DEPARTMENT OF TRANSPORT AND COMMUNICATIONS
FEDERAL OFFICE OF ROAD SAFETY
DOCUMENT RETRIEVAL INFORMATION

Report No.	Date	Pages	ISBN	ISSN
CR 75	JULY 1988	88	0 642 51179 9	OR = 0158-3077 CR = 0810-770X

Title and Subtitle

AN ANALYSIS OF THE RELATIONSHIP BETWEEN ROAD IMPROVEMENTS AND ROAD SAFETY

Author(s)

Nelson English, Loxton & Andrews Pty Ltd

Performing Organisation (Name and Address)
Nelson English, Loxton & Andrews Pty Ltd
231 Glenhuntly Road
ELSTERNWICK VIC 3185

Sponsor (Name and Address)
Federal Office of Road Safety
GPO Box 594
CANBERRA ACT 2601

Available from (Name and Address)
Federal Office of Road Safety
GPO Box 594
CANBERRA ACT 2601

Abstract

The report identifies aggregations of crashes by location (black spot), or by other common characteristics. Further work involved correlating crash occurrence with road parameters such as alignment, roughness etc, on a selected sample of road and examined the feasibility of automating the procedures nationwide.

Keywords

NOTES:

(1) FORS Research reports are disseminated in the interests of information exchange.
(2) The views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth Government.
(3) The Federal Office of Road Safety publishes two series of research report
    (a) reports generated as a result of research done within the FORS are published in the OR series;
    (b) reports of research conducted by other organisations on behalf of the FORS are published in the CR series.

AN ANALYSIS OF THE RELATIONSHIP BETWEEN ROAD IMPROVEMENTS AND ROAD SAFETY

Prepared for:

FEDERAL OFFICE OF ROAD SAFETY

Prepared by:

NELSON ENGLISH, LOXTON & ANDREWS PTY LTD
231 GLENHUNTLY ROAD
ELSTERNWICK VIC 3185

Telephone: (03) 528 1644

With assistance with:
COMMED ASSOCIATES

July 1988

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS

L I S T   O F   T A B L E S

Page No.

L I S T   O F   F I G U R E S

Page No.

EXECUTIVE SUMMARY

INTRODUCTION

In 1987 the Federal Office of Road Safety (FORS) commenced a review of the relative costs and road safety benefits accruing from road improvement measures identified from Australian and International research. Nelson English, Loxton & Andrews Pty. Ltd. (NELA) was commissioned to perform two parts of the project, herein referred to as Phase A and Phase B, with the objectives, respectively to:

- o identify aggregations of crashes by location (Black Spots), or by other common characteristics, at an appropriate level of detail; and
- o correlate crash occurrence with road parameters such as alignment, roughness etc, and examine the feasibility of automating the procedures nationwide.

PHASE A

DATA RETRIEVAL FROM STATE AUTHORITIES

Formal requests were made to all State Road Authorities for data relating to crash records and data bases, including:

(i) tabulation of crashes by severity (fatal, injury and property damage only), Local Government Area (LGA), and road number of all Functional Class 1, 2 and 3 roads in the three year period 1984-1986;

(ii) map showing the locations of Class 1, 2 and 3 roads; and

(iii) carriageway length of Class 1, 2 and 3 roads by road number and LGA.

Following discussions with the respective authorities, and upon receipt of the requested data items, it became apparent that all States have different reporting formats, although the content of information is consistent. In particular:

- o all States except Queensland and Tasmania were able to provide crash statistics by road, LGA, crash severity and year;
- o all States locate crashes;
  - identifying the distance from either closest intersection, start of road, end of road, or LGA boundary for mid-block crashes; and
  - road names identifying the intersection for intersection crashes;
- o precision of crash locations varied from State to State depending upon the police reporting practices; and
- o only Western Australia had a Functional Class data field incorporated into their crash data base.

REVIEW AND ANALYSIS OF CRASH RECORDS

Road links with poorest safety record were identified from manual observation of the tabulation of crashes by severity, LGA and road number of all Functional Class 1, 2 and 3 roads in the three year period 1984-1986.

The links were ranked according to the absolute number of fatal and injury crashes during the study period. This provided a candidate list for the subsequent case study.

SELECTION OF ROAD LINKS FOR CASE STUDY

Criteria for choice of links for case study included:

- o availability of crash location records, and compatibility with road inventory reference system;
- o availability of crash data by Functional Class;
- o availability of road inventory data; and
- o absence of significant changes to road parameters arising from road construction carried out during the study period.

On this basis, two road links were selected for case study:

- o the Pacific Highway in Coffs Harbour, New South Wales; and
- o the Eyre Highway in Dundas Shire, Western Australia.

PHASE B

The analysis of relationships between road inventory parameters and crash occurrence was performed in three steps, namely:

(i) a graphical, or visual check of crash concentrations;

(ii) comparison of frequency of crashes with the proportions of corresponding road characteristics, including statistical considerations; and

(iii) a multiple regression analysis of the contribution of selected road parameters to crash occurrence.

GRAPHICAL REPRESENTATION

A computer program was used to process both crash and road inventory data to produce an output representing the road as a continuous, sealed vertical line including marked locations of crashes and corresponding road inventory data for each section of the road. This graphical representation allows immediate location of black spots if they occur.

The output is shown in Appendix D.

CRASH AND ROAD CHARACTERISTIC FREQUENCY

This analysis compared the observed number of crashes with the expected number of crashes for road sections characterised by particular parameters. For example, the number of crashes observed on road sections for which some proportion of the horizontal alignment was curved was compared to the number of crashes which would be expected to occur on these sections purely by chance.

An appropriate test then determined whether or not the difference between the observed and expected crashes was statistically significant. A statistically significant difference provides evidence that the parameter in question (in this example, horizontal curvature) contributes to crashes.

The results of this analysis indicated that road alignment and road grade are associated with higher-than-expected crash occurrences.

LINEAR REGRESSION ANALYSIS

This analysis attempted to uncover an algebraic relationship between crash occurrence and road parameters by regressing the probability of observed crashes for each road section on four independent variables, namely;

- minimum horizontal curve in section;
- minimum vertical curve in section;
- NAASRA roughness meter reading; and
- maximum grade in section.

Although the regression failed to establish an acceptable linear relationship between the dependent and independent variables, it is possible that a relationship of some other form exists.

This analysis was completed for the Eyre Highway. It was not possible, within the resources of this study, to perform the Phase B analysis on the Pacific Highway in Coffs Harbour. This was because the permanent reference point system used to define sections in the road inventory was not used in the NSW crash records, rendering automatic cross referencing of crash occurrence and road parameters impossible.

CONCLUSION

The principal conclusions arising from the study are as follows:

(i) the varying formats of crash data bases between States mitigate against automation of the procedures for identifying crash black spots;

(ii) correlation between crash occurrence and road parameters is hampered by two major sources of error, namely;

   - error in the precise location of crashes due to reporting procedures particular to each State;

- error in identifying changes in road parameters due to the sectionised road inventory.

Note that the use of a continuous road inventory would eliminate the latter source of error;

(iii) correlation between crash occurrence and road parameters would also be facilitated through the use of a standardised reference system for locating crashes, which was compatible with the permanent reference system used in the road inventory - this would enable the correlation procedures to be automated nationwide.

1.0 INTRODUCTION

1.1 BACKGROUND

In 1987 the Federal Office of Road Safety (FORS) commenced a review of the relative costs and road safety benefits accruing from road improvement measures identified from Australian and international research.

The overall objectives of this research as set down by the FORS were to:

- identify, review and from a cost-effectiveness viewpoint, rank known measures for modifying the road and road environment to enhance road safety;

- identify areas of future research into improvements of the road environment that are likely to enhance road safety.

Nelson English, Loxton & Andrews Pty. Ltd. (NELA) was commissioned to perform two parts of the project, herein referred to as Phase A and Phase B.

1.2 OBJECTIVES

The objective of Phase A was to identify aggregations of crashes by location (Black Spots), or by other common characteristics, at an appropriate level of detail.

The aim of Phase B was to correlate crash occurrence with road parameters such as alignment, roughness etc, on a selected sample of road and examine the feasibility of automating the procedures nationwide.

1.3 PURPOSE OF THIS DOCUMENT

This report documents the work carried out within Phases A and B of the Study, and comprises two parts.

The first part reports on the effort involved in Phase A and presents its findings.

The second part reports on Phase B of the Study, and:

- describes the data used in the case study of Western Australia;

- presents the results of the analysis of relationships between crashes and road inventory;

- documents the procedures undertaken in this phase of the study; and

- comments on the feasibility of automating these procedures for nationwide applications.

1.4 DEFINITIONS

The following definitions are used throughout this document:

- road link - a stretch of road within a Local Government Area;
- LGA - Local Government Area;
- Functional Class - as defined by NAASRA (1977):

  CLASS 1 - Those roads which form the principal avenue for communication between major regions of the Commonwealth, including direct connections between capital cities.

  CLASS 2 - Those roads, not being Class 1, whose main function is to form the principal avenue of communication for movements:
  - between a capital city and adjoining States and their capital cities, or
  - between a capital city and key towns, or
  - between key towns.

  CLASS 3 - Those roads, not being Class 1 or 2, whose main function is to form an avenue of communication for movements:
  - between important centres and the Class 1 and Class 2 roads and/or key towns, or
  - between important centres, or
  - of an arterial nature within a town in a rural area.

STUDY PHASE A

2.0 STUDY DOCUMENTATION

2.1 STUDY FRAME

The study addressed the following States:

(i) New South Wales;
(ii) Victoria;
(iii) Queensland;
(iv) South Australia;
(v) Western Australia; and
(vi) Tasmania.

Roads within Functional Classes 1, 2 and 3 correspond to arterial roads for which road parameter data tends to be most comprehensive.

Although crashes with "Property Damage Only" (PDO) severity index were inspected it was noted that procedures governing the reporting of crashes in this category varied from State to State. This made comparisons between State crash rates difficult.

Since all crashes involving personal injury are required to be reported in all States, only those in Fatal and Injury categories were included in the study.

2.2 APPROACH

Phase A consisted of three major tasks:

(i) data retrieval from State Authorities;
(ii) review and analysis of crash histories; and
(iii) selection of road links for case studies.

Each of these is described in detail below.

2.2.1 Data Retrieval from State Authorities

This component involved the following sub-tasks:

- o initial introduction of the study to the appropriate State authorities by FORS;
- o response by State authorities providing names of contact representatives;
- o telephone or personal discussions by NELA with nominated officers in each State canvassing data availability and its retrieval;
- o formal requests to States for data, including the following items:

  (i) tabulation of crashes by severity (Fatal, Injury and Property Damage Only), LGA, and road number of all Functional Class 1, 2 and 3 roads in the three-year period 1984-86;

(ii) map showing the locations of Class 1, 2 and 3 roads;

(iii) carriageway length of Class 1, 2 and 3 roads by road number and LGA;

(iv) travel data of Class 1, 2 and 3 roads by road number and LGA;

(v) available traffic growth rate of Class 1, 2 and 3 roads by road number and LGA; and

(vi) list of locations of divided roads;

- further telephone reminders to expedite processing of requests; and
- receipt of data.

2.2.2 Review and Analysis of Crash Records

This step involved reviewing crash histories received from each State and processing the data in order to identify road links upon which greatest number of fatal and injury crashes occurred.

This process was performed manually by observing the tabulations of crashes by severity (Fatal and injury), LGA and road number of all Functional Class 1, 2 and 3 roads in the three year period 1984-1986.

The absolute number of crashes was used to define road links with the poorest safety record instead of other indicators such as crashes per kilometre. This indicator was chosen because it would maximise the number of data points for the subsequent correlation of crash occurrence with road parameters.

This process, although in this instance performed manually, would lend itself to automation, thereby increasing the efficiency and accuracy of selecting links with poorest safety record. The main constraint, however, that needs to be overcome before automation is possible is standardisation of crash record outputs among the States. At the moment all States have different reporting formats although most hold common information.

Sample outputs of crash records obtained from each State are shown in Appendix A.

2.2.3 Selection of Road Links for Case Studies

Prior to selecting road links which were suitable for the case studies, the road improvement history of links within the study period was considered. Cases where road parameters changed dramatically during the study period, e.g., by-pass construction or road sealing, do not lend themselves to case studies because another set of factors introduced by changed road parameters effectively reduce the number of available data points. In other words, crashes which occurred along the stretch of road affected by roadworks would need to be further divided into pre- and post-roadworks for their correlation with road inventory variables.

The need for roadwork information for candidate road links necessitated another formal request to States in which case studies were to be conducted, i.e., New South Wales and Western Australia.

The selection was then made of the road link along which no major improvements were made and which experienced the greatest number of crashes during the study period.

3.0 PHASE A RESULTS

3.1 INFORMATION FROM STATES

The following summarises the results of discussions held with State Road Authority officers with regard to crash record availability:

- o all States except Queensland and Tasmania were able to provide crash report by road, LGA, crash severity, and year;

- o Queensland, at the time discussions were held, was able to provide crash record by Statistical Local Areas for the entire State and a detailed crash analysis in Warwick Region. A new crash data base (PHYLAK) is being created which will enable automatic crash analysis on road links down to 1 km long and all intersections and includes Functional Class categories;

- o Tasmania has its own ranking system based on a severity and frequency index, traffic volume and growth rate of crash frequency. Each intersection and link is ranked and rankings are reviewed yearly. Although only ranked sites on crash score were obtained, records of crashes by LGA and road number could be obtained;

- o all States locate crashes by:
  - identifying the distance from either closest intersection, start of road, end of road, or LGA boundary for mid-block crashes; and
  - road names identifying the intersection for intersection crashes;

- o precision of crash locations varied from State to State depending on the Police reporting practices;

- o only Western Australia had a Functional Class data field incorporated into their crash data base and therefore only in Western Australia could crash records be retrieved by Functional Class. Other States store rural road information in crash data bases by State classifications, e.g.:

  - New South Wales:
    - Freeways;
    - State Highways;
    - Trunk Roads;
    - Main Roads; and
    - Local Roads;

  - Victoria:
    - State Declared Highways;
    - Rural Arterial Roads; and
    - Other Roads;

  - Tasmania:
    - National Highways;
    - Other Highways;
    - Main Roads; and
    - Local Roads.

A consequence of the discrepancies between NAASRA Functional Class and crash data base classifications is that the roads selected from crash records may not exhaustively correspond to a particular Functional Class or group of Classes. A major effort would be required to ensure that all roads which belong to a specific Functional Class are selected (particularly for Functional Classes 2 - 7) since in most States roads would need to be checked by individual numbers or names and LGAs against their Functional Class categories.

For more detailed descriptions of the relationship between NAASRA Functional Classification and other classification systems refer to Chapter 5 of NAASRA (1983).

3.2 CRASH RECORDS

3.2.1 New South Wales

Table 3.1 shows a summary of those road links on Functional Class 1, 2 and 3 roads in New South Wales which experienced the greatest absolute number of crashes during 1984-86. The Functional Class of each road was obtained by cross checking the road number on a DMR map of New South Wales showing Main Roads System and Functional Classes of Rural Roads.

The road link with by far the poorest safety record, both in terms of absolute number of crashes per LGA and crashes per kilometre, is Pacific Highway (Road No. 10) in Coffs Harbour and Tweed.

3.2.2 Victoria

Table 3.2 shows a summary of the highest ranking road links with respect to the number of fatal and injury crashes occurring along rural Victorian State Highways. These roads represent most of the Functional Class 1 and 2. About 25 percent of Class 3 roads are classified as State Highways and the task of identifying the remaining 75 percent of Class 3 roads is prohibitive since a match would need to be made by road name with a Functional Class listing as no road numbers other than State Declared Highway numbers are available in the crash data base.

The road link experiencing the greatest number of fatal and injury crashes is Princes Highway (West) in Corio, both in terms of absolute number of crashes per LGA (109) and the number of crashes per kilometre (3.59).

3.2.3 Queensland

As Queensland data did not break up crashes by roads and LGAs, no analysis by road link was performed. Refer Appendix A for sample output from Queensland data base.

TABLE 3.1: NUMBER OF FATAL AND INJURY CRASHES ALONG ROAD LINKS OF FUNCTIONAL CLASS 1, 2 AND 3 REPRESENTING HIGHEST CRASH RECORD IN NEW SOUTH WALES IN 1984-86

FUNCTIONAL CLASS	ROAD NUMBER	LGA NUMBER	LGA NAME	NUMBER OF CRASHES			CARRIAGEWAY LENGTH (KM)	NUMBER OF CRASHES PER KM
				FATAL	INJURY	TOTAL		
1	10	023	Ballina	9	91	100	41	2.44
1	10	062	Byron	5	98	103	34	3.03
1	09	402	Singleton	13	91	104	48	2.17
1	10	235	Kempsey	10	107	117	52	2.25
2	01	145	Eurobodalla	11	123	134	108	1.24
2	01	032	Bega Valley	6	129	135	157	0.86
1	02	515	Yass	15	144	159	67	2.37
1	10	410	Great Lakes	15	166	181	79	2.29
1	02	495	Wingecarribee	14	195	209	77	2.71
1	10	488	Tweed	11	204	215	36	5.97
1	10	110	Coffs Harbour	14	238	252	51	4.94

TABLE 3.2: CRASH RECORD OF HIGHEST NUMBER OF FATAL AND INJURY CRASH OCCURRING ALONG STATE DECLARED HIGHWAYS IN RURAL VICTORIA IN 1984-86

ROAD NUMBER	ROAD NAME	LGA NUMBER	LGA NAME	NUMBER OF CRASHES			CARRIAGEWAY LENGTH (KM)	NUMBER OF CRASHES PER KM
				FATAL	INJURY	TOTAL		
2550	Hume	615	Seymour	9	83	92	76.49	1.20
2510	Princes East	806	Orbost	10	81	91	171.23	0.53
2550	Hume	603	Benalla	11	42	53	86.34	0.61
2590	Midland	309	Buninyong	5	21	26	30.47	0.85
2510	Princes East	905	Pakenham	7	82	89	27.67	3.22
2510	Princes East	856	Morwell	5	74	79	9.43	8.38
2550	Hume	703	Chiltern	8	19	27	27.92	0.97
2530	Calder	454	Mildura	2	74	76	100.49	0.76
2510	Princes East	857	Narracan	5	40	45	(1)	
2510	Princes East	809	Tambo	-	64	64	48.74	1.31
2500	Princes West	106	Corio	2	107	109	30.40	3.59

Note: (1) No carriageway length provided.

3.2.4 South Australia

Crash data from South Australia was received too late to be incorporated in the analysis.

Nevertheless, discussions with South Australia indicated that although the Functional Class data item is not attached to the crash data base record, all those roads which are maintained by the road authority have allocated road numbers and can be automatically cross-referenced to the road data base. Thus although the process is somewhat time consuming, it is possible to obtain crash record by Functional Class.

3.2.5 Western Australia

Table 3.3 shows number of crashes per LGA and crashes per kilometre on road links with the greatest number of fatal and injury crashes during 1984-86.

The largest number of crashes occurred along the Eyre Highway (Road Number H3) in Dundas although this link does not experience a large number of crashes per kilometre due to its length of 724.51km.

3.2.6 Tasmania

Tasmania ranks rural locations along National Highways, other Highways and Main Roads on the basis of the crash score and frequency (refer discussion in Section 3.1).

Table 3.4 shows the three highest ranked locations in each road class and corresponding number of fatal and injury crashes.

3.3 SELECTION OF CASE STUDIES

Two road links were required to be selected for correlation of crash locations with road inventory parameters.

The States from which case studies were drawn are Western Australia and New South Wales. Criteria for choice included:

- o availability of crash location records, and compatibility with road inventory reference system;
- o availability of crash data by Functional Class; and
- o availability of road inventory data.

3.3.1 New South Wales

Three possible road link candidates in New South Wales were:

- o Pacific Highway (10) in Coffs Harbour;
- o Pacific Highway (10) in Tweed; and
- o Hume Highway (02) in Wingecaribee.

On the basis of road construction information received from the Department of Main Roads, New South Wales, the Pacific Highway in Coffs Harbour was selected for case study.

TABLE 3.3: HIGHEST CRASH RECORD ROAD LINKS IN WESTERN AUSTRALIA IN 1984-86

FUNCTIONAL CLASS	ROAD NUMBER	LGA NUMBER	LGA NAME	NUMBER OF CRASH			CARRIAGEWAY LENGTH (KM)	NUMBER OF CRASHES PER KM
				FATAL	INJURY	TOTAL		
1	H6	4	Wyndham-East Kimberley	4	26	30 (1)	207.29	0.14
1	H6	2	Halls Creek	6	27	33 (1)	375.62	0.08
1	H3	603	Dundas	6	55	61	724.51	0.09
1	H10	602	Coolgardie	5	14	19	123.64	0.15
1	H6	1	Broome	7	19	26	474.77	0.05
2	M2	215	Murray	5	35	40	41.40	0.97
2	H2	211	Harvey	2	38	40	42.52	0.94
2	M7	205	Busselton	6	30	36	30.60	1.18
2	H7	803	Carnarvon	2	32	34	402.67	0.08
2	H7	814	Roebourne	4	37	41	283.99	0.14
3	M20	814	Roebourne	N/A	23	23	25.80	0.89
3	M19	606	Boulder	N/A	27	27	52.66	0.51
3	M23	215	Murray	4	13	17	14.62	1.16
3	S134	811	West Pilbara	2	21	23	152.08	0.15
3	M31	419	Narrogin	2	4	6	30.49	0.20
3	M34	507	Gingin	3	13	16	62.97	0.25
3	S104	215	Murray	2	9	11	38.97	0.28
3	M22	607	Laverton	2	4	6	70.62	0.09
3	M24	213	Manjimup	2	6	8	75.16	0.11
3	M12	003	Derby-West Kimberley	2	7	9	313.83	0.03

Note (1) Combined Halls Creek and Wyndham-East Kimberley LGAs give 63 crashes along 582.91 km thus obtaining 0.11 crashes per kilometre.

TABLE 3.4: NUMBER OF FATAL AND INJURY CRASHES DURING 1984-86 ALONG HIGHEST RANKED LOCATIONS IN TASMANIA

RANK	MUNICIPALITY	LOCATION	CRASH SCORE	NUMBER OF CRASHES			
				FATAL	INJURY	PDO	TOTAL
NATIONAL HIGHWAY RURAL							
1	Evandale	Midland Highway Evandale Main Road Relbia Road	37	1	8	10	19
2	Westbury	Bass Highway Exton Road Hwy Deviation Westbury	36	3	8	9	20
3	Evandale	Midland Highway Evandale Main Road	34	1	8	7	16
OTHER HIGHWAYS RURAL							
1	Clarence	Tasman Highway Lindisfarne Main Road	146	0	35	59	94
2	Zeehan	Murchison Highway Clemens Street Rosebery Ardyn Street Tullah	60	1	12	29	42
3	Waratah	Murchison Highway Waratah Highway	54	0	16	14	30
MAIN ROADS RURAL							
1	Longford	Cressy Main Road Illawarra Main Road	17	0	5	4	9
2	Latrobe	Port Sorrell Main Road Pardoe Development Road	14	0	5	1	6
3	Latrobe	Mersey Main Road Railton Main Road Tarleton Road	13	0	3	4	7

The other candidate links were rejected on the basis of significant road improvement activity. The Tweed Heads bypass was constructed along the Pacific Highway in Tweed LGA and some 12 kilometres of dual carriageway including some bypasses were completed along the Hume Highway in Wingecaribee during the study period.

3.3.2 Western Australia

The selection for the Western Australia case study was the Eyre Highway (H3) in Dundas LGA.

Highway H6, within Halls Creek and up to its intersection with H11 in Wyndham-East Kimberley, was considered initially, but rejected due to major roadworks involving sealing and construction which took place along that stretch during the study period (refer Section 2.2.3).

The rationale for selecting the H6 Highway in Dundas link included the following:

- it provides sufficient length (724.51 km) for the road inventory analysis;
- it experienced the greatest absolute number of crashes in the period 1984-86 in one municipality;
- Western Australia road inventory and crash location reporting procedures are best suited for this analysis;
- it is a National Highway joining Perth and Adelaide; and
- roadworks carried out along this stretch in the period 1984-86 are mainly reconstructions and resealing, and are constrained to short sections.

Furthermore, the reference system used to locate crashes in the Western Australia crash data base is identical to the NAASRA road inventory reference system, thus facilitating the automatic cross referencing of crash location and road parameters.

STUDY PHASE B

4.0 DATA REQUIREMENTS

This Phase utilised road parameter data as recorded by NAASRA road inventory, and crashes which occurred along road links selected as case studies in Section 3.3.

Difficulties were experienced in analysing the crash data pertinent to the NSW case study. Refer Section 6.

Sections 4 and 5 cover the WA case study, i.e. the Eyre Highway in Dundas Shire, Western Australia.

4.1 CRASH RECORD

4.1.1 Data Items

Data items available in the detailed crash history consisted of:

- crash location and its error;
- date;
- time;
- day of week;
- severity (comprising four categories: Fatal, Injury, Major PDO and Minor PDO);
- pavement condition (wet, dry or other);
- road alignment (curve, straight or other);
- road grade (level, crest, slope or other);
- light conditions;
- vehicle description;
- direction of involved vehicles;
- movement of vehicle;
- crash nature;
- objects hit;
- traffic control; and
- location feature.

4.1.2 Items Selected for Analysis

The analysis used crash severity and the data items which were relevant to crash location and permanent road condition, namely road grade and alignment.

4.1.3 Data Format

A sample crash data record which formed an input to the analysis is shown in Appendix A.5.

The format of this standard output of detailed crash history is made up of six crash records per page and nine 136-character lines per crash record.

4.1.4 Error in Crash Location

There are some errors in the locations of some crashes.

The number of crashes falling into various error range categories is shown in Table 4.1.

TABLE 4.1: CRASH LOCATION ERROR RANGE IN CRASH RECORD

Error Range (+/- km)	No. of Crashes	Proportion of Crashes
0.00	12	6.38%
0.01- 0.50	69	36.70%
0.51- 1.00	13	6.91%
1.01- 3.00	25	13.30%
3.01- 5.00	60	31.91%
5.01-10.00	1	0.53%
10.01-25.00	1	0.53%
25.01-50.00	5	2.66%
› 50.00	2	1.06%
TOTAL	188	100.00%

As the Table shows, the majority of crashes (63 percent) are located within a 3km error range, 95 percent within a 5km range and some 6 percent were located precisely.

4.2 ROAD INVENTORY

4.2.1 Data Availability and Format

In general, there are two types of road inventory available; continuous and sectionised. Whereas the continuous inventory provides information about each road parameter as a change in that parameter occurs, the sectionised inventory provides entire road information pertaining to each given section of the road.

While both inventories could be used for the purpose of this study, the sectionised inventory was chosen because of its compatibility with the chosen time period for crash analysis.
In particular, the sectionised road inventory used for this study

In particular, the sectionised road inventory used for this study was developed for the Review of Road Vehicles Limits Study. The data format corresponded to that format used for the NAASRA Road Planning Model (NIMPAC).

Each record, corresponding to one inventory section, consisted of 510 alpha-numeric characters.

4.2.2 Data Items

A list of data items comprising this sectionised road inventory is shown in Appendix C.

Data items selected for the analysis on the basis of their relevance to the stretch of road under consideration were the following:

- distance from Permanent Reference Point 1;
- length of section;
- formation width;
- surface width;
- horizontal road alignment;
- road grade;
- vertical curve data;
- NAASRA roughness meter reading;
- legal speed limit;
- average annual daily traffic;
- proportion of cars in daily traffic;
- number of intersections;
- number of railway crossings; and
- number of bridges.

5.0 ROAD INVENTORY AND CRASH ANALYSIS

The analysis of relationships between road inventory parameters and crash occurrence was performed in three steps:

(i) a graphical or visual check of crash concentrations;

(ii) comparison of frequency of crashes with the proportions of corresponding road characteristics, including statistical considerations; and

(iii) a multiple regression analysis of the contribution of selected road parameters to crash occurrence.

Each of these steps is described in detail below.

5.1 A GRAPHICAL REPRESENTATION

In order to identify whether black spots (with high concentration of crashes) occur, it is useful to represent the locations of crashes graphically along a given stretch of road. Such a visual test also allows immediate location of any black spots.

A computer program, developed specifically for this analysis, was used to process both crash and road inventory data and produce an output representing the road as a continuous vertical line to scale including marked locations of crashes and corresponding road inventory data for each section of the road. This output is shown in Appendix D.

As shown in this sample, graphical representation of the road at the smallest marked interval is 1km long. However, if a high concentration of crashes was found, the program allows "zooming in" onto a selected section of the road with smaller intervals thus allowing a more accurate identification of locations of crashes occurring along that section.

The left hand side of the listing (shown in Appendix D) represents crash information including a pointer to their location, severity, number and the error of crash location. In the case where more than one crash occurs at the same location the error shown corresponds to the largest error for all crashes occurring at that location.

Road inventory data corresponding to each section of the road is presented on the right hand side of the printout. A legend of symbols used to aid its interpretation is included in Appendix D.

Road alignment data, including horizontal and vertical alignment and grade, is expressed in percentages of the road section length. The exact length of each section can be obtained by subtracting the distance measured from Permanent Reference Point 1 (PRP1) from the distance given in the preceding section.

5.2 OVERALL ANALYSES OF CRASH AND ROAD CHARACTERISTIC FREQUENCIES

5.2.1 Summary of Road Characteristics

A summary of road alignment parameters is shown in Table 5.1. As the Table, shows the Eyre Highway in Dundas consists of 99 percent of straight alignment and 85 percent of flat alignment. Most of the vertical curves are in the 70-110km/h design category and most of the road vertical grades are in the range between 2 and 6 percent.

It can be seen from the printout in Appendix C that other road parameters do not vary to a large extent. The average annual daily traffic is 395 vehicles per day with about 213 of these being cars and the rest being light commercial vehicles, trucks, semi-trailers, or road trains. The legal speed limit is 110km/h for most of the road. There are very few (if any) intersections, railway crossings and bridges along this stretch of Eyre Highway.

The road roughness count and road width are discussed in Section 5.2.3.

5.2.2 Crash Summary Analysis

A standard crash history summary obtainable from the Main Roads Department Western Australia is shown in Appendix B. The items relevant to this analysis are crash severity and road alignment/grades. These three items were analysed for the crash data set and the results are shown in Table 5.2.

As the Table shows, about 90 percent of crashes occurred on the straight stretches of road and 76 percent on the flat alignment.

5.2.3 Relationship Between Crash Occurrences and Road Characteristics

By combining the road inventory data with data of crash locations as shown graphically in Appendix D, it is possible to describe the relationship between the frequencies of occurrence of road characteristics and crashes. Four road characteristics are considered; road roughness, surface width, vertical and horizontal alignment. It is possible, however, to perform similar analysis on any road parameter given in the road inventory (refer Appendix C).

The comparisons of NAASRA roughness meter reading and surface width with crash occurrence are shown in Tables 5.3, and 5.4 respectively.

The proportion of road length within a given road parameter category gives an indication of the number of crashes which are expected to occur within that category by chance. A comparison between this number and the actual number of crashes which occurred within that category provides some information about the relevance of this road parameter to crash frequency.

TABLE 5.1: SUMMARY OF ROAD ALIGNMENT PARAMETERS

ROAD ALIGNMENT

	Length (km)	Proportion	No. of curves
Straight	718.375	99.30%	n/a
<80 km/h curve	0.000	0.00%	0
80-110 km/h curve	5.096	0.70%	23
TOTAL	723.470 (1)	100.00%	23

CREST VERTICAL CURVE DATA

	Length (km)	Proportion	No. of curves
<70 km/h curve	0.110	0.02%	2
70-110 km/h curve	19.738	2.73%	152
TOTAL	19.848 (2)	2.74%	154

ROAD GRADE

	Length (km)	Proportion
Flat (<2%)	615.721	85.11%
2-6 %	63.191	8.73%
>6 %	1.030	0.14%
TOTAL	679.942 (2)	93.98%

Total Road Length = 723.460 km.
Total sections (records) processed: 171

Note: (1) This total does not add up to the road length of 724.51km because the first section in the road inventory commenced at the distance of 1.04km from Permanent Reference Point 1. Thus, this first section of Eyre Highway was missing from the road inventory data.

(2) These do not total 724.51km due to road sag vertical curves not being included in road inventory data.

TABLE 5.2: CRASH DATA SUMMARY

TOTAL NUMBER OF CRASHES

	Crash Severity			
	Fatal	Injury	PDO	TOTAL
Number	6	57	125	188
Proportion	3.19%	30.32%	66.49%	100.00%

ROAD ALIGNMENT IN CRASH RECORD

	Number of Crashes				%
	Fatal	Injury	PDO	TOTAL	
STRAIGHT	6	52	112	170	90.43%
CURVE	0	5	11	16	8.51%
OTHER	0	0	2	2	1.06%
TOTAL	6	57	125	188	100.00%

ROAD GRADE IN CRASH RECORD

	Number of Crashes				%
	Fatal	Injury	PDO	TOTAL	
LEVEL	5	44	94	143	76.06%
CREST	0	2	7	9	4.79%
SLOPE	1	11	23	35	18.62%
OTHER	0	0	1	1	0.53%
TOTAL	6	57	125	188	100.00%

TABLE 5.3: NAASRA ROUGHNESS METER READING AND CRASHES

Roughness Counter	Road Length (km)	Proportion of road	Number of Crashes Fatal	Injury	PDO	TOTAL
<= 30	23.65	3.27%	0	2	6	8
31-35	151.03	20.88%	1	17	25	43
36-40	63.47	8.77%	0	2	7	9
41-45	214.54	29.65%	2	16	46	64
46-50	52.97	7.32%	0	1	9	10
51-60	75.24	10.40%	1	9	11	21
61-60	121.46	16.79%	2	9	19	30
> 70	21.10	2.92%	0	1	2	3
TOTAL	723.46	100.00%	6	57	125	188

TABLE 5.4: ROAD SURFACE WIDTH AND CRASHES

Surface Width	Road Length (km)	Proportion of road	Number of Crashes Fatal	Injury	PDO	TOTAL
<= 5M	0.00	0.00	0	0	4	4
6 M	554.34	76.62%	5	42	85	132
7 m	169.12	23.38%	1	15	36	52
> 7 m	0.00	0.00	0	0	0	0
TOTAL	723.46	100.00%	6	57	125	188

When comparing these proportions, however, statistical significance needs to be considered. Appropriate statistical tests for this analysis are presented in Section 5.2.4.

Although it is possible to analyse the contribution of road alignment to crashes using a similar method to that shown in Tables 5.3 and 5.4 for road roughness and surface width, it is appropriate to combine the alignment data from crash record and alignment proportions from the road inventory. The reason for this is twofold:

(i) most of the crash locations (94 percent) have some built-in error (refer Table 4.1); and

(ii) sectionised road inventory does not precisely show which part of the road section corresponds to a particular alignment but rather expresses alignment in terms of percentage of the entire section. For example, within any section it may be known that 20 percent of the section length consists of horizontal curves with design speeds in the range 80-90 kph. However, the precise location of these curves within the section is unknown.

These two elements would have a combined effect of introducing an unknown error into a hypothesis that a particular crash occurred in a given road alignment category. Although this error could have been reduced somewhat by using a continuous road inventory, thereby eliminating the error component described in (ii) above, a continuous inventory for Western Australia was unavailable at the time of the study.

Since road alignment data, however, is included in the Crash Record summary, the proportions of these (shown in Table 5.2) can be compared with road data (shown in Table 5.1). Combining the data from Tables 5.1 and 5.2 results are presented in Table 5.5.

5.2.4 Statistical Tests of Road and Crash Comparisons

The statistical significance of comparisons of crash frequency and road parameters should be considered before meaningful conclusions are drawn about the contribution of these road parameters to crash occurrence.

Poisson distribution of crashes was assumed in the statistical tests carried out (Langley:1968) and Walpole and Myers (1978).

Table 5.6 shows the statistical probabilities of no significant difference between expected and observed number of crashes. These results indicate that only road alignment and road grade (slope and level) comparisons reached statistical significance.

Details of calculations of these tests are shown in Appendix E. Briefly, the Tables in Appendix E compare the observed number of crashes on road lengths characterised by a particular parameter with the expected number of crashes. For example, Table E3 shows that for road sections for which some proportion of the horizontal alignment is curved, the expected and observed number of crashes are 1.32 and 16 respectively.

TABLE 5.5: ROAD ALIGNMENT AND CRASHES

Road Alignment	Length (km)	Proportion of Road	Total Number of Crashes	Proportion of Crashes
HORIZONTAL				
Straight	718.375	99.30%	170	90.43%
Curve	5.096	0.70%	16	8.51%
VERTICAL				
Flat	615.721	85.11%	143	76.06%
Crest	19.848	2.74%	9	4.79%
Slope (Grade)	64.221	8.87%	35	18.62%

TABLE 5.6: SUMMARY OF ROAD CRASH STATISTICS FOR DIFFERENT ROAD VARIABLES

Road Variable	Probability (P) of No Significant Difference Between Expected(1) and Observed Number of Crashes
Roughness:	
< 30	P > 10%
31-35	P > 10%
36-40	10% > P > 5%
41-45	P > 10%
46-50	P > 10%
51-60	(2)
61-70	(2)
> 70	P > 10%
Road Width:	
6 m.	1% < P < 5%
7 m.	P > 10%
Road Alignment:	
Straight	P < .2%
Curved	P < .2%
Road Grade:	
Level	P < .2%
Crest	P > 10%
Slope	P < .2%

Note: (1) Expected number of crashes is derived from the proportion of road with the particular characteristic being statistically tested.
(2) Poisson and ZI test cannot be used in these cases since p_x > 10 percent and x < 40.

The expected number of crashes is calculated by multiplying the total number of crashes along the highway by the proportion of highway which is curved. Thus this represents the number of crashes which would be expected, on average, along such sections if crashes were randomly distributed without bearing any correlation to horizontal curvature.

Application of the appropriate statistical test indicates a probability of no significant difference between the observed and expected crashes is less than 0.2 percent. In other words, there is less than 1 chance in 500 that the observed number of crashes results from chance alone, indicating a higher than average crash occurrence on these road sections. On this evidence it would appear that horizontal curvature contributes to road crashes, and therefore measures which reduce road curvature could be expected to enhance road safety.

5.3 LINEAR REGRESSION ANALYSIS

5.3.1 Preamble

The analysis described in Section 5.2 has yielded results which, in a very broad sense, identify measures for modifying the road and road environment to enhance road safety, insofar as:

(i) the analysis compares the observed number of crashes with the expected number of crashes for road sections characterised by particular parameters; and

(ii) the analysis determines whether the difference between the observed and expected number of crashes is statistically significant.

Having identified the parameters which most significantly contribute towards road crashes, it becomes desirable to further quantify the extent to which improvements in the road environment will reduce crashes. For example, if a correlation between curvature and crashes is accepted, the question becomes, to what extent should curvature be reduced such that the expected decrease in crashes justifies the cost of the road modifications. If it could be established that (say) curves with a design speed less than 50k.p.h. accounted for 90 percent of crashes on curved sections, this provides more precise information as to where funds should be directed.

The analysis described in the following Section has attempted to address this issue by using the technique of multiple linear regression.

5.3.2 Methodology

Each data record in the regression analysis corresponded to a road section as specified by the NAASRA road inventory, and consisted of one dependent and four independent variables pertaining to that road section. The four independent variables were:

(i) Minimum Horizontal Curve - this is the smallest radius horizontal curve (in terms of design speed) occurring in the road section;

(ii) Minimum Vertical Curve - this is the smallest vertical curve (in terms of design speed) occurring in the road section;

(iii) Roughness - the NAASRA roughness meter reading for the road section;

(iv) Maximum Grade - the largest grade (up or down) for the road section.

The rationale for selecting these as the independent variables was based upon the analysis in Section 5.2, which indicated that horizontal and vertical alignment, roughness and road width were candidates for further investigation.

In the cases of horizontal/vertical curvature and grade, the minimum horizontal and vertical curve, and maximum grade within each road section were considered to be the most appropriate measures of these parameters. Although it would have been possible, for example, to have used the proportions of road length within each section which were <40k.p.h. curves, 40-50k.p.h. curves etc., this would have given an unmanageably large number of variables. In the case of road width, this was excluded as only two values (i.e. 6m and 7m) were assumed by this parameter for the entire road length examined.

The dependent variable was the probability of observed crashes for each road section, defined as:

$$\text{Pr (observed crashes)} = \frac{e^{-\lambda} \cdot \lambda^{x}}{x!} \quad (1)$$

where x = the observed number of crashes in the road section;

λ = the mean (or expected) number of crashes in the road section;

$$= \frac{\text{Total crashes on highways(2)}}{\text{Highway length}} \times \text{section length}$$

$= 63/723.46 \times$ section length

This was chosen as the dependent variable because:

Note: (1) This assumes that crashes are distributed according to a Poisson Distribution.

(2) Property Damage Only crashes have been excluded.

(i) previous attempts to correlate the number of crashes with road parameters have shown that the relationship is not linear. It was therefore felt that some non-linear function of the number of crashes offered the best chance of detecting a relationship;

(ii) the majority of road sections had no recorded crashes during the study period. Thus, if the number of crashes was used as the dependent variable, a data set would have resulted in which the majority of values of the dependent variable were equal to zero.

With the dependent variable configured in this way, the dependent variable would be expected to decrease as road conditions become more severe, as such road sections would be expected to experience a higher than average number of road crashes compared to the overall mean for the entire highway. As the difference between the overall mean and observed crashes for a road section increases, the probability that the observed crashes result from statistical scatter about the mean decreases.

It was anticipated that if a relationship between the dependent and independent variables could be established, this would provide an aid in assessing the changes to the road environment which would most significantly reduce crashes.

5.3.3 Analysis and Results

Prior to the regression analysis, each independent variable was individually plotted against the dependent variable. This was to determine whether or not any of the independent variables, viewed individually, showed any relationship with the dependent variable. The plots are shown in Figures 5.1 to 5.4.

As can be seen from the Figures, the independent variables appear to show a random association with the dependent variable in each case.

A stepwise regression of the dependent variable on the independent variables was then performed. The results indicate that there is no linear relationship between the variables as selected, as the analysis yielded a correlation coefficient of 0.17.

Although there appears to be no linear relationship between crash probabilities and the selected road parameters, there is no evidence to suggest that some other type of relationship may or may not exist. It is possible that a relationship could be developed through other transformations of the crashes, or crash probabilities (e.g. a regression of log (crashes) road parameters), although exhaustive trials may be required until a satisfactory relationship was found.

Furthermore, it is questionable whether these variables lend themselves to such rigorous analytical techniques, or whether much simpler (albeit cruder) analytical procedures, such as those shown in Section 5.2 and Appendix D, are more useful.

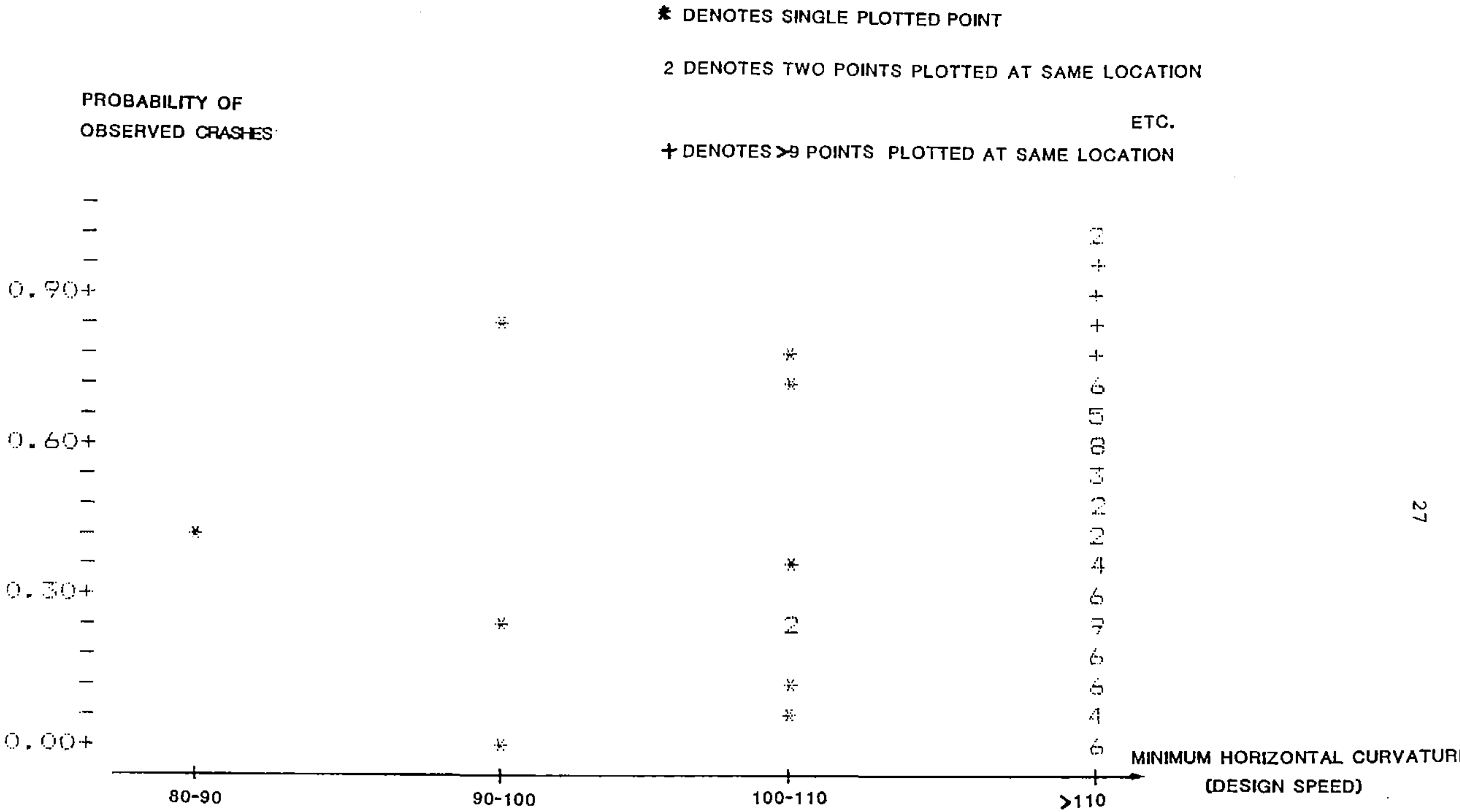

FIGURE 5.1: PROBABILITY OF OBSERVED CRASHES VS MINIMUM HORIZONTAL CURVATURE

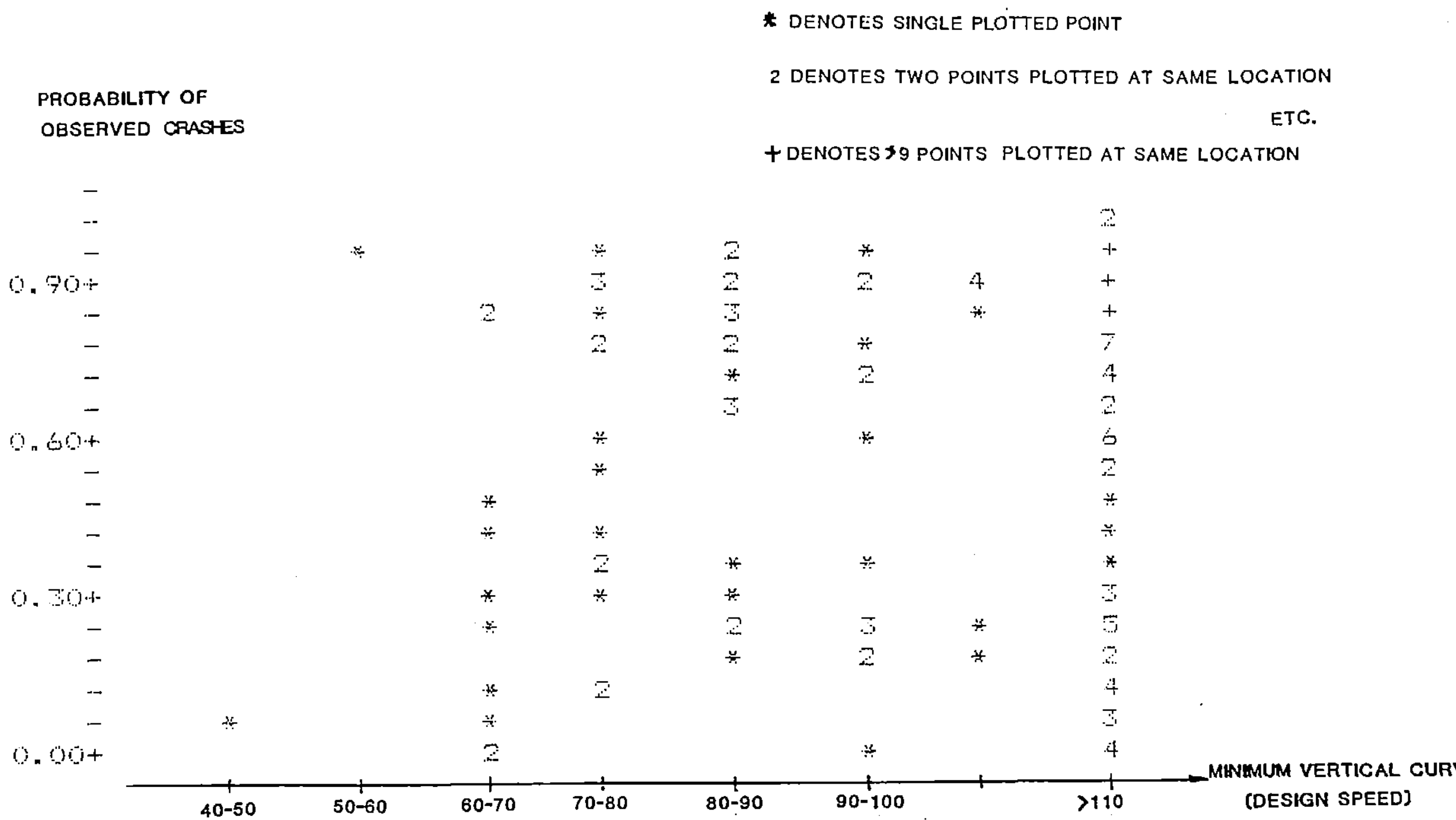

FIGURE 5.2: PROBABILITY OF OBSERVED CRASHES VS MINIMUM VERTICAL CURVE

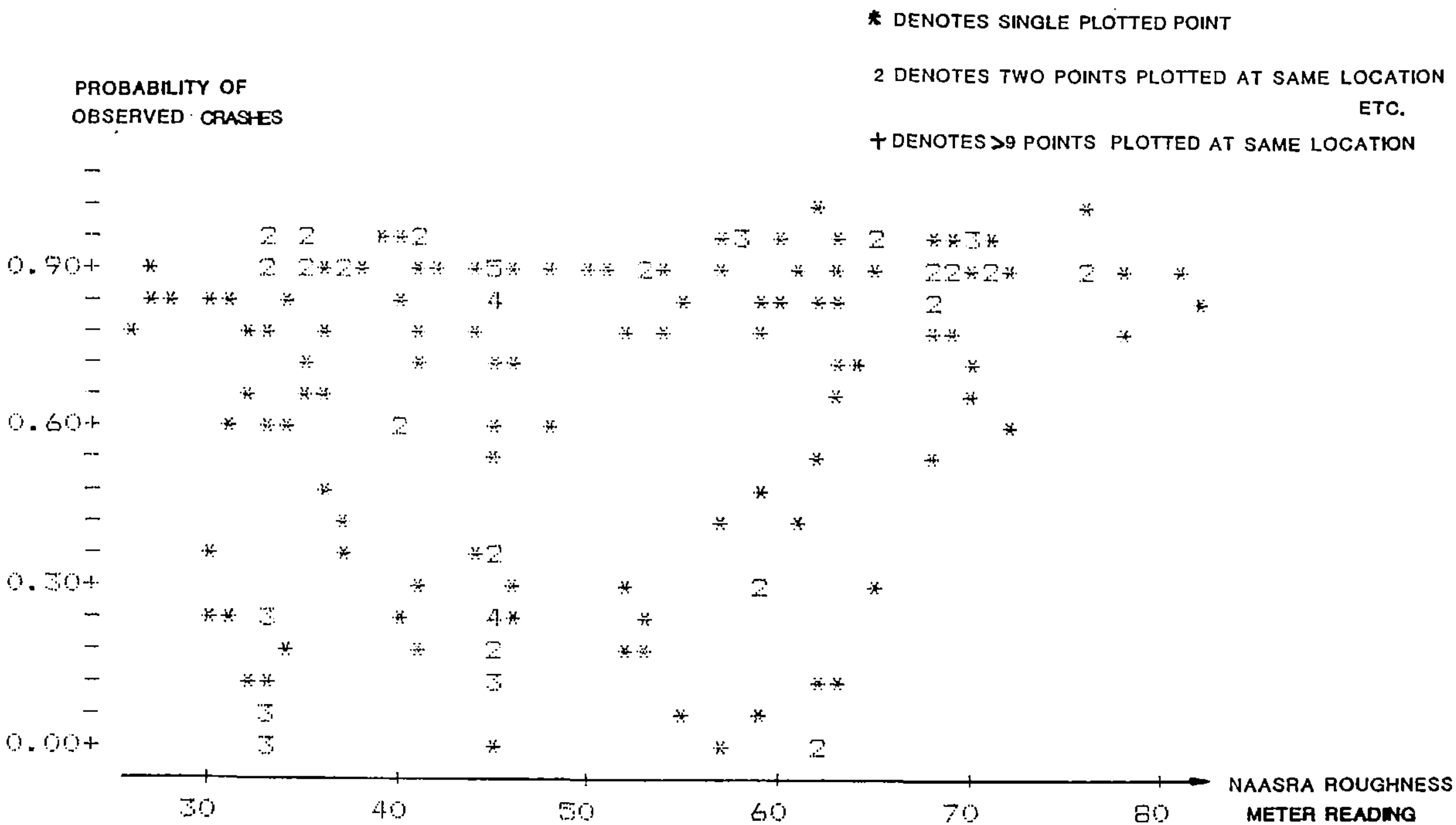

FIGURE 5.3: PROBABILITY OF OBSERVED CRASHES VS ROUGHNESS

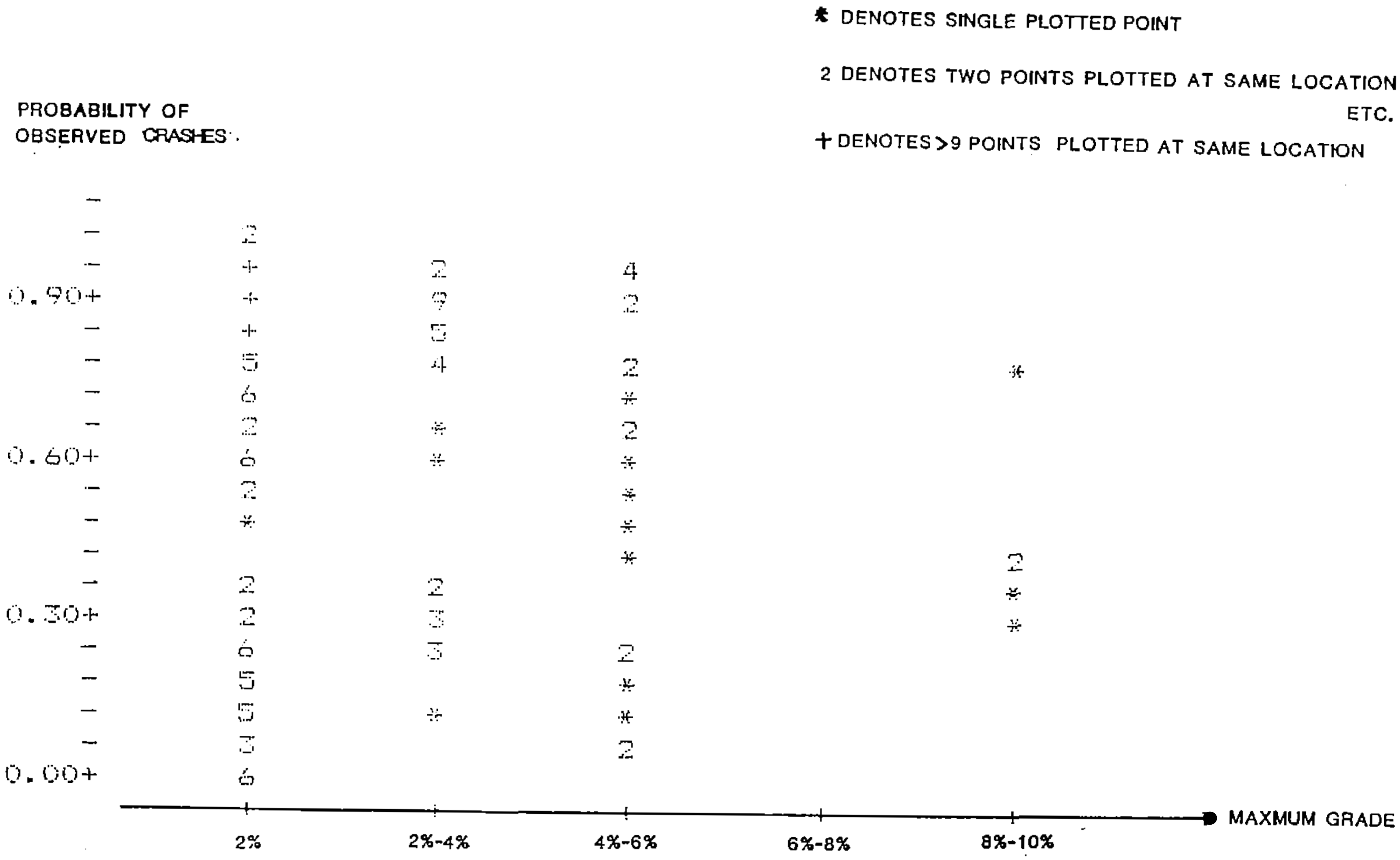

FIGURE 5.4: PROBABILITY OF OBSERVED CRASHES VS MAXIMUM GRADE

6.0 DISCUSSION ON NSW CASE STUDY

As stated in Section 3.3.1, it was intended that the Phase B analysis would include the section of the Pacific Highway within Coffs Harbour LGA, New South Wales, for the period 1984-86. The decision to use the NSW crash data was, in part, based upon a review of a document produced by the Department of Main Roads (DMR) NSW entitled "Traffic Section. Crash Statistics 1984 and 1985 NSW". The Divisional ranking statistics produced in that report (a copy of which is shown in Appendix F) appeared to associate each crash with a road section, suggesting that some sort of cross-referencing procedure between crash statistics and a road inventory was in place.

The analysis was to have proceeded along similar lines to that documented in Section 5 of this Report, in which accident statistics were cross-referenced with the NAASRA road inventory for the section of the Eyre Highway within Dundas LGA, Western Australia.

To this end, the Consultant obtained from the DMR, the following items:

(i) crash records for the section of the Pacific Highway being considered, for the years 1984-86; and

(ii) the NAASRA sectionised road inventory for the study area.

The analysis was to be based upon automatically (i.e. via a computer program) cross-referencing the crash data within the road inventory data. This would enable each crash to be associated with a section in the road inventory so that road parameters (such as road width, horizontal and vertical alignment, etc.) at each crash location could be identified.

Upon examination of the crash records, however, it was immediately apparent that such automatic cross-referencing would not be possible. This was because of the method of identifying crash locations. Whereas the location of each road section defined in the road inventory is identified in terms of its distance from a datum referred to as the Permanent Reference Point, crash locations from the crash record are identified by their distance from roads intersecting the Pacific Highway. Without a data base which identifies the location of these intersections relative to the Permanent Reference Point, automatic cross-referencing between the two was not possible.

Subsequent telephone conversations with officers of the Department of Main Roads, New South Wales, confirmed that a manual procedure for cross-referencing the two data sets would be necessary. It was suggested that by marking each crash location on a map of the study area, and then measuring its distance from the Permanent Reference Point (the absolute location of which would be identified and marked upon the same map), crash locations relative to the road inventory could be identified.

A map of the Study Area was forwarded to the Consultant by the Department. The Consultant then proceeded with the manual cross-referencing. However, many of the crash locations could not be identified as the identifying cross road was not marked on the map. In the case of crashes in non (provincial) urban areas(1), the majority of crash locations could not be identified. Table 6.1 shows the breakdown between identified and non-identified crash locations; note that only 32 out of 112 fatality/injury crashes (all years) in non-urban areas could be located on the map.

At present, the following conclusions can be made regarding the NSW data:

1. Automatic cross-referencing of the NSW crash statistics and road inventory data is not possible, with current data bases(2).

2. Manual cross-referencing of the crash statistics and road inventory data is not possible with the information made available by the DMR to the Consultant.

3. Manual cross-referencing of the crash statistics and road inventory data would be possible if documentation sufficient in detail to enable all crash locations to be identified were made available. This would, however, require a considerable commitment in terms of labour resources(3).

Note: (1) Assumed to be all crash locations with a speed limit recorded as › 100k.p.h.

(2) Recent telephone conversations with officers of the DMR have confirmed that this is the situation at present. However, the consultant is advised that a pilot study for automatically cross-referencing crash locations with road inventory using permanent reference points in a system known as ROADLOC is about to commence.

(3) The Divisional Ranking Process illustrated in Appendix F relies upon manual correlation of crash report forms with a series of road maps and gazettes and is currently undertaken by the Traffic Authority of New South Wales.

TABLE 6.1: BREAKDOWN OF IDENTIFIED AND NON-IDENTIFIED CRASH LOCATIONS, PACIFIC HIGHWAY, NSW

	1984			1985			1986		
	Provincial Urban(1)	Non-Urban(2)	Total	Provincial Urban(1)	Non-Urban(2)	Total	Provincial Urban(1)	Non-Urban(2)	Total
No. of crashes with deaths/ injuries	47	52	99	58	36	94	32	24	56
No. of above crashes located	36	15	51	53	11	64	30	6	36
Total crashes	96	73	169	58	36	94	32	24	56

Note: (1) Provincial Urban assumed to be locations with speed limit recorded as $<$ 100k.p.h.
(2) Non-urban assumed to be locations with speed limit recorded as $\geq$ 100k.p.h.

7.0 CONCLUSIONS

The following conclusions were reached as a result of the Phase A study:

- o Western Australia is the only State which has a facility to retrieve crash data automatically by reference to a common permanent reference system;

- o all States except Queensland provide a breakdown of crash records by road and LGA. New crash data bases in Queensland, currently being developed, will have this facility;

- o all States have unique crash report output formats which poses a constraint on automation of this process at present;

- o automation of the Phase A process is possible, providing that either output formats are standardised or crash data processing computer programs are adapted specifically for each State. The disadvantages of the latter option are its potential cost and constant updates as the State authorities change or update their data bases.

With regard to Phase B, the Western Australian crash data proved to be suitable for automatic cross-referencing with the road inventory. It was therefore a relatively simple procedure to identify within which section of the highway, as defined by the road inventory, a particular crash has occurred, and therefore the corresponding road parameters (such as road width, roughness, etc.) pertaining to that location.

It would therefore appear that the data set would readily lend itself to an analysis of the relationship between crash frequency and the road environment. Some difficulty exists in that the road inventory relates to road sections, within which the precise location of certain parameters is unknown. For example, for a particular road section it is known that 20 percent of its length consists of horizontal curves with design speeds in the range of 50-60k.p.h. It is also known that an crash has occurred within this road section. However, whether or not the crash occurred on a curved or straight part of the road section is unknown, and attempts to correlate crash statistics with parameters such as horizontal and vertical curvature, and road grade, become somewhat subjective.

Notwithstanding, useful information was obtained from the data set. As detailed in Section 5.2, it was possible to compare the observed number of crashes with the expected number for road sections characterised by particular parameters, and determine the statistical significance of any difference between the two. On this basis and for this particular data set, it was concluded that:

(i) roughness and road width did not appear to have any effect upon crash frequency; and

(ii) horizontal alignment and road grade appeared to have an effect upon crash frequency, insofar as certain road sections experience higher than average crash frequencies. These road sections are those for which some proportion of the horizontal alignment is curved or consists of grades greater than 2 percent.

Attempts to further quantify the relationship between crash frequency and road environment proved inconclusive (Section 5.3). This is not surprising, considering the inability to relate crashes and road parameters to a precise location.

If more detailed relationships between crash frequency and road environment are to be established, it would first be necessary to produce a data base relating crash occurrence to the road environment at the precise location at which the crash occurred. Further work should be directed to this end.

BIBLIOGRAPHY

1. Langley, R., (1968), "Practical Statistics", London: Pan Books Limited.

2. NAASRA (1977) Data Base Study, Initial List of Data Items Definitions.

3. NAASRA (1983) Roads Study, Road Classification - Technical Report T-4.

4. Nelson English, Loxton & Andrews Pty. Ltd., (1987a), "A Proposal for Research Project 86R 4.6 Road Safety Benefits from Road Improvements", prepared for the Federal Office of Road Safety.

5. Nelson English, Loxton & Andrews Pty. Ltd. (1987b), "Research Project 86R4.6, Working Paper No. 1 - Progress Report and Study Design", prepared for the Federal Office of Road Safety.

6. Nelson English, Loxton & Andrews Pty. Ltd. (1987c), "Research Project 86R4.6, Working Paper No. 2 - Progress Report", prepared for the Federal Office of Road Safety.

7. Nelson English Loxton & Andrews Pty. Ltd. (1988), "Research Project 86R4.6, Road Safety Benefits from Road Improvements, Description of Existing Crash Patterns, Sub-Phase 2.1", prepared for Federal Office of Road Safety.

8. Walpole, R.E. and Myers R.H. (1978), "Probability and Statistics for Engineers and Scientists", 2nd Edition, New York: MacMillan Publishing Co. Inc.

APPENDIX A: SAMPLE CRASH DATA OUTPUTS FROM STATES

APPENDIX A.1:

Sample crash data output from New South Wales.

```
TRAFFIC ACCIDENT REPORTING SYSTEM
------- -------- --------- ------

        ARP VER 1.0

    11.36.46    20 OCT 87

     ACCIDENT REPORT DEFINITION
     -------- ------ ----------

1 - LOCAL GOVERNMENT AREA (LGA)  (DEFAULT)
2 - LGA AND STREET
3 - LGA, STREET AND IDENTIFYING OBJECT
4 - ACCIDENT NO.
5 - OTHER PARAMETERS
6 - REPROCESSING EXISTING FILE

REPORT BY (1-6) ? 5

1 - 132 COL. BRIEF LISTING (DEFAULT)
2 - 80  COL. BRIEF LISTING
3 - 132 COL. CODE LISTING
4 - NO ACCIDENT LISTING

5 - TOTALS (DEFAULT)
6 - BREAKDOWN OF TOTALS
7 - HISTOGRAMS
8 - EXTENDED HISTOGRAMS

PRINTOUT OPTIONS ? 4,5

OTHER OPTIONS ? Y
SORT REPORT BY & PRINT SUBTOTALS FOR ? LGA,ROUTE
TRAFFIC UNIT SORT KEYS TO OPERATE ON TRAFFIC UNIT NO ?
LOCATE & SORT BY THE FOLLOWING VALUES OF THE FIRST TRAFFIC UNIT SORT KEY ?
PRINT EXTENDED HISTOGRAM AT A PEAK NUMBER OF ?
PRINT QUERY/UPDATE OUTPUT (Y/N) DEFAULT=N ?
JOB PRIORITY ? 0
SUBMIT BATCH JOB (Y/N) DEFAULT=Y ? N
BATCH OUTPUT TO WAIT QUEUE (Y/N) DEFAULT=N ? .

    ACCIDENT SELECTION DEFINITION
    -------- --------- ----------

        75-83     NOT AVAILABLE
        84-86(4)  AVAILABLE

ENTER QUERY STATEMENT

? DEGREE=1 AND ACCDMP=1-6 AND DATE=010184-311286
?

ENTER QUERY STATEMENT

?

RECORD COUNTS :-
   INPUT RECORDS READ FROM FILE QDATA       =  3379
   OUTPUT RECORDS WRITTEN TO FILE ARPGAD    =  1936
   OUTPUT RECORDS WRITTEN TO FILE ARPTUD    =  3378
```

LGA ROUTE NOS

*	TOTAL ROUTE : 2	ACCIDENTS:	195	0	F	195	I	PEOPLE:	0	K	264	I
*	TOTAL ROUTE : 20	ACCIDENTS:	44	0	F	44	I	PEOPLE:	0	K	67	I
*	TOTAL ROUTE : 125	ACCIDENTS:	13	0	F	13	I	PEOPLE:	0	K	16	I
**	TOTAL 004 CITY OF ALBURY	ACCIDENTS:	252	0	F	252	I	PEOPLE:	0	K	347	I
*	TOTAL ROUTE : 9	ACCIDENTS:	60	0	F	60	I	PEOPLE:	0	K	74	I
*	TOTAL ROUTE : 74	ACCIDENTS:	11	0	F	11	I	PEOPLE:	0	K	14	I
*	TOTAL ROUTE : 124	ACCIDENTS:	2	0	F	2	I	PEOPLE:	0	K	3	I
**	TOTAL 009 CITY OF ARMIDALE	ACCIDENTS:	73	0	F	73	I	PEOPLE:	0	K	91	I
*	TOTAL ROUTE : 2	ACCIDENTS:	128	0	F	128	I	PEOPLE:	0	K	157	I
*	TOTAL ROUTE : 5	ACCIDENTS:	129	0	F	129	I	PEOPLE:	0	K	174	I
*	TOTAL ROUTE : 167	ACCIDENTS:	14	0	F	14	I	PEOPLE:	0	K	16	I
*	TOTAL ROUTE : 549	ACCIDENTS:	38	0	F	38	I	PEOPLE:	0	K	48	I
*	TOTAL ROUTE :2013	ACCIDENTS:	45	0	F	45	I	PEOPLE:	0	K	61	I
*	TOTAL ROUTE :2018	ACCIDENTS:	9	0	F	9	I	PEOPLE:	0	K	11	I
*	TOTAL ROUTE :2027	ACCIDENTS:	12	0	F	12	I	PEOPLE:	0	K	17	I
*	TOTAL ROUTE :2029	ACCIDENTS:	17	0	F	17	I	PEOPLE:	0	K	20	I
*	TOTAL ROUTE :2040	ACCIDENTS:	5	0	F	5	I	PEOPLE:	0	K	5	I
*	TOTAL ROUTE :2056	ACCIDENTS:	81	0	F	81	I	PEOPLE:	0	K	108	I
*	TOTAL ROUTE :2064	ACCIDENTS:	18	0	F	18	I	PEOPLE:	0	K	25	I
*	TOTAL ROUTE :2065	ACCIDENTS:	13	0	F	13	I	PEOPLE:	0	K	16	I
**	TOTAL 010 ASHFIELD MUNICIPALITY	ACCIDENTS:	510	0	F	510	I	PEOPLE:	0	K	658	I
*	TOTAL ROUTE : 5	ACCIDENTS:	132	0	F	132	I	PEOPLE:	0	K	202	I
*	TOTAL ROUTE : 190	ACCIDENTS:	123	0	F	123	I	PEOPLE:	0	K	191	I
*	TOTAL ROUTE : 532	ACCIDENTS:	44	0	F	44	I	PEOPLE:	0	K	61	I
*	TOTAL ROUTE :2057	ACCIDENTS:	32	0	F	32	I	PEOPLE:	0	K	51	I
*	TOTAL ROUTE :2069	ACCIDENTS:	49	0	F	49	I	PEOPLE:	0	K	77	I
*	TOTAL ROUTE :2096	ACCIDENTS:	53	0	F	53	I	PEOPLE:	0	K	86	I
*	TOTAL ROUTE :6004	ACCIDENTS:	34	0	F	34	I	PEOPLE:	0	K	44	I
**	TOTAL 012 AUBURN MUNICIPALITY	ACCIDENTS:	467	0	F	467	I	PEOPLE:	0	K	712	I
*	TOTAL ROUTE : 10	ACCIDENTS:	91	0	F	91	I	PEOPLE:	0	K	140	I
*	TOTAL ROUTE : 16	ACCIDENTS:	43	0	F	43	I	PEOPLE:	0	K	52	I
*	TOTAL ROUTE : 146	ACCIDENTS:	8	0	F	8	I	PEOPLE:	0	K	11	I
*	TOTAL ROUTE : 545	ACCIDENTS:	33	0	F	33	I	PEOPLE:	0	K	41	I
*	TOTAL ROUTE : 555	ACCIDENTS:	13	0	F	13	I	PEOPLE:	0	K	15	I
*	TOTAL ROUTE :4051	ACCIDENTS:	19	0	F	19	I	PEOPLE:	0	K	25	I
**	TOTAL 023 BALLINA SHIRE	ACCIDENTS:	207	0	F	207	I	PEOPLE:	0	K	284	I
*	TOTAL ROUTE : 14	ACCIDENTS:	27	0	F	27	I	PEOPLE:	0	K	42	I
*	TOTAL ROUTE : 67	ACCIDENTS:	12	0	F	12	I	PEOPLE:	0	K	21	I
*	TOTAL ROUTE : 514	ACCIDENTS:	1	0	F	1	I	PEOPLE:	0	K	1	I
*	TOTAL ROUTE : 533	ACCIDENTS:	2	0	F	2	I	PEOPLE:	0	K	5	I
**	TOTAL 025 BALRANALD SHIRE	ACCIDENTS:	42	0	F	42	I	PEOPLE:	0	K	69	I
*	TOTAL ROUTE : 2	ACCIDENTS:	362	0	F	362	I	PEOPLE:	0	K	507	I
*	TOTAL ROUTE : 13	ACCIDENTS:	44	0	F	44	I	PEOPLE:	0	K	57	I
*	TOTAL ROUTE : 167	ACCIDENTS:	265	0	F	265	I	PEOPLE:	0	K	403	I
*	TOTAL ROUTE : 130	ACCIDENTS:	141	0	F	141	I	PEOPLE:	0	K	203	I
*	TOTAL ROUTE : 315	ACCIDENTS:	7	0	F	7	I	PEOPLE:	0	K	12	I
*	TOTAL ROUTE : 508	ACCIDENTS:	134	0	F	134	I	PEOPLE:	0	K	201	I
*	TOTAL ROUTE :2060	ACCIDENTS:	20	0	F	20	I	PEOPLE:	0	K	28	I
*	TOTAL ROUTE :2061	ACCIDENTS:	55	0	F	55	I	PEOPLE:	0	K	73	I
*	TOTAL ROUTE :2068	ACCIDENTS:	88	0	F	88	I	PEOPLE:	0	K	120	I
*	TOTAL ROUTE :2090	ACCIDENTS:	68	0	F	68	I	PEOPLE:	0	K	82	I
*	TOTAL ROUTE :2094	ACCIDENTS:	24	0	F	24	I	PEOPLE:	0	K	33	I
**	TOTAL 026 CITY OF BANKSTOWN	ACCIDENTS:	1208	0	F	1208	I	PEOPLE:	0	K	1719	I
*	TOTAL ROUTE : 63	ACCIDENTS:	14	0	F	14	I	PEOPLE:	0	K	19	I
*	TOTAL ROUTE : 132	ACCIDENTS:	4	0	F	4	I	PEOPLE:	0	K	4	I
*	TOTAL ROUTE : 360	ACCIDENTS:	4	0	F	4	I	PEOPLE:	0	K	5	I
**	TOTAL 029 BARRABA SHIRE	ACCIDENTS:	22	0	F	22	I	PEOPLE:	0	K	28	I
*	TOTAL ROUTE : 5	ACCIDENTS:	66	0	F	66	I	PEOPLE:	0	K	88	I
*	TOTAL ROUTE : 6	ACCIDENTS:	8	0	F	8	I	PEOPLE:	0	K	10	I
*	TOTAL ROUTE : 7	ACCIDENTS:	15	0	F	15	I	PEOPLE:	0	K	20	I
*	TOTAL ROUTE : 54	ACCIDENTS:	32	0	F	32	I	PEOPLE:	0	K	39	I
*	TOTAL ROUTE : 253	ACCIDENTS:	2	0	F	2	I	PEOPLE:	0	K	4	I
**	TOTAL 030 CITY OF BATHURST	ACCIDENTS:	123	0	F	123	I	PEOPLE:	0	K	161	I
*	TOTAL ROUTE : 13	ACCIDENTS:	106	0	F	106	I	PEOPLE:	0	K	150	I
*	TOTAL ROUTE : 156	ACCIDENTS:	28	0	F	28	I	PEOPLE:	0	K	31	I
*	TOTAL ROUTE : 157	ACCIDENTS:	30	0	F	30	I	PEOPLE:	0	K	40	I
*	TOTAL ROUTE : 160	ACCIDENTS:	169	0	F	169	I	PEOPLE:	0	K	213	I
*	TOTAL ROUTE : 181	ACCIDENTS:	15	0	F	15	I	PEOPLE:	0	K	25	I
*	TOTAL ROUTE : 182	ACCIDENTS:	1	0	F	1	I	PEOPLE:	0	K	5	I
*	TOTAL ROUTE : 184	ACCIDENTS:	211	0	F	211	I	PEOPLE:	0	K	275	I
*	TOTAL ROUTE : 574	ACCIDENTS:	1	0	F	1	I	PEOPLE:	0	K	1	I
*	TOTAL ROUTE :2034	ACCIDENTS:	41	0	F	41	I	PEOPLE:	0	K	54	I
*	TOTAL ROUTE :4006	ACCIDENTS:	8	0	F	8	I	PEOPLE:	0	K	10	I

APPENDIX A.2:

Sample crash data output from Victoria.

ROAD TRAFFIC AUTHORITY
ROAD TRAFFIC ACCIDENTS - VIC 1986
NUMBER OF FATAL , INJURY AND PROPERTY DAMAGE ACCIDENTS
ON NUMBERED ROADS IN LGAs
ACCIDENTS OCCURRING AT INTERSECTIONS

INJURY ACCIDENT

	ROAD NUMBER																				
	0	2100	2110	2300	2500	2510	2520	2530	2540	2550	2570	2580	2590	2600	2610	2620	2630	2640	2670	2680	
309..	4												1								
310..	3												2								
311..	1												6								
312..	2																		3		
313..																					
314..	1						3														
315..	6																		2		
316..	2																				
403..	1																				
404..																					
405..	1																				
406..	12						6														
407..							1														
408..	1																				
409..	1		1																		
410..	1						4														
411..	12						2														
412..	4						1														
413..																					
414..	1																				
451..	6										1										
452..											2										
453..	46							6							20						
454..	13							8							3						
455..	5										11										
456..	8																				
457..	1																				
458..								1													
501..	80							21					8				2				
502..	2																				
503..	8												5								
504..																					
505..	1																				
506..	7																4				
508..	15								4		5										
509..	1							5													
510..	2																				
511..	6												1								
512..	2																				
513..	1							3													
514..	4							4													
515..	3								2												
516..																					
517..	5							5													

(continued)

APPENDIX A.2:

Sample crash data output from Victoria.

ROAD TRAFFIC AUTHORITY
ROAD TRAFFIC ACCIDENTS - VIC 1986
NUMBER OF FATAL , INJURY AND PROPERTY DAMAGE ACCIDENTS
ON NUMBERED ROADS IN LGAs
ACCIDENTS OCCURRING AT INTERSECTIONS

INJURY ACCIDENT

	ROAD NUMBER																			
	0	2100	2110	2300	2500	2510	2520	2530	2540	2550	2570	2580	2590	2600	2610	2620	2630	2640	2670	2680
309..	4												1							
310..	3												2							
311..	1												6							
312..	2																		3	
313..																				
314..	1						3													
315..	6																		2	
316..	2																			
403..	1																			
404..																				
405..	1																			
406..	12						6													
407..							1													
408..	1																			
409..	1		1																	
410..	1						4													
411..	12						2													
412..	4						1													
413..																				
414..	1																			
451..	6										1									
452..											2									
453..	46							6							20					
454..	13							8							3					
455..	5										11									
456..	8																			
457..	1																			
458..								1												
501..	80							21					8				2			
502..	2																			
503..	8												5							
504..																				
505..	1																			
506..	7																4			
508..	15								4		5									
509..	1							5												
510..	2																			
511..	6												1							
512..	2																			
513..	1							2												
514..	4							4												
515..	3								2											
516..																				
517..	5							5												

(continued)

APPENDIX A.3:

Sample crash data output from Queensland.

DATE 22/09/87

NUMBER OF CRASHES VS SEVERITY OF CRASH

* * * NUMBER OF CRASHES IN SLA * * *

+ + + + + + + + + + + ACCIDENT SEVERITY + + + + + + + + + + +

DEATH	HOSP	TREATED	MINOR	PROP
0 (.00)	0 (.00)	0 (.00)	0 (.00)	0 (.00)

TOTAL NUMBER OF CRASHES IN SLA 0

* * * NUMBER OF CRASHES IN SLA*580 * * *

+ + + + + + + + + + + ACCIDENT SEVERITY + + + + + + + + + + +

DEATH	HOSP	TREATED	MINOR	PROP
25 (.05)	105 (.21)	123 (.25)	33 (.06)	201 (.41)

TOTAL NUMBER OF CRASHES IN SLA*580 487

* * * NUMBER OF CRASHES IN SLA*587 * * *

+ + + + + + + + + + + ACCIDENT SEVERITY + + + + + + + + + + +

DEATH	HOSP	TREATED	MINOR	PROP
24 (.01)	327 (.18)	445 (.24)	85 (.04)	923 (.51)

TOTAL NUMBER OF CRASHES IN SLA*587 1807

* * * NUMBER OF CRASHES IN SLA0051 * * *

+ + + + + + + + + + + ACCIDENT SEVERITY + + + + + + + + + + +

DEATH	HOSP	TREATED	MINOR	PROP
2 (.01)	30 (.17)	44 (.25)	13 (.07)	87 (.49)

TOTAL NUMBER OF CRASHES IN SLA0051 176

*** NOTE : CRASHES SELECTED ARE THOSE FOR WHICH SELECTION CODE IS ALL OVER 01/01/1984 TO 31/12/1986

APPENDIX A.4:

Sample crash tabulation from Western Australia.

FILE NONAME (CREATION DATE = 87/09/23)

* * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *

ROAD BY LGA

CONTROLLING FOR..

SEV SEVERITY VALUE 2. INJURY

* PAGE 1 OF 3

ROAD (COUNT)	LGA 1.	2.	3.	4.	310.	406.	409.	414.	420.	421.	ROW TOTAL
1. H003	0	0	0	0	0	0	0	0	0	0	55 12.9
2. H005	0	0	0	0	0	10	6	18	12	23	121 28.3
3. H006	19	27	22	26	0	0	0	0	0	0	175 40.9
4. H007	0	0	0	0	0	0	0	0	0	0	8 1.9
5. H010	0	0	0	0	0	0	0	0	0	0	19 4.4
6. H011	0	0	0	10	1	0	0	0	0	0	11 2.6
8. H004	9	0	0	0	0	0	0	0	0	0	9 2.1
9. M011	0	0	5	0	0	0	0	0	0	0	5 1.2
10. M030	0	0	0	0	0	0	0	0	0	0	17 4.0
11. M036	0	0	0	0	0	0	0	0	0	0	8 1.9
COLUMN TOTAL	28 6.5	27 6.3	27 6.3	36 8.4	1 .2	10 2.3	6 1.4	18 4.2	12 2.8	23 5.4	428 100.0

(CONTINUED)

APPENDIX A.5:

Sample detailed crash history output from Western Australia.

D E T A I L E D   A C C I D E N T   H I S T O R Y

EYRE HWY (SLK 0.00-724.51 WA/SA BORDER,DUNDAS SHIRE)
FROM 01/01/83 TO 15/09/87

EYRE HIGHWAY 000H003 0000.00-0724.51 MINOR PDO ACCS INCLUDED DATE OF REPORT 16/11/87

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0540.84		30/09/83	10.15AM	FRI	INJ	NON COLL	DRY	STR LEVEL	DAYLIGHT	NO SIGN
ERROR										
+-0001.12		PANEL VAN		FROM W	TO E	OUT OF CONTROL - VEH COND				LOC FEAT
		OVERTURNS	ON RIGHT ROAD VERGE/FTPATH							
		OBJECTS HIT								

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0540.84		24/10/83	03.45PM	MON	INJ	NON COLL	DRY	STR LEVEL	DAYLIGHT	NO SIGN
ERROR										
+-0001.12		CAR		NK	NK	OUT OF CONTROL - DRIVER COND				LOC FEAT
		OVERTURNS	OFF ROAD RESERVE							
		OBJECTS HIT								

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0540.84		21/11/83	UNKNOWN	MON	INJ	NON COLL	DRY	CURVE LEVEL	DAYLIGHT	NO SIGN
ERROR										
+-0001.12		MOTORCYCLE		NK	NK	MOVEMENT NOT KNOWN				LOC FEAT
		FALLS	ON CARRIAGEWAY							
		OBJECTS HIT								

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0540.84		10/02/85	09.40PM	SUN	INJ	HIT OBJ	DRY	STR LEVEL	DARK NO LT	NO SIGN
ERROR										
+-0001.12		UTILITY		FROM W	TO E	SWERVING - TO AVOID ANIMAL				LOC FEAT
		HITS	ON LEFT ROAD VERGE/FTPATH							
		OBJECTS HIT		FIXED OBJECT - OTHER						

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0570.84		01/05/85	11.00AM	WED	MAJ	NON COLL	DRY	STR LEVEL	DAYLIGHT	NO SIGN
ERROR										
+-0001.12		PANEL VAN		FROM W	TO E	OUT OF CONTROL VEH SIDE WIND				LOC FEAT
		OVERTURNS	ON LEFT ROAD VERGE/FTPATH							
				FROM	TO					
		OBJECTS HIT								

SLK	CROSS RD	DATE	TIME	DAY	SEV	ACC NAT	PAV	ALIGN	LT COND	TR CONT
0590.84		20/01/83	01.15PM	THU	INJ	NON COLL	DRY	STR LEVEL	DAYLIGHT	NO SIGN
ERROR										
+-0001.12		STATION WAGON		FROM E	TO W	OUT OF CONTROL - BLOW OUT				LOC FEAT
		OVERTURNS	ON LEFT ROAD VERGE/FTPATH							
		OBJECTS HIT								

APPENDIX A.6:

Ranking crash data output from Tasmania

ANSPORT TASMANIA
TRAFFIC ENGINEERING DIVISION
RESEARCH SECTION

PROGRAM - TFC5025R

DEFINITIONS :	LOCATION
TWO ROAD NAMES	INTERSECTION
THREE ROAD NAMES	LINK

DEFINITIONS :	ACCIDENT SEVERITY	SCORE VALUES
NS	NOT STATED	1
PD-	PROPERTY DAMAGE - minor	1
PD+	PROPERTY DAMAGE - major	1
FA	FIRST AID	1
I-	INJURY - NOT DETAINED IN HOSPITAL	3
I+	INJURY - ADMITTED TO HOSPITAL	3
F	FATAL	3

LOCATION IDENTIFIERS

RANK : HIGHEST SCORING LOCATION RECEIVES RANK 1 AND SO ON.

TOTLOC : TOTAL NUMBER OF LOCATIONS ABOVE AND INCLUDING THE LOCATION IN QUESTION ON RANKED LIST

NOTE ON CONTROL HISTORY

IF 'SEE P.1' NOTATION APPEARS, SITE CONTROLS MAY HAVE BEEN PRESENT BUT, IF SO, WERE NOT NOTED BY REPORTING POLICE

MAINRDS. RURAL. 84-6

RANKING OF TOP 5000 SITES
RANKED ON ACCIDENT SCORE

RANK	MUNICIPALITY / LOCATION	SCORE	SEVERITY TOTAL	PDO	INJ	FATAL		ACCIDENT YEAR 1980	1981	1982	1983	1984	1985	1986	TYPE	CONTROL HISTORY
1	LONGFORD	17	9	4	5		ACC					4	2	3	T-JUNC	GIVWAY 85 GIVWAY 86
	CRESSY MAIN ROAD						SCORE					6	6	5		UNCONT 84
	ILLAWARRA MAIN ROAD															
2	LATROBE	14	6	1	5		ACC					2		4	T-JUNC	GIVWAY 84 UNCONT 86
	PORT SORELL MAIN ROAD						SCORE					4		10		
	PARDOE DEVELOPMENTAL ROA															
3	LATROBE	13	7	4	3		ACC						4	3	LINK	UNCONT 85 UNCONT 86
	MERSEY MAIN ROAD						SCORE						8	5		
	RAILTON MAIN ROAD															
	TARLETON RD															
4	CAMPBELL TOWN	12	6	3	2	1	ACC						4	2	LINK	UNCONT 85 UNCONT 86
	ESK MAIN ROAD						SCORE						6	6		
	MIDLAND HIGHWAY															
	MILFORD RD															
4	FINGAL	12	6	2	4		ACC					1	1	4	LINK	UNCONT 85 UNCONT 86
	ESK MAIN ROAD						SCORE					1	3	8		UNCONT 84
	STOREYS CREEK SECONDARY															
	BONNEYS PLAINS RD															
4	LATROBE	12	4		3	1	ACC						2	2	4 LEGS	GIVWAY 85 GIVWAY 86
	FRANKFORD MAIN ROAD						SCORE						6	6		
	PORT SORELL MAIN ROAD															
7	WESTBURY	10	4	1	2	1	ACC						3	1	LINK	UNCONT 85 UNCONT 86
	ILLAWARRA MAIN ROAD						SCORE						7	3		
	BASS HIGHWAY															
	DUMMY - USED FOR LGA BOU															
7	DEVONPORT	10	4	1	1	2	ACC					4			LINK	UNCONT 84
	FORTH MAIN ROAD						SCORE					10				
	BRADDONS L O RD															
	LILLICO RD															
9	CAMPBELL TOWN	9	3		3		ACC							3	LINK	UNCONT 86
	LAKE LEAKE MAIN ROAD						SCORE							9		
	SPRENT ST															
	DUMMY - USED FOR LGA BOU															
9	ULVERSTONE	9	3		2	1	ACC					2		1	LINK	UNCONT 84 UNCONT 86
	FORTH MAIN ROAD						SCORE					6		3		
	KINDRED MAIN ROAD															
	TURNERS BEACH RD															
9	KENTISH	9	3		3		ACC						2	1	T-JUNC	UNCONT 85 GIVWAY 86
	SHEFFIELD MAIN ROAD						SCORE						6	3		
	NOOK RD															

APPENDIX B: CRASH HISTORY SUMMARY

ACCI T HISTORY SUMMARY

EYRE HWY (SLK 0.00-724.51 WA/SA BORDER, DUNDAS SHIRE)
FROM 01/01/83 TO 15/09/87

EYRE HIGHWAY 000H003 0000.00-0724.51 DATE OF REPORT 16/11/87

ACCIDENT NATURE	NO	%
REAR END	14	5
HEAD ON	2	1
SIDESWIPE OPP DIR	16	6
SIDESWIPE SAM DIR	32	11
RIGHT ANGLE	2	1
IND RIGHT ANGLE		
HIT PEDESTRAIN	1	
HIT ANIMAL	54	19
HIT OBJECT	34	12
NON COLLISION	129	45
UNKNOWN		
TOTAL	284	100

ACCIDENTS INVOLVING	NO	%
OVERTAKING	36	13
PARKING		
ANIMALS	80	28
PEDESTRAINS	1	
DRIVEWAYS	5	2
OTHER	162	57
TOTAL	284	100

OBJECTS HIT	NO	%
SEC/PMG POLES		
TRAFFIC LIGHT POSTS		
TRAFFIC SIGN POSTS		
COMM SIGN POSTS		
TREES	17	18
OTHER	75	62
TOTAL	92	100

LIGHT CONDITIONS	NO	%
DAYLIGHT	169	60
DAWN	21	7
DUSK	14	5
DARK STREET LTS ON	1	
DARK STREET LTS OFF		
DARK NO STREET LTS	77	27
UNKNOWN	2	1
TOTAL	284	100

SEVERITY	NO	%
FATAL	12	4
INJURY	88	31
PDO-MAJ	159	56
PDO-MIN	25	9
TOTAL	284	100

PAVEMENT COND	NO	%
WET	39	14
DRY	245	66
OTHER		
TOTAL	284	100

ROAD ALIGNMENT	NO	%
CURVE	30	11
STRAIGHT	252	89
OTHER	2	1
TOTAL	284	100

ROAD GRADE	NO	%
LEVEL	218	77
CREST OF HILL	12	4
SLOPE	54	19
OTHER		
TOTAL	284	100

REPORT EXCLUDES ACCIDENTS AT INTERSECTIONS WHERE XRD HAS HIGHER HIERARCHICAL VALUE

APPENDIX C: DATA ITEMS AVAILABLE IN NAASRA SECTIONISED ROAD INVENTORY

N A A S R A   R O A D   P L A N N I N G   M O D E L   -   N I M P A C

TABLE 1 : SECTIONIZED ROAD INVENTORY - DATA ITEMS FOR NIMPAC

REFERENCE NUMBER	ITEM MNEMONIC		NO OF CHARS	CHARACTER POSITIONS	PICTURE	DESCRIPTION OF ITEM
	IDENTIFIER-FIELDS					
	IDENTIFIER AND SORT-KEY ITEMS					
1	REC-TYPE		2	1- 2	99	RECORD TYPE (01)
2	ROUTE		8	3- 10	XXXXXXXX	ROUTE IDENTIFIER
3	RDN		8	11- 18	XXXXXXXX	ROAD NUMBER
4	PRP1		9	19- 27	XXXXXXXXX	PERMANENT REFERENCE POINT 1
5	PRP2		9	28- 36	XXXXXXXXX	PERMANENT REFERENCE POINT 2
6	YEAR-INV	YRINV	4	37- 40	9999	NOMINAL YEAR OF INVENTORY
7	SECTION-NO	SECNO	6	41- 46	999999	SECTION NUMBER
8	COST-GROUP-CODE	CSTGRP	4	47- 50	9999	CODE TO INDICATE REQUIRED COST GROUP
9	LINK-SEQ-NO	LINKNO	3	51- 53	999	LINK SEQUENCE NUMBER
10	DIST		8	54- 61	99999V999	DISTANCE FROM PRP1 (KM)
11	CARR		1	62- 62	9	CARRIAGEWAY IDENTIFIER
	GEOGRAPHICAL AND LEGAL CLASSIFICATION ITEMS					
12	STATE		1	63- 63	9	STATE OR TERRITORY IDENTIFIER
13	DVN		2	64- 65	99	S.R.A. DIVISION NUMBER
14	LGA		3	66- 68	999	LOCAL GOVERNMENT AREA
15	ABSNO		6	69- 74	999999	A.B.S. STATISTICAL AREA
16	FC		1	75- 75	9	FUNCTIONAL CLASS
17	SLC		2	76- 77	99	STATE LEGAL CLASS
18	CLC		2	78- 79	99	COMMONWEALTH LEGAL CLASS
19	AREAC		1	80- 80	9	AREA CLASS
20	LU		4	81- 84	9999	LAND USE
21	GT		1	85- 85	9	GENERAL TERRAIN
	FILLER		5	86- 90	99999	
	GENERAL-ROAD-DATA					
	GEOMETRIC AND MATERIAL CLASSIFICATION DATA					
22	LENGTH		8	91- 98	99999V999	LENGTH OF ROAD SECTION (KM)
23	FT		1	99- 99	9	FORMATION TYPE
24	FW		3	100-102	99V9	FORMATION WIDTH (M)
25	PT		1	103-103	9	PAVEMENT TYPE
26	PW		3	104-106	99V9	PAVEMENT WIDTH (M)
27	ST		1	107-107	9	SURFACE TYPE
28	SW		3	108-110	99V9	SURFACE WIDTH (M)
29	SHTL		1	111-111	9	SHOULDER TYPE - LEFT
30	SHWL		2	112-113	9V9	SHOULDER WIDTH (M) - LEFT
31	SHTR		1	114-114	9	SHOULDER TYPE - RIGHT
32	SHWR		2	115-116	9V9	SHOULDER WIDTH (M) - RIGHT
33	OSW		3	117-119	99V9	OUTER SEPARATOR WIDTH (M)
34	MW		3	120-122	99V9	MEDIAN WIDTH (M)
35	SAFBAR		1	123-123	9	SAFETY BARRIER IN MEDIAN
36	SVLL		1	124-124	9	SLOW VEHICLE LANE - LEFT
37	SVLR		1	125-125	9	SLOW VEHICLE LANE - RIGHT

TABLE I : SECTIONIZED ROAD INVENTORY - DATA ITEMS FOR NIMPAC

REFERENCE NUMBER	ITEM MNEMONIC		NO OF CHARS	CHARACTER POSITIONS	PICTURE	DESCRIPTION OF ITEM
* ROAD ALIGNMENT DATA						
38	PCLT40	PCNC(1,1)	4	126-129	9V999	PROPORTION OF LENGTH WITH CURVE SPEED LESS THAN 40 KM/H
39	NCLT40	PCNC(2,1)	3	130-132	999	NUMBER OF CURVES WITH CURVE SPEED LESS THAN 40 KM/H
40	PC4050	PCNC(1,2)	4	133-136	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [40,50) KM/H
41	NC4050	PCNC(2,2)	3	137-139	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [40,50) KM/H
42	PC5060	PCNC(1,3)	4	140-143	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [50,60) KM/H
43	NC5060	PCNC(2,3)	3	144-146	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [50,60) KM/H
44	PC6070	PCNC(1,4)	4	147-150	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [60,70) KM/H
45	NC6070	PCNC(2,4)	3	151-153	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [60,70) KM/H
46	PC7080	PCNC(1,5)	4	154-157	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [70,80) KM/H
47	NC7080	PCNC(2,5)	3	158-160	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [70,80) KM/H
48	PC8090	PCNC(1,6)	4	161-164	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [80,90) KM/H
49	NC8090	PCNC(2,6)	3	165-167	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [80,90) KM/H
50	PC9010	PCNC(1,7)	4	168-171	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [90,100) KM/H
51	NC9010	PCNC(2,7)	3	172-174	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [90,100) KM/H
52	PC1011	PCNC(1,8)	4	175-178	9V999	PROPORTION OF LENGTH WITH CURVE SPEED IN THE RANGE [100,110) KM/H
53	NC1011	PCNC(2,8)	3	179-181	999	NUMBER OF CURVES WITH CURVE SPEED IN THE RANGE [100,110) KM/H
54	PCGE11		4	182-185	9V999	PROPORTION OF LENGTH WITH STRAIGHT ALIGNMENT
55	PFLAT		4	186-189	9V999	PROPORTION OF LENGTH WITH FLAT ALIGNMENT (I.E. GRADES LESS THAN 2%)
UPGRADES						
56	PUG24	PUGNUG(1,1)	4	190-193	9V999	PROPORTION OF LENGTH WITH UP GRADES IN THE RANGE [2,4) %
57	NUG24	PUGNUG(2,1)	3	194-196	999	NUMBER OF UP GRADES IN THE RANGE [2,4) %
58	PUG46	PUGNUG(1,2)	4	197-200	9V999	PROPORTION OF LENGTH WITH UP GRADES IN THE RANGE [4,6) %
59	NUG46	PUGNUG(2,2)	3	201-203	999	NUMBER OF UP GRADES IN THE RANGE [4,6) %
60	PUG68	PUGNUG(1,3)	4	204-207	9V999	PROPORTION OF LENGTH WITH UP GRADES IN THE RANGE [6,8) %
61	NUG68	PUGNUG(2,3)	3	208-210	999	NUMBER OF UP GRADES IN THE RANGE [6,8) %
62	PUG810	PUGNUG(1,4)	4	211-214	9V999	PROPORTION OF LENGTH WITH UP GRADES IN THE RANGE [8,10) %
63	NUG810	PUGNUG(2,4)	3	215-217	999	NUMBER OF UP GRADES IN THE RANGE [8,10) %
64	PUGE10	PUGNUG(1,5)	4	218-221	9V999	PROPORTION OF LENGTH WITH UP GRADES GREATER THAN OR EQUAL TO 10%
65	NUGE10	PUGNUG(2,5)	3	222-224	999	NUMBER OF UP GRADES GREATER THAN OR EQUAL TO 10%
DOWNGRADES						
66	PDG24	PDGNDG(1,1)	4	225-228	9V999	PROPORTION OF LENGTH WITH DOWN GRADES IN THE RANGE [2,4) %
67	NDG24	PDGNDG(2,1)	3	229-231	999	NUMBER OF DOWN GRADES IN THE RANGE [2,4) %
68	PDG46	PDGNDG(1,2)	4	232-235	9V999	PROPORTION OF LENGTH WITH DOWN GRADES IN THE RANGE [4,6) %
69	NDG46	PDGNDG(2,2)	3	236-238	999	NUMBER OF DOWN GRADES IN THE RANGE [4,6) %
70	PDG68	PDGNDG(1,3)	4	239-242	9V999	PROPORTION OF LENGTH WITH DOWN GRADES IN THE RANGE [6,8) %
71	NDG68	PDGNDG(2,3)	3	243-245	999	NUMBER OF DOWN GRADES IN THE RANGE [6,8) %
72	PDG810	PDGNDG(1,4)	4	246-249	9V999	PROPORTION OF LENGTH WITH DOWN GRADES IN THE RANGE [8,10) %
73	NDG810	PDGNDG(2,4)	3	250-252	999	NUMBER OF DOWN GRADES IN THE RANGE [8,10) %
74	PDGE10	PDGNDG(1,5)	4	253-256	9V999	PROPORTION OF LENGTH WITH DOWN GRADES GREATER THAN OR EQUAL TO 10%
75	NDGE10	PDGNDG(2,5)	3	257-259	999	NUMBER OF DOWN GRADES GREATER THAN OR EQUAL TO 10%

NAASRA ROAD PLANNING MODEL - NIMPAC

TABLE 1 : SECTIONIZED ROAD INVENTORY - DATA ITEMS FOR NIMPAC

REFERENCE NUMBER	ITEM MNEMONIC		NO OF CHARS	CHARACTER POSITIONS	PICTURE	DESCRIPTION OF ITEM
	VERTICAL-CURVE-DATA					
76	PVLT50	PVNV(1,1)	4	260-263	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES LESS THAN 50 KM/H
77	NVLT50	PVNV(2,1)	3	264-266	999	NUMBER OF SUMMIT VC'S WITH SPEED LESS THAN 50 KM/H
78	PV5060	PVNV(1,2)	4	267-270	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [50,60) KM/H
79	NV5060	PVNV(2,2)	3	271-273	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [50,60) KM/H
80	PV6070	PVNV(1,3)	4	274-277	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [60,70) KM/H
81	NV6070	PVNV(2,3)	3	278-280	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [60,70) KM/H
82	PV7080	PVNV(1,4)	4	281-284	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [70,80) KM/H
83	NV7080	PVNV(2,4)	3	285-287	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [70,80) KM/H
84	PV8090	PVNV(1,5)	4	288-291	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [80,90) KM/H
85	NV8090	PVNV(2,5)	3	292-294	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [80,90) KM/H
86	PV9010	PVNV(1,6)	4	295-298	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [90,100) KM/H
87	NV9010	PVNV(2,6)	3	299-301	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [90,100) KM/H
88	PV1011	PVNV(1,7)	4	302-305	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES IN THE RANGE [100,110) KM/H
89	NV1011	PVNV(2,7)	3	306-308	999	NUMBER OF SUMMIT VC'S WITH SPEED IN THE RANGE [100,110) KM/H
90	PVGE11	PVNV(1,8)	4	309-312	9V999	PROPORTION OF LENGTH WITH VERTICAL CURVES GREATER THAN OR EQUAL TO 110 KM/H
91	NVGE11	PVNV(2,8)	3	313-315	999	NUMBER OF SUMMIT VC'S WITH SPEED GREATER THAN OR EQUAL TO 110 KM/H
92	PNOVHC		4	316-319	9V999	PROPORTION OF LENGTH WHICH HAS NO VERTICAL OR HORIZ CURVES
•	ROAD RIDEABILITY DATA					
93	PDT		1	320-320	9	PAVEMENT DATA TYPE
94	PYEAR		4	321-324	9999	YEAR OF (RE)CONSTRUCTION OR PAVING/RESHEETING
95	PSR		2	325-326	9V9	"PRESENT" SERVICEABILITY RATING
96	SYEAR		4	327-330	9999	YEAR OF SURFACING/RESURFACING
97	SURFR		2	331-332	99	SURFACE RATING
98	NRMYR		4	333-336	9999	YEAR OF NRM READING/P.S. RATING
99	NRM		3	337-339	999	NAASRA ROUGHNESS METER READING (COUNTS/KM)
•	DRAINAGE-RELATED DATA					
100	MARIP		4	340-343	9V999	PROPORTION OF LENGTH WHICH HAS RIPPABLE ADJACENT MATERIAL
101	MATRAF		4	344-347	9V999	PROPORTION OF LENGTH WHICH HAS UNTRAFFICABLE ADJACENT MATERIAL
102	MDA		4	348-351	9V999	PROPORTION OF LENGTH WHICH HAS ADEQUATE MINOR DRAINAGE
	CULVERTS					
103	CULVA		8	352-359	99999999	TOTAL WATERWAY AREA FOR CULVERTS IN THE SECTION (SQ.M)
104	NCULV		3	360-362	999	NUMBER OF CULVERTS IN THE SECTION
	FLOODWAYS					
105	FLENTH		6	363-368	999999	TOTAL LENGTH OF FLOODWAY IN THE SECTION (M)
106	NFLWAY		3	369-371	999	NUMBER OF FLOODWAYS
107	NFERRY		2	372-373	99	NUMBER OF FERRIES
108	NFORD		2	374-375	99	NUMBER OF FORDS
109	NCAUS		2	376-377	99	NUMBER OF CAUSEWAYS
	BRIDGES					
110	NWATBR		2	378-379	99	NUMBER OF BRIDGES OVER WATER
111	NOTHBR		2	380-381	99	NUMBER OF BRIDGES NOT OVER WATER

APPENDIX D: GRAPHICAL ANALYSIS OF INJURY AND FATAL CRASHES AND SELECTED ROAD PARAMETERS

In order to increase readability of the printout included in this report the following symbols and abbreviations are used(1):

Inj.	=	Injury Crash
Fat.	=	Fatal Crash
PDO	=	Property Damage Only Crash
PRP1	=	Permanent Reference Point 1
Curve < 80	=	Curve with 80km/h design
AADT	=	Average Annual Daily Traffic
vpd	=	vehicles per day
~	=	Horizontal Curve
^	=	Vertical Curve
/§	=	Up and Down Grade
x	=	Intersection
#	=	Railway Crossing
][	=	Bridge

Note: (1) Refer also to discussion in Section 3.1.

TABLE 1 1 SECTIONIZED ROAD INVENTORY - DATA ITEMS FOR NIMPAC

REFERENCE NUMBER	ITEM MNEMONIC	NO OF CHARS	CHARACTER POSITIONS	PICTURE	DESCRIPTION OF ITEM
• TRAFFIC OPERATION DATA					
112	NCARR	1	382-382	9	NUMBER OF CARRIAGEWAYS
113	OC	1	383-383	9	OPERATIONAL CLASS
114	AC	1	384-384	9	DEGREE OF ACCESS CONTROL
115	LSL	3	385-387	999	LEGAL SPEED LIMIT (KM/H)
116	KEL	4	388-391	9V999	PROPORTION OF LENGTH FOR WHICH KERBS EXIST - LEFT
117	KER	4	392-395	9V999	PROPORTION OF LENGTH FOR WHICH KERBS EXIST - RIGHT
118	KELR	4	396-399	9V999	PROPORTION OF LENGTH FOR WHICH KERBS EXIST - LEFT & RIGHT
119	AMPL	1	400-400	9	STANDING ALLOWED A.M. PEAK - LEFT
120	PMPL	1	401-401	9	STANDING ALLOWED P.M. PEAK - LEFT
121	OFPL	1	402-402	9	STANDING ALLOWED OFF-PEAK - LEFT
122	AMPR	1	403-403	9	STANDING ALLOWED A.M. PEAK - RIGHT
123	PMPR	1	404-404	9	STANDING ALLOWED P.M. PEAK - RIGHT
124	OFPR	1	405-405	9	STANDING ALLOWED OFF-PEAK - RIGHT
125	OCOTYP	1	406-406	9	TYPE OF OFF-CENTRE OPERATION
126	OCONL	1	407-407	9	NUMBER OF LANES INVOLVED IN OFF-CENTRE OPERATION
127	PLTYP	1	408-408	9	PRIORITY LANE TYPE
128	PLWDTH	3	409-411	99V9	PRIORITY LANE WIDTH (M)
129	ROW	3	412-414	999	RIGHT OF WAY WIDTH (M)
	PED-XNG-DATA				
130	NPXNG1	2	415-416	99	NUMBER OF UNSIGNALIZED PEDESTRIAN CROSSINGS
131	NPXNG2	2	417-418	99	NUMBER OF PEDESTRIAN CROSSINGS WITH SIGNS ONLY
132	NPXNG3	2	419-420	99	NUMBER OF PEDESTRIAN CROSSINGS WITH FLASHING LIGHTS
133	NPXNG4	2	421-422	99	NUMBER OF PEDESTRIAN CROSSINGS WITH PEDESTRIAN-OPERATED STOP-GO SIGNALS
	INTERSECTIONS				
134	NINT1	2	423-424	99	NUMBER OF INTERSECTIONS WITH NO TRAFFIC CONTROL
135	NINT2	2	425-426	99	NUMBER OF INTERSECTIONS WITH 'GIVE WAY TO RIGHT' RULE
136	NINT3	2	427-428	99	NUMBER OF INTERSECTIONS WITH STOP/GIVE-WAY SIGNS
137	NINT4	2	429-430	99	NUMBER OF INTERSECTIONS WITH STOP-GO SIGNALS
	RAIL-XINGS				
138	NRXNG1	2	431-432	99	NUMBER OF RAILWAY LEVEL CROSSINGS WITH NO WARNING DEVICE
139	NRXNG2	2	433-434	99	NUMBER OF RAILWAY LEVEL CROSSINGS WITH SIGNS/MARKINGS ONLY
140	NRXNG3	2	435-436	99	NUMBER OF RAILWAY LEVEL CROSSINGS WITH WIG-WAGS OR FLASHING LIGHTS
141	NRXNG4	2	437-438	99	NUMBER OF RAILWAY LEVEL CROSSINGS WITH BOOM BARRIERS
142	NRXNG5	2	439-440	99	NUMBER OF RAILWAY LEVEL CROSSINGS WITH GATES
• TRAFFIC DATA					
143	YRAADT	4	441-444	9999	YEAR OF AADT
144	AADT	6	445-450	999999	ANNUAL AVERAGE DAILY TRAFFIC FOR YEAR OF AADT (VEHICLES/DAY)
	TRAFFIC-GROWTH				
145	YRADT1	4	451-454	9999	YEAR 1 OF TRAFFIC FORECAST
146	ADT1	6	455-460	999999	TRAFFIC FORECAST FOR YEAR 1 (VEHICLES/DAY)
147	YRADT2	4	461-464	9999	YEAR 2 OF TRAFFIC FORECAST
148	ADT2	6	465-470	999999	TRAFFIC FORECAST FOR YEAR 2 (VEHICLES/DAY)
149	YRADT3	4	471-474	9999	YEAR 3 OF TRAFFIC FORECAST
150	ADT3	6	475-480	999999	TRAFFIC FORECAST FOR YEAR 3 (VEHICLES/DAY)
	TRAFFIC-COMPOSITION				
151	TCCR	3	481-483	V999	PROPORTION OF AADT WHICH IS CARS
152	TCLT	3	484-486	V999	PROPORTION OF AADT WHICH IS LIGHT COMMERCIALS
153	TCRTK	3	487-489	V999	PROPORTION OF AADT WHICH IS RIGID TRUCKS
154	TCST	3	490-492	V999	PROPORTION OF AADT WHICH IS SEMI-TRAILERS
155	TCRT	3	493-495	V999	PROPORTION OF AADT WHICH IS ROAD TRAINS
156	BUSES	4	496-499	9999	NUMBER OF BUSES/WEEKDAY
157	TRAMS	4	500-503	9999	NUMBER OF TRAMS/WEEKDAY
	FILLER	7	504-510	9999999	

ANALYSIS OF FATAL AND INJURY ACCIDENT LOCATIONS DURING 1984-86 AND ROAD PARAMETERS ALONG H3 EYRE HIGHWAY IN DUNDAS (WA)

km	ACCIDENT DATA Numbers of accidents	Largest error of location	NAASRA ROAD DATA Dist-PRP1	HORIZ <80	CURVE 80-110	VERT <70	CURVE 70-110	GRADE 2-6%	>6%	Surf. width	Form width	Rough-ness	Speed Limit	AADT	% cars	No int	No RX	No Br
0																		
1			1.05km	~ 0.0%	0.0%^	0.0%	6.2%/\	30.6%	0.0%	6m	9m	Rough= 59	80k/h	406vpd	(63%)	x0	#0	][0
2																		
3			2.98km	~ 0.0%	0.0%^	0.0%	5.6%/\	71.9%	0.0%	6m	9m	Rough= 59	110k/h	406vpd	(63%)	x0	#0	][0
4																		
5	<=- 1 Inj.		5.47km	~ 0.0%	37.8%^	4.9%	0.0%/\	57.3%	0.0%	6m	9m	Rough= 59	110k/h	227vpd	(64%)	x1	#0	][0
6			6.29km	~ 0.0%	0.0%^	0.0%	0.0%/\	88.2%	0.0%	6m	9m	Rough= 60	110k/h	227vpd	(64%)	x0	#0	][0
7			6.80km	~ 0.0%	5.1%^	0.0%	12.5%/\	71.7%	0.0%	6m	9m	Rough= 60	110k/h	395vpd	(54%)	x0	#0	][0
8																		
9			8.96km	~ 0.0%	0.0%^	0.0%	9.8%/\	1.4%	0.0%	6m	9m	Rough= 69	110k/h	395vpd	(54%)	x0	#0	][0
10			10.40km	~ 0.0%	0.0%^	0.0%	0.0%/\	0.0%	0.0%	6m	9m	Rough= 69	110k/h	395vpd	(54%)	x0	#0	][0
11			10.95km	~ 0.0%	0.0%^	0.0%	0.0%/\	1.1%	0.0%	6m	9m	Rough= 61	110k/h	395vpd	(54%)	x0	#0	][0
12			11.88km	~ 0.0%	0.0%^	0.0%	3.7%/\	17.6%	0.0%	6m	9m	Rough= 61	110k/h	395vpd	(54%)	x0	#0	][0
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22			22.40km	~ 0.0%	0.0%^	0.0%	5.1%/\	24.1%	0.0%	6m	9m	Rough= 55	110k/h	395vpd	(54%)	x0	#0	][0
23																		
24																		
25	<=- 2 Inj.	[+/- 0.50]																
26																		
27			26.88km	~ 0.0%	0.0%^	0.0%	16.1%/\	28.2%	0.0%	6m	9m	Rough= 76	110k/h	395vpd	(54%)	x0	#0	][0
28	<=- 1 Inj.	[+/- 1.73]	28.37km	~ 0.0%	0.0%^	0.0%	2.2%/\	0.0%	0.0%	6m	9m	Rough= 62	110k/h	395vpd	(54%)	x0	#0	][0
29																		
30	<=- 1 Inj.	[+/- 0.50]																
31			30.66km	~ 0.0%	0.0%^	0.0%	0.0%/\	0.0%	0.0%	6m	9m	Rough= 62	110k/h	395vpd	(54%)	x0	#0	][0
32	<=- 1 Inj.	[+/- 0.50]	30.77km	~ 0.0%	0.0%^	0.0%	5.6%/\	0.0%	0.0%	6m	9m	Rough= 62	110k/h	395vpd	(54%)	x0	#0	][0
33			32.20km	~ 0.0%	0.0%^	0.0%	7.0%/\	6.5%	0.0%	6m	9m	Rough= 62	110k/h	395vpd	(54%)	x0	#0	][0
34			34.34km	~ 0.0%	24.5%^	0.0%	7.2%/\	65.1%	0.0%	6m	9m	Rough= 62	110k/h	395vpd	(54%)	x0	#0	][0
35	<=- 3 Inj.	[+/- 4.62]																
36																		
37			36.83km	~ 0.0%	0.0%^	0.0%	3.0%/\	3.2%	0.0%	6m	9m	Rough= 48	110k/h	395vpd	(54%)	x0	#0	][0
38																		
39																		
40																		
41																		
42																		
43			42.80km	~ 0.0%	0.0%^	0.0%	3.4%/\	35.4%	0.0%	6m	9m	Rough= 59	110k/h	395vpd	(54%)	x0	#0	][0
44																		
45	<=- 1 Inj.	[+/- 4.62]																
46																		
47																		
48																		
49			49.50km	~ 0.0%	0.0%^	0.0%	6.5%/\	8.3%	0.0%	6m	9m	Rough= 59	110k/h	395vpd	(54%)	x1	#0	][0
50																		
51																		

```
52
53  <=-  1 Inj.          [+/- 1.98]
54
55
56                      56.24km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 71 110k/h   395vpd( 54%) x0 #0 ][0
57                      57.35km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 71 110k/h   395vpd( 54%) x0 #0 ][0
58                      57.73km ~ 0.0% 0.0%^ 0.0% 8.8%/\28.3% 0.0%  6m  9m Rough= 65 110k/h   395vpd( 54%) x0 #0 ][0
59                      59.32km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 65 110k/h   395vpd( 54%) x0 #0 ][0
60                      59.95km ~ 0.0% 0.0%^ 0.0% 7.8%/\ 0.0% 0.0%  6m  9m Rough= 65 110k/h   395vpd( 54%) x0 #0 ][0
61                      60.59km ~ 0.0% 0.0%^ 0.0% 7.2%/\55.9% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
62                      61.70km ~ 0.0% 0.0%^ 0.0% 0.0%/\100%  0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
63
64                      63.70km ~ 0.0% 0.0%^ 0.0%11.3%/\11.3% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
65                      65.30km ~ 0.0% 0.0%^ 0.0%17.0%/\34.0% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
66                      66.30km ~ 0.0% 0.0%^ 0.0% 4.8%/\24.2% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
67
68
69
70
71
72
73                      73.30km ~ 0.0% 0.0%^ 0.0% 5.3%/\15.4% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
74
75                      75.13km ~ 0.0% 0.0%^ 0.0% 9.3%/\ 0.0% 0.0%  6m  9m Rough= 68 110k/h   395vpd( 54%) x0 #0 ][0
76
77
78                      77.64km ~ 0.0% 0.0%^ 0.0% 5.5%/\37.4% 0.0%  6m  9m Rough= 65 110k/h   395vpd( 54%) x0 #0 ][0
79
80
81
82
83
84
85  <=-  2 Inj.          [+/- 4.62]
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101                     100.76km ~ 0.0% 0.0%^ 0.0% 0.0%/\76.4% 0.0%  6m  9m Rough= 78 110k/h   395vpd( 54%) x0 #0 ][0
102                     102.03km ~ 0.0% 0.0%^ 0.0% 0.0%/\100%  0.0%  6m  9m Rough= 78 110k/h   395vpd( 54%) x0 #0 ][0
103
104
105                     105.25km ~ 0.0% 0.0%^ 0.0% 1.6%/\98.4% 0.0%  6m  9m Rough= 58 110k/h   395vpd( 54%) x0 #0 ][0
106                     105.89km ~ 0.0% 0.0%^ 0.0%25.5%/\ 0.0% 0.0%  6m  9m Rough= 58 110k/h   395vpd( 54%) x0 #0 ][0
107                     106.40km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 58 110k/h   395vpd( 54%) x0 #0 ][0
108                     106.75km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
109                     108.20km ~ 0.0% 0.0%^ 0.0% 4.0%/\ 0.0% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
110
111
```

```
112 -                                  112.17km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
113 -                                  112.81km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 2.4% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
114 -
115 -
116 -
117 -                                  117.48km ~ 0.0% 0.0%^ 0.0% 0.0%/\54.2% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
118 -                                  117.96km ~ 0.0% 0.0%^25.9% 0.0%/\63.0% 0.0%  6m  9m Rough= 70 110k/h   395vpd( 54%) x0 #0 ][0
119 -                                  118.23km ~ 0.0% 0.0%^ 0.0% 0.0%/\84.4% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
120 -                                  118.55km ~ 0.0% 0.0%^ 0.0% 3.2%/\ 7.9% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
121 -
122 -
123 -
124 -                                  123.60km ~ 0.0% 0.0%^ 0.0%11.8%/\23.5% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
125 -                                  125.30km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
126 -
127 -                                  126.80km ~ 0.0% 0.0%^ 0.0% 0.0%/\31.4% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
128 -
129 -
130 -                                  130.34km ~ 0.0% 0.0%^ 0.0% 9.7%/\25.7% 0.0%  6m  9m Rough= 57 110k/h   395vpd( 54%) x0 #0 ][0
131 -
132 -
133 -
134 -
135 -
136 -
137 -
138 -
139 -
140 -                                  139.68km ~ 0.0% 0.0%^ 0.0% 7.4%/\14.1% 0.0%  6m  9m Rough= 59 110k/h   395vpd( 54%) x0 #0 ][0
141 -
142 -
143 -
144 -
145 -
146 -
147 -
148 -
149 -                                  148.66km ~ 0.0% 0.0%^ 0.0%22.0%/\76.0% 0.0%  6m  9m Rough= 53 110k/h   395vpd( 54%) x0 #0 ][0
150 -                                  150.16km ~ 0.0% 0.0%^ 0.0% 6.0%/\44.0% 0.0%  6m  9m Rough= 54 110k/h   395vpd( 54%) x0 #0 ][0
151 -                                  151.16km ~ 0.0% 0.0%^ 0.0%15.7%/\47.2% 0.0%  6m  9m Rough= 69 110k/h   395vpd( 54%) x0 #0 ][0
152 -
153 -
154 -                                  154.15km ~ 0.0% 0.0%^ 0.0% 0.0%/\32.0% 0.0%  6m  9m Rough= 54 110k/h   395vpd( 54%) x0 #0 ][0
155 -
156 -
157 -                                  156.65km ~ 0.0% 0.0%^ 0.0% 6.9%/\12.7% 0.0%  6m  9m Rough= 63 110k/h   395vpd( 54%) x0 #0 ][0
158 -
159 -
160 -
161 -
162 -
163 -
164 -<=-  1 Inj.          [+/- 0.50]
165 -<=-  1 Inj.          [+/- 4.62]
166 -<=-  1 Fat.          [+/- 0.50]
167 -
168 -
169 -
170 -
171 -
```

```
                                         174 45km ~ 0.0% 0 0%^ 0.0%14 5%/\25 9% 0.0%  6m  9m Rough= 52 110k/h   395vpd( 54%) x0 #0 ][0
<=-   1 Inj.               [+/- 0.50]
                                         177 61km ~ 0.0% 0 0%^ 0.0% 8 2%/\14 3% 0.0%  6m  9m Rough= 46 110k/h   395vpd( 54%) x1 #0 ][0
<=-   1 Inj.               [+/- 0.38]
                                         201.67km ~ 0.0% 0.0%^ 0.0%15 7%/\29 3% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%)  0 #0 ][0
                                         206.52km ~ 0.0% 0.0%^ 0.0% 4.4%/\25.3% 0.0%  6m  9m Rough= 27 110k/h   395vpd( 54%) x0 #0 ][0
                                         208.10km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 72 110k/h   395vpd( 54%) x0 #0 ][0
                                         209.15km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 31 110k/h   395vpd( 54%) x0 #0 ][0
                                         211.02km ~ 0.0% 0.0%^ 0.0% 7.2%/\12.9% 0.0%  6m  9m Rough= 30 110k/h   395vpd( 54%) x0 #0 ][0
< -   1 Inj.               [+/  0.99]
                                         214.51km ~ 0.0% 0.0%^ 0.0% 0 0%/\ 0 0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
                                         218.01km ~ 0.0% 0.0%^ 0.0% 0 0%/\28 0% 0.0%  6m  9m Rough= 32 110k/h   395vpd( 54%) x0 #0 ][0
                                         220.51km ~ 0.0% 0.0%^ 0.0% 2 9%/\10 8% 0.0%  6m  9m Rough= 26 110k/h   395vpd( 54%) x0 #0 ][0
                                         223.57km ~ 0.0% 0.0%^ 0.0% 0 0%/\ 4 2% 0.0%  6m  9m Rough= 46 110k/h   395vpd. 54%)  0 #0 ][0
```

```
232
233
234
235
236
237
238                                          238.50km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 76 110k/h   395vpd( 54%) x0 #0 ][0
239
240                                          240.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 76 110k/h   395vpd( 54%) x0 #0 ][0
241                                          240.08km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
242
243                                          242.83km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 64 110k/h   395vpd( 54%) x0 #0 ][0
244
245
246                                          246.49km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 71 110k/h   395vpd( 54%) x0 #0 ][0
247
248                                          247.99km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 82 110k/h   395vpd( 54%) x0 #0 ][0
249
250                                          249.99km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 72 110k/h   395vpd( 54%) x0 #0 ][0
251
252
253
254
255
256                                          255.99km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 62 110k/h   395vpd( 54%) x0 #0 ][0
257
258
259
260
261
262
263                                          263.48km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 81 110k/h   395vpd( 54%) x0 #0 ][0
264
265                                          264.98km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 52 110k/h   395vpd( 54%) x0 #0 ][0
266 <=-  1 Inj.                  [+/- 0.50]
267
268
269
270                                          270.48km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 57 110k/h   395vpd( 54%) x0 #0 ][0
271
272 <=-  1 Inj.                  [+/- 0.99]  272.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 57 110k/h   395vpd( 54%) x0 #0 ][0
273                                          272.20km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 57 110k/h   395vpd( 54%) x0 #0 ][0
274                                          272.98km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 40 110k/h   395vpd( 54%) x0 #0 ][0
275                                          274.98km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 44 110k/h   395vpd( 54%) x0 #0 ][0
276                                          276.47km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 40 110k/h   395vpd( 54%) x0 #0 ][0
277 <=-  1 Inj.                  [+/- 4.01]
278
279
280
281                                          280.97km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 51 110k/h   395vpd( 54%) x0 #0 ][0
282                                          282.47km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  8m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
283
284
285
286
287
288
289
290
291
```

```
292
293
294
295
296                    296.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
297                    296.24km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 53 110k/h   395vpd( 54%) x0 #0 ][0
298                    297.73km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 36 110k/h   395vpd( 54%) x0 #0 ][0
299
300
301
302                    302.23km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 46 110k/h   395vpd( 54%) x0 #0 ][0
303
304                    303.73km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 38 110k/h   395vpd( 54%) x0 #0 ][0
305                    305.23km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 37 110k/h   395vpd( 54%) x0 #0 ][0
306
307                    306.73km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 69 110k/h   395vpd( 54%) x0 #0 ][0
308 <=-  1 Fat.        307.73km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
309
310                    310.23km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 53 110k/h   395vpd( 54%) x0 #0 ][0
311
312 <=-  1 Inj.       [+/- 0.99]
313
314                    313.73km ~ 0.0% 0.0%^ 0.0% 3.0%/\ 0.0% 0.0%  6m  9m Rough= 30 110k/h   395vpd( 54%) x0 #0 ][0
315
316                    315.73km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 36 110k/h   395vpd( 54%) x0 #0 ][0
317
318
319
320
321
322
323
324                    324.23km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 31 110k/h   395vpd( 54%) x0 #0 ][0
325
326
327
328
329
330                    330.46km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 36 110k/h   395vpd( 54%) x0 #0 ][0
331
332
333                    333.22km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
334                    333.40km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 41 110k/h   395vpd( 54%) x0 #0 ][0
335                    334.72km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 34 110k/h   395vpd( 54%) x0 #0 ][0
336
337 <=-  1 Inj.       [+/- 4.01] 337.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 34 110k/h   395vpd( 54%) x0 #0 ][0
338
339
340                    340.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 34 110k/h   395vpd( 54%) x0 #0 ][0
341
342
343
344
345
346                    345.72km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%) x0 #0 ][0
347                    346.25km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%) x0 #0 ][0
348                    346.75km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%) x0 #0 ][0
349                    347.72km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 27 110k/h   395vpd( 54%) x0 #0 ][0
350                    349.72km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%) x0 #0 ][0
351                    351.22km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 3.6% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
```

```
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367 <=-  1 Inj              [+/- 4 01] 367.25km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
368                                    367.75km ~ 0.0% 2.3%^ 0.0% 2.6%/\11.1% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
369
370
371
372 <=-  2 Inj.             [+/-50 00]
373 <=-  1 Inj.
374
375
376
377
378
379
380
381
382
383
384
385
386
387                                    386.60km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
388 <=-  1 Inj.             [+/- 0.50] 387.10km ~ 0.0% 8.3%^ 0.0% 1.9%/\ 2.2% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
389
390
391 <=-  1 Inj.             [+/- 1.51]
392
393
394
395
396
397
398
399
400
401
402
403
404
405                                    404.60km ~ 0.0% 0.0%^ 0.0% 6.3%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
406 <=-  2 Inj.             [+/- 3.49]
407 <=-  1 Inj.             [+/- 0.50] 407.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
408                                    407.20km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
409
410
411
```

```
412 -
413 -                          412.72km ~ 0.0% 7.6%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 44 110k/h   395vpd( 54%) x0 #0 ][0
414 -
415 -                          415.21km ~ 0.0% 0.0%^ 0.0%12.7%/\ 0.0% 0.0%  6m  9m Rough= 48 110k/h   395vpd( 54%) x0 #0 ][0
416 -
417 -                          416.71km ~ 0.0% 1.3%^ 0.0% 2.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x1 #0 ][0
418 -
419 -
420 -
421 -
422 -
423 -
424 -
425 -
426 -<=-  1 Inj.        [+/- 3.49]
427 -
428 -
429 -
430 -
431 -
432 -
433 -
434 -
435 -
436 -
437 -
438 -
439 -
440 -                          440.50km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
441 -<=-  2 Inj.        [+/- 1.51] 441.20km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
442 -
443 -                          442.60km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
444 -                          443.72km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
445 -<=-  1 Inj.                   445.15km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
446 -<=-  1 Inj.        [+/- 3.49] 446.10km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
447 -                          446.58km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 40 110k/h   395vpd( 54%) x0 #0 ][0
448 -                          447.10km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 40 110k/h   395vpd( 54%) x0 #0 ][0
449 -
450 -
451 -
452 -
453 -                          453.00km ~ 0.0% 0 0%^ 0.0% 2 5%/\16 1% 0.0%  6m  9m Rough= 40 110k/h   395vpd( 54%) x0 #0 ][0
454 -
455 -
456 -
457 -
458 -
459 -                          458.65km ~ 0.0% 4 6%^ 0.0% 2 8%/\ 0 0% 0.0%  6m  9m Rough  46 110k/h   395vpd( 54%) x0 #0 ][0
460 -
461 -
462 -                          462.16km ~ 0.0% 0 0%^ 0.0% 4 0%/\ 9 2% 0.0%  6m  9m Rough  30 110k/h   395vpd( 54%) x0 #0 ][0
463 -
464 -<=-  1 Inj.        [+/- 0 50]
465 -
466 -
467 -
468 -
469 -
470 -
471 -
```

```
472                                          471.68km ~ 0.0% 0.0%^ 0.0% 7.9%/\17.2% 0.0%  6m  9m Rough= 36 110k/h   395vpd( 54%) x0 #0 ][0
473                                          473.19km ~ 0.0% 0.0%^ 0.0% 5.0%/\ 7.0% 0.0%  6m  9m Rough= 33 110k/h   395vpd( 54%) x0 #0 ][0
474
475
476                                          476.19km ~ 0.0% 0.0%^ 0.0% 6.6%/\ 0.0% 0.0%  6m  9m Rough= 42 110k/h   395vpd( 54%) x0 #0 ][0
477
478                                          477.70km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 37 110k/h   395vpd( 54%) x0 #0 ][0
479                                          479.20km ~ 0.0% 0.0%^ 0.0% 7.0%/\ 0.0% 0.0%  6m  9m Rough= 28 110k/h   395vpd( 54%) x0 #0 ][0
480
481                                          481.20km ~ 0.0% 0.0%^ 0.0% 8.0%/\ 0.0% 0.0%  6m  9m Rough= 35 110k/h   395vpd( 54%) x0 #0 ][0
482
483
484
485                                          484.71km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 32 110k/h   395vpd( 54%) x0 #0 ][0
486 <=-  1 Inj                   [+/- 3.49]
487                                          486.71km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 55 110k/h   395vpd( 54%) x0 #0 ][0
488                                          488.44km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 11m Rough= 39 110k/h   395vpd( 54%) x0 #0 ][0
489                                          489.06km ~ 0.0% 0.0%^ 0.0% 2.3%/\ 0.0% 0.0%  6m  9m Rough= 32 110k/h   395vpd( 54%) x0 #0 ][0
490
491
492
493
494                                          494.23km ~ 0.0% 0 0%^ 0.0% 0.9%/\ 1.9% 0.0%  6m  9m Rough= 44 110k/h   395vpd( 54%) x0 #0 ][0
495
496 <=-  1 Fat.                  [+/- 3.49]
497
498
499
500
501
502
503
504
505
506                                          505 76km ~ 0.0% 4 1%^ 0.0% 2 5%/\ 0.0% 0.0%  6m  9m Rough= 31 110k/h   395vpd( 54%)  0 #0 ][0
507
508
509 <=-  1 Fat
510
511
512
513
514
515
516 <=-  1 Inj                   [+/- 3.49]
517
518
519
520
521
522                                          521.79km ~ 0.0% 0.0%^ 0.0% 5.2%/\ 0.0% 0.0%  6m  9m Rough= 53 110k/h   395vpd( 54%) x0 #0 ][0
523 <=-  1 Fat
524                                          524.30km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 50 110k/h   395vpd( 54%) x0 #0 ][0
525
526                                          525.80km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 52 110k/h   395vpd( 54%) x0 #0 ][0
527
528                                          528.50km ~ 0.0% 0.0%^ 0.0% 6.4%/\ 8.2%22.9%  7m  9m Rough= 45 110k/h   395vpd( 54%) x1 #0 ][0
529
530 <=-  1 Inj                        1.00]
531
```

```
532
533                                         533.00km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
534                                         534.13km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  6m  9m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
535
536 <=-  1 Inj.              [+/- 3.87]
537
538                                         538.00km ~ 0.0% 0.0%^ 0.0% 1.5%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
539
540
541 <=-  1 Inj.              [+/- 1.12]
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556 <=-  2 Inj.              [+/--3.87]
557
558
559
560
561
562
563 <=-  2 Inj.              [+/- 0.50] 562.56km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
564 <=-  1 Fat.                         563.92km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
565 <=-  1 Inj.              [+/- 0.50] 565.42km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
566
567                                         567.41km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
568
569                                         569.41km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
570
571                                         571.40km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
572                                         572.40km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
573                                         573.40km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
574
575
576
577
578
579                                         579.39km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
580
581
582
583                                         583.38km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
584
585                                         585.37km ~ 0.0% 0.0%^ 0.0% 1.1%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
586
587
588
589
590
591
```

```
592
593
594
595
596  <=-  1 Inj.         [+/- 3 65]
597
598
599
600                                600.34km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
601
602  <=-  1 Inj.         [+/- 0 50] 602.33km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
603
604
605
606                                606.32km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
607
608                                607.82km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x1 #0 ][0
609
610
611
612
613
614
615
616
617
618
619  <=-  1 Inj.         [+/- 0.85]
620
621
622
623
624                                624.28km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
625  <=-  1 Inj.         [+/- 3.20]
626                                625.78km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
627
628
629
630
631
632
633                                633.00km ~ 0.0% 0.0%^ 0.0% 0 8%/\ 0.0% 0.0%  7m 10m Rough= 4  110k/h   395vpd( 54%) x0 #0 ][0
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
```

```
652 -
653 -
654 -
655 -
656 -
657 -
658 -
659 -
660 -
661 -<=-  1 Inj                [+/- 1 12]
662 -                                      661.91km ~ 0.0% 0.0%^ 0.0% 0.0%/\ 0.0% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
663 -                                      663.41km ~ 0.0% 0.0%^ 0.0% 2.0%/\ 1.2% 0.0%  7m 10m Rough= 45 110k/h   395vpd( 54%) x0 #0 ][0
664 -
665 -
666 -
667 -
668 -
669 -
670 -
671 -
672 -
673 -
674 -<=-  1 Inj                [+/- 0.75]
675 -
676 -
677 -
678 -
679 -
680 -
681 -
682 -
683 -
684 -
685 -<=-  1 Inj.               [+/-40.00]
686 -
687 -<=-  1 Inj.               [+/- 0.50]
688 -
689 -
690 -
691 -
692 -
693 -
694 -
695 -
696 -
697 -
698 -
699 -
700 -
701 -
702 -                                      702.00km ~ 0.0% 4 6%^ 0.0% 0 0%/\17.5% 0.0%  6m  9m Rough= 37 110k/h   395vpd( 54%) x0 #0 ][0
703 -
704 -
705 -
706 -
707 -
708 -
709 -
710 -
711 -
```

712
713
714
715 <== 1 Inj [+/- 0.50]
716
717
718
719
720
721
722
723

712.13km ~ 0.0% 3.2%^ 0.0% 6.7%/\19.1% 0.0% 6m 9m Rough= 37 110k/h 294vpd(64%) x2 #0][0

Printed: 19/02/88

NELA

APPENDIX E: STATISTICAL TESTS OF COMPARISONS BETWEEN CRASH FREQUENCY AND ROAD PARAMETERS

TABLE E1: ROUGHNESS AND CRASHES - STATISTICAL COMPARISON

Roughness Counter	Proportion of Road (Px)	Py=1-Px	No. of Crashes on Given Road Roughness (x)	Total No. of Crashes (n)	Expected No. of Crashes E=Px x n	Z-Statistic (if applic-able)	Probably of No signifi-cant Difference (P)	Statistical Test
<=30	.0327	.9673	8	188	6.15	N/A	P > 10%	Poisson
31-35	.2088	.7912	43	188	39.25	.58	P > 10%	zI
36-40	.0877	.9123	9	188	16.49	N/A	10% > P 75%	Poisson
41-45	.2965	.7035	64	188	55.74	1.24	P > 10%	zI
46-50	.732	.9268	10	188	13.76	N/A	P > 10%	Poisson
51-60	.1040	.8960	21	188	19.55	N/A	(1)	-
61-70	.1679	.8321	30	188	31.57	N/A	(1)	-
>70	.0292	.9708	3	188	5.49	N/A	P > 10%	Poisson

Note: (1) Poisson test does not apply since Px > 10%.
(2) zI test does not apply since x < 40.

TABLE E2: SURFACE WIDTHS AND CRASHES - STATISTICAL COMPARISON

Road Surface Width	Proportion of Road (Px)	Py=1-Px	No. of Crashes on Given Road Width (x)	Total No. of Crashes (n)	Expected No. of Crashes E=Px x n	Z-Statistic (if applic-able)	Probably of No signifi-cant Difference (P)	Statistical Test
6m	.7662	.2338	132	188	144.05	2.08	1% < P < 5%	zI
7m	.2338	.7662	52	188	43.95	1.30	P > 10%	zI

TABLE E3: ALIGNMENT AND CRASHES - STATISTICAL COMPARISON

Road Alignment	Proportion of Road (Px)	Py=1-Px	No. of Crashes on Given Road Type (x)	Total No. of Crashes (n)	Expected No. of Crashes E=Px x n	Z-Statistic (if applic-able)	Probably of No signifi-cant Difference (P)	Statistical Test
Straight	.9930	.0070	170	188	188.68	14.59	P < 0.2%	zI
Curve	.0070	.9930	16	188	1.32	N/A	P < 0.2%	Poisson

TABLE E4: ROAD GRADE AND CRASHES - STATISTICAL COMPARISON

Road Grade	Proportion of Road (Px)	Py=1-Px	No. of Crashes on Given Road Type (x)	Total No. of Crashes (n)	Expected No. of Crashes E=Px x n	Z-Statistic (if applic-able)	Probably of No significant Difference (P)	Statistical Test
Level	.8511	.1489	143	188	150.01	3.48	P < 0.2%	zI
Crest	.0275	.9725	9	188	5.17	N/A	P > 10%	Poisson
Slope	.0887	.9113	35	188	16.68	N/A	P < 0.2%	Poisson

APPENDIX F: EXTRACT FROM DEPARTMENT OF MAIN ROADS NSW DOCUMENT ENTITLED "TRAFFIC SECTION. CRASH STATISTICS 1984 AND 1985 NSW"

LOCATION					NON INTERSECTION CRASHES				INTERSECTION CRASHES	ALL CRASHES	
DIVS RANK	MAIN ROAD	SECTION	LGA	LENGTH KM	TOTAL	RATE /KM	FATAL	INJURY	TOTAL	TOTAL	RATE /KM
1	0147	LGA	320	.15	2	13.33		2		2	13.33
2	0010	0070	160	16.80	143	8.51	5	77	115	258	15.35
3	0093	LGA	213	5.64	40	7.09		15	46	86	15.24
4	0293	LGA	213	1.32	7	5.30		4	11	18	13.63
5	0545	LGA	116	4.39	22	5.01		10	22	44	10.02
6	0010	0060	353	22.60	112	4.95	1	55	96	208	9.20
7	0151	LGA	213	1.60	7	4.37	1	4	3	10	6.25
8	0015	0002	252	15.40	67	4.35		42	87	154	10.00
9	0016	0001	116	13.00	55	4.23	3	24	12	67	5.15
10	0010	0079	262	18.90	73	3.86	1	31	4	77	4.07
11	0010	0075	262	16.30	60	3.68	2	23	8	68	4.17
12	0010	0069	121	18.60	67	3.60	1	27	20	87	4.67
13	0010	0035	116	16.30	58	3.55	1	27	13	71	4.35
14	0010	0027	141	14.60	49	3.35	1	23	12	61	4.17
15	0010	0068	141	18.15	59	3.25	3	26	3	62	3.42
16	0011	0089	255	15.70	50	3.18	3	25	15	65	4.14
17	0010	0076	213	16.20	49	3.02	1	26	16	65	4.01
18	0010	0084	116	13.00	38	2.92	1	19	44	82	6.30
19	0010	0052	320	13.10	35	2.67	2	11	6	41	3.12
20	0010	0073	356	14.40	38	2.63	1	11	2	40	2.77
21	0010	0071	220	13.30	33	2.48	3	15	1	34	2.55
22	0010	0071	160	13.10	32	2.44	1	16	10	42	3.20
23	0010	0072	160	14.90	36	2.41	1	20	15	51	3.42
24	0065	LGA	161	33.33	77	2.31	3	39	14	91	2.73
25	0010	0074	256	13.00	27	2.07	1	11	1	28	2.15
26	0151	LGA	140	34.13	69	2.02	1	41	41	110	3.22
27	0065	LGA	252	18.50	36	1.94		20	35	71	3.83
28	0016	0034	153	19.79	38	1.92		20	23	61	3.09
29	0010	0045	114	16.80	32	1.90	3	13	13	45	2.67
30	0143	LGA	320	.64	1	1.56				1	1.56
31	0079	LGA	212	5.83	9	1.54		6	7	16	2.74
32	0542	LGA	160	1.37	2	1.45			1	3	2.18
33	0075	LGA	121	71.04	100	1.41	1	41	8	108	1.52
34	0085	LGA	153	12.68	17	1.34		4	13	30	2.37
35	0010	0077	262	16.00	21	1.31	1	5	2	23	1.43
36	0540	LGA	160	9.87	12	1.21		5	6	18	1.82
37	0544	LGA	252	14.04	16	1.13		9	6	22	1.56
38	0010	0080	220	16.30	18	1.10	2	7		18	1.10
39	0555	LGA	252	8.30	9	1.08		3	5	14	1.68
40	0010	0075	213	22.60	23	1.01	1	9	1	24	1.06
41	0143	LGA	252	41.51	40	.96	1	22	13	53	1.28
42	0016	0004	252	12.80	12	.93		5	9	21	1.64
43	0146	LGA	252	11.05	10	.90		6	1	11	.99
44	0076	LGA	248	7.75	7	.90		3	1	8	1.03
45	0555	LGA	116	18.00	16	.88	1	8	4	20	1.11
46	0142	LGA	353	40.62	33	.81	1	18	21	54	1.32
47	0622	LGA	244	5.10	4	.78		2	2	6	1.17
48	0152	LGA	262	35.24	25	.70	1	12	8	33	.93
49	0010	0033	116	15.80	10	.63		6	5	15	.94

LOCATION					NON INTERSECTION CRASHES				INTERSECTION CRASHES	ALL CRASHES	
DIVS RANK	MAIN ROAD	SECTION	LGA	LENGTH KM	TOTAL	RATE /KM	FATAL	INJURY	TOTAL	TOTAL	RATE /KM
50	0147	LGA	252	33.78	21	.62	1	10	4	25	.74
51	0146	LGA	116	14.38	9	.62		6		9	.62
52	0083	LGA	320	36.65	22	.60	3	3	1	23	.62
53	0083	LGA	177	67.74	40	.59	3	25	4	44	.64
54	0083	LGA	244	78.10	46	.58	1	13	9	55	.70
55	0149	LGA	320	27.26	16	.58		7	4	20	.73
56	0119	LGA	121	19.95	10	.50		5		10	.50
57	0012	0001	215	34.10	17	.49	2	7	9	26	.76
58	0151	LGA	252	17.06	8	.46		3		8	.46
59	0544	LGA	329	10.77	5	.46		5	1	6	.55
60	0012	0002	299	28.50	13	.45	1	4		13	.45
61	0145	LGA	320	16.47	7	.42		3	1	8	.48
62	0306	LGA	252	30.51	13	.42	2	7		13	.42
63	0143	LGA	353	12.00	5	.41		4	2	7	.58
64	0015	0004	244	18.10	7	.39		4	1	8	.44
65	0541	LGA	353	23.58	9	.38		2	2	11	.46
66	0010	0045	121	13.40	5	.37	1	1	1	6	.44
67	0151	LGA	356	43.36	16	.36	1	11	1	17	.39
68	0120	LGA	121	22.47	8	.35		3		8	.35
69	0074	LGA	299	97.77	34	.34		10		34	.34
70	0016	0008	244	8.80	3	.34		1		3	.34
71	0141	LGA	244	26.59	9	.33	1	3		9	.33
72	0141	LGA	252	12.21	4	.32		2		4	.32
73	0361	LGA	244	69.38	22	.31		11		22	.31
74	0016	0005	320	16.50	5	.30	1	3		5	.30
75	0152	LGA	220	10.51	3	.28		1		3	.28
76	0524	LGA	141	12.00	3	.25		1	7	10	.83
77	0074	LGA	256	8.68	2	.23		2		2	.23
78	0149	LGA	[illegible]	4.96	1	.20		1	3	4	.80
79	0143	LGA	252	14.15	3	.20	1	2		3	.20
80	0117	LGA	121	15.14	3	.19		3		3	.19
81	0299	LGA	253	25.95	5	.19		5	1	6	.23
82	0119	LGA	299	6.23	1	.16				1	.16
83	0544	LGA	244	11.78	2	.16		1		2	.16
84	0306	LGA	141	19.53	3	.15		2	1	4	.21
85	0151	LGA	172	28.34	4	.14		1		4	.14
86	0150	LGA	172	104.99	13	.12		7		13	.12
87	0150	LGA	244	14.95	1	.06				1	.06
88	0016	0007	244	14.90	1	.06				1	.06
89	0120	LGA	160	32.94	2	.05		1		2	.05
90	0141	LGA	353	3.84		.00			1	1	.26
				.00		.00					.00