 - Standard Drawings, Catch Drains (CD-01) and other relevant drawings that is Catch Drains – Grass Lined (CD-03), Catch Drains – Geotextile Lined (CD-04), Catch Drains – Rock Lined (CD-05). Type C drains (triangular V drains) not to be used on dispersive soils

g) where required, installing an energy dissipater or spreader at the outlet of the drainage line

h) maintenance of the drainage line, including but not limited to the removal and disposal of sediment deposition and repair / replacement of lining, grass or turf

i) removal of catch drain and all materials, including grading the area and smooth it out in preparation for stabilisation works.

Item 20555P Flow diversion bank / berm [*material*] (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) design of diversion bank or berm in accordance with *IECA Manual* Book 4 - Design Fact Sheets

c) supplying all materials

d) clearing the location of the diversion bank or berm including removal and disposal of trees, roots, stumps and other debris

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e) grading or excavating the bank to the required slope, and disposal of unsuitable material or placement and compaction of material (compost, cold mix and etc.)

f) constructing all work in accordance with relevant *IECA Manual* Book 6 that is, Standard Drawings Diversion Bank (CD-01) or Control Berms (CB-01)

g) where required, installing an energy dissipater or spreader at the outlet of the diversion drain

h) maintenance of the diversion bank/berm, including but not limited to the removal and disposal of sediment deposition and repair/replacement of bank and berm

i) removal of all materials including deposited sediment and dispose of in a suitable manner that will not cause an erosion, pollution or environmental hazard

j) grading the area and smoothing it out in preparation for stabilisation works.

Item 20559P Batter chutes [*material*] (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) design of batter chute in accordance with *IECA Manual* Book 4 - Design Fact Sheets

c) supplying all materials

d) excavation of subgrade for batter chutes, including diversion into chute and disposal of unsuitable material

e) compaction of the soil to at least one metre each side of the chute to minimise erosion

f) constructing all work accordance with relevant *IECA Manual* Book 6 - Standard Drawings ie. Chutes – General (CH-01, CH-02), Chutes - Synthetic Linings (CH-03), Chutes – Rock Linings (CH-06)

g) install appropriate outlet structure (energy dissipater) such as rock outlet pad at the base of the chute

h) maintenance of the batter chute, including but not limited to removal/disposal of deposited sediment and replacement of damaged lining

i) removal of all materials including deposited sediment and disposal in a suitable manner that will not cause an erosion, pollution or environmental hazard.

Item 20563P Check dams [*material*] (Provisional Quantity)

> The department's preference is for rock check dams. Sandbags may be used in circumstances where rock is not available. Fibre rolls and coir logs must be appropriately secured.

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) Design / use of check dams in accordance with *IECA Manual* Book 4 - Design Fact Sheets

c) supplying all materials

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d) constructing all works in accordance with relevant *IECA Manual* Book 6 - Standard Drawings i.e., Rock Check Dams (RCD-01), Fibre rolls (FR-01) and/or Coir Logs (Log-01)

e) maintenance of the rock check dam, including but not limited to the removal and disposal of sediment deposition, repair / replacement of check dam material

f) removal of all materials including deposited sediment and disposal in a suitable manner that will not cause an erosion, pollution or environmental hazard.

Erosion controls

The following work items relate to methods to minimise erosion from surfaces from raindrop / wind impacts (that is, erosion not relating to concentrated flow). It is the responsibility of the Contractor to determine which erosion controls shall be used where and to allow appropriate quantities.

Item 20601P Geobinders (Provisional Quantity)

In this specification the term geobinders refers to non-toxic materials substance sprayed on soil to prevent soil erosion. This includes bonded mulch tackifiers, polyacylamide, and other soil binders.

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) application in accordance with manufacturers recommendations, including rate and application method.

Item 20605P Erosion Control Blanket (Provisional Quantity)

Erosion Control Blankets means products placed over batter to reduce impact of raindrop and low velocity flow. They may include jute blankets geotextile coir blankets or other. Products with synthetic netting may not be used where native animals are likely to traverse – for example riparian zones or adjacent to sensitive environmental areas.

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) select in accordance with Erosion Control Blanket - *IECA Manual* Book 4 - Design Fact Sheets

c) supplying all materials

d) excavation of toe trench to secure the leading edges of the blanket

e) placement of blanket on batters or disturbed areas

f) installation of pins and backfilling of toe trench following the placement of blanket

g) constructing all works in accordance with relevant *IECA Manual* Book 6 –Standard Drawings e.g. Erosion Control Blankets (ECB-01)

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h) maintenance of placed blanket, including repining, removing built up sediment and repair to sections damaged by construction work

i) where works require, removal and replacement to facilitate works beneath the erosion control matting

j) removal and disposal of material when no longer required.

Item 20609P Temporary Cover Crop (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials (refer to MRTS16 *Landscape and Revegetation Works* for mix design)

c) mechanical application of temporary cover crop

d) watering of temporary cover crop to achieve a minimum 70% strike rate

e) where the temporary cover crop fails to achieve a 70% strike rate within 20 days of seeding, or prior to the shutdown of the site (whichever comes first), the Contractor shall reapply a temporary cover crop

f) repair of soil scours and rill erosion.

Item 20613P Mulch (Provisional Quantity)

This Work Item is principally for the use of vegetation mulch produced on site, it may however also refer to use of gravel, rock or other material as mulch layer to prevent erosion.

The production and stockpiling of mulch is covered by Standard Work Item 50655P (MRS16).

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) place mulch evenly over area at thickness, or in berms depending on the function of the mulch control

c) maintenance of the mulch layer including re-placement of displaced mulch and removal of captured sediment

d) repair of soil scours and rill erosion

e) treatment of area for weeds that appear due to use of mulch containing weed seed

f) where required, removal and disposal of mulch control

g) where required, stabilisation/rehabilitation of any disturbed areas created by application of removal of mulch.

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Sediment controls

Commonly used sediment controls are itemised below.

Grassed buffer zones or filter strips are not itemised as a work item as these are likely to be permanent vegetation installed early and hence should be costed using Work Item 50901 designated in MRS16. Some sediment control devices (for example, check dams) have been included previously under drainage control and are not duplicated here.

Items 20651P to 20675P Sediment Basins (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) selection and design of sediment basins in accordance with *IECA Manual* Book 4 - Design Fact Sheets and Clause 10 of MRTS52

c) supplying all materials

d) carry out excavations

e) utilising or disposing of excavated materials, including management of excavated material required for backfilling of the basin at the completion of the works

f) compaction of basin walls and foundations

g) stabilisation of basin walls, being topsoil and hydromulch or similar

h) construction of sediment basin including spillways, inlets and outlets

i) jar test or similar to determine appropriate flocculation rate

j) flocculation of sediment basin

k) testing of treated water prior to release

l) mechanical or passive release and management of all stormwater captured in the sediment basin

m) appropriate removal and disposal of any captured sediment

n) removal and disposal of basin and associated works when no longer required

o) reinstatement of existing ground profile

p) topsoil and revegetate to match adjacent landscape treatment.

Item 20679P Kerb Inlet Protection (Provisional Quantity)

Care must be taken when using kerb inlet protection to ensure water does not extend into portion of the road in use. Should only be specified for minor works on existing roadways.

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) supplying all materials

c) installation and maintenance all works in accordance with relevant *IECA Manual* Book 4 - Kerb Inlet Sediment Trap Design Fact Sheet

d) maintenance of controls including removal of accumulated sediment

e) removal, storage and disposal of material when no longer required.

Item 20683P Drop Inlet Protection (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) installation and maintenance all works in accordance with relevant *IECA Manual* - Design Fact Sheet for example, Excavated drop inlet protection, Fabric Wrap Drop inlet protection, Rock and aggregate drop inlet protection

d) maintenance of inlet protection controls including removal of accumulated sediment

e) removal of material when no longer required.

Item 20687P Silt / Sediment Fence (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) carry out excavations

d) utilising or disposing of excavated materials

e) erecting sediment fence with support system

f) constructing all work in accordance with Standard Drawing Sediment Fence (SF - 01 and SF - 02) from *IECA Manual* Book 6.

g) regular maintenance of sediment fence including the appropriate disposal of accumulated sediment

h) removing of material when no longer required

i) where required, stabilisation of any areas disturbed during removal of the sediment fence.

Item 20691P Site Exit Point – Shaker Ramp [*description*] (Provisional Quantity)

Site exit points may either be vibration grids or rock grids. The department's preference is for vibration grids. Where Principal wishes to specify type this can be specified within [*description*].

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

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c) constructing all works in accordance with relevant *IECA Manual Book 6* - Standard Drawings e.g. Construction Exit Rock Pad (Exit 01, Exit 02) or Construction Exit Vibration Grid (Exit-04, Exit 05)

d) maintenance of site exit point including removal of sediment from below vibration grid, turnover of rock pad, addition of new rock or extension of rock pad when exit no longer effective

e) removal of any sediment from adjacent sealed road

f) removal, storage and disposal of material when no longer required.

Item 20695P Site Exit Point – Wheel Wash (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) constructing all works in accordance with relevant *IECA Manual* Book 6 –Standard Drawings e.g. Construction Exit Wash Bay (Exit 06)

d) maintenance of site exit point including addition of new rock or extension of rock pad when exit no longer effective, discharge of dirty water to appropriate device, refilling as necessary

e) removal of any sediment from adjacent sealed road

f) removal, storage and disposal of material when no longer required

g) inspect locations of water and sediment discharge for declared weeds and treat as necessary.

In stream controls

Coffer dams and other major in stream controls have not been developed as line items as these are considered part of general construction methodology.

Item 20751P In-Stream Silt Curtain (Provisional Quantity)

Work Operations shall include but not be limited to:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supplying all materials

c) installation of the in-stream silt curtain in accordance with the manufacturer's specifications and Standard Drawings Floating Silt Curtain (FSC-01, FSC-02 and FSC-03) from *IECA Manual* Book 6.

d) maintenance of silt curtain will include repair or replacement of damaged silt curtain

e) prior to the removal of the silt curtain, the Contractor must ensure the contained water meets the project requirements for water discharge. Where required, the Contractor may need to chemically treat or pump contaminated water prior to removing the silt curtain.

f) removal of silt curtain.

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Other

This work item should be included in all tender Specifications but should never be the only erosion and sediment control work item specified.

Where contractor proposes to use device not covered by standard work items it shall be incorporated into the item. The main purpose of this item is to ease the administrative burden to contractor and principal for the minor costs and devices.

3 Payment

3.1 Regular internal inspections and audits

Regular inspection of devices and audits of site compliance with ESCP and legislative requirements by the Contractor are considered part of Contractors quality plan and/or environmental management system. No additional payment made for these items.

Where an environmental investigation demonstrates a non-conformance with the EMP(C), the Contractor shall be responsible for investigation costs and all associated amelioration costs.

3.2 Payment for installation, maintenance and removal of erosion and sediment control devices

Unless otherwise stated or negotiated, payment for all other erosion and sediment control devices shall be:

a) 80% of tendered amount on installation of the device to appropriate standard

b) the balance of monies owed to the Contractor (20%) is payable on removal of device and making good the area.

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Specification (Measurement)

Transport and Main Roads Specifications MRS58 Subgrade Reinforcement using Pavement Geosynthetics

July 2017

Queensland Government

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Contents

1 Introduction 1

2 Measurement of Work 1

2.1 Standard Work Items 1

2.2 Work Operations 1

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FOI 26-292 - Document 21

1 Introduction

This Specification applies to the physical, material and construction requirements for Subgrade Reinforcement using Pavement Geosynthetics.

This Specification shall be read in conjunction with MRS01 *Introduction to Specifications* and other Specifications as appropriate.

This Specification forms part of the Transport and Main Roads Specifications Manual.

2 Measurement of Work

2.1 Standard Work Items

In accordance with the provisions of Clause 2 of MRS01 *Introduction to Specifications*, the Standard Work Items covered by this Specification are listed in Table 2.1. The measured quantity for payment shall be the area installed excluding laps and joints.

Table 2.1 – Standard Work Items

Standard Item No.	Description	Unit of Measurement
Subgrade Reinforcement using Pavement Geosynthetics		
43501	Supply of Pavement Geosynthetic Material [*geogrid* | *geocomposite* | *woven geotextile]*	m²
43502	Transport of Pavement Geosynthetic Material supplied by the Principal [*geogrid* | *geocomposite* | *woven geotextile*], from [*supply location*]	m²
43503	Placement of Pavement Geosynthetic Material [*geogrid* | *geocomposite* | *woven geotextile*]	m²

2.2 Work Operations

Item 43501 Supply of Pavement Geosynthetic Material [*geogrid* | *geocomposite* | *woven geotextile]*

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) supply of Pavement Geosynthetic Material *(Geogrid/Geocomposite/Woven Geotextile)* including allowance for lapping and joining

c) loading, hauling, delivery and storage out of direct sunlight of Pavement geosynthetic material and such that water does not enter the geosynthetic material(s), and

d) associated material compliance testing.

Item 43502 Transport of Pavement Geosynthetic Material supplied by the Principal [*geogrid* | *geocomposite* | *woven geotextile],* from [*supply location]*

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

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b) transport of material from the point of supply by the Principal to the Site or other location as set out in the Principal Supplied Material List (Form C6827), and

c) storage of material out of direct sunlight.

Item 43503 Placement of Pavement Geosynthetic Material [*geogrid* | *geocomposite* | *woven geotextile]*

Work Operations incorporated in the above item include:

a) Work Operations listed in Clause 2.1.5 of MRS01 *Introduction to Specifications*

b) preparation of the surface prior to placement of pavement geosynthetic material

c) dispensing and placement of pavement geosynthetic material including lapping and joining

d) rolling of geosynthetic material, and

e) removal and disposal of excess material from the Site.

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