

Travelling Speed and the Risk of Crash Involvement

Volume 2 - Case and Reconstruction Details

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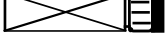
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CASE SUMMARIES AND SITE DIAGRAMS

The following pages give a summary and site diagram for each of the crashes included in the study. Locations are not given and details of the crashes are kept to a minimum to protect the anonymity of the crashes.

LEGEND FOR SITE DIAGRAMS

The following symbols and markings are used in the site diagrams of the crashes.

	Sedan
	Sedan (Final Position)
	Station Wagon
	Four Wheel Drive
	Van
	Utility
	Truck
	Bus
	Bicycle
	Impact Point
	Skidmark/Tyre Mark
	Vehicle Direction of Travel
	Pedestrian Movement
	Final Position of Pedestrian or Bicycle
	Stobie Pole
	Metal Pole
	Tree
	Fence Line
	Median Strip/Traffic Island
	Oil Trail
	Flower Bed

CN001

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 saw Unit 2 and braked and then struck the right hand front corner of Unit 2. Negligible deformation was incurred by Unit 2 as the impact was taken by the right front wheel. Unit 1 suffered crush of the left hand front but was still capable of being driven away.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from vehicle damage and CRASH 3.
Travelling speed from skid marks (18.5 m).

Reconstruction Notes

Final position of Unit 2 unknown.
Assumed damage on Unit 2.

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	16

Control Speeds

45	48
55	57

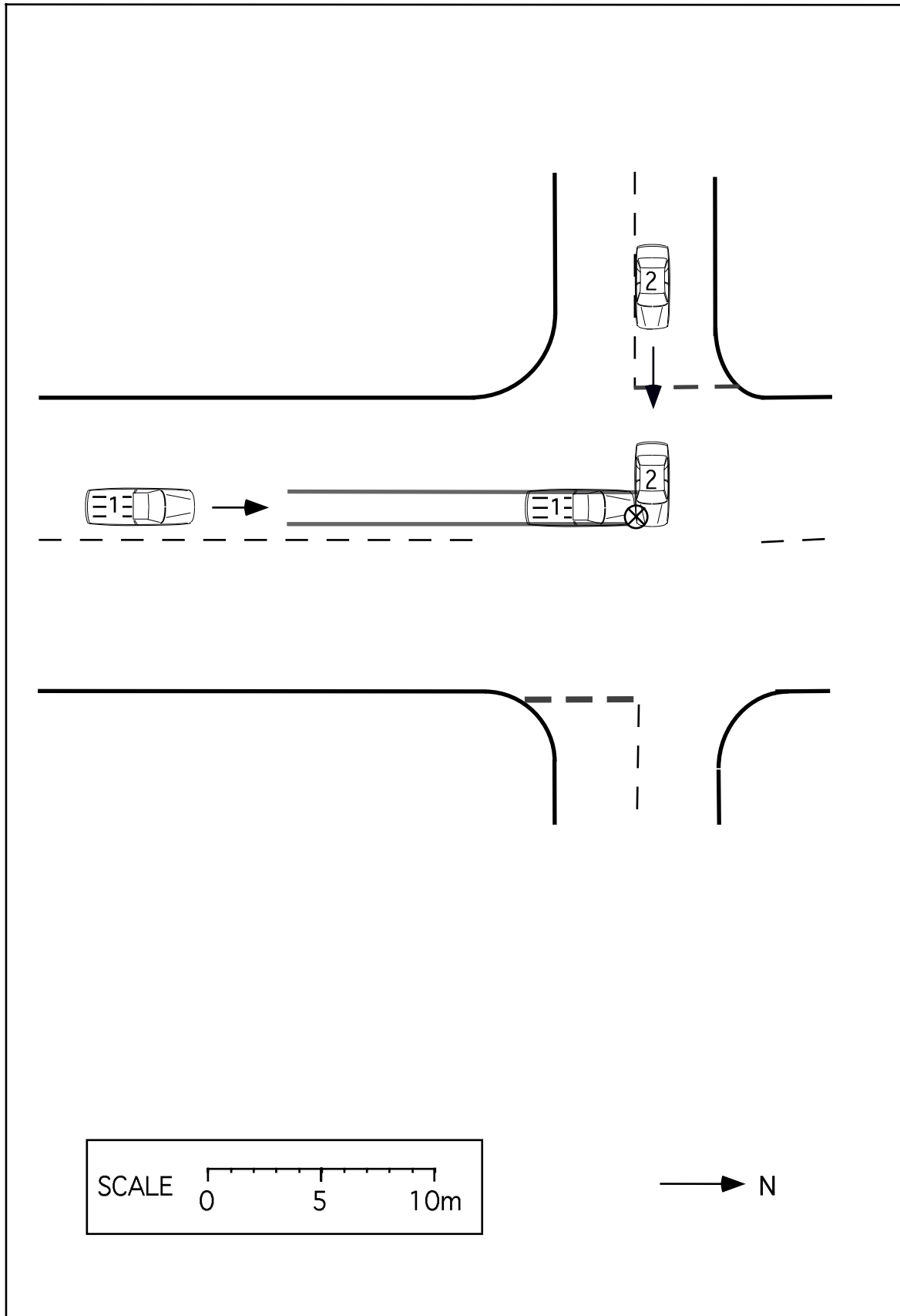
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	16	16
5 km/hour speed reduction	62	0	0
10 km/hour speed reduction	57	0	0
Speed Limit 50 with similar compliance	57	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN001



CN004

Crash Description

Unit 2 went through stop sign into path of Unit 1. Unit 1 applied brakes and then collided with Unit 2. Following the collision, Unit 2 continued for approximately 50 metres eventually colliding with a fence that was extensively damaged.

Injury Outcomes

Unit 2 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (7.1m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	47

Control Speeds

51	52
57	63

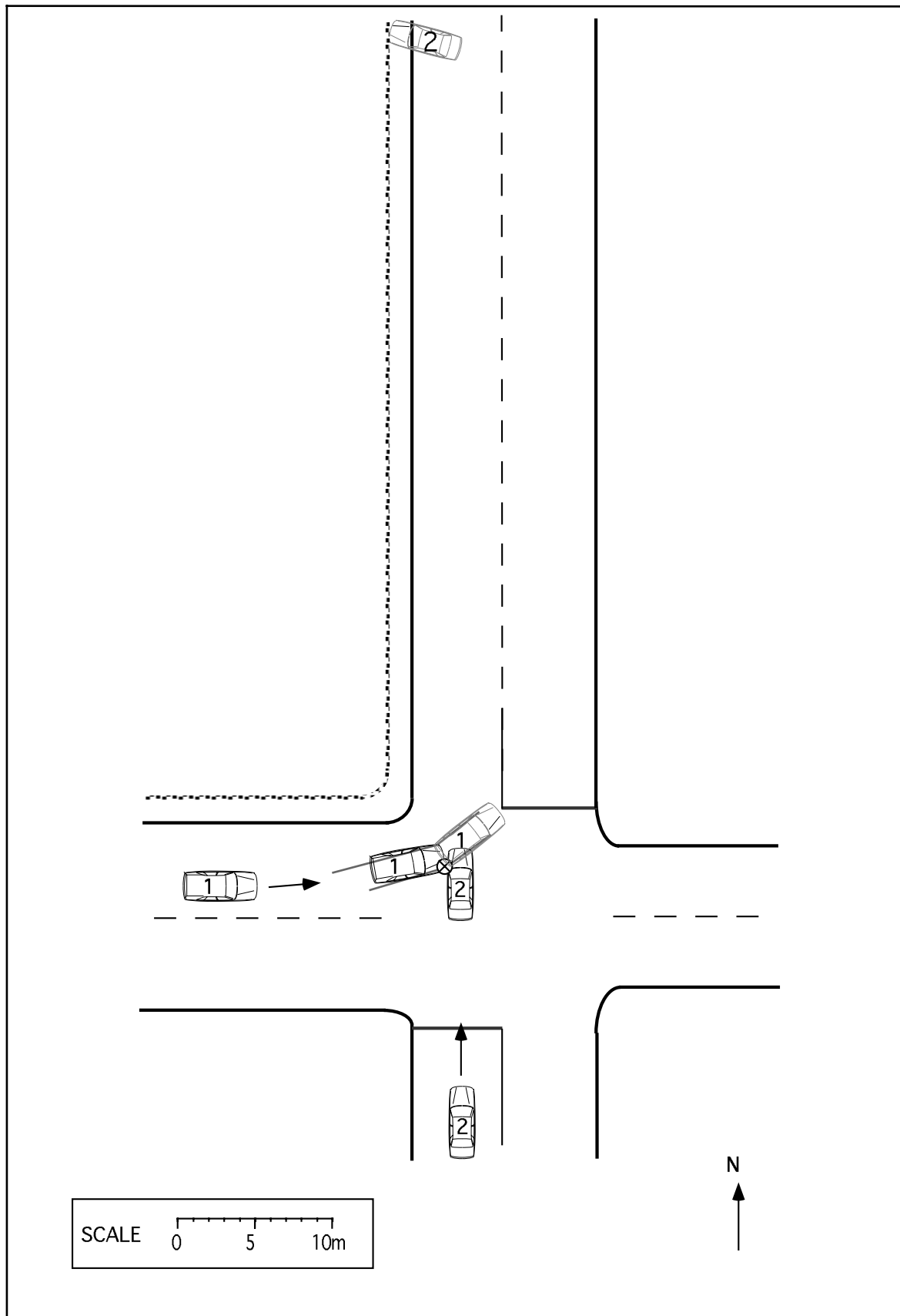
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	47	30
5 km/hour speed reduction	61	35	24
10 km/hour speed reduction	56	16	13
Speed Limit 50 with similar compliance	56	16	13
Speed Limit 60 with total compliance	60	32	23

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	27
5 km/hour speed reduction	21
10 km/hour speed reduction	10
Speed Limit 50 with similar compliance	10
Speed Limit 60 with total compliance	20

CN004



CN009

Crash Description

Unit 2 doing a U-turn in front of Unit 1. Unit 1 braked and then collided with left side of Unit 2. The left hand front door of Unit 1 took most of the impact imposed by the front of the Unit 2. Following the impact, the front of Unit 2 penetrated a corrugated steel fence on the side of the road.

Injury Outcomes

Unit 2 driver transported by ambulance.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions SMAC run.
Travelling speed from skid marks (32 m).

Reconstruction Notes

Steering applied to Unit 2.

Case Vehicle Speeds

Free Travelling Speed	99
Impact Speed	46

Control Speeds

50	57
64	67

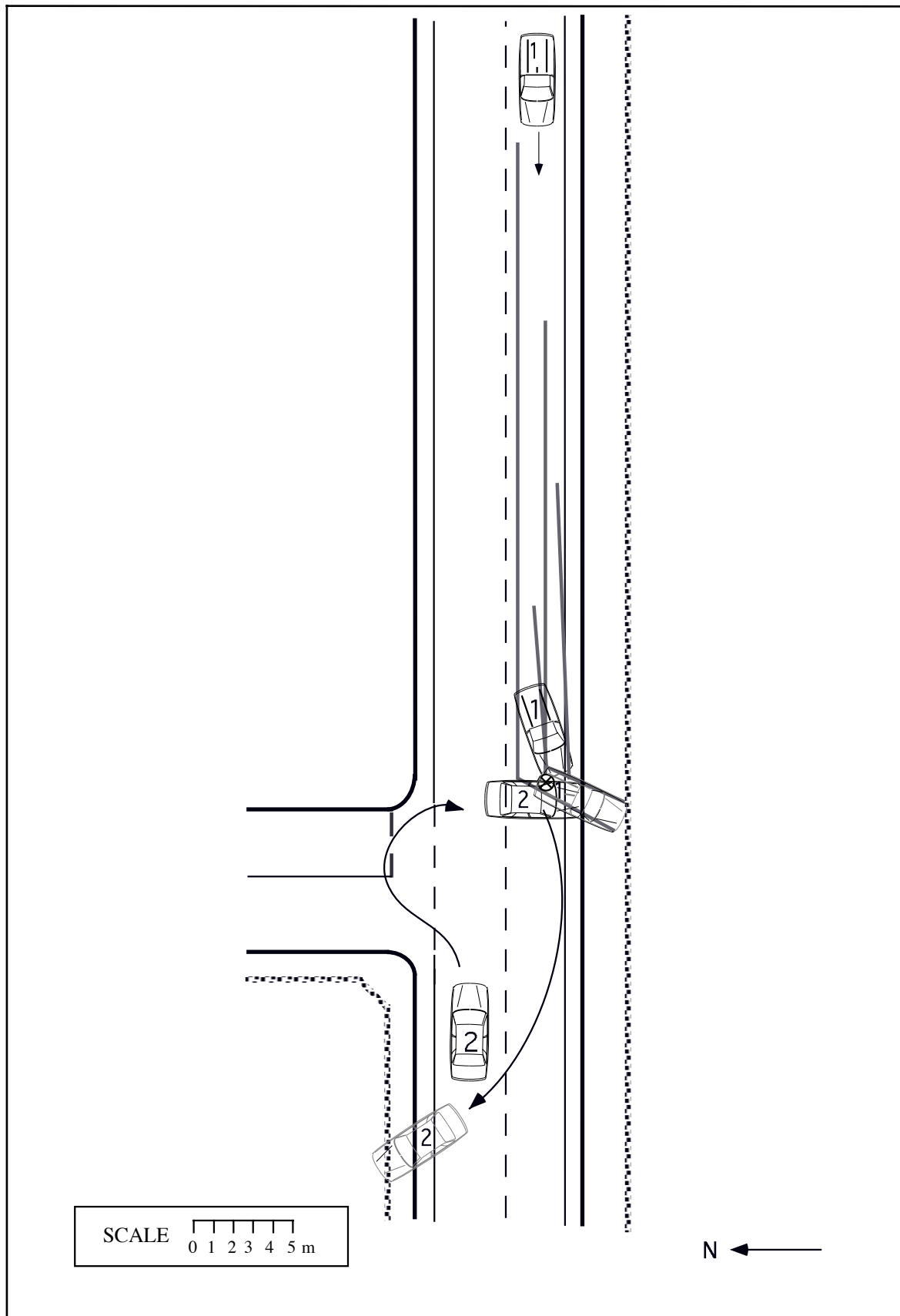
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	99	46	22
5 km/hour speed reduction	94	29	16
10 km/hour speed reduction	89	0	0
Speed Limit 50 with similar compliance	89	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	22
5 km/hour speed reduction	14
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN009



CN015

Crash Description

Unit 1 proceeding along road a pedestrian stepped onto road in front of Unit 1. Unit 1 applied brakes, causing the vehicle to skid and veer across to the right hand lane of the road. The driver believed he collided with the pedestrian two thirds of the way through the skid and in the middle of the two lane road.

Injury Outcomes

Pedestrian fatally injured.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid marks (15m).
Impact speed from post-impact skid marks (5m).

Reconstruction Notes

Uncertain about pedestrian impact point.
Does not affect travelling speed estimate.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	30

Control Speeds

50	52
54	60

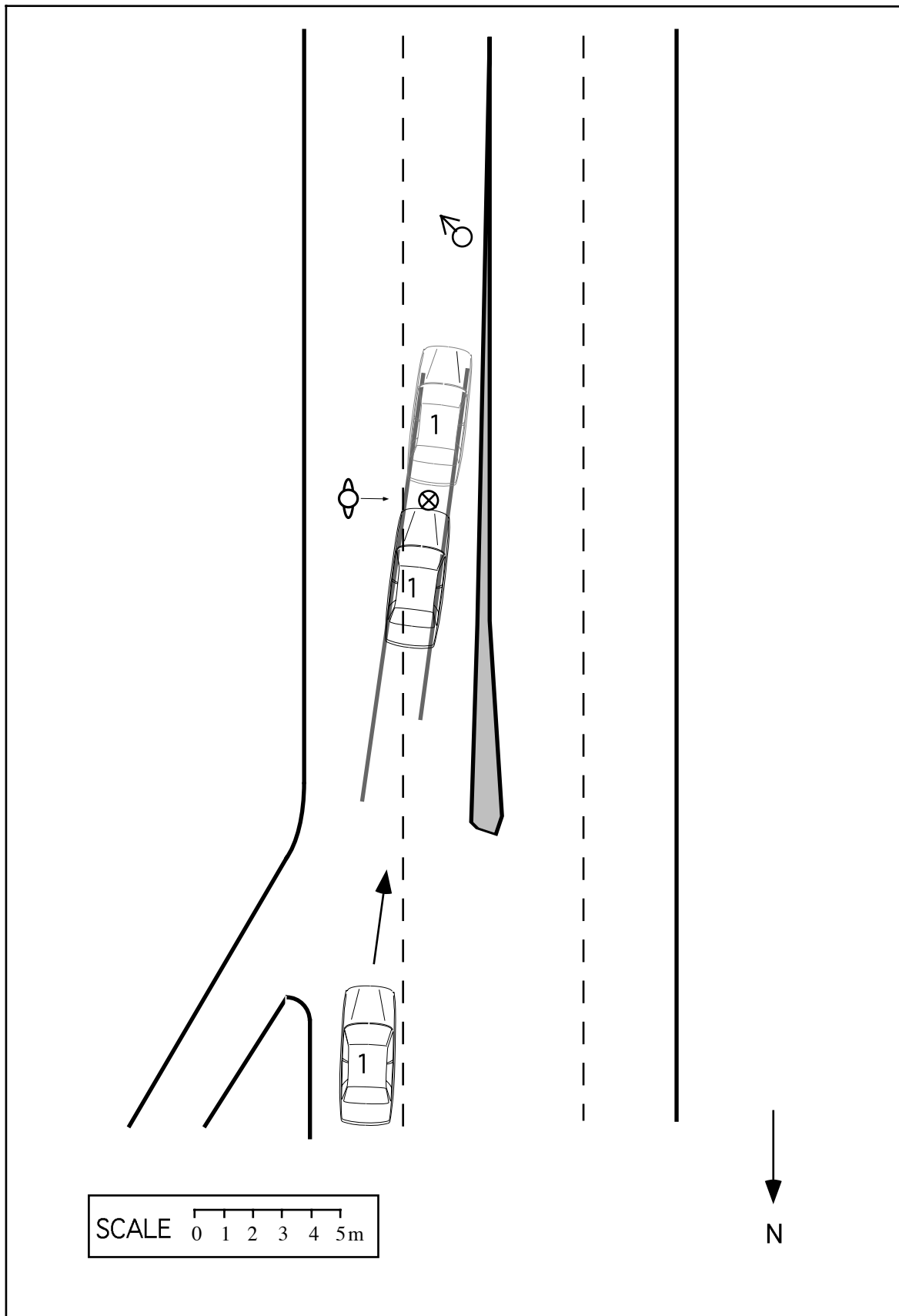
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	30	0
5 km/hour speed reduction	53	0	0
10 km/hour speed reduction	48	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	58	30	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	30
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	30

CN015



CN021

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 braked and then collided with Unit 2. Witness estimates of the travelling speed of Unit 1 varied over a wide range.

Injury Outcomes

Unit 1 driver transported by ambulance.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (5m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	46

Control Speeds

48	53
54	63

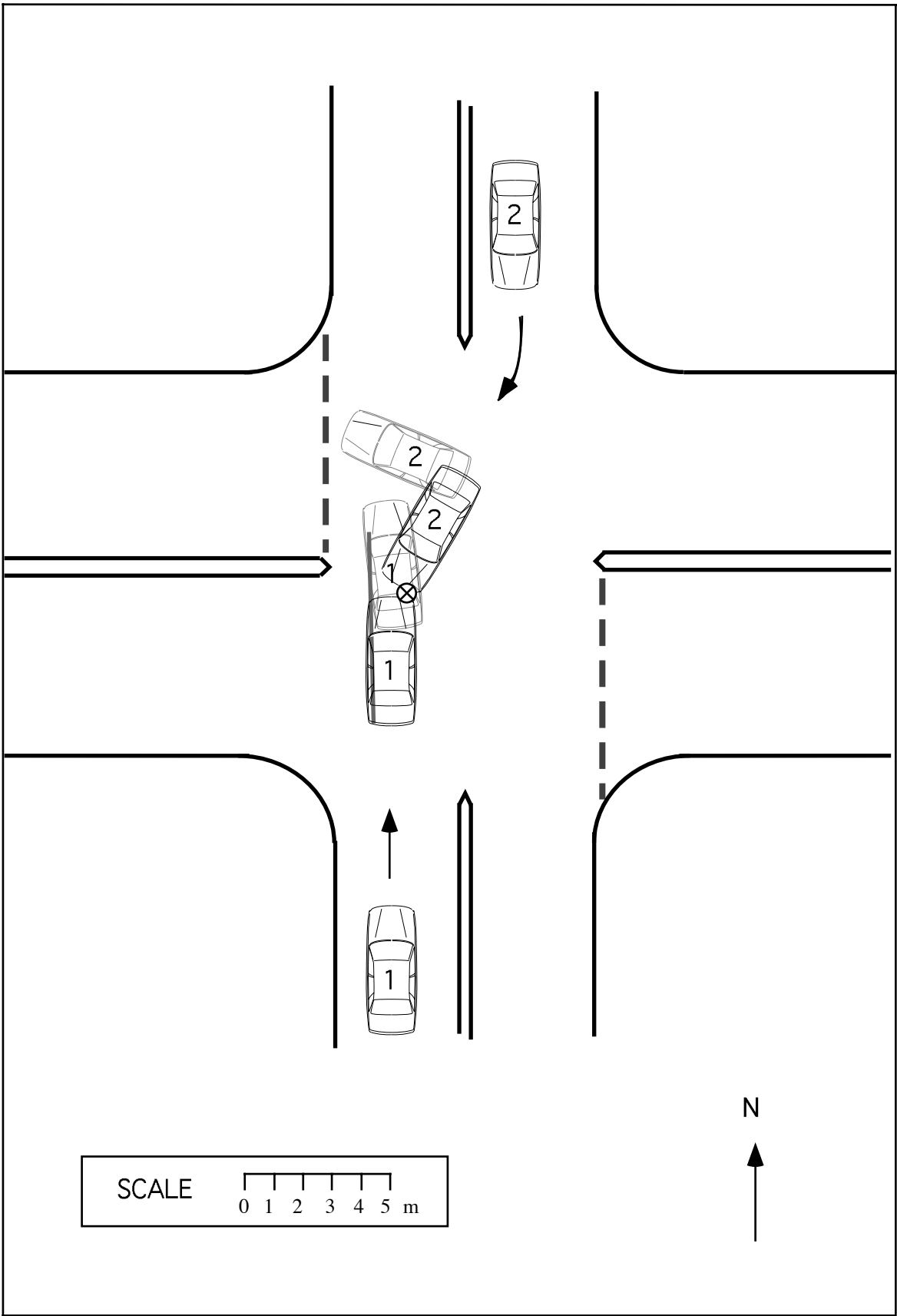
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	46	37
5 km/hour speed reduction	56	34	31
10 km/hour speed reduction	51	15	20
Speed Limit 50 with similar compliance	51	15	20
Speed Limit 60 with total compliance	60	43	36

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	39
5 km/hour speed reduction	32
10 km/hour speed reduction	22
Speed Limit 50 with similar compliance	22
Speed Limit 60 with total compliance	37

C N 0 2 1



CN025

Crash Description

Unit 1 was travelling in the right hand when a pedestrian attempted to cross the road in front of Unit 1. Unit 1 braked and then collided with pedestrian.

Injury Outcomes

Pedestrian admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid length (22.2m).
Impact speed from post-impact skid mark (5.9m).

Reconstruction Notes

Impact point estimated.
Does not affect travelling speed estimate.

Case Vehicle Speeds

Free Travelling Speed	71
Impact Speed	33

Control Speeds

62	62
65	70

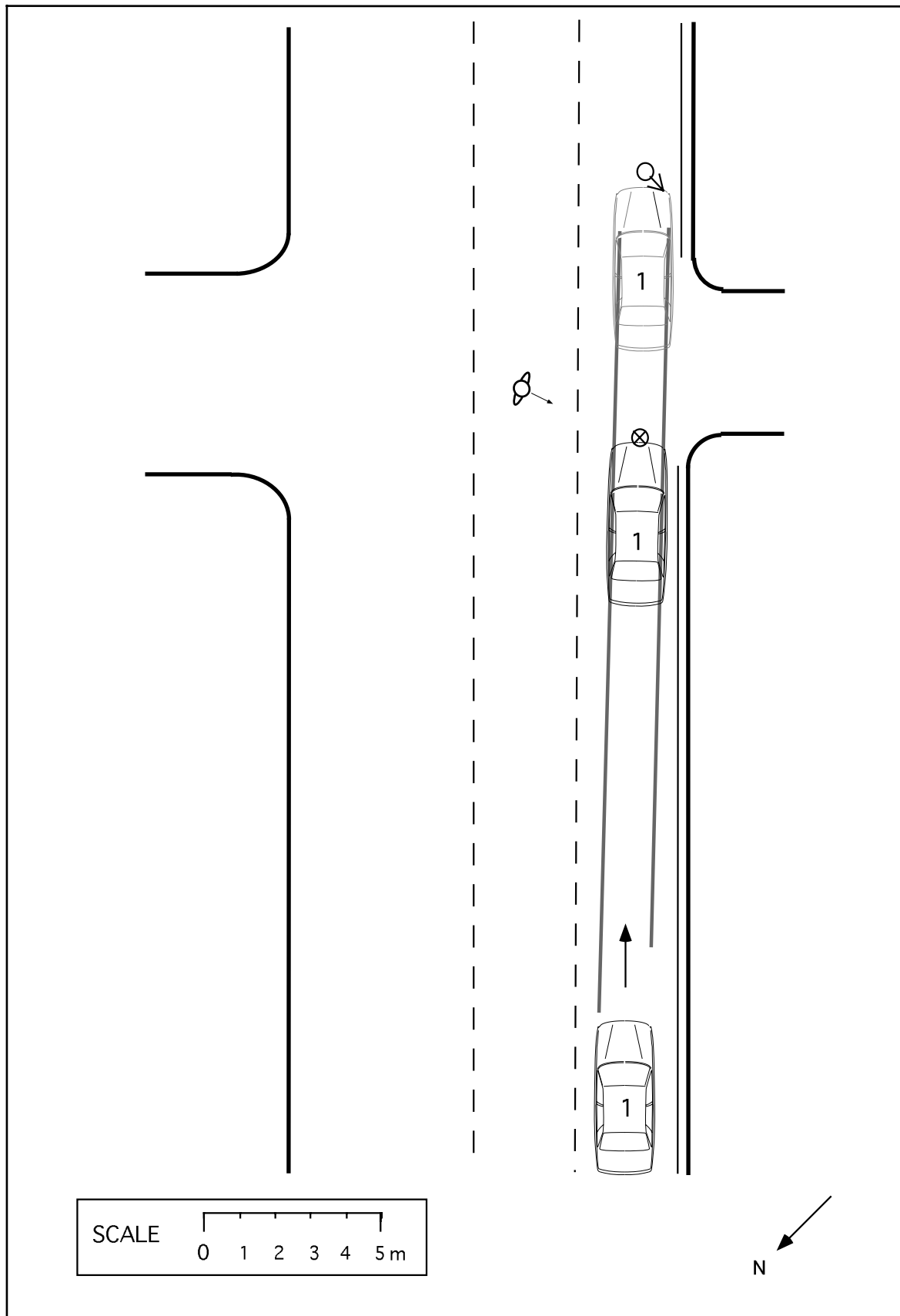
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	71	33	0
5 km/hour speed reduction	66	7	0
10 km/hour speed reduction	61	0	0
Speed Limit 50 with similar compliance	61	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	33
5 km/hour speed reduction	7
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN025



CN026

Crash Description

Unit 2 passing through give way sign at intersection to turn right in across path of Unit 1. Unit 1 took no evasive action and collided with side of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 assumed braking at and after impact.

Unit 2 assumed no braking and some acceleration.

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	66

Control Speeds

67	67
81	82

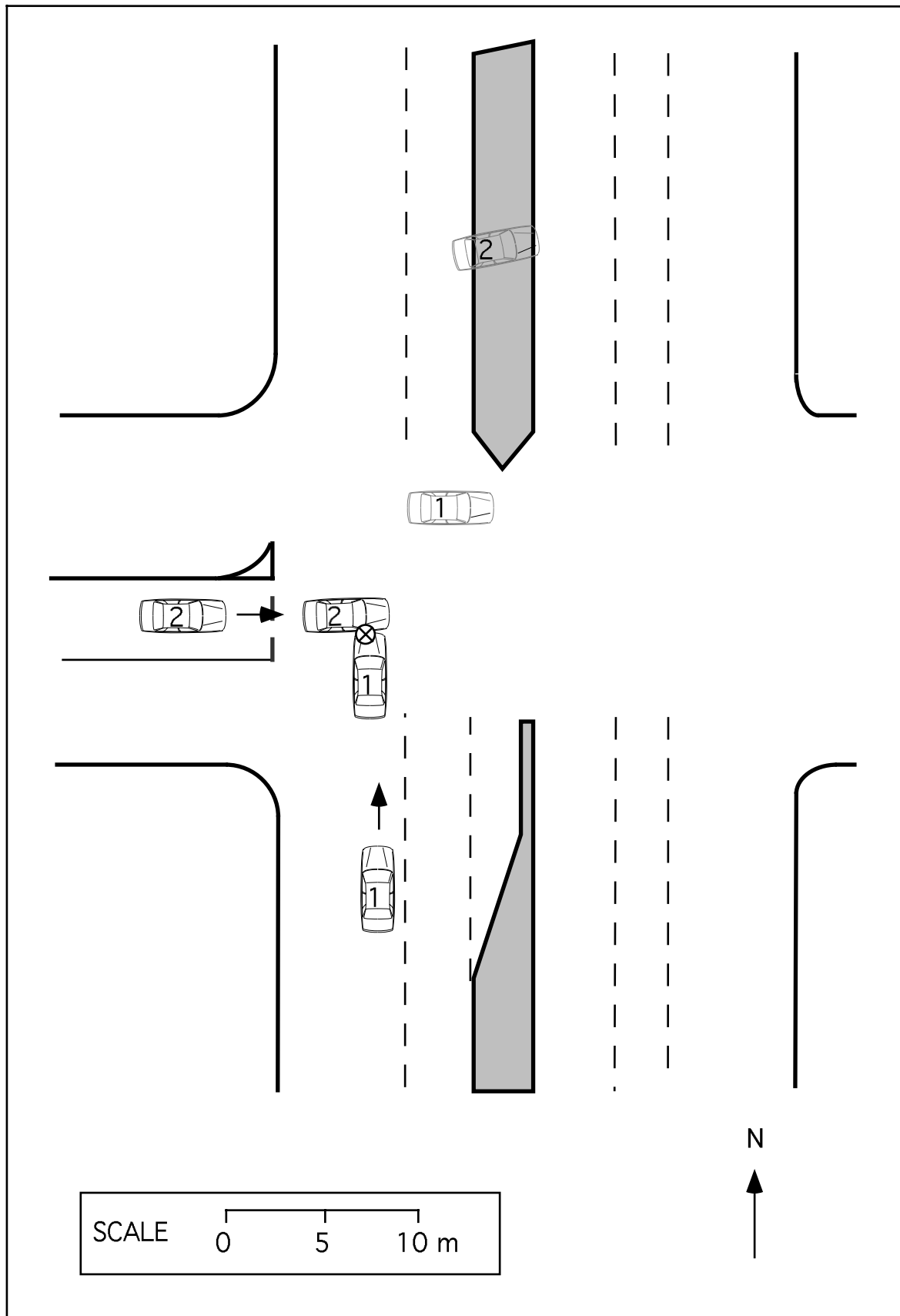
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	66	35
5 km/hour speed reduction	61	61	32
10 km/hour speed reduction	56	56	30
Speed Limit 50 with similar compliance	56	56	30
Speed Limit 60 with total compliance	60	60	32

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	45
5 km/hour speed reduction	42
10 km/hour speed reduction	39
Speed Limit 50 with similar compliance	39
Speed Limit 60 with total compliance	41

C N 0 2 6



CN027

Crash Description

Unit 1 travelling in far right lane. Pedestrian stepped in front of Unit 1. Unit 1 braked and then collided with pedestrian.

Injury Outcomes

Pedestrian admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid mark (20m).
Impact speed from post-impact skid mark (7.8m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	37

Control Speeds

67	70
72	84

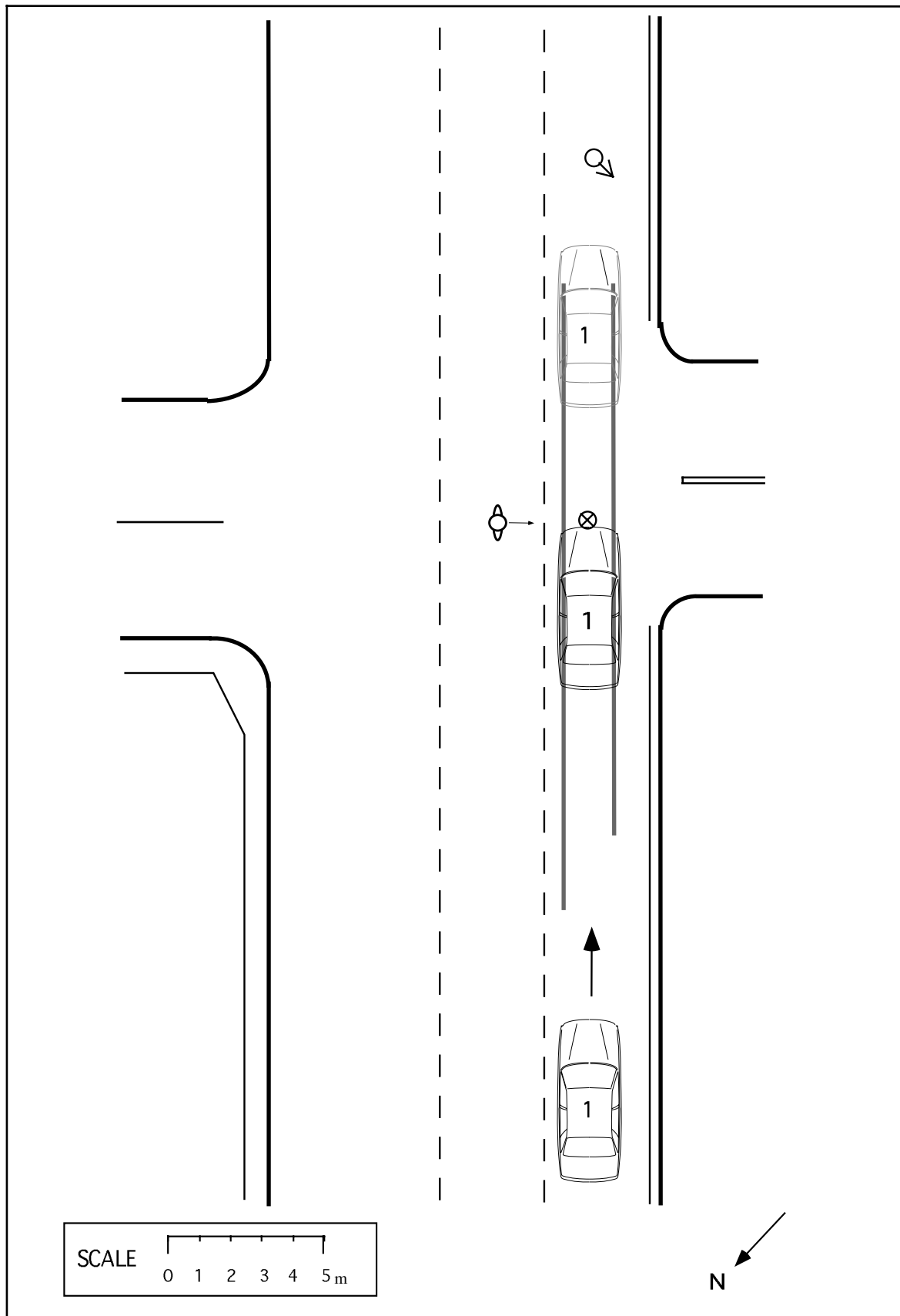
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	37	0
5 km/hour speed reduction	62	19	0
10 km/hour speed reduction	57	0	0
Speed Limit 50 with similar compliance	57	0	0
Speed Limit 60 with total compliance	60	8	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	19
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	8

CN027



CN029

Crash Description

Unit 2 stopped at stop sign and then proceeded across road in front of Unit 1. Unit 1 applied brakes and collided with side of Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (7.2m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	47

Control Speeds

53	57
61	65

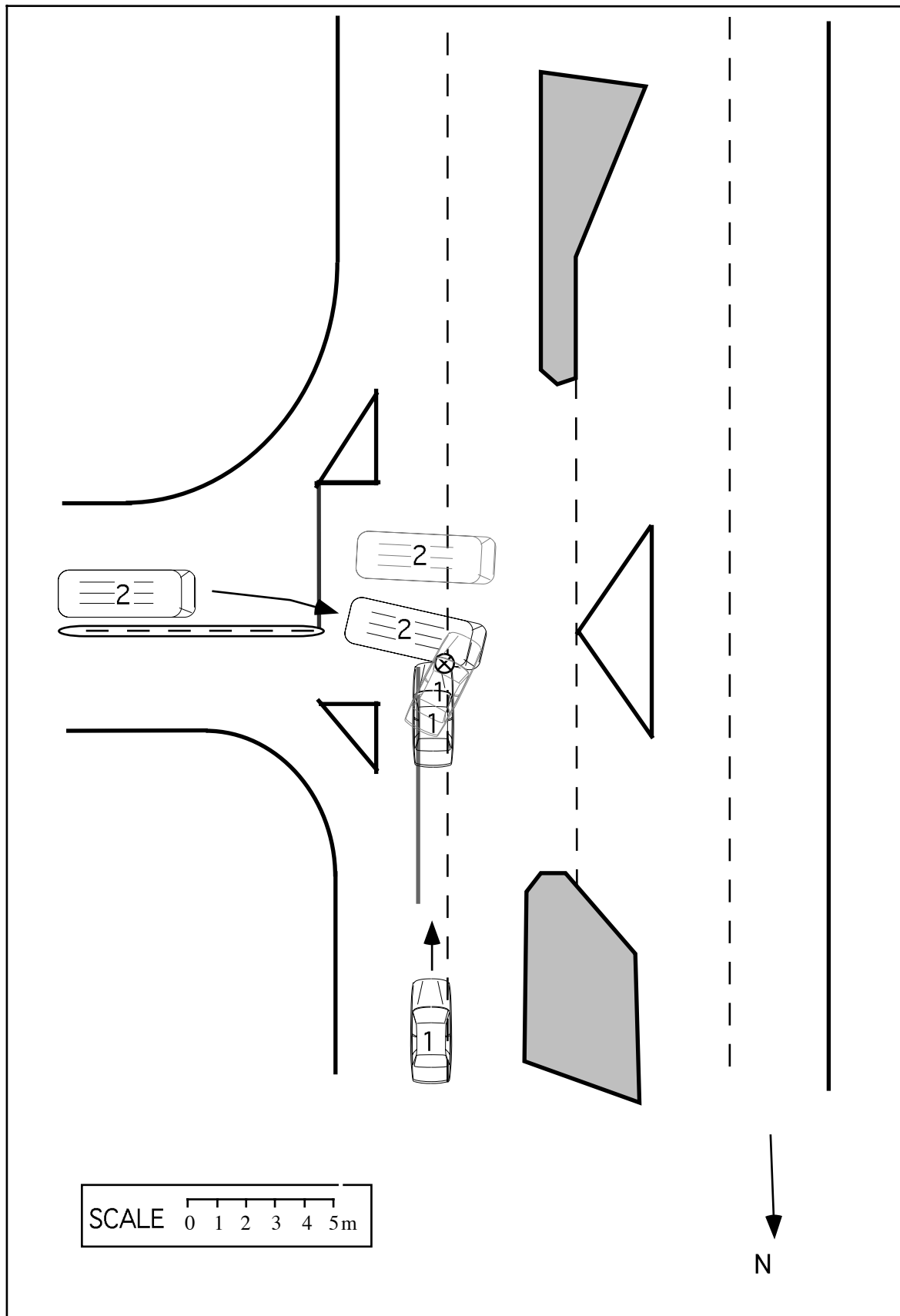
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	47	38
5 km/hour speed reduction	61	35	30
10 km/hour speed reduction	56	16	15
Speed Limit 50 with similar compliance	56	16	15
Speed Limit 60 with total compliance	60	32	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	23
5 km/hour speed reduction	17
10 km/hour speed reduction	7
Speed Limit 50 with similar compliance	7
Speed Limit 60 with total compliance	16

C N 0 2 9



CN031

Crash Description

Unit 2 turning right across intersection and path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (6m).

Reconstruction Notes

Assumed Unit 1 ceased braking at impact.

Case Vehicle Speeds

Free Travelling Speed	72
Impact Speed	56

Control Speeds

60	60
62	69

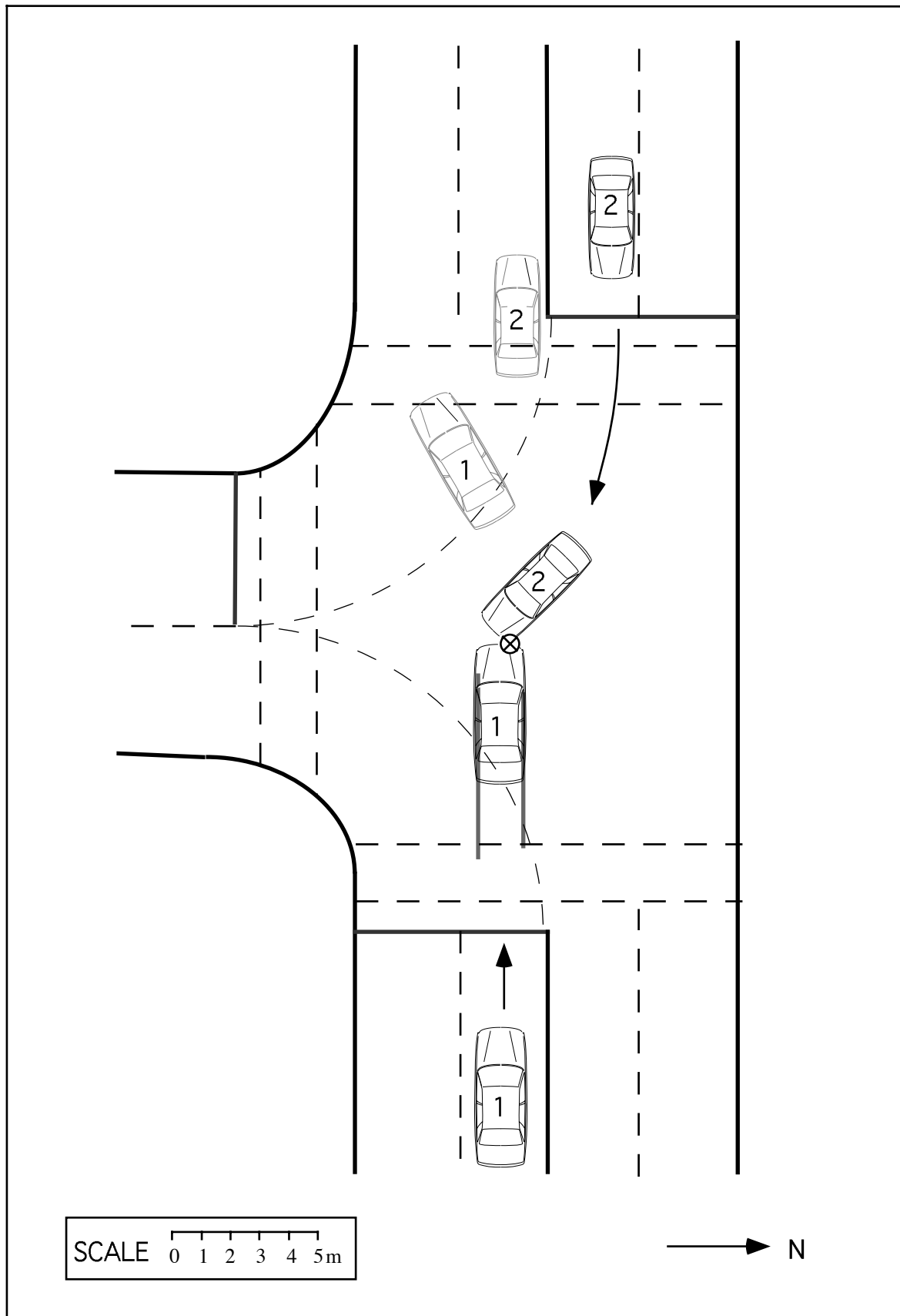
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	72	56	37
5 km/hour speed reduction	67	46	33
10 km/hour speed reduction	62	33	28
Speed Limit 50 with similar compliance	62	33	28
Speed Limit 60 with total compliance	60	24	24

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	53
5 km/hour speed reduction	46
10 km/hour speed reduction	38
Speed Limit 50 with similar compliance	38
Speed Limit 60 with total compliance	32

CN031



CN035

Crash Description

Unit 2 turning right across intersection in front of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (11m).

Reconstruction Notes

Some steering of Unit 2 towards end of travelling to avoid collision.

Case Vehicle Speeds

Free Travelling Speed	78
Impact Speed	54

Control Speeds

62	63
66	76

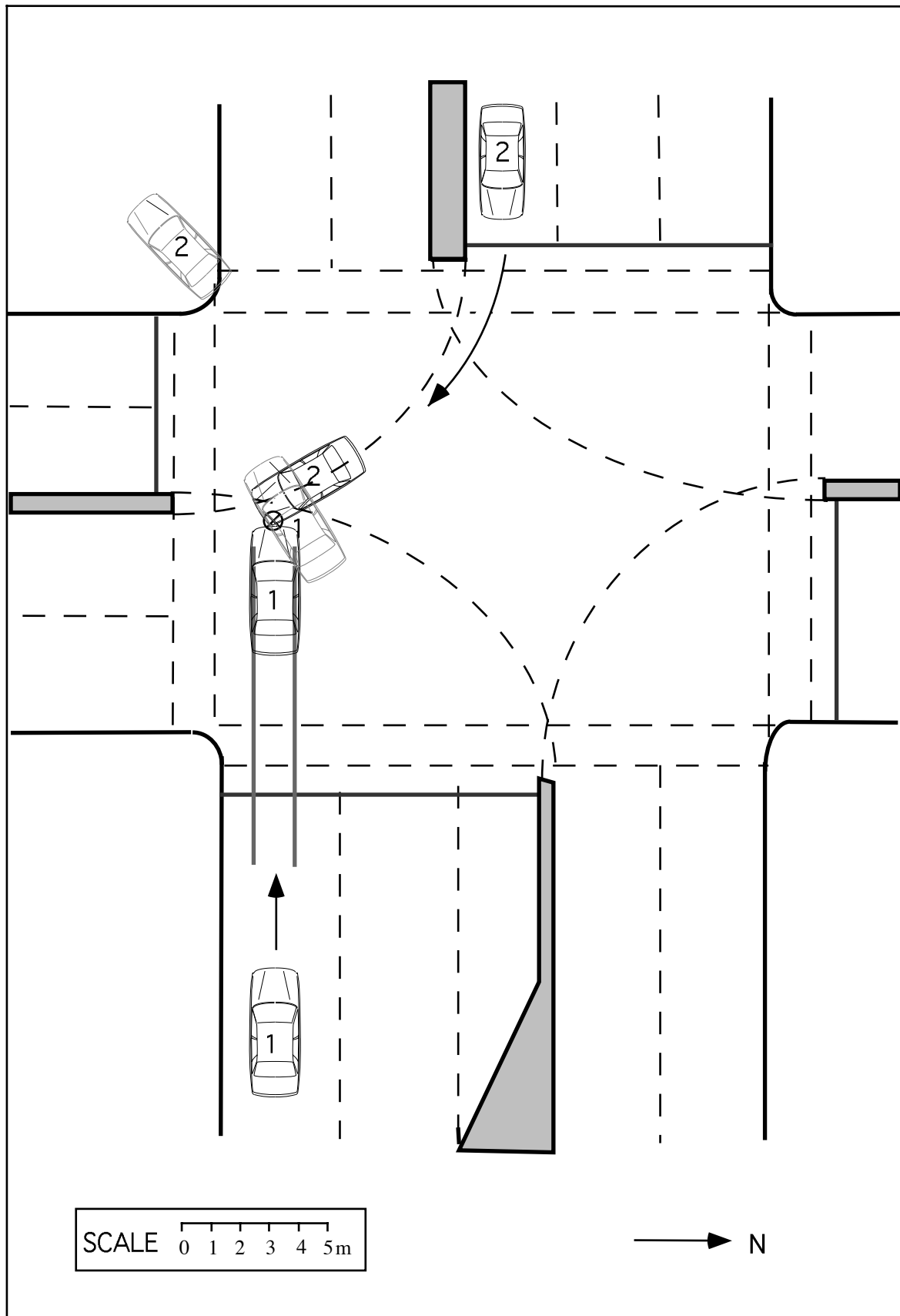
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	78	54	33
5 km/hour speed reduction	73	43	28
10 km/hour speed reduction	68	28	21
Speed Limit 50 with similar compliance	68	28	21
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	39
5 km/hour speed reduction	32
10 km/hour speed reduction	22
Speed Limit 50 with similar compliance	22
Speed Limit 60 with total compliance	0

CN035



CN036

Crash Description

Unit 2 proceeded from side street between stopped vehicles to turn right in front of Unit 1. A minor collision occurred with Unit 1. Unit 1 then applied its brakes and skidded into tree and came to rest.

Injury Outcomes

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from pole impact deformation (30cm).

Travelling speed from skid marks (16.5m).

Reconstruction Notes

Unit 2 impact considered to have insignificant effect on speed.

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	24

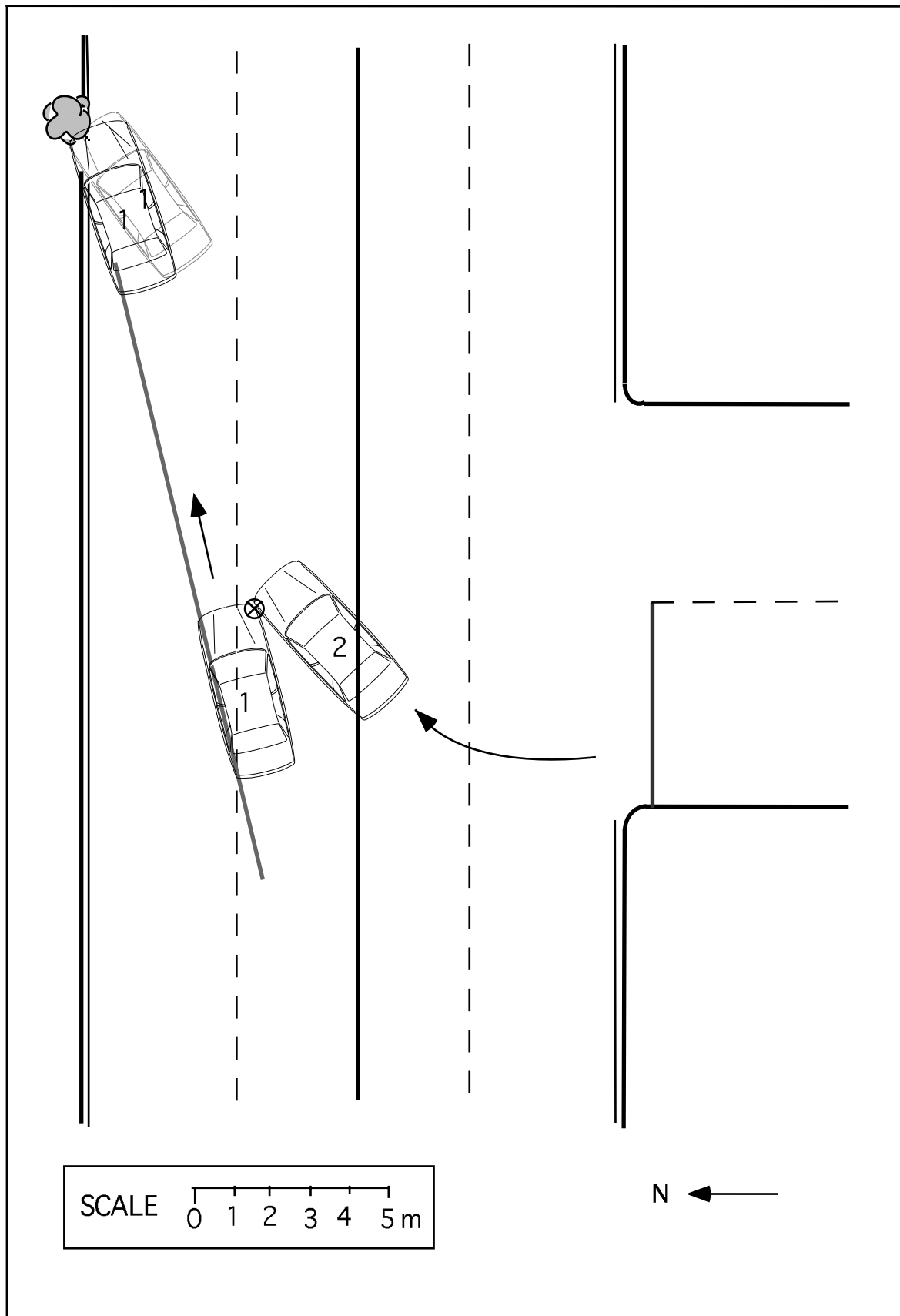
Control Speeds

55	57
62	62

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	24	24
5 km/hour speed reduction	61	0	0
10 km/hour speed reduction	56	0	0
Speed Limit 50 with similar compliance	56	0	0
Speed Limit 60 with total compliance	60	0	0

CN036



CN037

Crash Description

Unit 2 turning right across T-Junction in path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run (confirmed by damage).
Travelling speed from skid mark (2.4m).

Reconstruction Notes

Unit 2 final position uncertain.
Angle of Unit 1 at impact uncertain.

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	57

Control Speeds

39	54
54	54

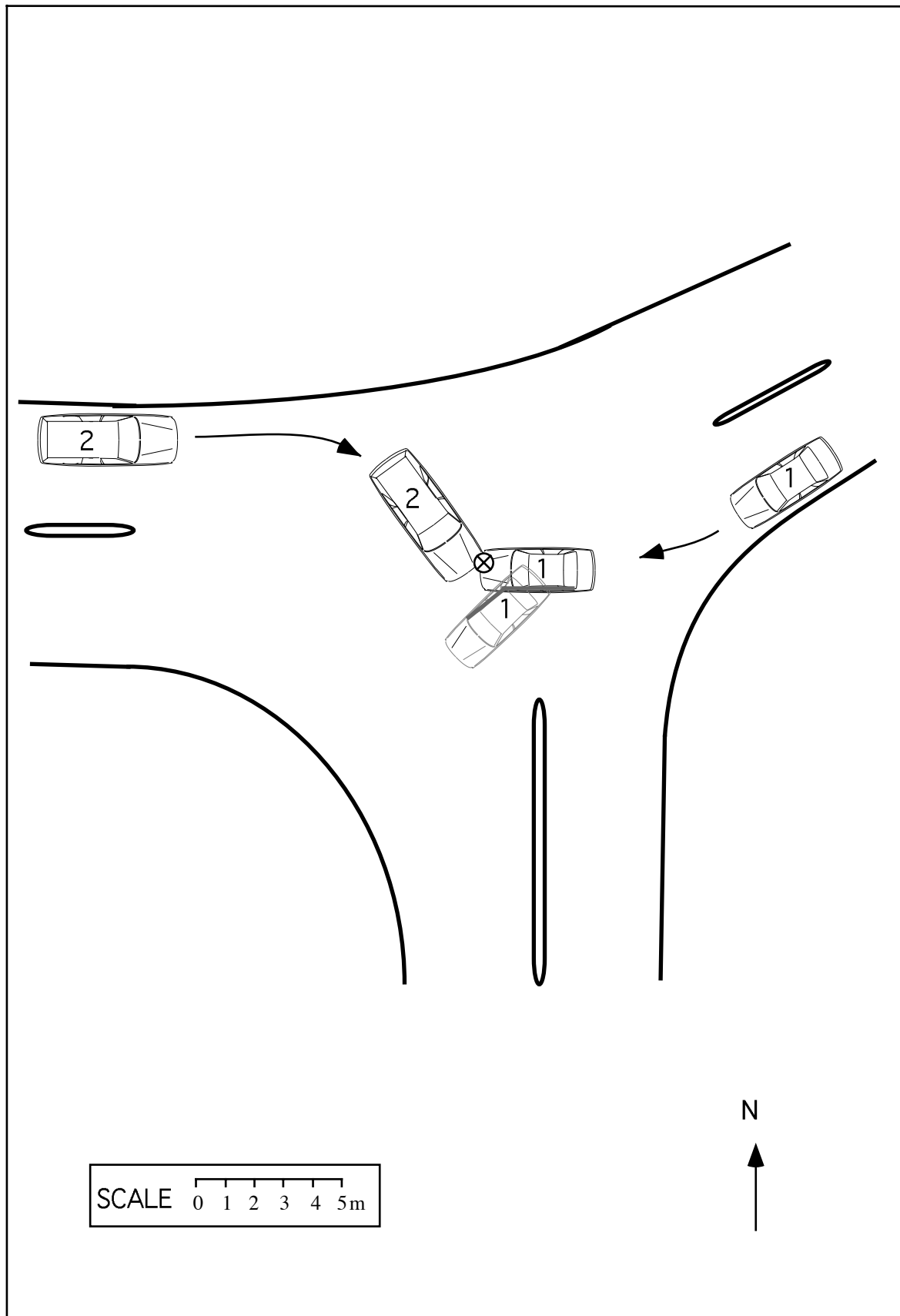
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	57	44
5 km/hour speed reduction	63	47	39
10 km/hour speed reduction	58	36	33
Speed Limit 50 with similar compliance	58	36	33
Speed Limit 60 with total compliance	60	41	36

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	35
5 km/hour speed reduction	30
10 km/hour speed reduction	25
Speed Limit 50 with similar compliance	25
Speed Limit 60 with total compliance	27

CN037



CN038

Crash Description

Unit 2 turning into petrol station across path of Unit 1. Unit 1 collided with Unit 2. Unit 1 probably accelerated after impact and continued down road.

Injury Outcomes

Unit 1 driver transported by ambulance.
Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 2 and SMAC run.

Reconstruction Notes

Unit 1 steered after impact so its final position could not be reconstructed.

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	61

Control Speeds

56	59
59	72

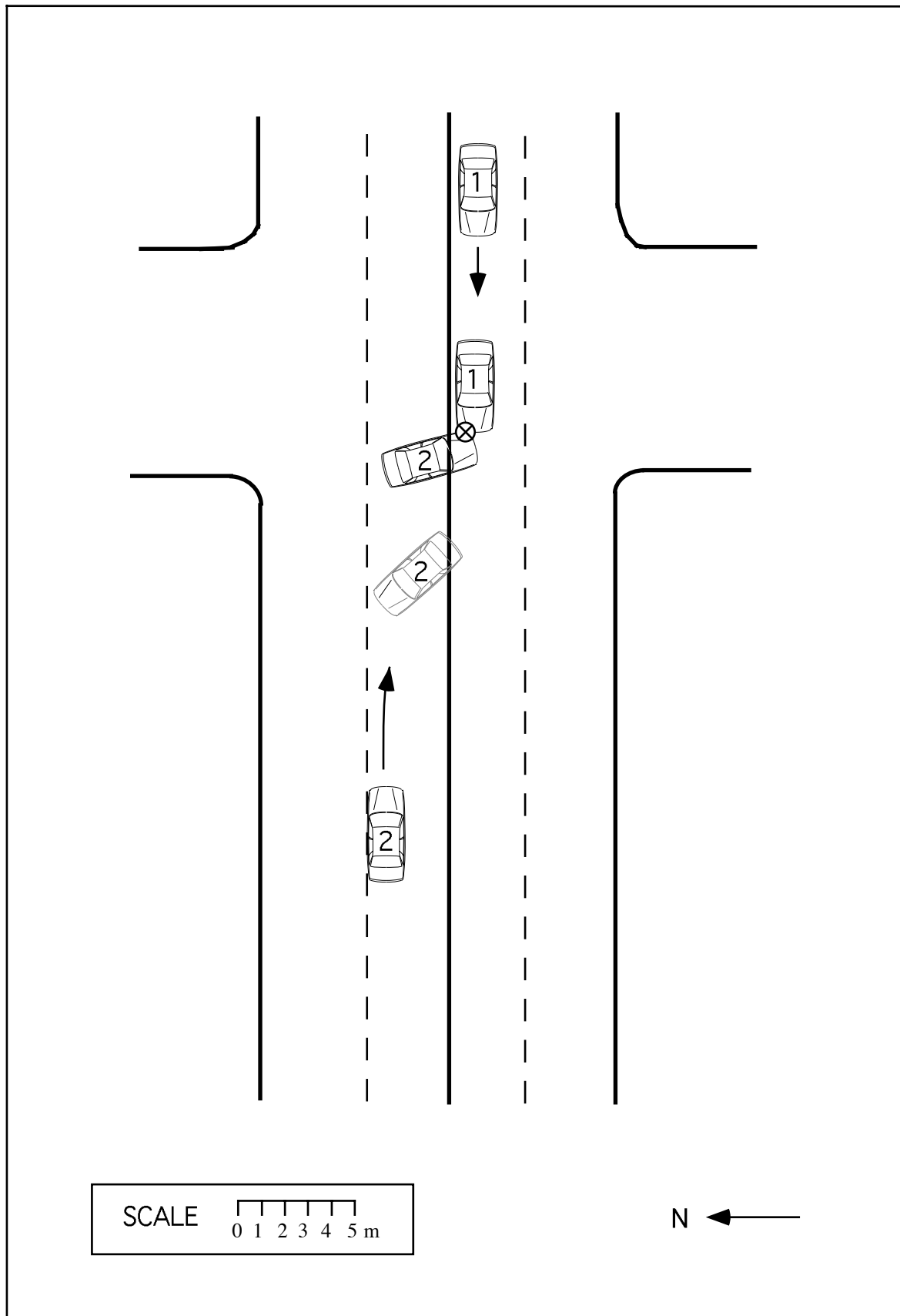
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	61	35
5 km/hour speed reduction	56	56	33
10 km/hour speed reduction	51	51	31
Speed Limit 50 with similar compliance	51	51	31
Speed Limit 60 with total compliance	60	60	35

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	29
5 km/hour speed reduction	27
10 km/hour speed reduction	25
Speed Limit 50 with similar compliance	25
Speed Limit 60 with total compliance	28

CN038



CN040

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2. Unit 2 then collided with fence.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (6m).

Reconstruction Notes

Assumed Unit 1 ceased braking after impact.

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	44

Control Speeds

54	56
60	63

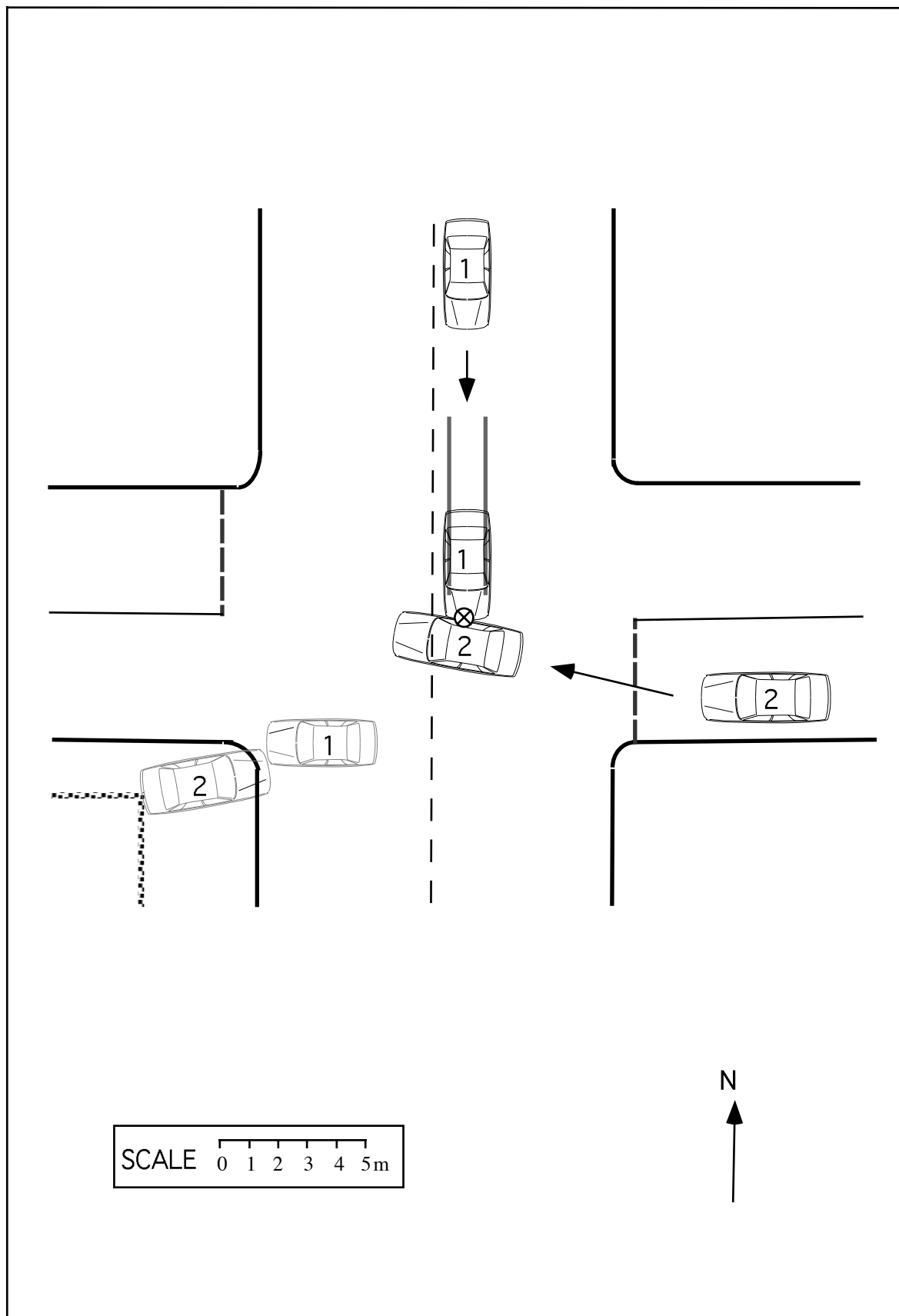
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	44	28
5 km/hour speed reduction	56	31	21
10 km/hour speed reduction	51	8	5
Speed Limit 50 with similar compliance	51	8	5
Speed Limit 60 with total compliance	60	41	26

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	16
5 km/hour speed reduction	12
10 km/hour speed reduction	2
Speed Limit 50 with similar compliance	2
Speed Limit 60 with total compliance	16

CN040



CN041

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 driver transported to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (17m).

Reconstruction Notes

No final position of Unit 2.

Speed verified by lack of second collision between vehicles.

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	21

Control Speeds

60	60
61	61

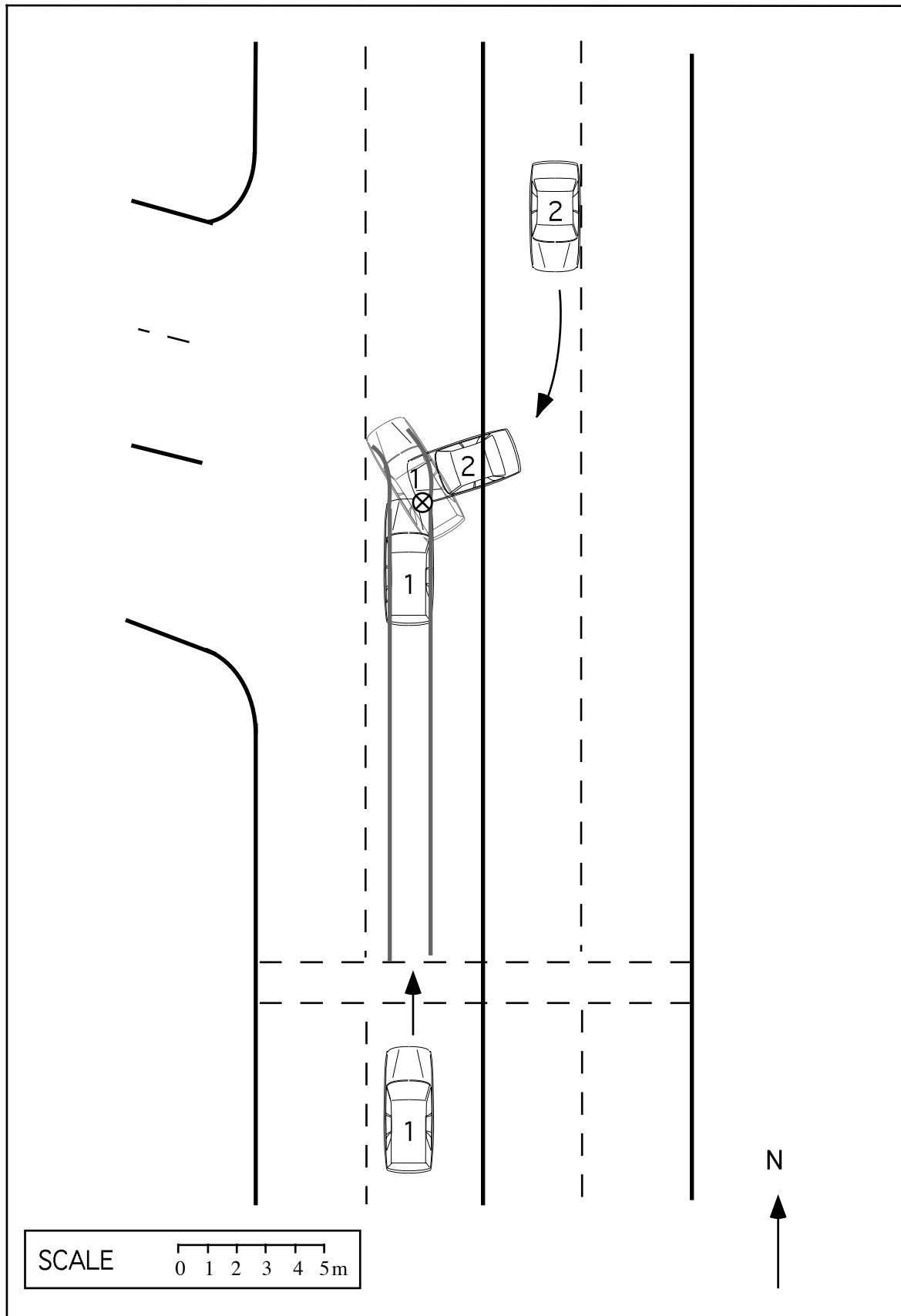
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	21	11
5 km/hour speed reduction	61	0	0
10 km/hour speed reduction	56	0	0
Speed Limit 50 with similar compliance	56	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	16
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

C N 0 4 1



CN042

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 2 then collided with parking sign and fire plug marker post.

Injury Outcomes

Unit 1 left rear passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (9m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	36

Control Speeds

51	59
60	60

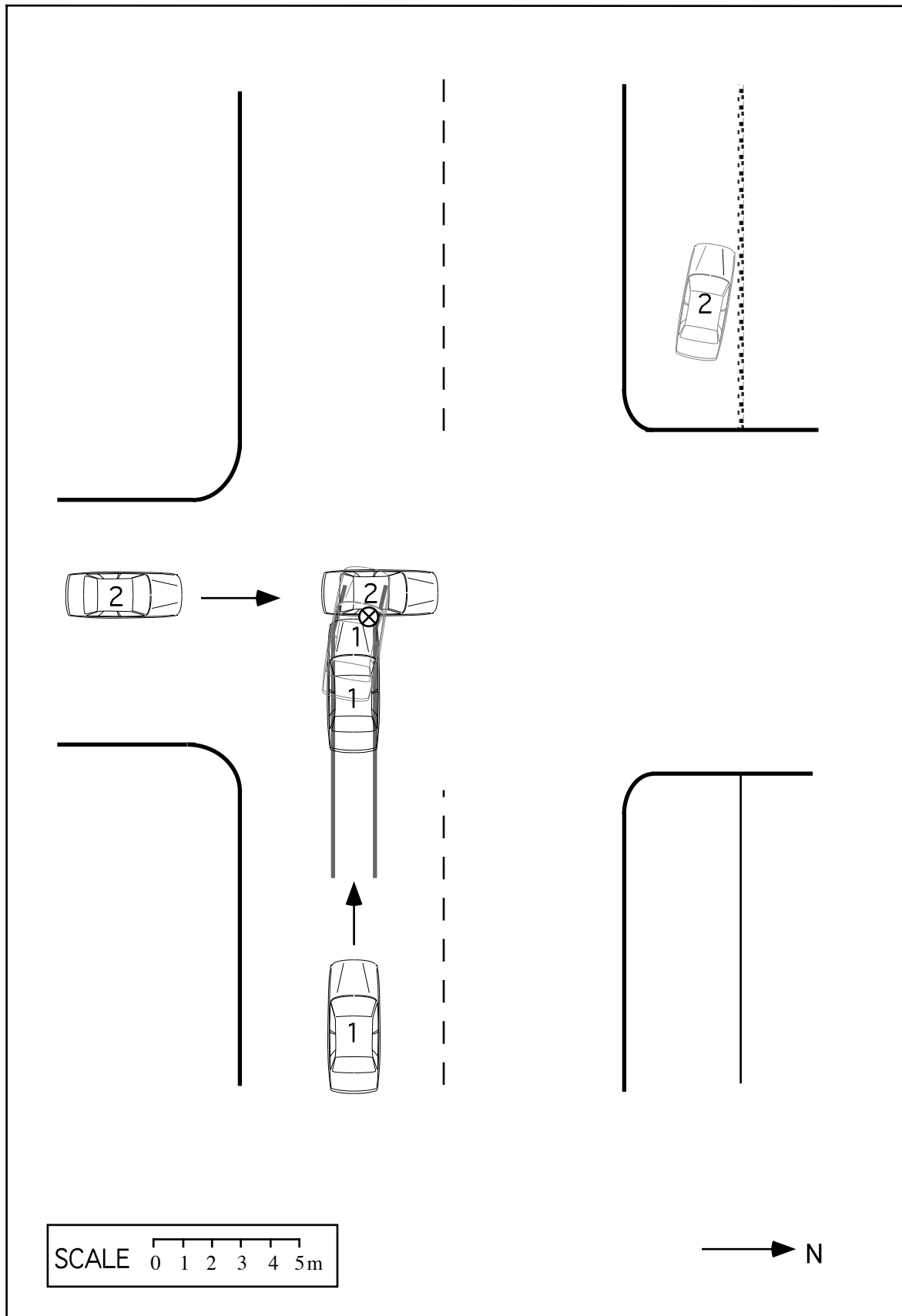
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	36	15
5 km/hour speed reduction	55	19	9
10 km/hour speed reduction	50	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	60	36	15

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	20
5 km/hour speed reduction	11
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	20

CN042



CN044

Crash Description

Unit 2 attempted a U-Turn and crossed path of Unit 1. Unit 1 collided with Unit 2 without any evidence of braking.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	54
Impact Speed	54

Control Speeds

56	62
67	67

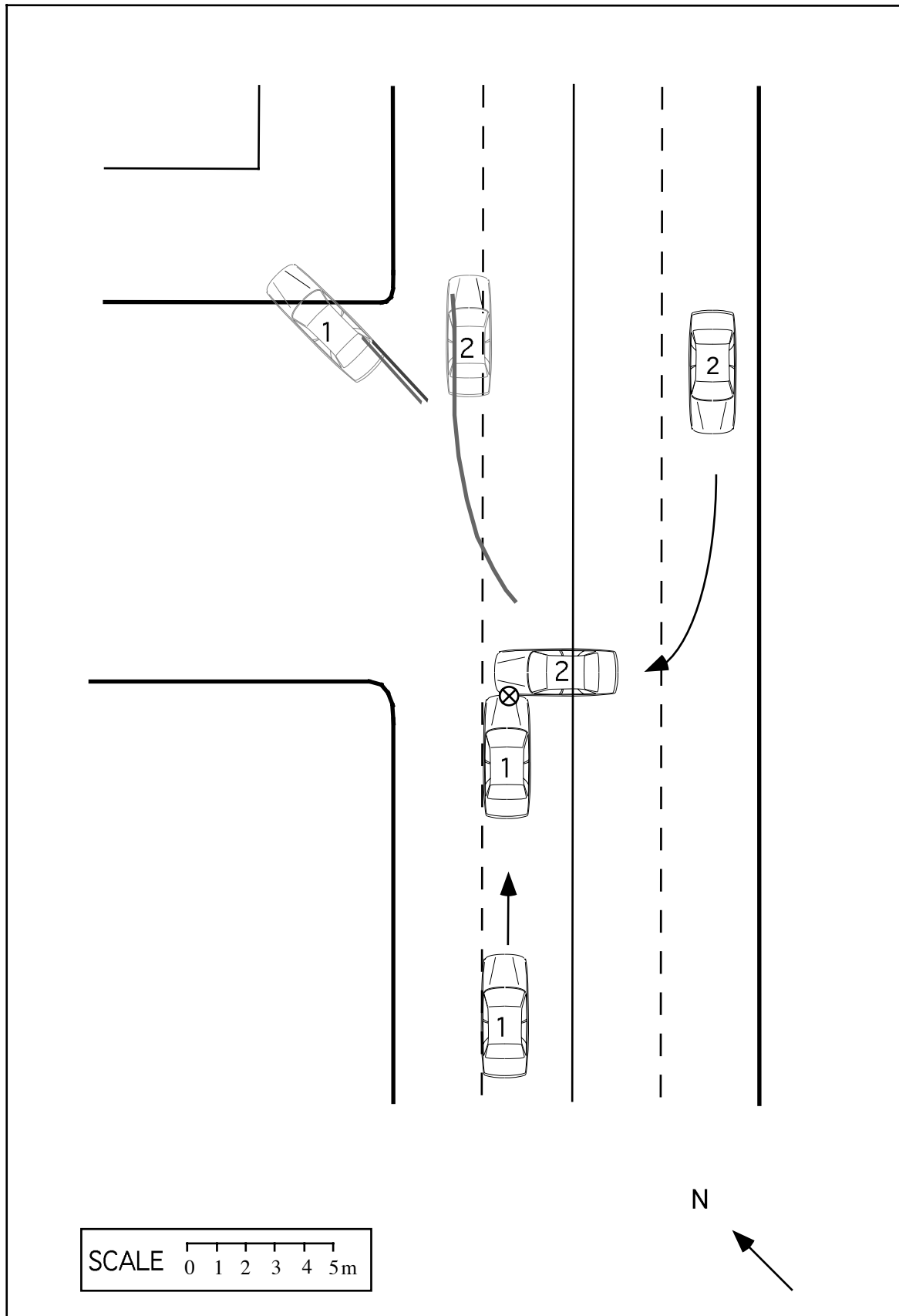
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	54	54	28
5 km/hour speed reduction	49	49	26
10 km/hour speed reduction	44	44	24
Speed Limit 50 with similar compliance	50	50	27
Speed Limit 60 with total compliance	54	54	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	28
5 km/hour speed reduction	26
10 km/hour speed reduction	24
Speed Limit 50 with similar compliance	27
Speed Limit 60 with total compliance	28

CN044



CN045

Crash Description

Unit 2 attempting a U-turn in front of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from pre-impact skid marks (7.4m).

Reconstruction Notes

Final position of Unit 1 inferred from skid mark.
Final position of Unit 2 unknown.

Case Vehicle Speeds

Free Travelling Speed	45
Impact Speed	17

Control Speeds

45	48
52	55

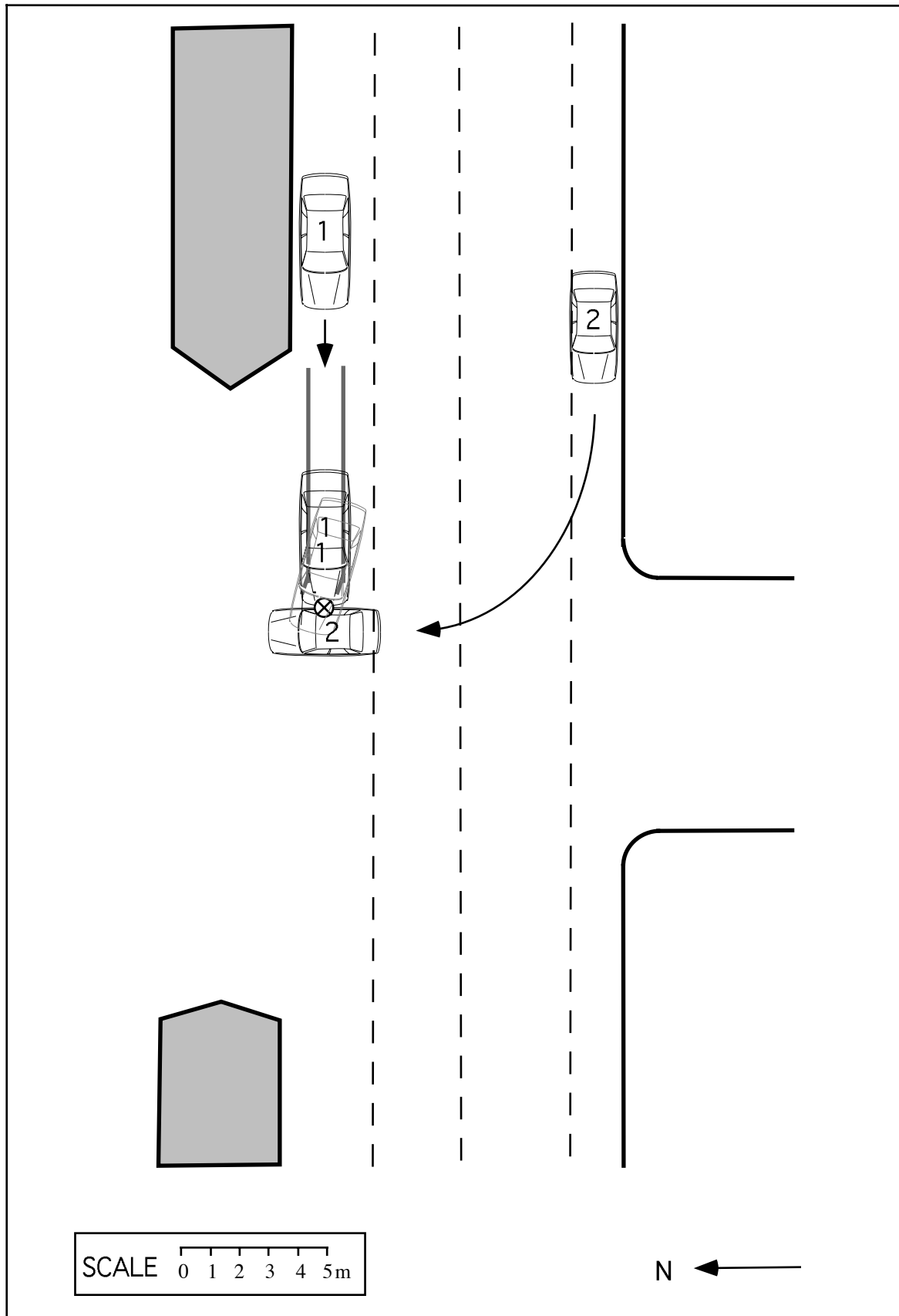
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	45	17	12
5 km/hour speed reduction	40	0	0
10 km/hour speed reduction	35	0	0
Speed Limit 50 with similar compliance	45	17	12
Speed Limit 60 with total compliance	45	17	12

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	12
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	12
Speed Limit 60 with total compliance	12

CN045



CN047

Crash Description

Unit 2 applied brakes and changed lanes suddenly from right to left due to stationary traffic in front of it, causing following Unit 1 to swerve into the left lane also. Skid marks produced by Unit 1 commenced in the right hand lane and curved into the left lane until the final collision with the rear of a stationary Unit 2 occurred.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

CRASH 3 used to calculate delta Vs for vehicles.
Impact speed for Unit 1 assumed same as delta V (ie it stopped at collision point).
Travelling speed calculated from skid mark (16.6m).

Reconstruction Notes

Final positions of vehicles not known.
Assumed Unit 2 came to a stop before impact.
Assumed Unit 1 stopped at impact point.

Case Vehicle Speeds

Free Travelling Speed	64
Impact Speed	19

Control Speeds

45	48
52	55

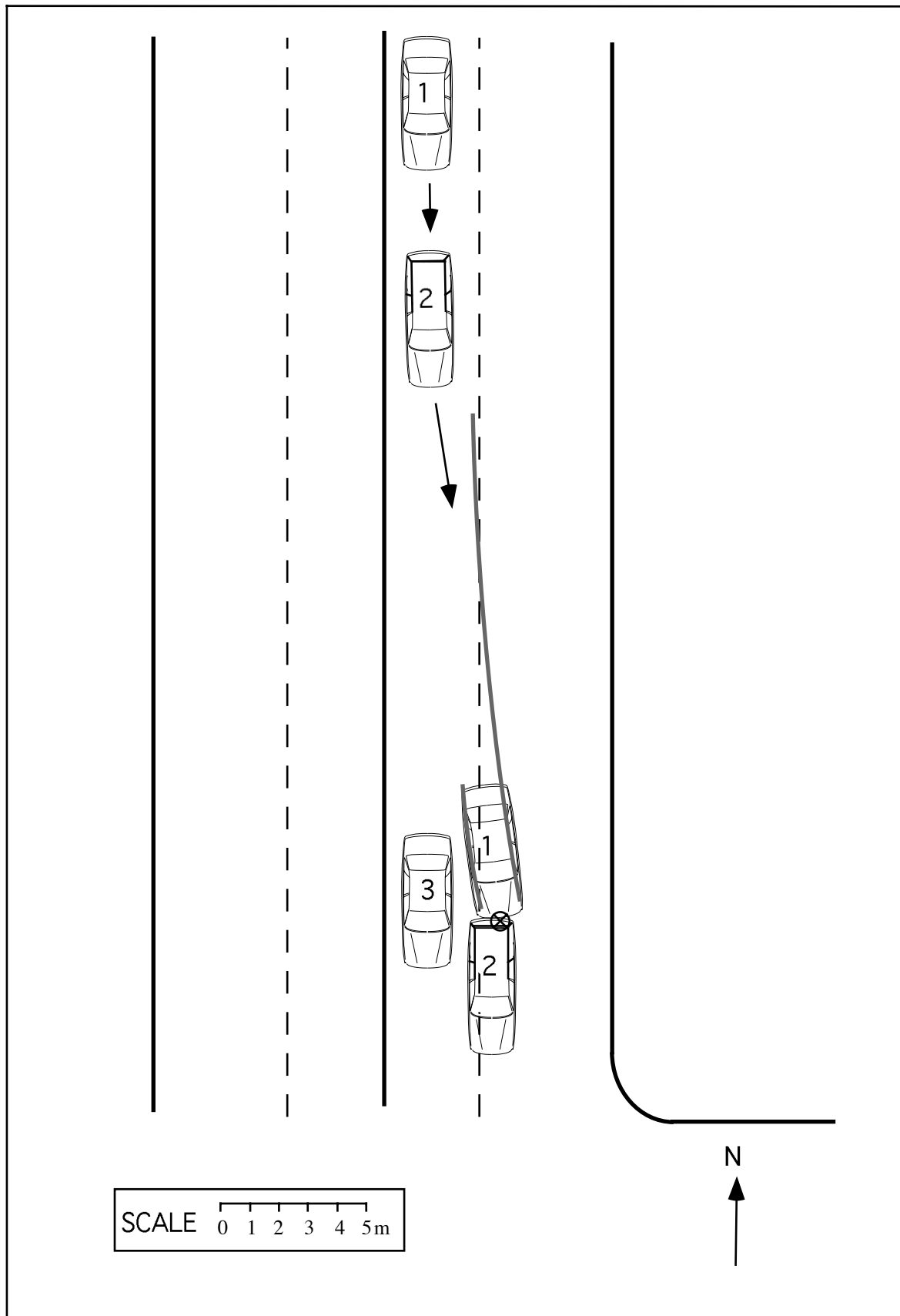
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	64	19	19
5 km/hour speed reduction	59	0	0
10 km/hour speed reduction	54	0	0
Speed Limit 50 with similar compliance	54	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	16
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN047



CN048

Crash Description

Unit 2 turning right at intersection in front of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 driver transported by ambulance.
Unit 1 left front passenger transported by ambulance.
Unit 1 left rear passenger transported by ambulance.
Unit 2 driver transported by ambulance.
Unit 2 left front passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (10m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	87
Impact Speed	65

Control Speeds

59	62
63	65

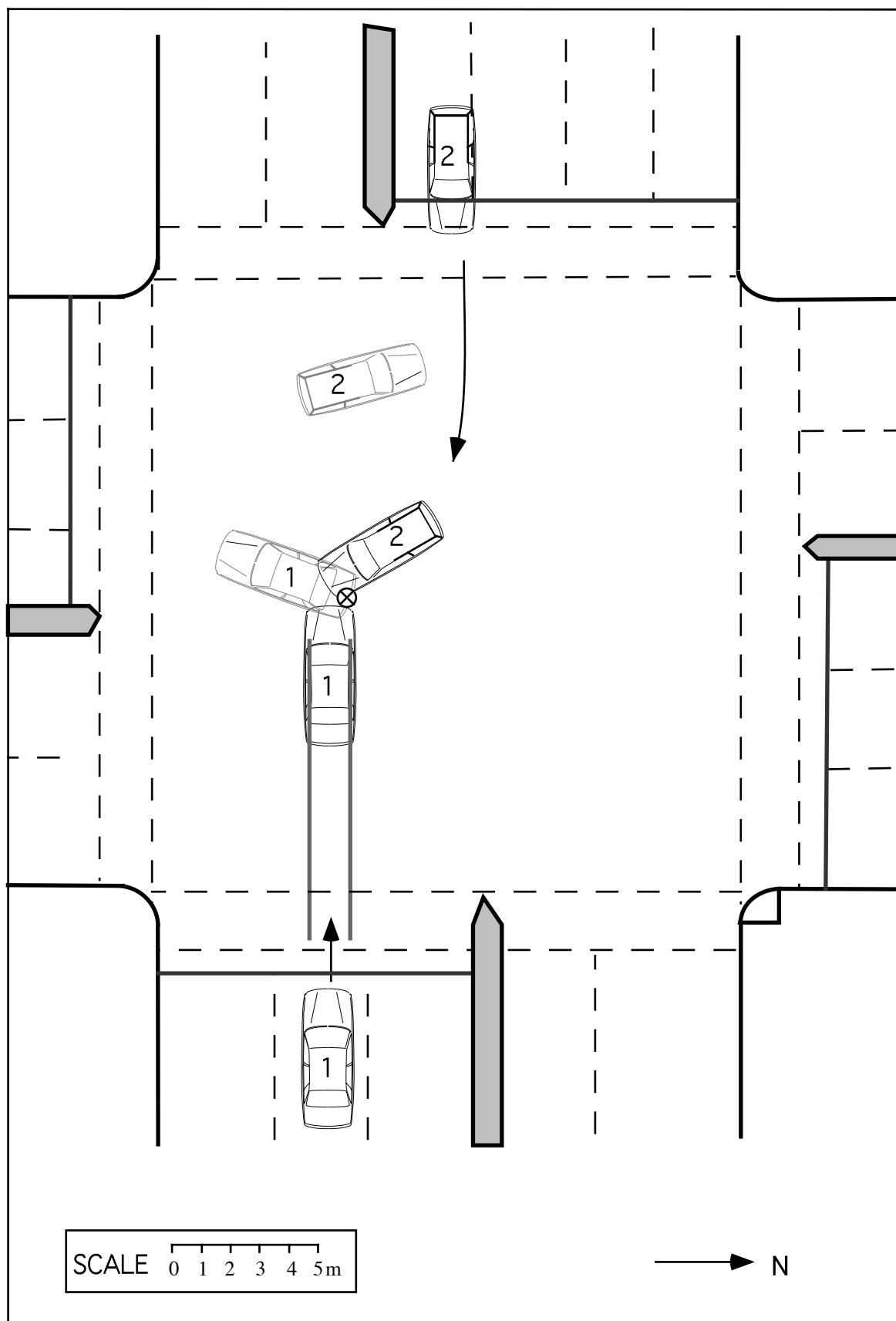
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	87	65	42
5 km/hour speed reduction	82	55	37
10 km/hour speed reduction	77	44	33
Speed Limit 50 with similar compliance	77	44	33
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	49
5 km/hour speed reduction	43
10 km/hour speed reduction	37
Speed Limit 50 with similar compliance	37
Speed Limit 60 with total compliance	0

C N 0 4 8



CN050

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (6m).

Reconstruction Notes

Vehicles locked together in real crash, but travelled same distance in simulation.

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	50

Control Speeds

57	63
66	67

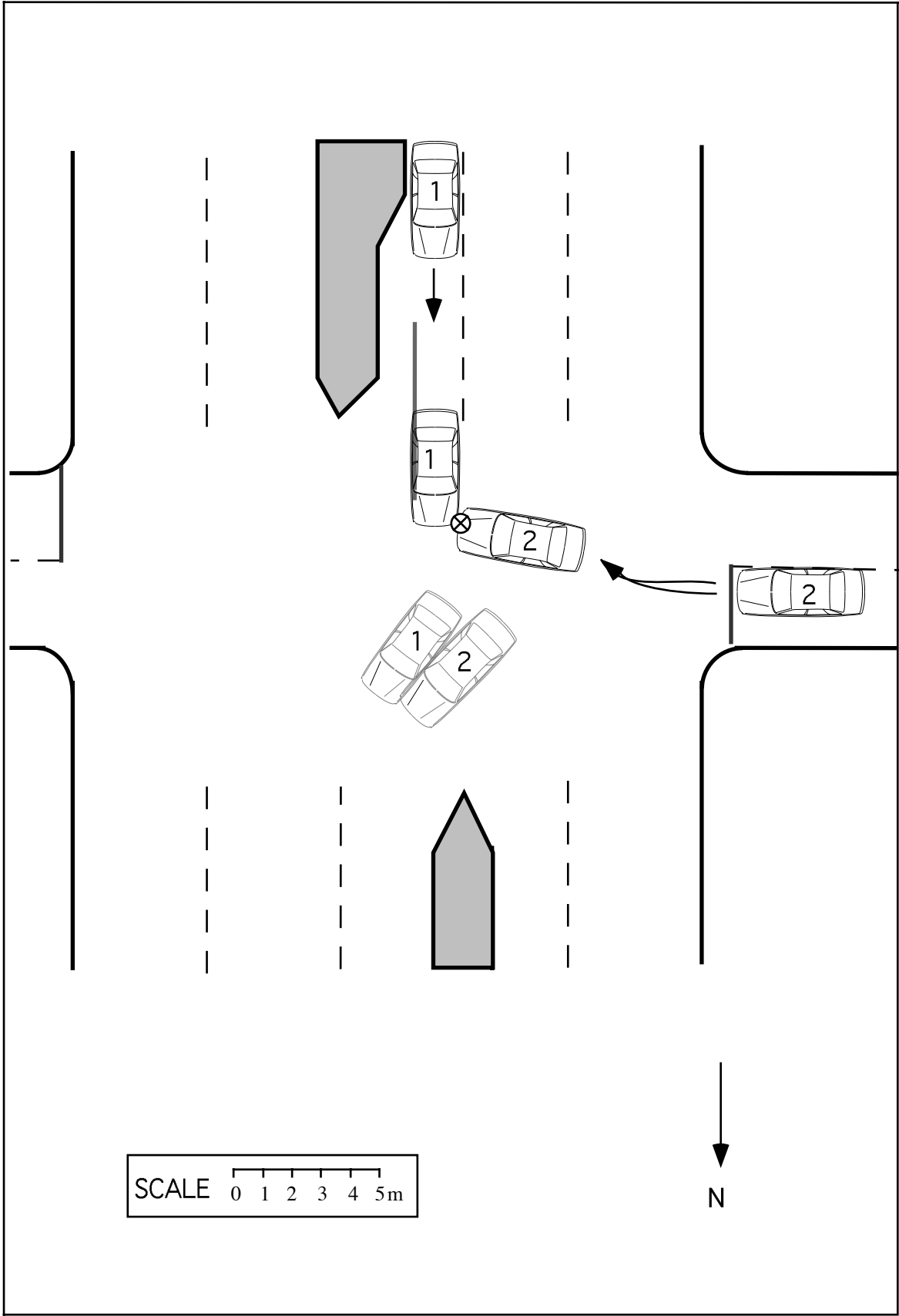
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	50	33
5 km/hour speed reduction	62	39	30
10 km/hour speed reduction	57	23	24
Speed Limit 50 with similar compliance	57	23	24
Speed Limit 60 with total compliance	60	34	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	23
10 km/hour speed reduction	19
Speed Limit 50 with similar compliance	19
Speed Limit 60 with total compliance	22

C N 0 5 0



CN055

Crash Description

Unit 1 lost control and mounted curb. It then yawed back onto the road, skidded across median strip and collided with oncoming Unit 2. Both Units qualify as cases.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 1 left front passenger fatally injured.
Unit 1 right rear passenger admitted to hospital.
Unit 2 driver admitted to hospital.
Unit 2 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed of Unit 1 from curved yaw mark (radius = 78m gives 83km/hour).
Impact speed of Unit 1 from pre-impact skid marks (7m).
Impact and travelling speed of Unit 2 from impact speed of Unit 1 and SMAC run.

Reconstruction Notes

Skidding of Unit 1 due to braking presumed to start just before median strip (following on from yaw mark).
Assumed Unit 1 straightened up after crossing median strip.

Case Vehicle 1 Speeds

Free Travelling Speed	83
Impact Speed	65

Control Speeds

63	63
68	69

Case Vehicle 2 Speeds

Free Travelling Speed	68
Impact Speed	68

Control Speeds

60	67
67	68

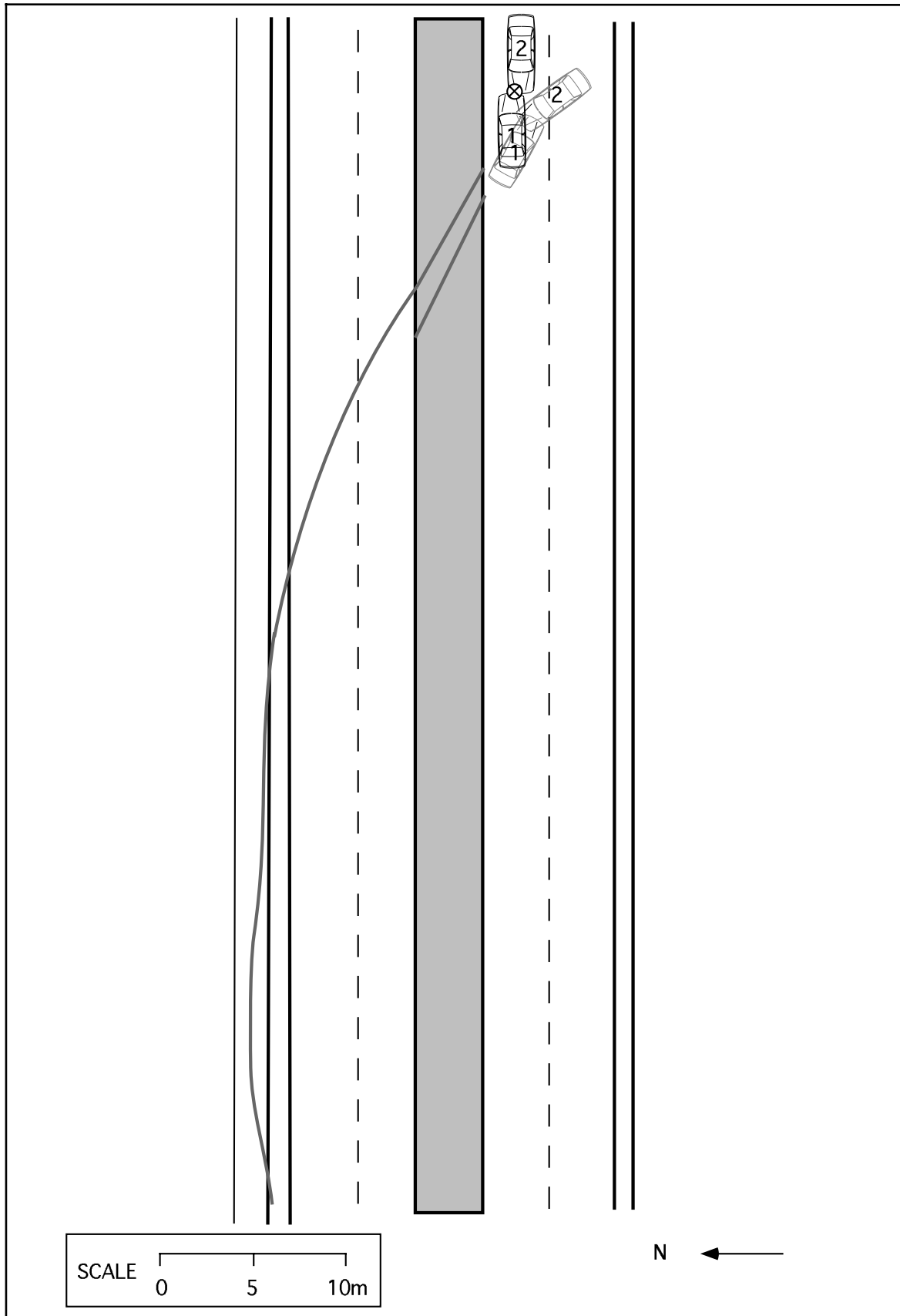
Hypothetical Scenarios (Case Vehicle 1)

Scenario	Travelling Speed	Impact Speed	Delta V
Actual Calculated	83	65	68
5 km/hour speed reduction	78	56	62
10 km/hour speed reduction	73	45	55
Speed Limit 50 with similar compliance	73	45	55
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Case Vehicle 2)

Scenario	Travelling Speed	Impact Speed	Delta V
Actual Calculated	68	68	71
5 km/hour speed reduction	63	63	65
10 km/hour speed reduction	58	58	58
Speed Limit 50 with similar compliance	58	58	58
Speed Limit 60 with total compliance	60	60	0

C N 0 5 5



CN057

Crash Description

Unit 1 proceeding along road. Pedestrian stepped off curb into path of Unit 1. Unit 1 swerved and applied brakes and then collided with pedestrian.

Injury Outcomes

Pedestrian treated at hospital.

Type of Road

Local street.

Reconstruction Method

Travelling speed from total skid mark length (15.6m).

Impact speed from post-impact skid marks (5m).

Reconstruction Notes

Unsure of pedestrian impact point.

Does not affect travelling speed estimate.

Case Vehicle Speeds

Free Travelling Speed	59
Impact Speed	30

Control Speeds

57	57
59	61

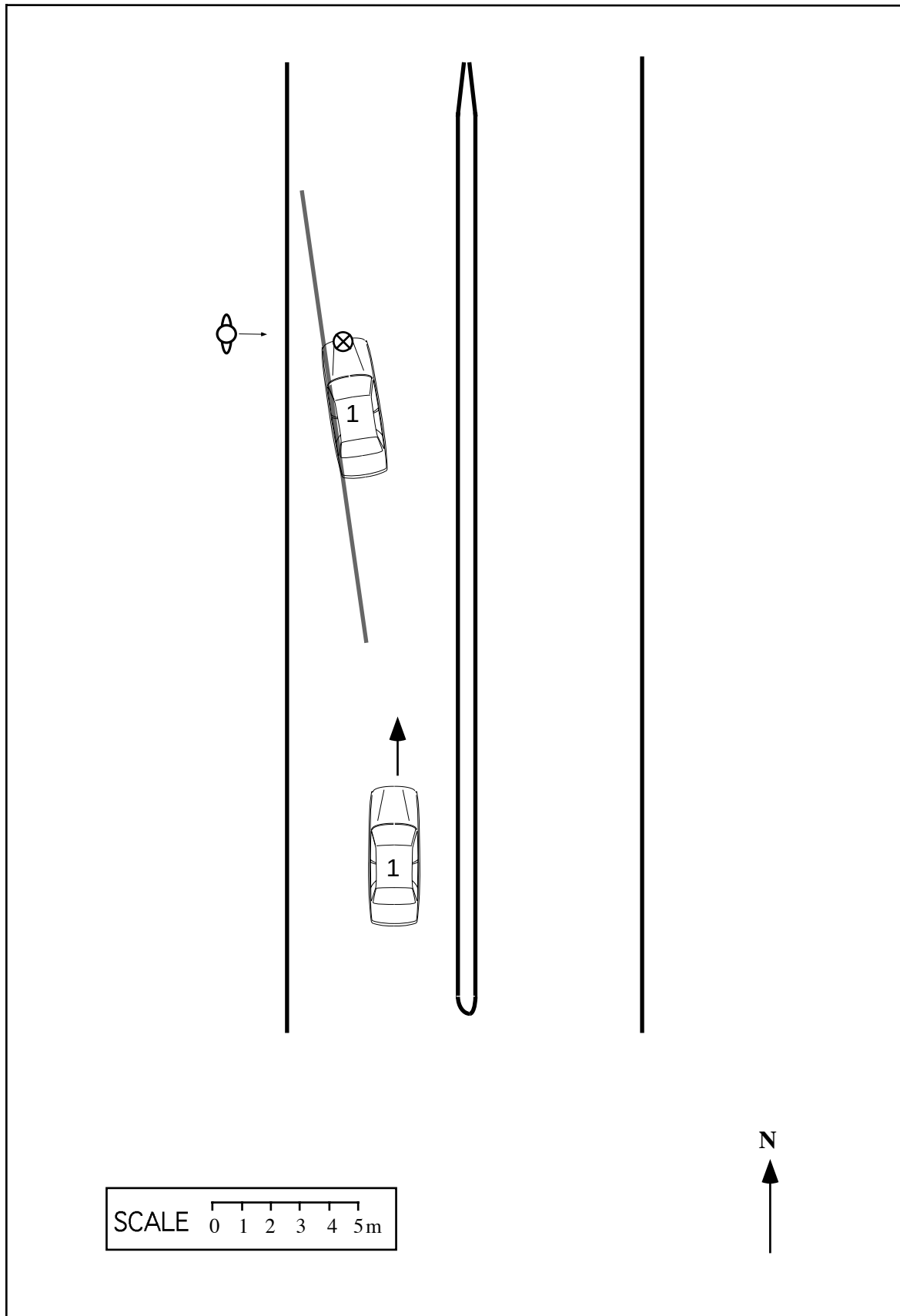
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	59	30	0
5 km/hour speed reduction	54	0	0
10 km/hour speed reduction	49	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	59	30	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	30
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	30

C N 0 5 7



CN058

Crash Description

Unit 1 was travelling through a large roundabout when Unit 2 entered roundabout without giving way to Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 1 left front passenger admitted to hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	65

Control Speeds

46	50
53	54

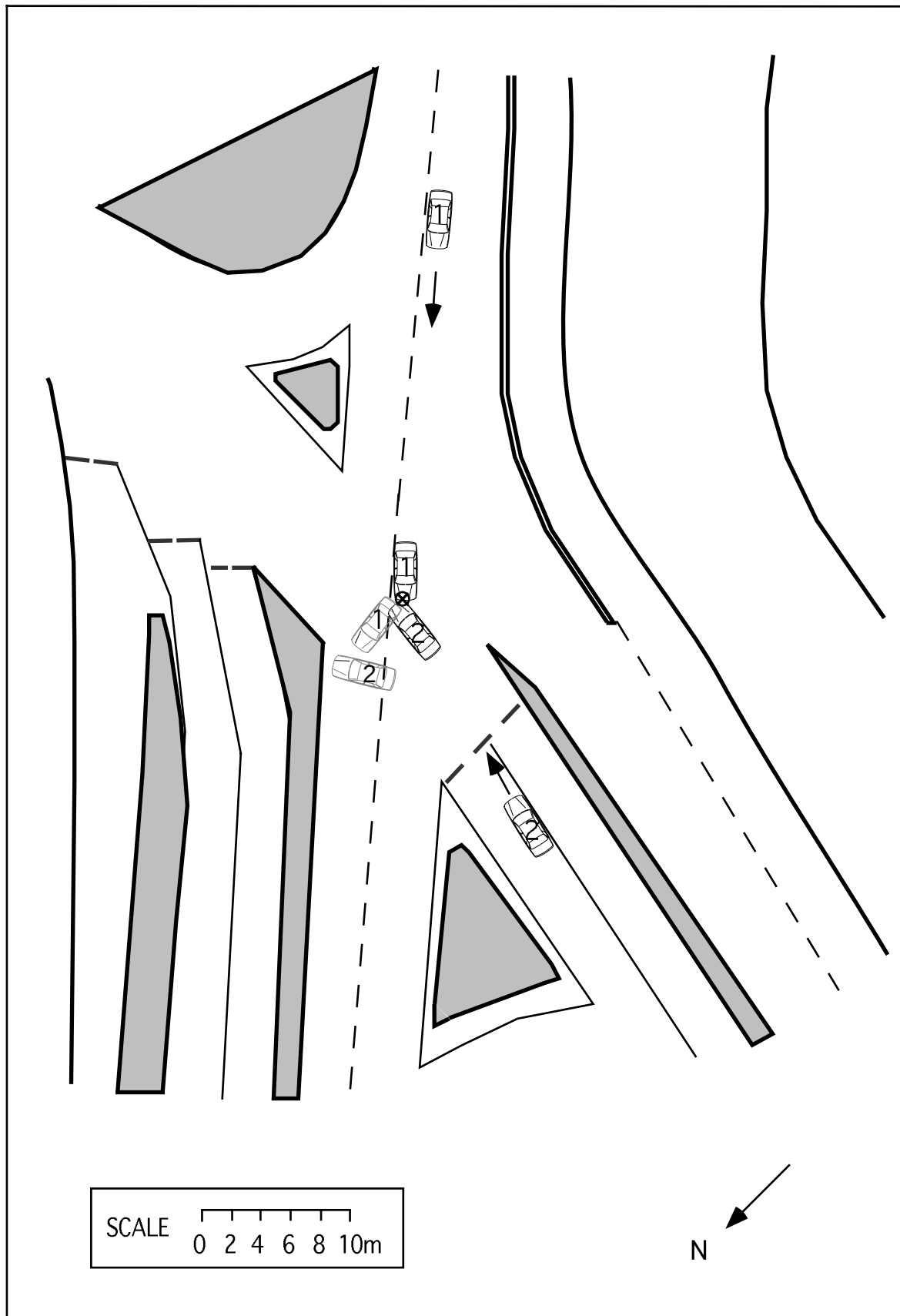
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	65	57
5 km/hour speed reduction	60	60	54
10 km/hour speed reduction	55	55	51
Speed Limit 50 with similar compliance	55	55	51
Speed Limit 60 with total compliance	60	60	54

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	53
5 km/hour speed reduction	51
10 km/hour speed reduction	48
Speed Limit 50 with similar compliance	48
Speed Limit 60 with total compliance	51

CN058



CN059

Crash Description

Unit 2 turning right into side street across path of Unit 1. Unit 2 collided with corner of Unit 1.

Injury Outcomes

Unit 1 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Not a perfect match in SMAC run.

Impact point estimated.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	65

Control Speeds

36	59
61	66

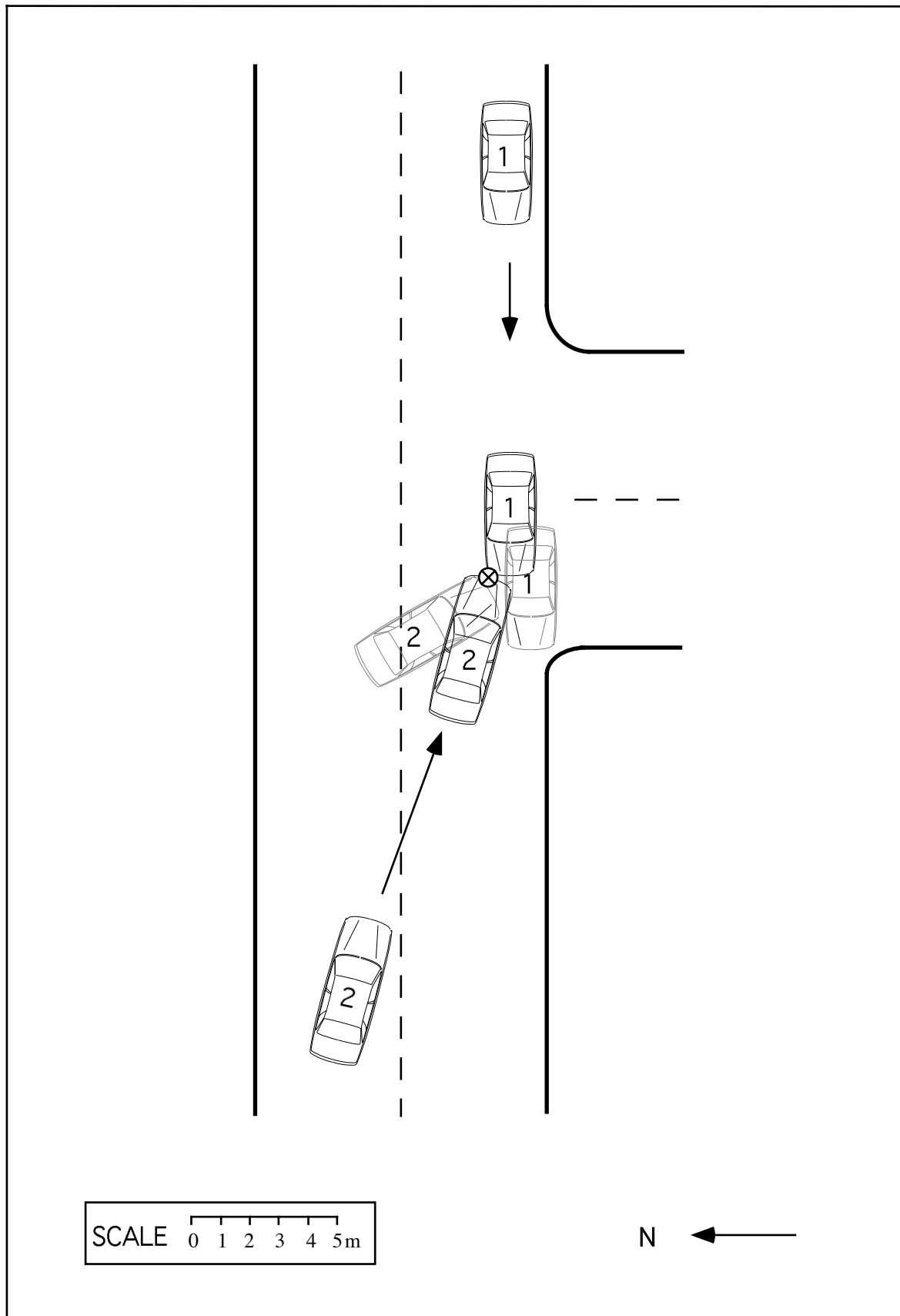
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	65	63
5 km/hour speed reduction	60	60	60
10 km/hour speed reduction	55	55	57
Speed Limit 50 with similar compliance	55	55	57
Speed Limit 60 with total compliance	60	60	60

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	36
5 km/hour speed reduction	34
10 km/hour speed reduction	33
Speed Limit 50 with similar compliance	33
Speed Limit 60 with total compliance	34

CN059



CN060

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 driver treated by private doctor (no ambulance transport).

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (5.3m).

Reconstruction Notes

Final position of Unit 2 uncertain (reported by driver of Unit 1).

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	47

Control Speeds

52	53
61	74

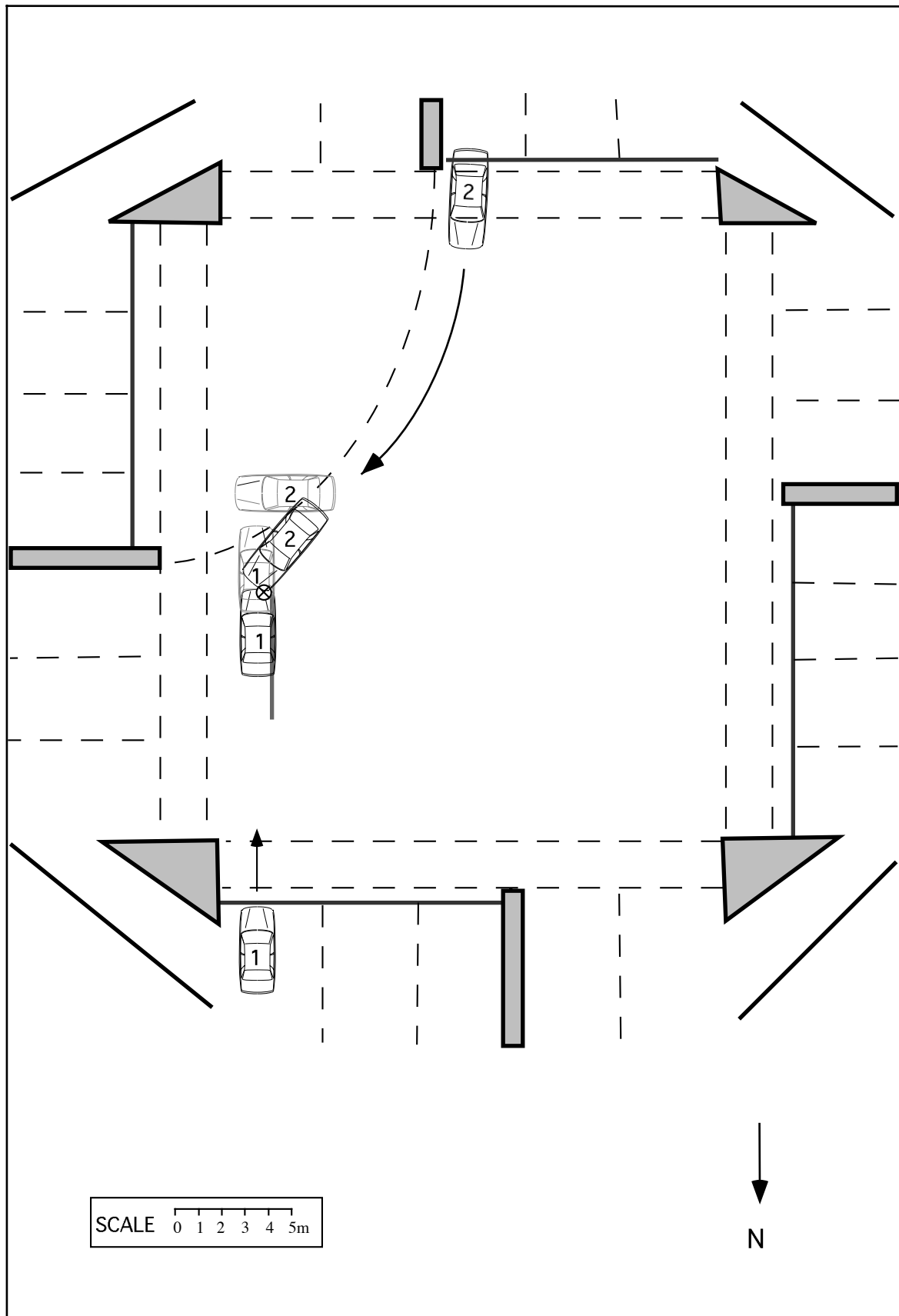
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	47	43
5 km/hour speed reduction	58	35	36
10 km/hour speed reduction	53	18	25
Speed Limit 50 with similar compliance	53	18	25
Speed Limit 60 with total compliance	60	41	40

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	36
5 km/hour speed reduction	30
10 km/hour speed reduction	21
Speed Limit 50 with similar compliance	21
Speed Limit 60 with total compliance	33

CN060



CN062

Crash Description

Unit 2 doing U-turn at median strip. Unit 1 applied brakes and then collided with rear of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from skid marks (6.9m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	50

Control Speeds

51	57
58	59

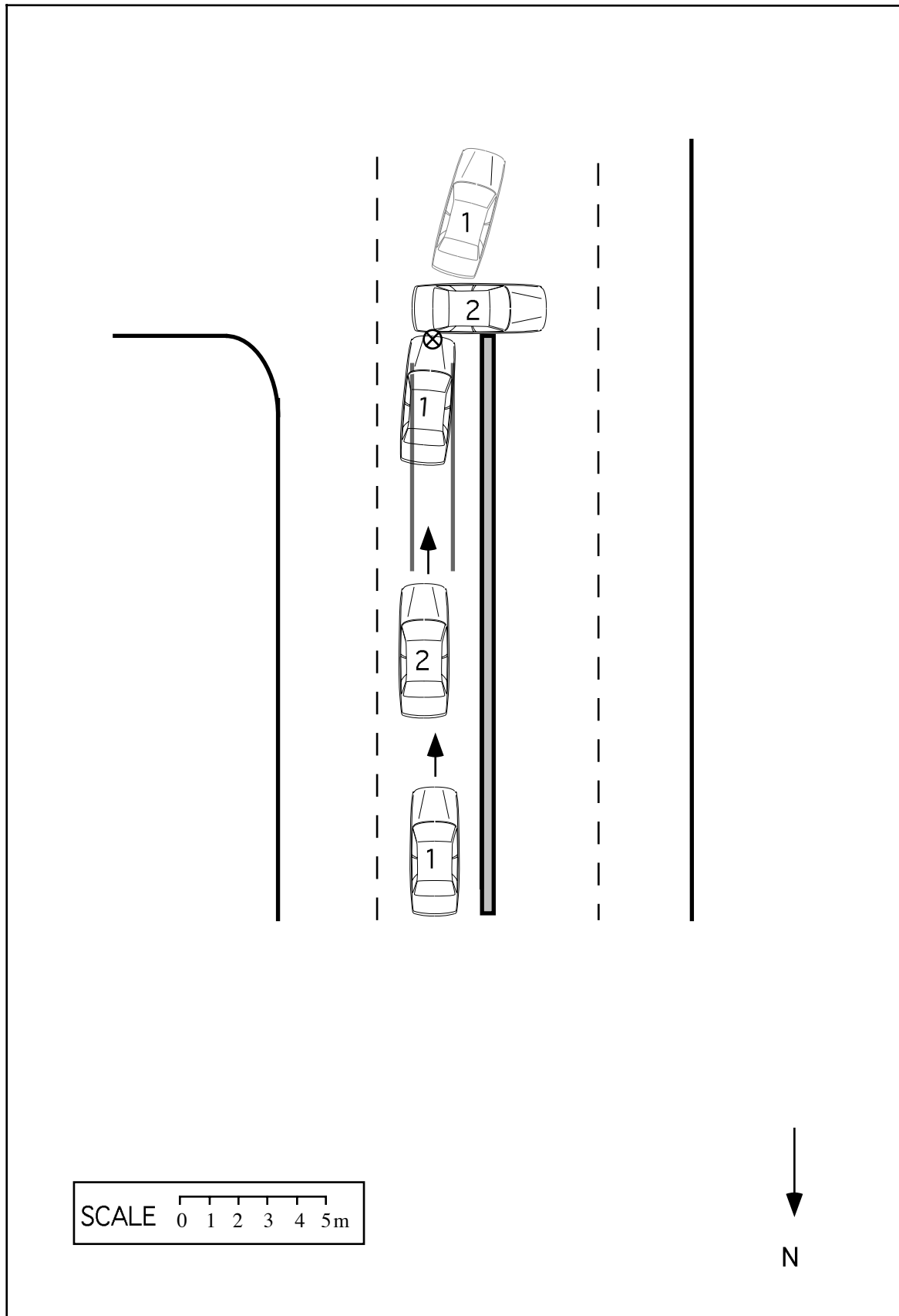
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	50	20
5 km/hour speed reduction	63	39	16
10 km/hour speed reduction	58	23	10
Speed Limit 50 with similar compliance	58	23	10
Speed Limit 60 with total compliance	60	29	12

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	15
5 km/hour speed reduction	11
10 km/hour speed reduction	6
Speed Limit 50 with similar compliance	6
Speed Limit 60 with total compliance	8

CN062



CN063

Crash Description

Unit 2 went through red light at intersection in front of Unit 1. Unit 1 collided with Unit 2 and then collided with Unit 3 which then hit Unit 4. Unit 2 went on to collide with Unit 5.

Injury Outcomes

Unit 1 driver transported by ambulance.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Uncertain as to steering and braking on cars after impact.
Not a perfect SMAC run.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	58

Control Speeds

51	57
58	59

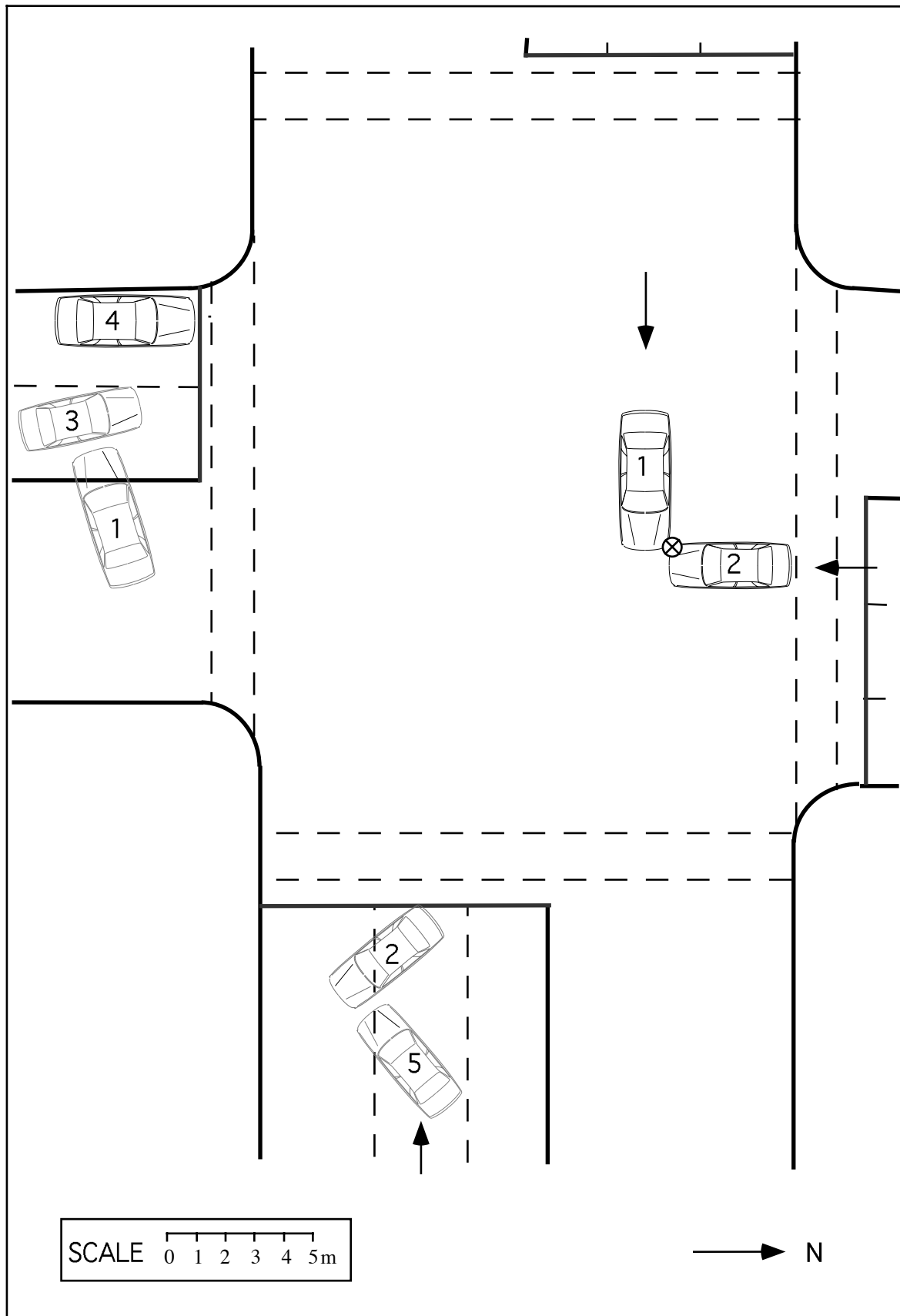
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	58	34
5 km/hour speed reduction	53	53	32
10 km/hour speed reduction	48	48	31
Speed Limit 50 with similar compliance	50	50	32
Speed Limit 60 with total compliance	58	58	34

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	47
5 km/hour speed reduction	45
10 km/hour speed reduction	43
Speed Limit 50 with similar compliance	44
Speed Limit 60 with total compliance	47

CN063



CN064

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 2 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Uncertain of final position of Unit 1.

Uncertain of final angle of Unit 2.

Case Vehicle Speeds

Free Travelling Speed	79
Impact Speed	79

Control Speeds

54	55
63	65

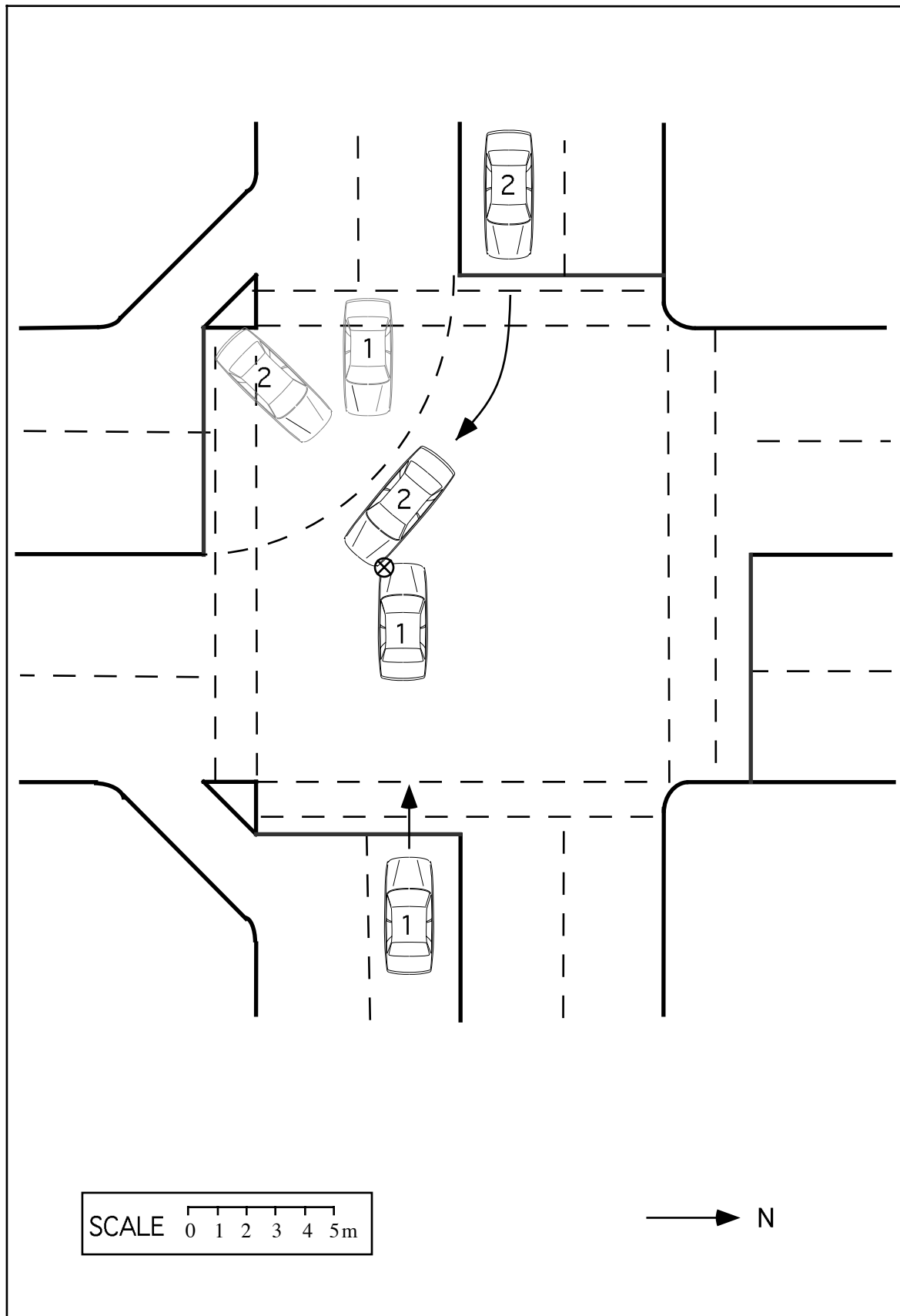
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	79	79	49
5 km/hour speed reduction	74	74	46
10 km/hour speed reduction	69	69	43
Speed Limit 50 with similar compliance	69	69	43
Speed Limit 60 with total compliance	60	60	39

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	35
5 km/hour speed reduction	33
10 km/hour speed reduction	31
Speed Limit 50 with similar compliance	31
Speed Limit 60 with total compliance	28

CN064



CN066

Crash Description

Unit 2 crossing intersection. Unit 1 saw Unit 2 and applied brakes and then collided with side of Unit 2.

Injury Outcomes

Unit 2 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid mark (14.6m).

Reconstruction Notes

Final position of Unit 2 unknown.

Assumed Unit 1 stopped at end of skid marks.

Case Vehicle Speeds

Free Travelling Speed	70
Impact Speed	36

Control Speeds

58	58
60	62

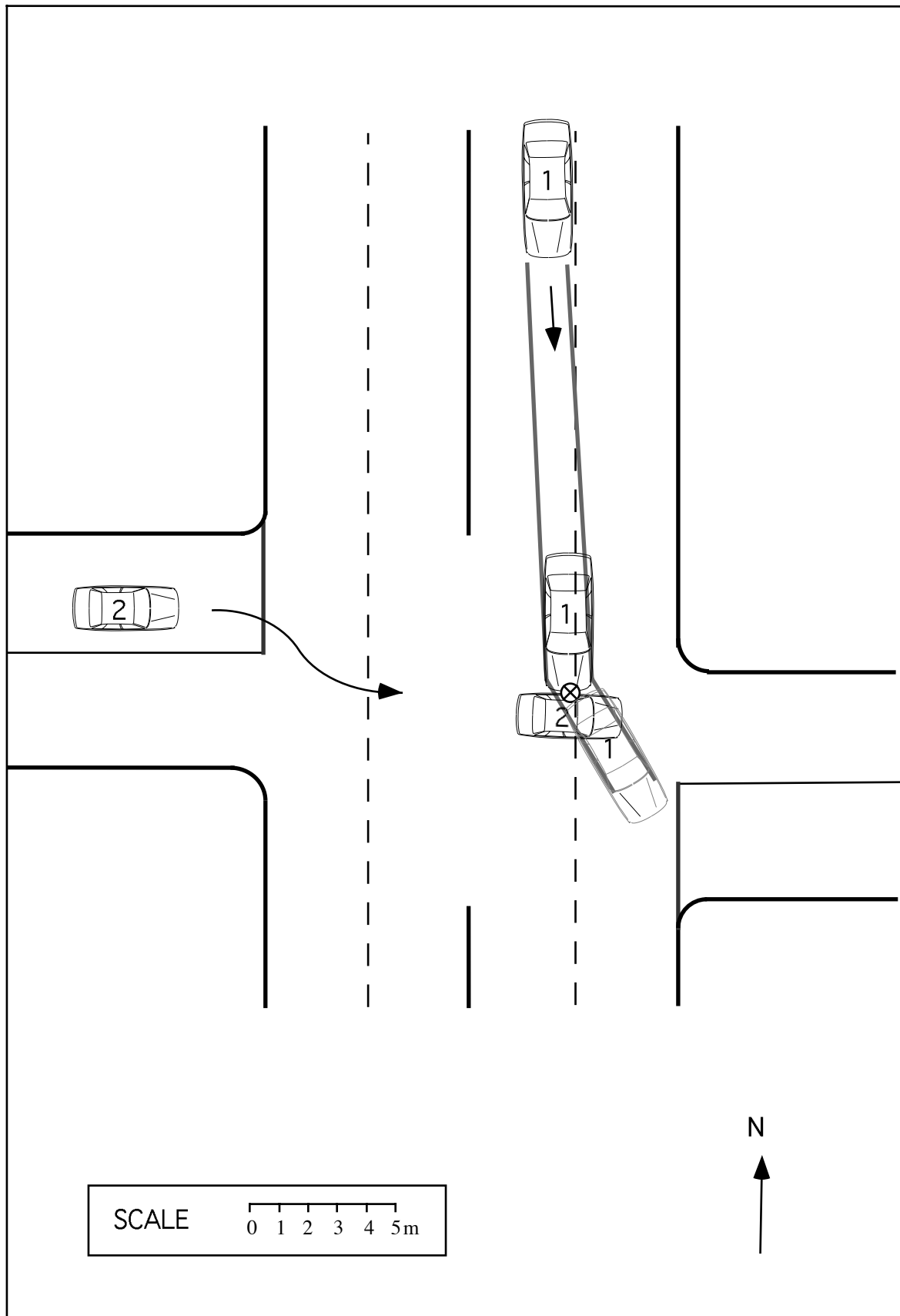
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	70	36	19
5 km/hour speed reduction	65	16	8
10 km/hour speed reduction	60	0	0
Speed Limit 50 with similar compliance	60	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	10
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

C N 0 6 6



CN068

Crash Description

Unit 1 lost control, mounted curb and collided with stobie pole.

Injury Outcomes

Unit 1 left rear passenger admitted to hospital.

Type of Road

Local street.

Reconstruction Method

Pole impact calculation used to get delta V of Unit 1 (max crush = 1082mm).
This was also travelling and impact speed.

Reconstruction Notes

Added stobie pole deformation to crush of Unit 1 (300mm).

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	68

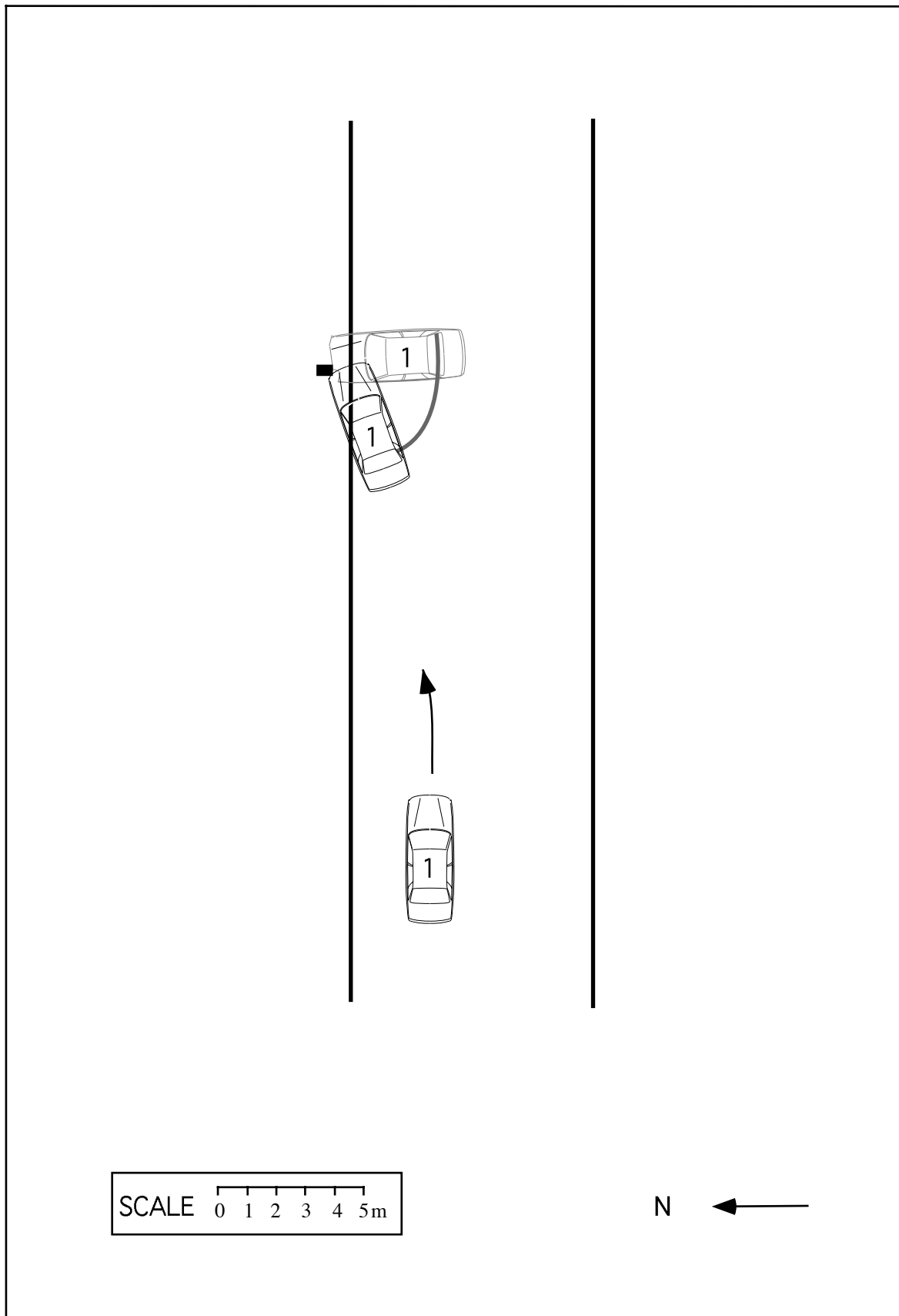
Control Speeds

53	55
62	70

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	68	68
5 km/hour speed reduction	63	63	63
10 km/hour speed reduction	58	58	58
Speed Limit 50 with similar compliance	58	58	58
Speed Limit 60 with total compliance	60	60	60

C N 0 6 8



CN069

Crash Description

Unit 1 on the divided main road in the right hand lane, collided head on with Unit 2 on the same road after Unit 2 crossed the centre median. Unknown Unit 2 travelling speed.

Injury Outcomes

Unit 1 driver admitted to hospital.

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Not a perfect SMAC run (damage not a good match).

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	65

Control Speeds

60	62
63	74

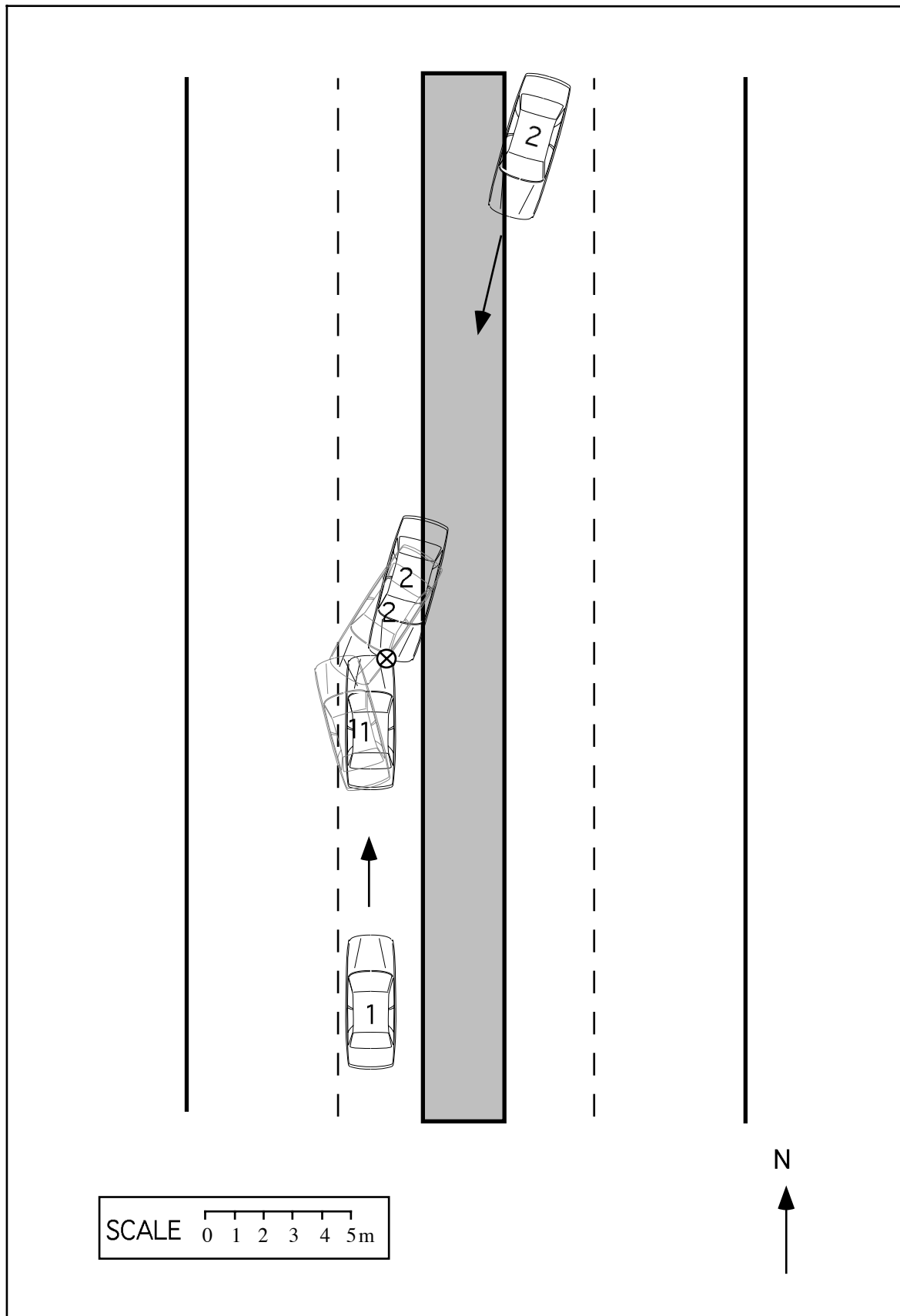
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	65	66
5 km/hour speed reduction	60	60	64
10 km/hour speed reduction	55	55	61
Speed Limit 50 with similar compliance	55	55	61
Speed Limit 60 with total compliance	60	60	64

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	55
5 km/hour speed reduction	53
10 km/hour speed reduction	51
Speed Limit 50 with similar compliance	51
Speed Limit 60 with total compliance	53

CN069



CN074

Crash Description

Unit 1 travelling along road. Unit 1 saw pedestrian, applied brakes and then collided with pedestrian.

Injury Outcomes

Pedestrian treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid marks (13.4m).

Impact speed from post-impact skid marks (1.1m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	55
Impact Speed	14

Control Speeds

58	60
65	68

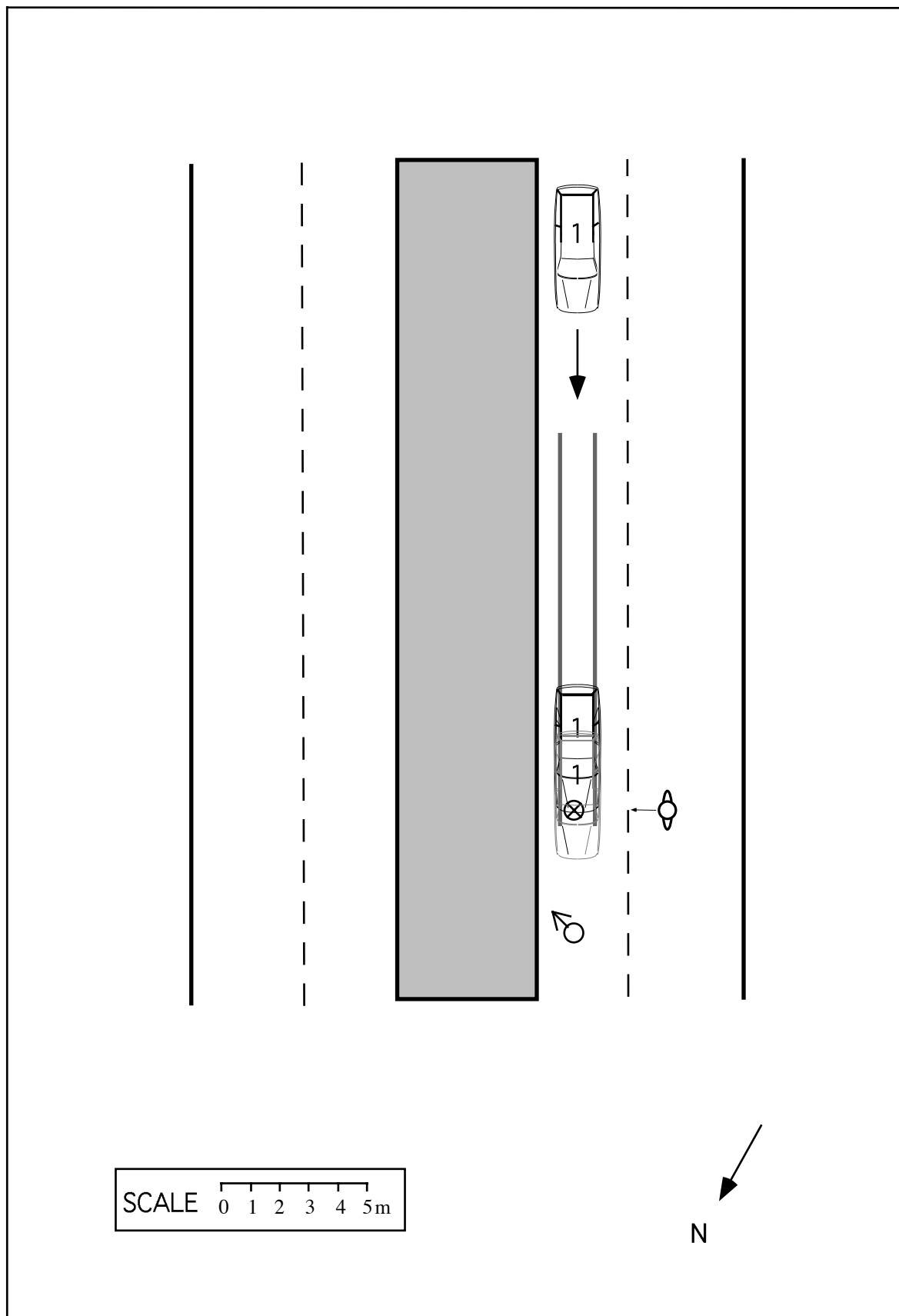
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	55	14	0
5 km/hour speed reduction	50	0	0
10 km/hour speed reduction	45	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	55	14	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	14
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	14

C N 0 7 4



CN076

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with front of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 may have disobeyed traffic lights.
We assumed it went through on yellow light.

Case Vehicle Speeds

Free Travelling Speed	54
Impact Speed	54

Control Speeds

47	53
59	59

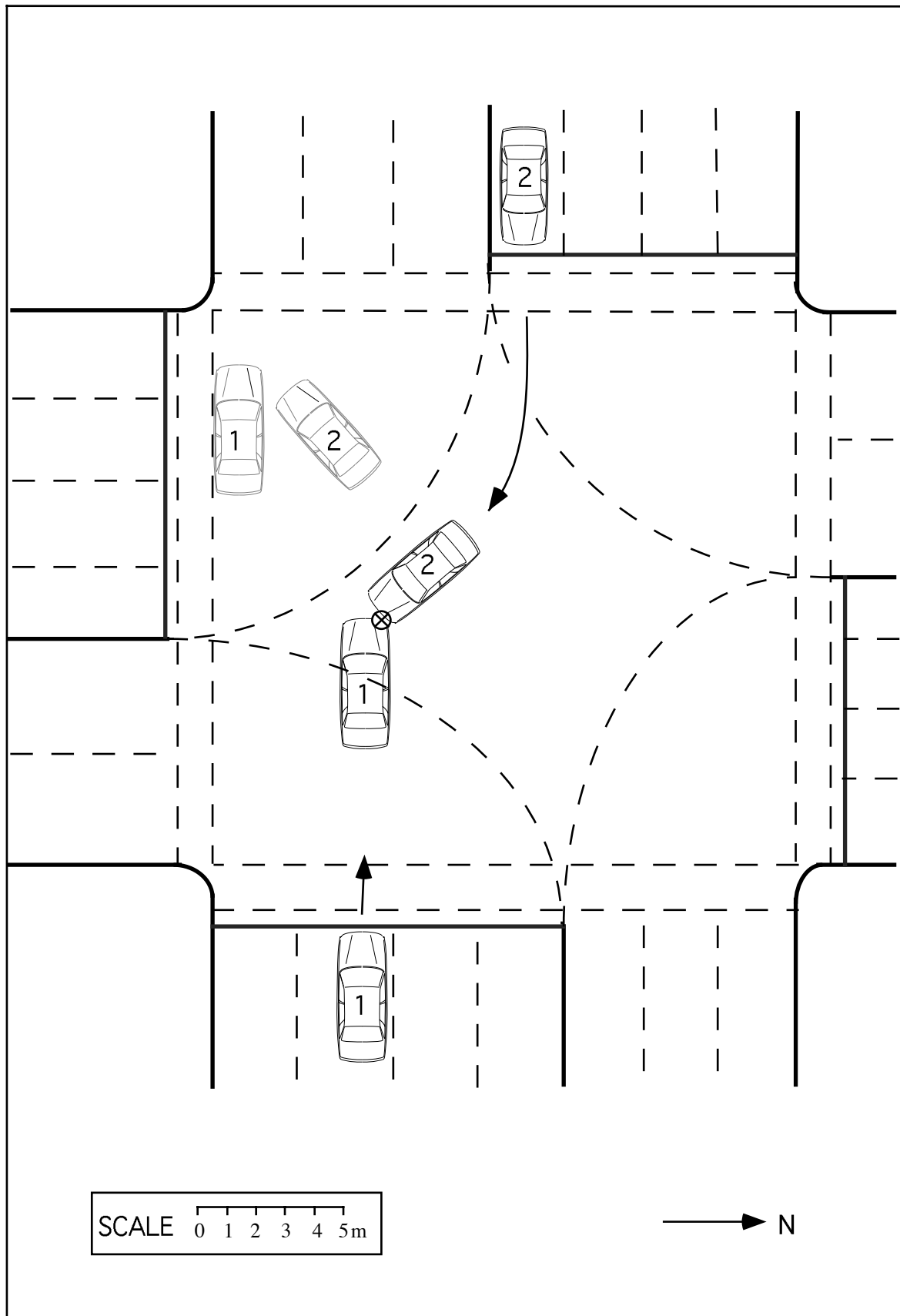
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	54	54	36
5 km/hour speed reduction	49	49	34
10 km/hour speed reduction	44	44	32
Speed Limit 50 with similar compliance	50	50	35
Speed Limit 60 with total compliance	54	54	36

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	45
5 km/hour speed reduction	43
10 km/hour speed reduction	41
Speed Limit 50 with similar compliance	43
Speed Limit 60 with total compliance	45

CN076



CN077

Crash Description

Unit 2 crossing intersection across path of Unit 1. Unit 1 collided with side of Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.
Unit 2 driver fatally injured.

Type of Road

Local street.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Unit 2 driver thrown out of Unit 2.

Case Vehicle Speeds

Free Travelling Speed	86
Impact Speed	86

Control Speeds

58	61
69	70

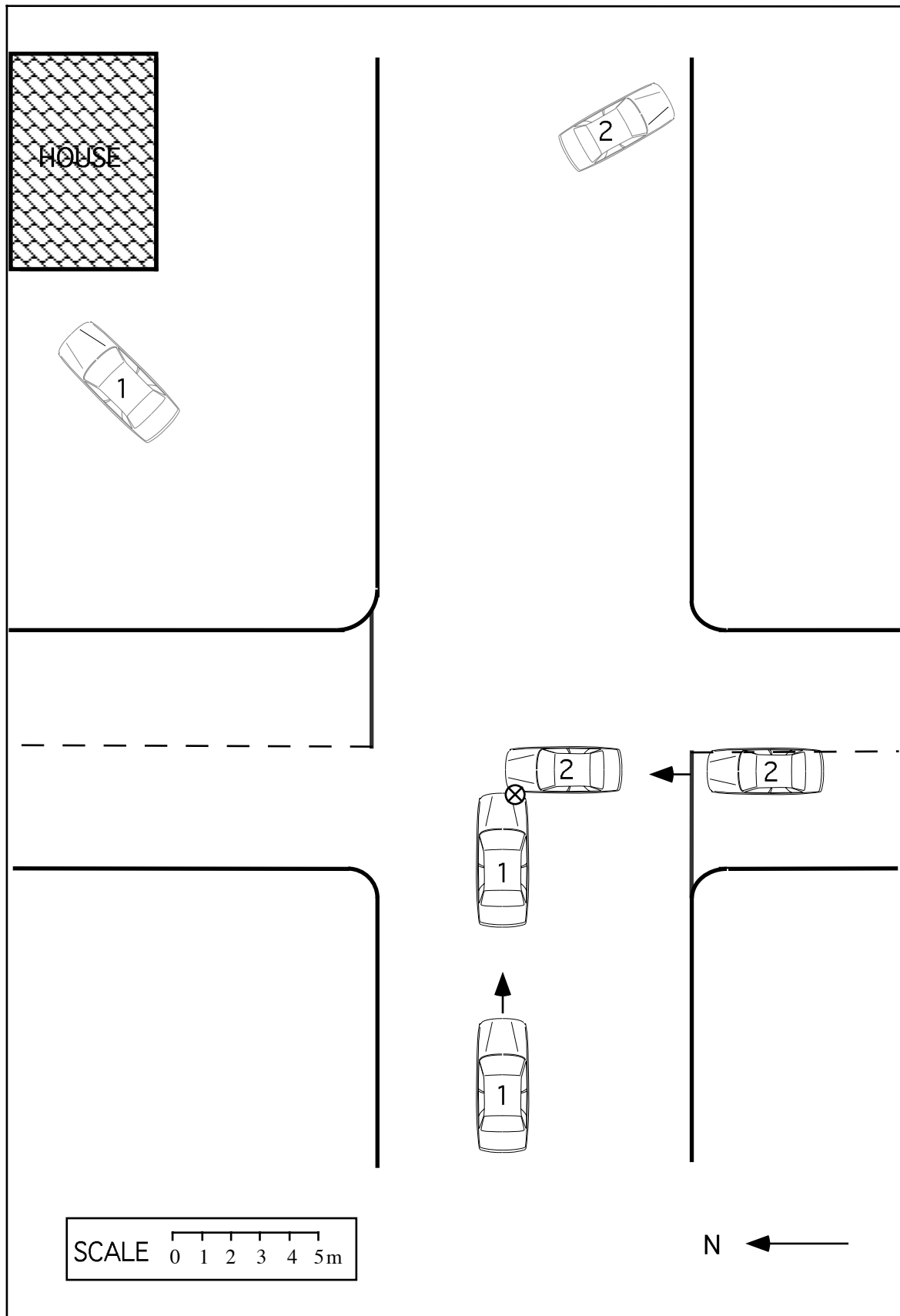
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	86	86	40
5 km/hour speed reduction	81	81	38
10 km/hour speed reduction	76	76	36
Speed Limit 50 with similar compliance	76	76	36
Speed Limit 60 with total compliance	60	60	31

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	63
5 km/hour speed reduction	60
10 km/hour speed reduction	57
Speed Limit 50 with similar compliance	57
Speed Limit 60 with total compliance	49

CN077



CN078

Crash Description

Unit 1 lost control on slight left hand bend and crossed road into path of Unit 2. Unit 2 saw that a collision was imminent and applied brakes. A frontal collision occurred between Unit 1 and Unit 2. Both Units are considered to be cases.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speeds from final positions and SMAC run.
Travelling speed of Unit 1 same as impact speed.
Travelling speed of Unit 2 from skid marks (10m).

Reconstruction Notes

Damage profile match not perfect.

Case Vehicle 1 Speeds

Free Travelling Speed	72
Impact Speed	72

Control Speeds

54	60
64	66

Case Vehicle 2 Speeds

Free Travelling Speed	80
Impact Speed	58

Control Speeds

58	59
60	63

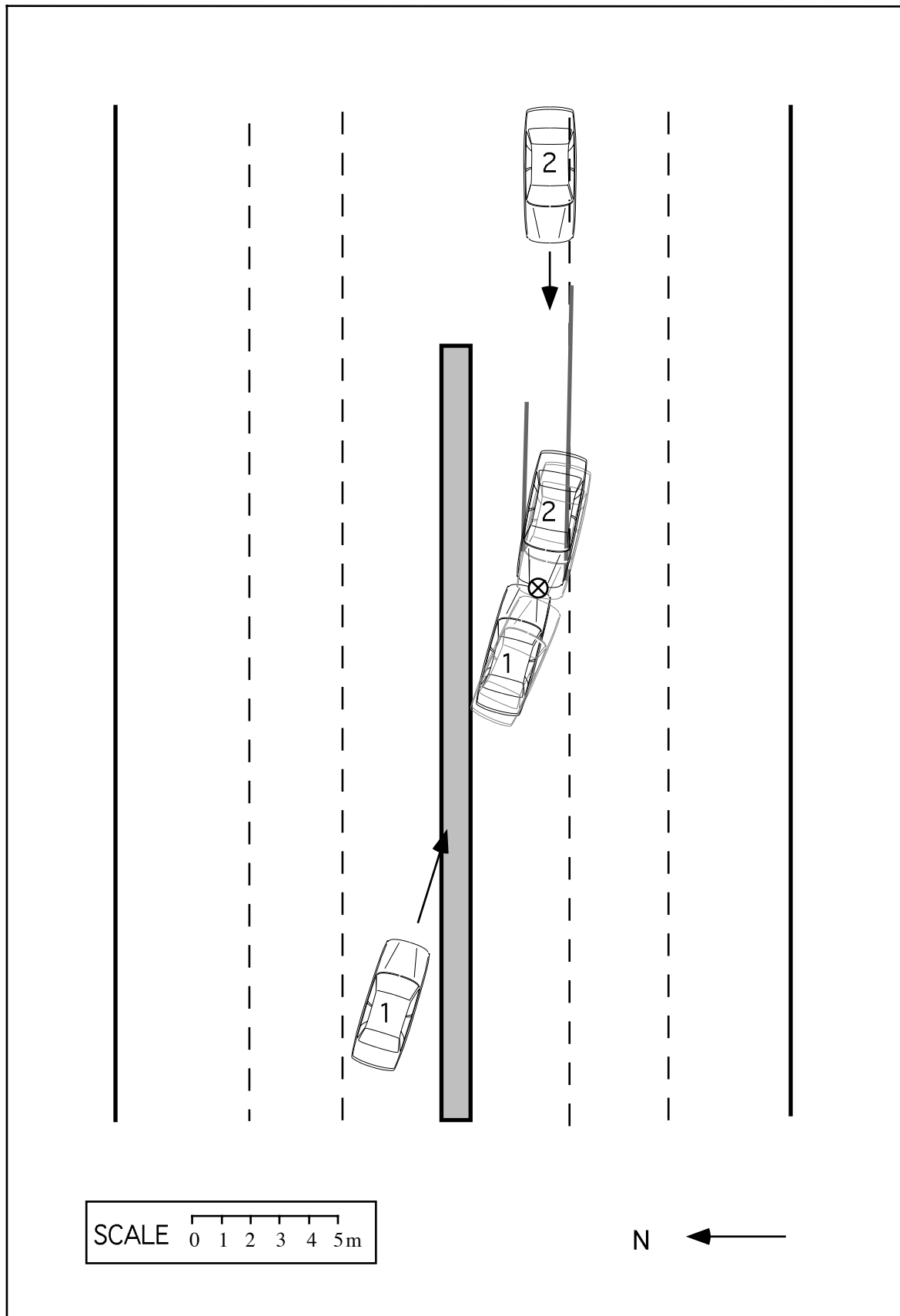
Hypothetical Scenarios (Case Vehicle 1)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	72	72	84
5 km/hour speed reduction	67	67	76
10 km/hour speed reduction	62	62	65
Speed Limit 50 with similar compliance	62	62	65
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Case Vehicle 2)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	80	58	62
5 km/hour speed reduction	75	47	55
10 km/hour speed reduction	70	34	47
Speed Limit 50 with similar compliance	70	34	47
Speed Limit 60 with total compliance	60	0	0

CN078



CN079

Crash Description

Unit 2 turning right at intersection in front of Unit 1. Unit 1 collided with front of Unit 2. Neither Unit attempted evasive action.

Injury Outcomes

Unit 2 driver transported by ambulance.
Unit 2 left front passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Not a perfect SMAC match.

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	68

Control Speeds

54	60
61	61

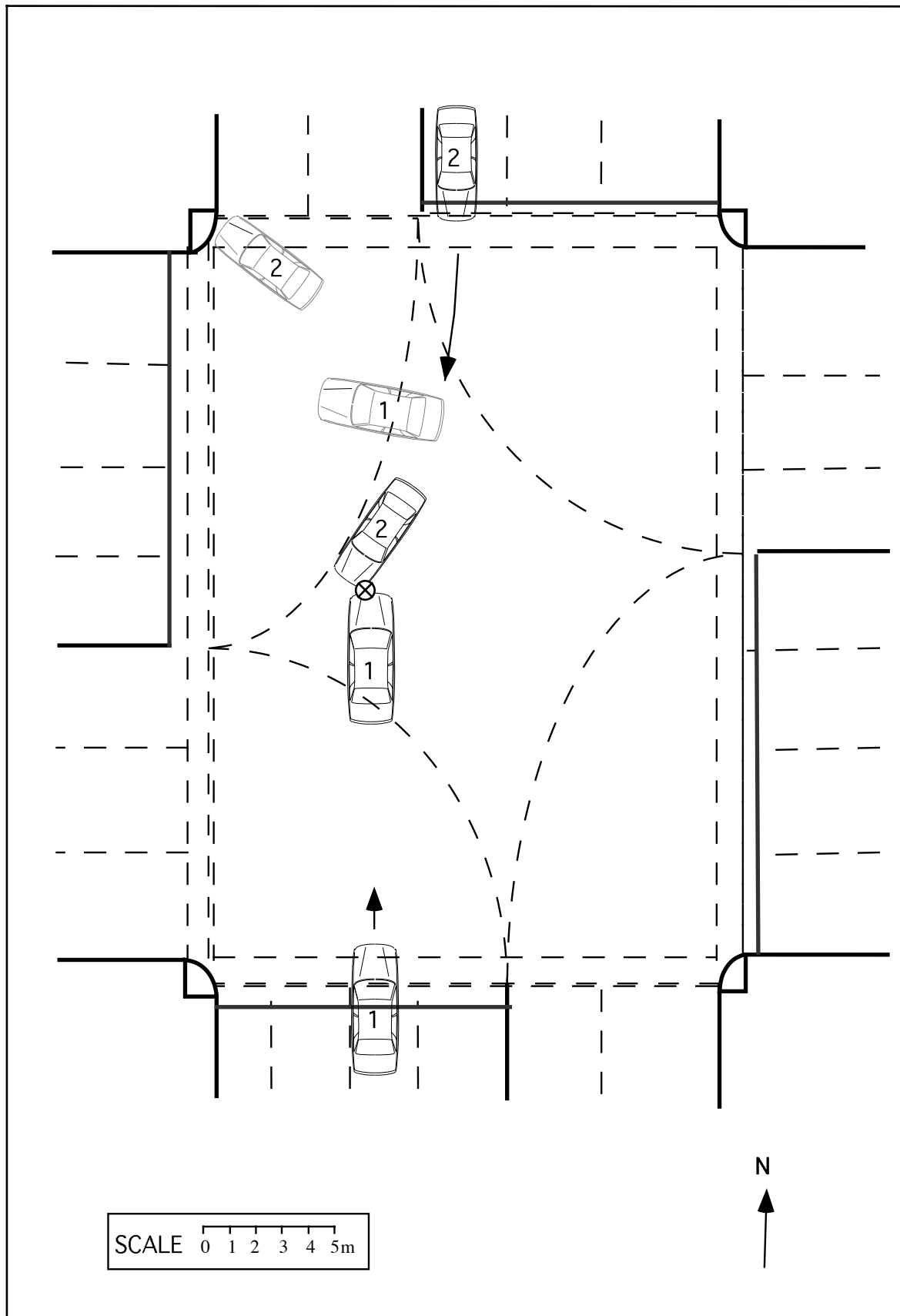
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	68	45
5 km/hour speed reduction	63	63	42
10 km/hour speed reduction	58	58	40
Speed Limit 50 with similar compliance	58	58	40
Speed Limit 60 with total compliance	60	60	41

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	58
5 km/hour speed reduction	53
10 km/hour speed reduction	50
Speed Limit 50 with similar compliance	50
Speed Limit 60 with total compliance	52

CN079



CN080

Crash Description

Unit 2 stationary waiting to turn right off main road. Unit 1 saw Unit 2, applied brakes and collided with rear of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Reconstruction Notes

Unit 2 final position unknown.

Case Vehicle Speeds

Free Travelling Speed	53
Impact Speed	36

Control Speeds

55	59
63	63

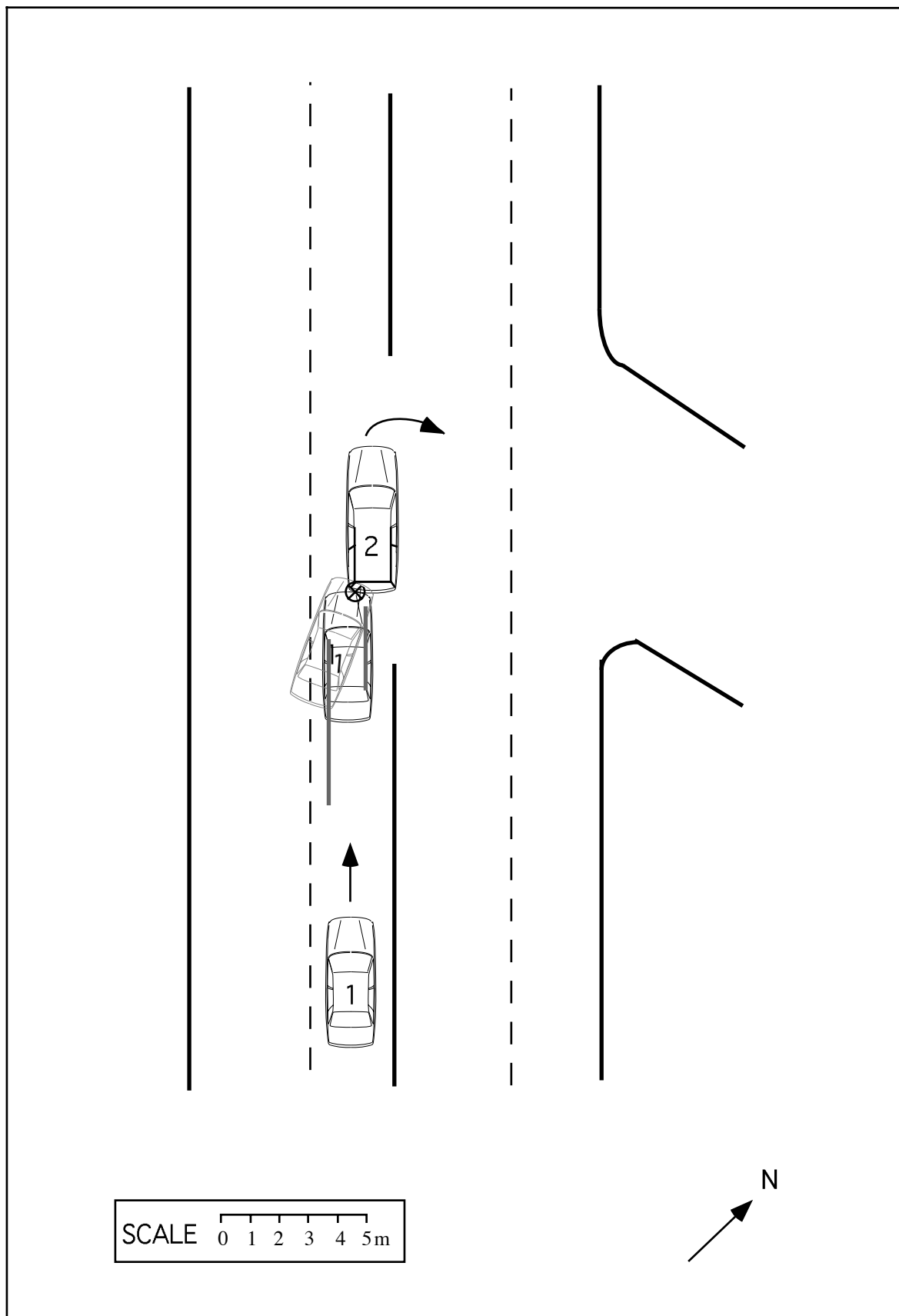
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	53	36	21
5 km/hour speed reduction	48	20	13
10 km/hour speed reduction	43	0	0
Speed Limit 50 with similar compliance	50	26	16
Speed Limit 60 with total compliance	53	36	21

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	22
5 km/hour speed reduction	12
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	15
Speed Limit 60 with total compliance	21

CN080



CN082

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with front of Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver treated at hospital.
Unit 2 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	72
Impact Speed	72

Control Speeds

54	58
58	65

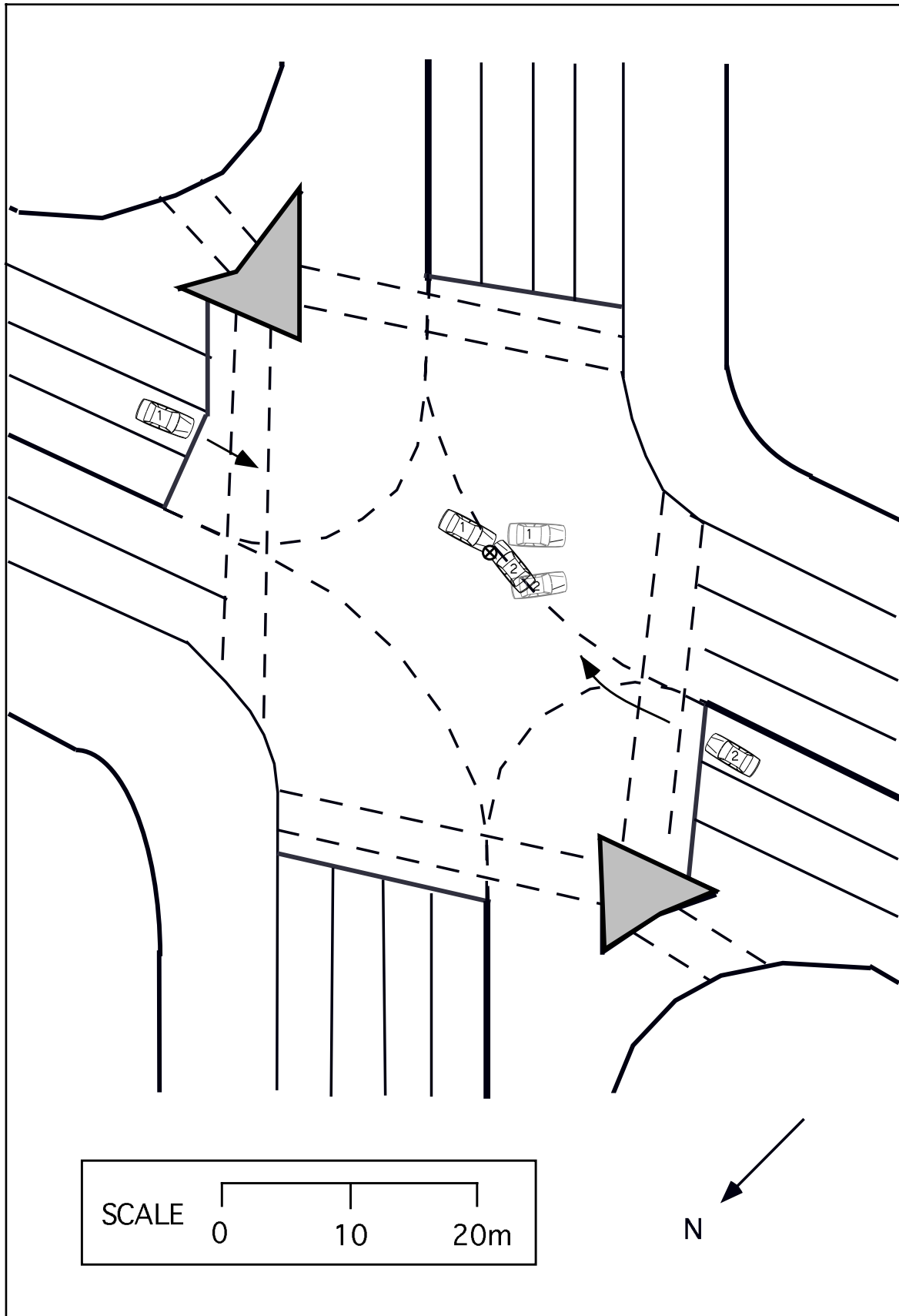
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	72	72	61
5 km/hour speed reduction	67	67	59
10 km/hour speed reduction	62	62	57
Speed Limit 50 with similar compliance	62	62	57
Speed Limit 60 with total compliance	60	60	56

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	61
5 km/hour speed reduction	59
10 km/hour speed reduction	57
Speed Limit 50 with similar compliance	57
Speed Limit 60 with total compliance	56

CN082



CN083

Crash Description

Unit 1 travelling along road when the driver apparently lost control over a slight hump at the intersection with a side street. Quite possibly the car became airborne over the hump causing the driver to lose control and veer to the left. The car then veered to the right as it jumped the curb and struck a stobie pole on the left rear door. Following the impact, the left rear of the vehicle was almost torn off. Before coming to rest, the front of the vehicle knocked over a substantial bollard comprising a 2 metre high reinforced concrete pipe.

Injury Outcomes

Unit 1 right rear passenger admitted to hospital.
Unit 1 left rear passenger admitted to hospital.
Unit 1 centre rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from curve of the yaw mark on the road.
Speed after impact from post impact distance (28m = 70km/hour).
Delta V from difference between pre and post impact speeds.

Reconstruction Notes

Witnesses in car reported higher speed.
Ignored speed lost in second pole impact.
Hypothetical delta Vs set as same proportion of impact speed.

Case Vehicle Speeds

Free Travelling Speed	95
Impact Speed	95

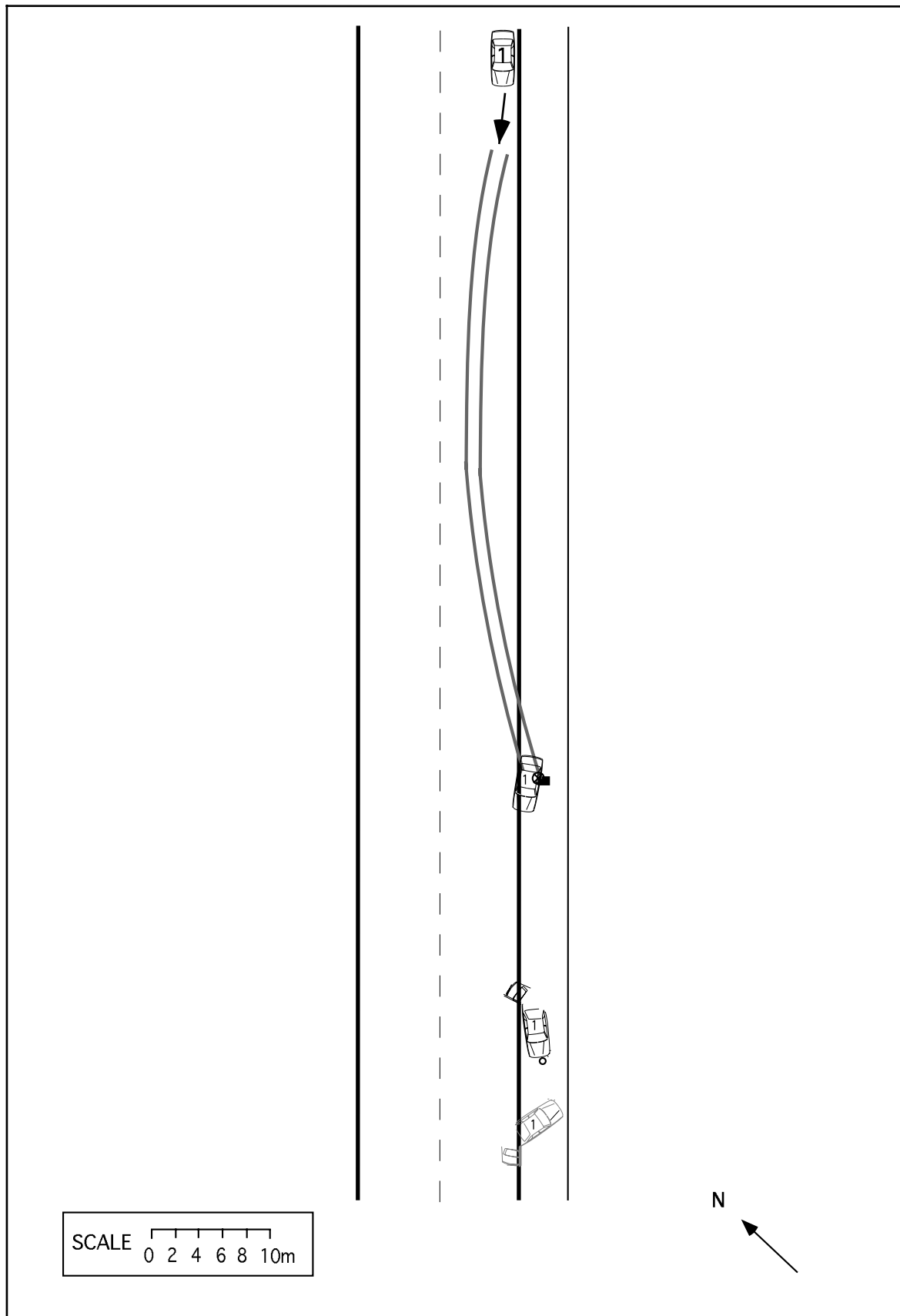
Control Speeds

54	62
63	69

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	95	95	25
5 km/hour speed reduction	90	90	24
10 km/hour speed reduction	85	85	22
Speed Limit 50 with similar compliance	85	85	22
Speed Limit 60 with total compliance	60	60	16

CN083



CN084

Crash Description

Unit 1 and Unit 2 travelling in same direction along road. Unit 2 veered into right lane to avoid vehicle that pulled out from curb. Sideswipe occurred between Unit 1 and Unit 2. Unit 1 applied brakes and came to rest on top of planter box on median strip. Unit 2 not at free speed (had just come out of a car park).

Injury Outcomes

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid mark (38m).
Impact speed from post-impact skid mark (13.7m).

Reconstruction Notes

Assumed no speed lost from sideswipe.
Assumed no speed lost hitting planter box.
Speed estimate is lower bound.
Unknown speed of Unit 2 - cannot do hypotheticals.

Case Vehicle Speeds

Free Travelling Speed	92
Impact Speed	49

Control Speeds

51	53
55	59

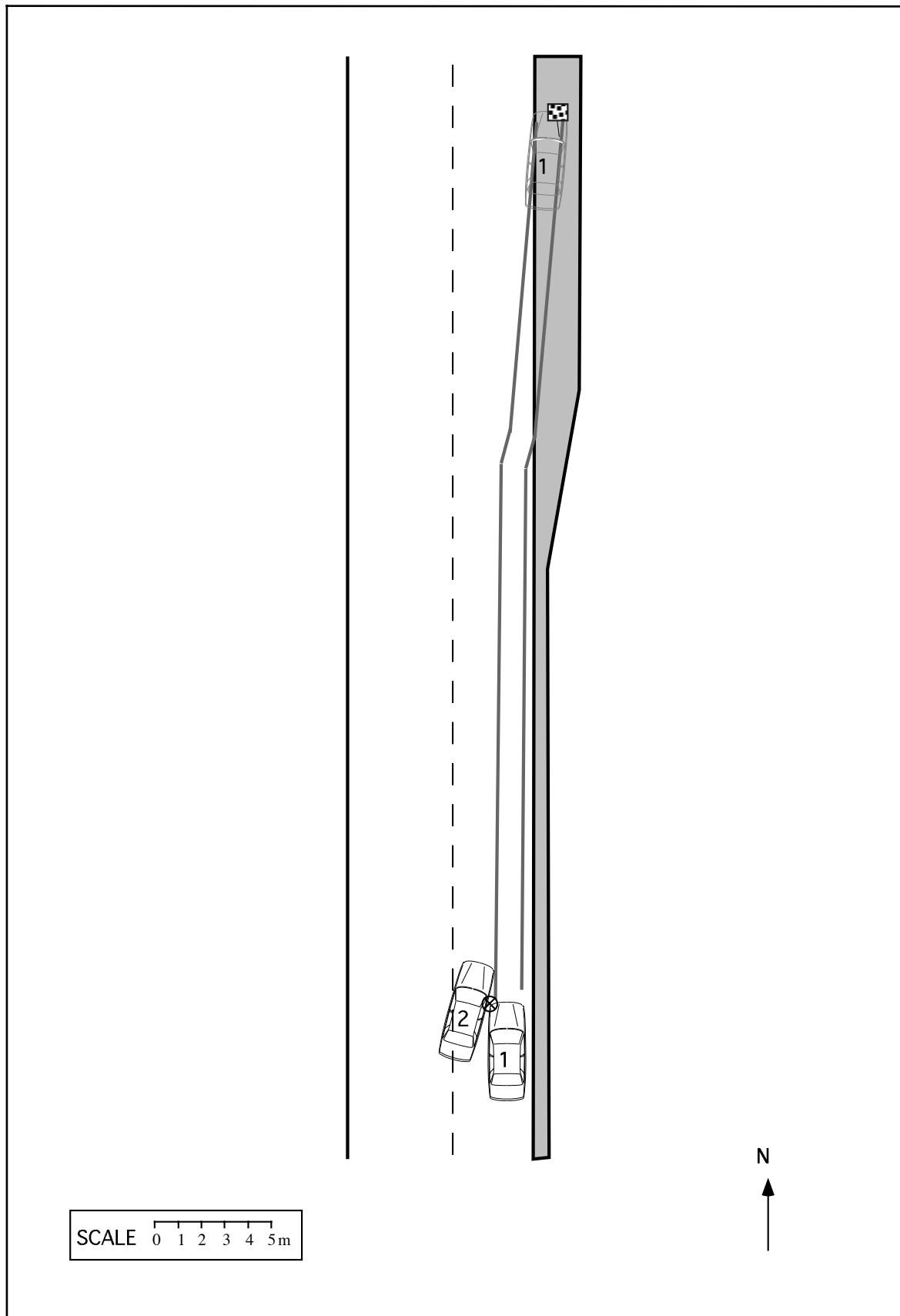
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	92	49	na
5 km/hour speed reduction	87	35	na
10 km/hour speed reduction	82	6	na
Speed Limit 50 with similar compliance	82	6	na
Speed Limit 60 with total compliance	60	0	na

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	na
5 km/hour speed reduction	na
10 km/hour speed reduction	na
Speed Limit 50 with similar compliance	na
Speed Limit 60 with total compliance	na

CN084



CN085

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with front of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 1 left front passenger treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid mark (4.6m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	54

Control Speeds

51	51
60	64

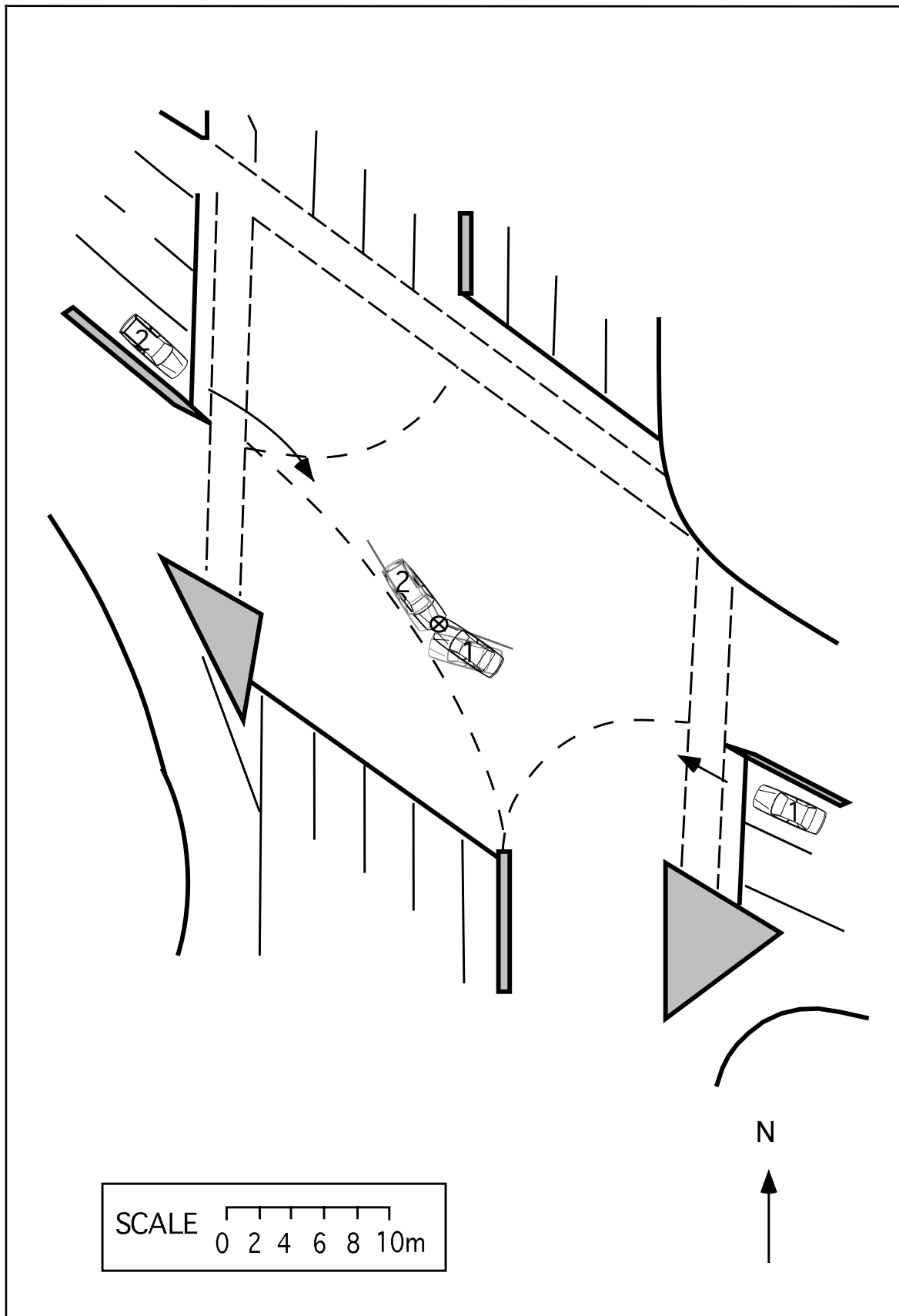
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	54	54
5 km/hour speed reduction	63	44	49
10 km/hour speed reduction	58	30	43
Speed Limit 50 with similar compliance	58	30	43
Speed Limit 60 with total compliance	60	35	45

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	61
5 km/hour speed reduction	56
10 km/hour speed reduction	49
Speed Limit 50 with similar compliance	49
Speed Limit 60 with total compliance	52

CN085



CN088

Crash Description

Unit 2 emerging from side street to turn right across path of Unit 1. Unit 1 applied brakes and then collided with front corner of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 2 and SMAC run and damage match.
Travelling speed from skid marks (12.8m).

Reconstruction Notes

Final position of Unit 1 unknown.

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	34

Control Speeds

60	60
63	69

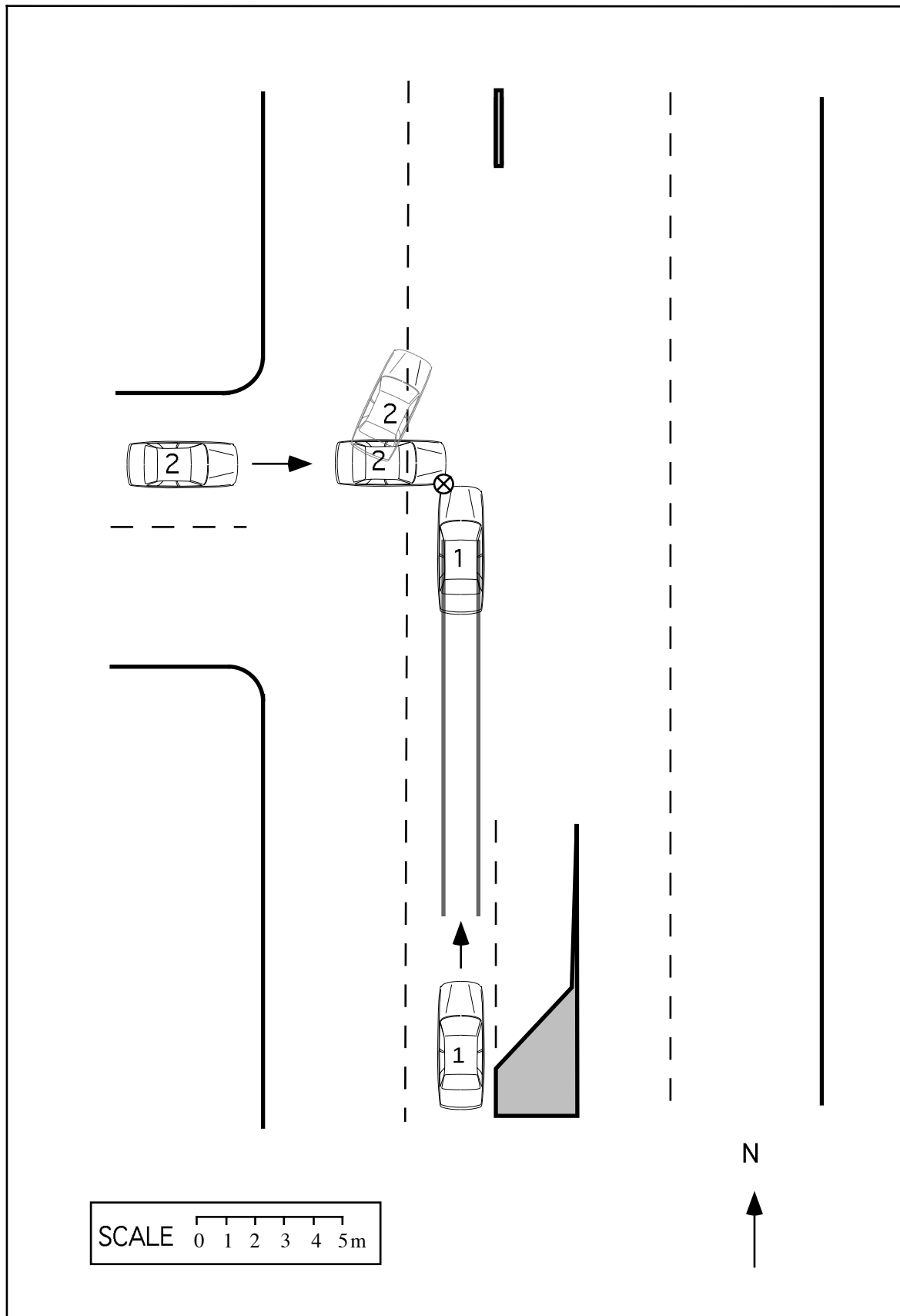
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	34	16
5 km/hour speed reduction	61	13	9
10 km/hour speed reduction	56	0	0
Speed Limit 50 with similar compliance	56	0	0
Speed Limit 60 with total compliance	60	8	6

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	14
5 km/hour speed reduction	6
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	3

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CN089

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 centre front passenger treated at hospital.
Unit 2 driver treated by private doctor.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (3m)

Reconstruction Notes

Assumed Unit 1 interaction with Unit 2 made it not rotate as much as in SMAC run.

Case Vehicle Speeds

Free Travelling Speed	62
Impact Speed	50

Control Speeds

54	64
68	75

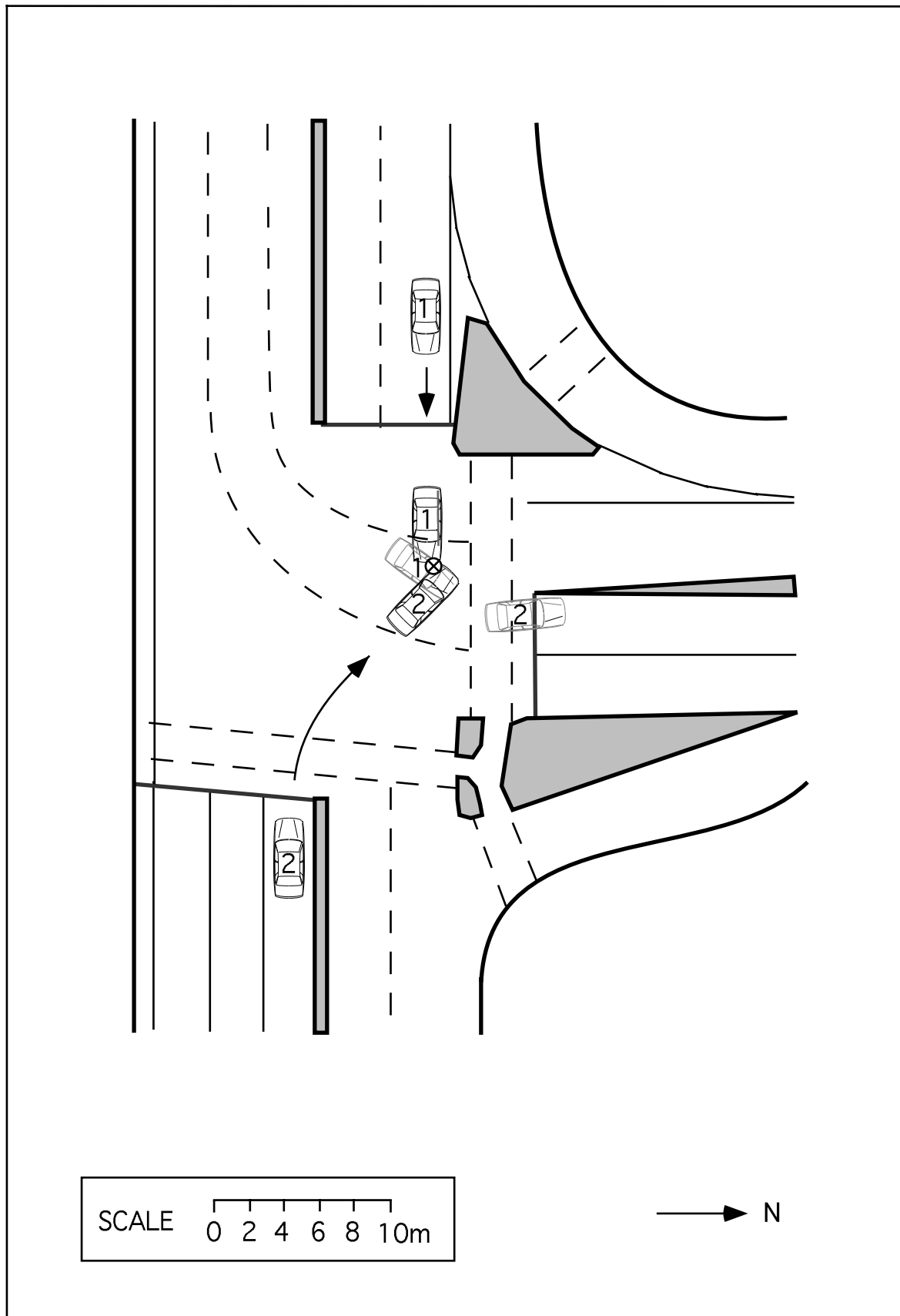
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	62	50	44
5 km/hour speed reduction	57	39	36
10 km/hour speed reduction	52	25	26
Speed Limit 50 with similar compliance	52	25	26
Speed Limit 60 with total compliance	60	47	42

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	30
5 km/hour speed reduction	25
10 km/hour speed reduction	17
Speed Limit 50 with similar compliance	17
Speed Limit 60 with total compliance	29

CN089



CN090

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with side of Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run and damage match.
Travelling speed from skid marks (5m).

Reconstruction Notes

Exact final position of Unit 2 unknown.
Conservative estimate of impact speed.

Case Vehicle Speeds

Free Travelling Speed	83
Impact Speed	68

Control Speeds

55	55
59	62

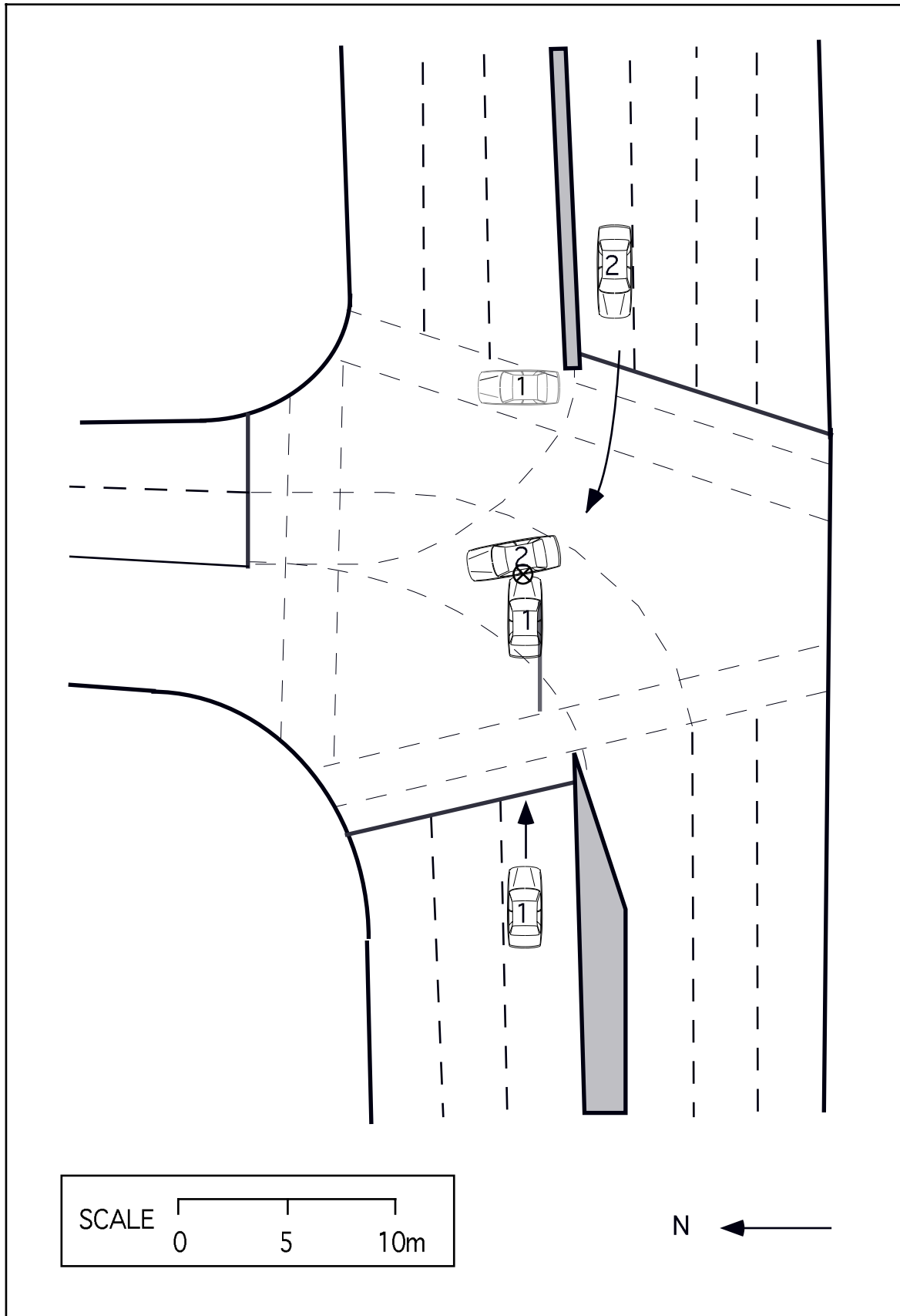
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	83	68	44
5 km/hour speed reduction	78	59	39
10 km/hour speed reduction	73	49	33
Speed Limit 50 with similar compliance	73	49	33
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	33
10 km/hour speed reduction	28
Speed Limit 50 with similar compliance	28
Speed Limit 60 with total compliance	0

CN090



CN091

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (4m).

Reconstruction Notes

Estimated final positions from investigator prior observation and fluid on road.

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	54

Control Speeds

47	48
49	55

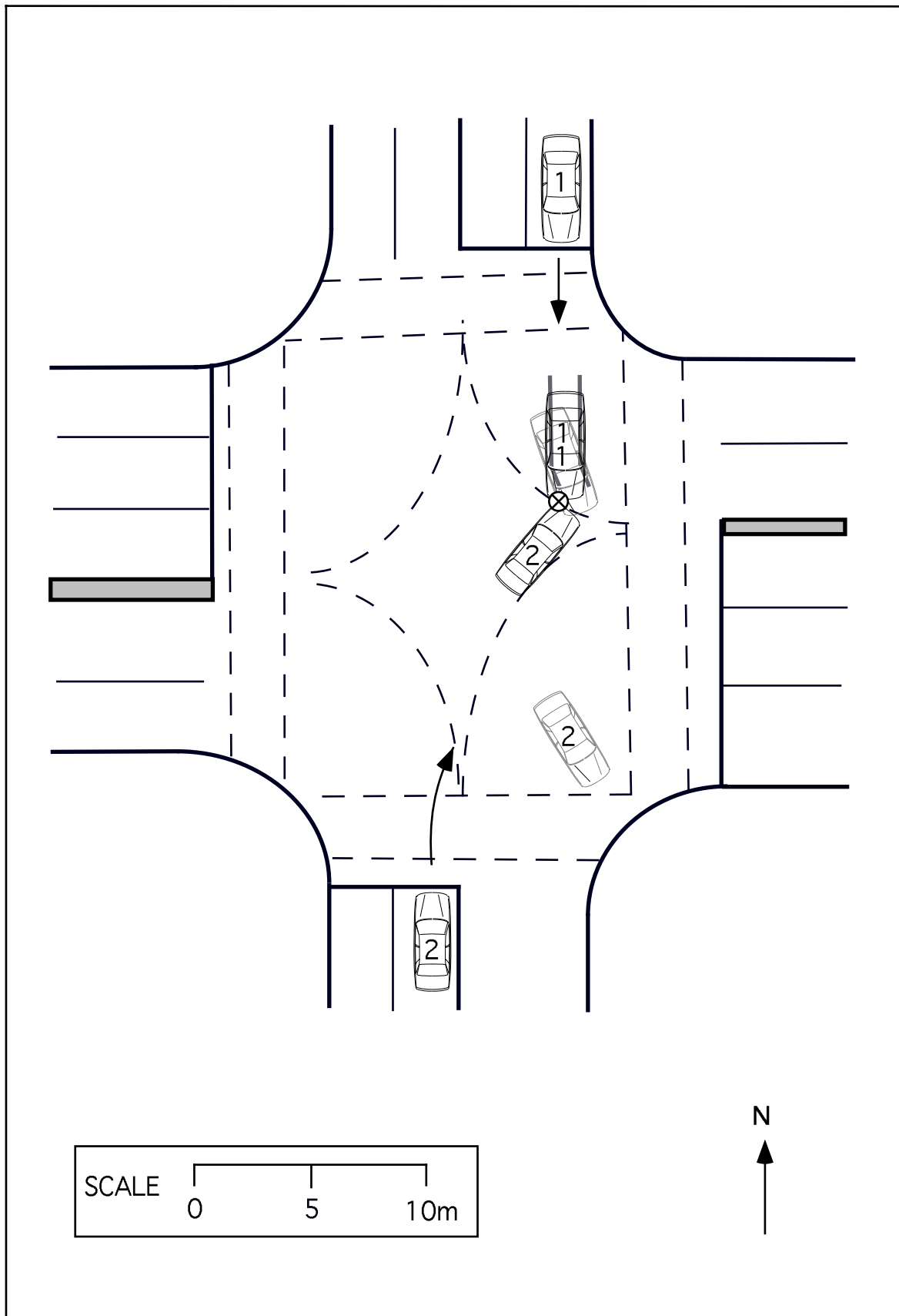
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	54	37
5 km/hour speed reduction	62	44	33
10 km/hour speed reduction	57	31	27
Speed Limit 50 with similar compliance	57	31	27
Speed Limit 60 with total compliance	60	38	30

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	46
5 km/hour speed reduction	40
10 km/hour speed reduction	32
Speed Limit 50 with similar compliance	32
Speed Limit 60 with total compliance	36

CN091



CN092

Crash Description

Unit 2 crossing main road across path of Unit 1. Unit 1 collided with side of Unit 2.

Injury Outcomes

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 2 and SMAC run and damage match.

Reconstruction Notes

Unit 1 final position unknown.
Speeds 60-65 give similar results.

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	60

Control Speeds

56	56
60	67

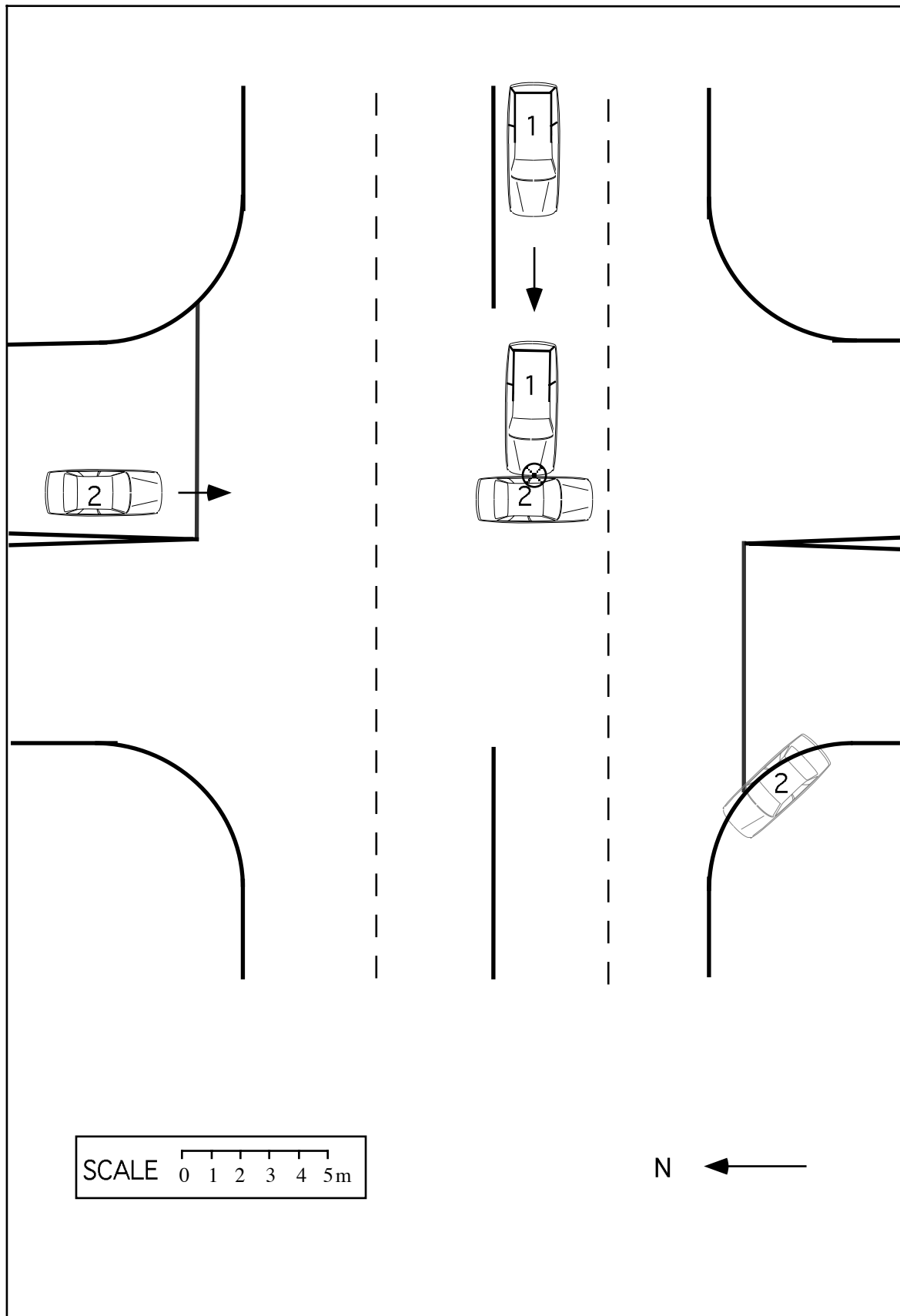
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	60	29
5 km/hour speed reduction	55	55	26
10 km/hour speed reduction	50	50	24
Speed Limit 50 with similar compliance	50	50	24
Speed Limit 60 with total compliance	60	60	29

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	33
10 km/hour speed reduction	30
Speed Limit 50 with similar compliance	30
Speed Limit 60 with total compliance	37

CN092



CN093

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid mark (8m).

Reconstruction Notes

Unit 2 must have accelerated after impact to reach its final position.

Case Vehicle Speeds

Free Travelling Speed	78
Impact Speed	59

Control Speeds

43	61
64	68

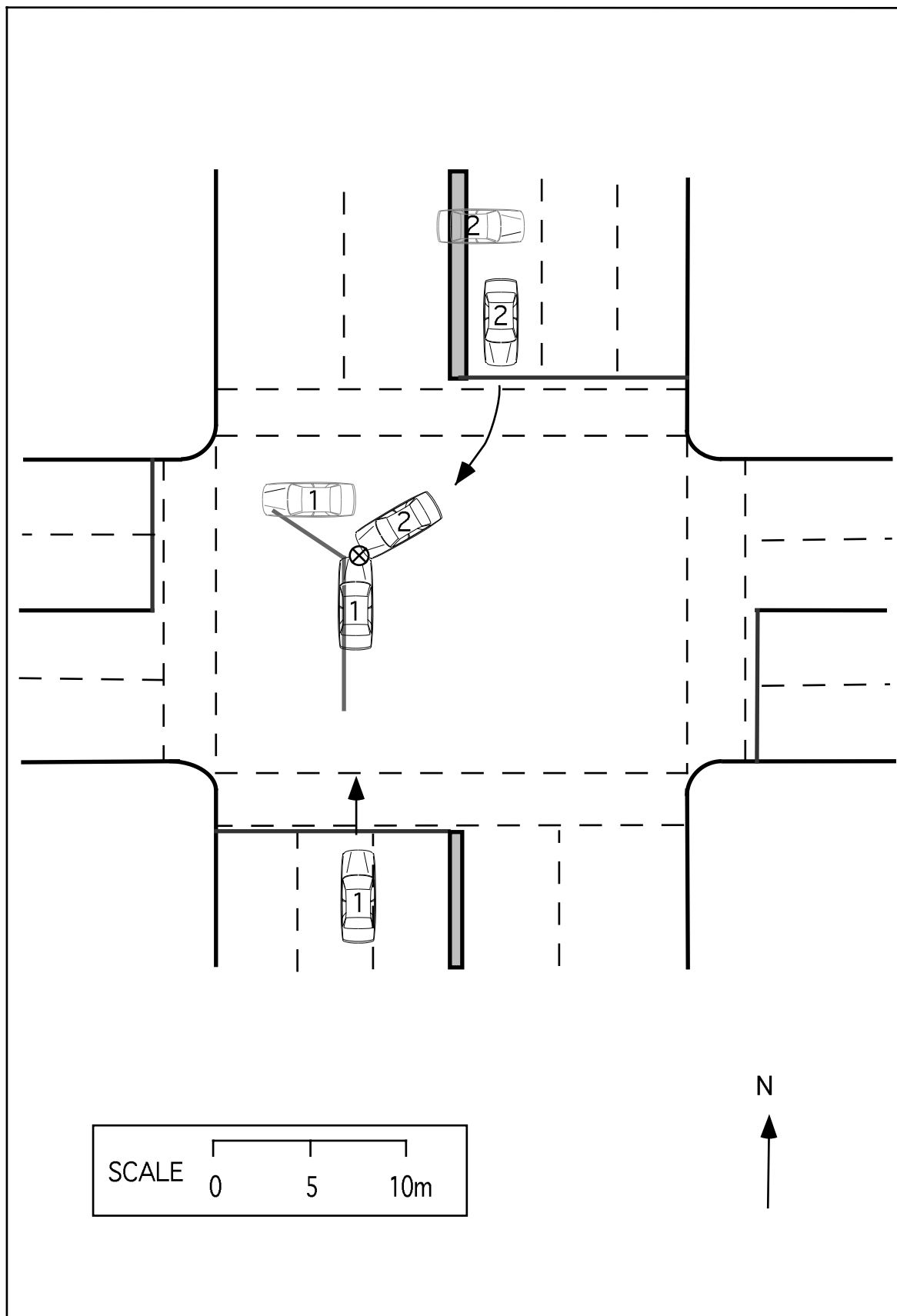
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	78	59	39
5 km/hour speed reduction	73	49	35
10 km/hour speed reduction	68	36	30
Speed Limit 50 with similar compliance	68	36	30
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	47
5 km/hour speed reduction	42
10 km/hour speed reduction	36
Speed Limit 50 with similar compliance	36
Speed Limit 60 with total compliance	0

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CN094

Crash Description

Unit 2 turning right at T-junction across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 1 left front passenger treated at hospital.
Unit 1 right rear passenger treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (17m)

Reconstruction Notes

Unit 1 pocketed in to front corner of Unit 2.
Assumed SMAC over spins Unit 2.

Case Vehicle Speeds

Free Travelling Speed	95
Impact Speed	65

Control Speeds

58	60
61	66

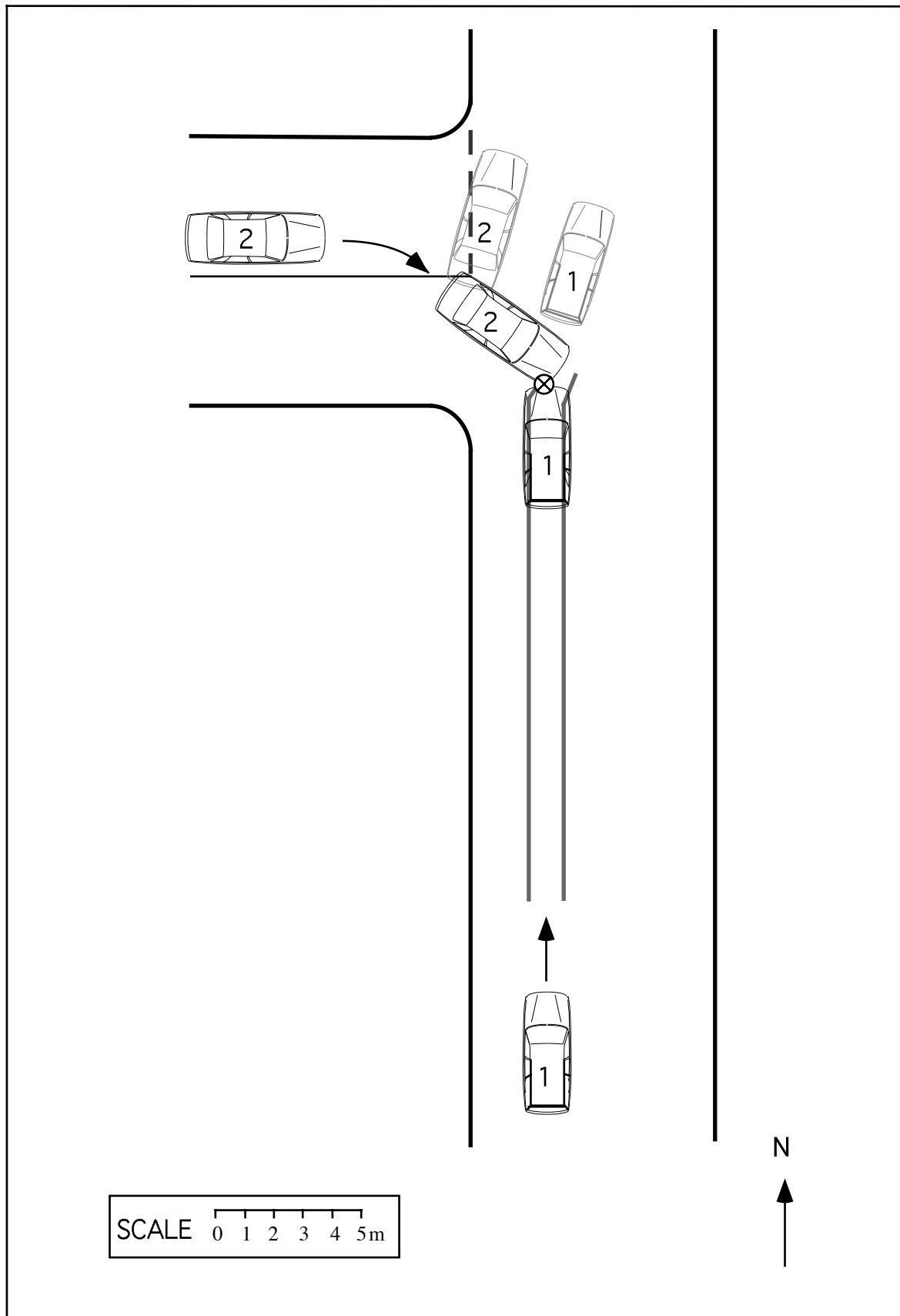
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	95	65	39
5 km/hour speed reduction	90	55	34
10 km/hour speed reduction	85	42	27
Speed Limit 50 with similar compliance	85	42	27
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	22
10 km/hour speed reduction	17
Speed Limit 50 with similar compliance	17
Speed Limit 60 with total compliance	0

CN094



CN095

Crash Description

Unit 2 doing U-turn across path of Unit 1. Unit 1 applied brakes and then collided with side of Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 2 and SMAC run.
Travelling speed from skid marks (14.6m).

Reconstruction Notes

Final position of Unit 1 unknown.
Assumed Unit 2 accelerated during and after impact.

Case Vehicle Speeds

Free Travelling Speed	83
Impact Speed	54

Control Speeds

60	61
61	64

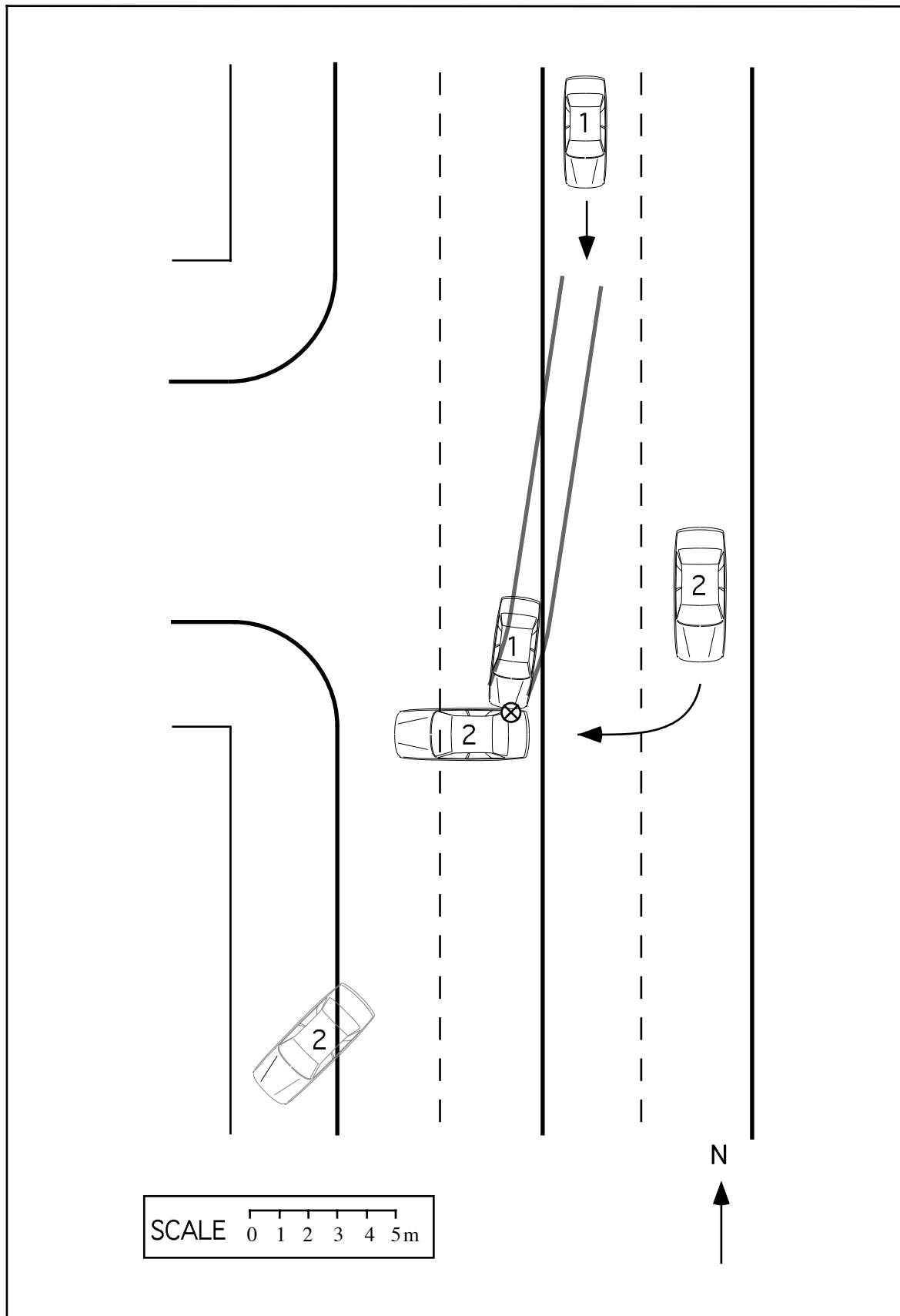
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	83	54	26
5 km/hour speed reduction	78	42	20
10 km/hour speed reduction	73	26	12
Speed Limit 50 with similar compliance	73	26	12
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	18
5 km/hour speed reduction	14
10 km/hour speed reduction	8
Speed Limit 50 with similar compliance	8
Speed Limit 60 with total compliance	0

CN095



CN098

Crash Description

Unit 1 lost control, mounted curb and collided with a stobie pole.

Injury Outcomes

Unit 1 driver admitted to hospital.

Unit 1 left front passenger treated at hospital.

Unit 1 rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from pole impact deformation (1000mm).

Reconstruction Notes

Assumed minimal loss in speed from mounting curb.

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	63

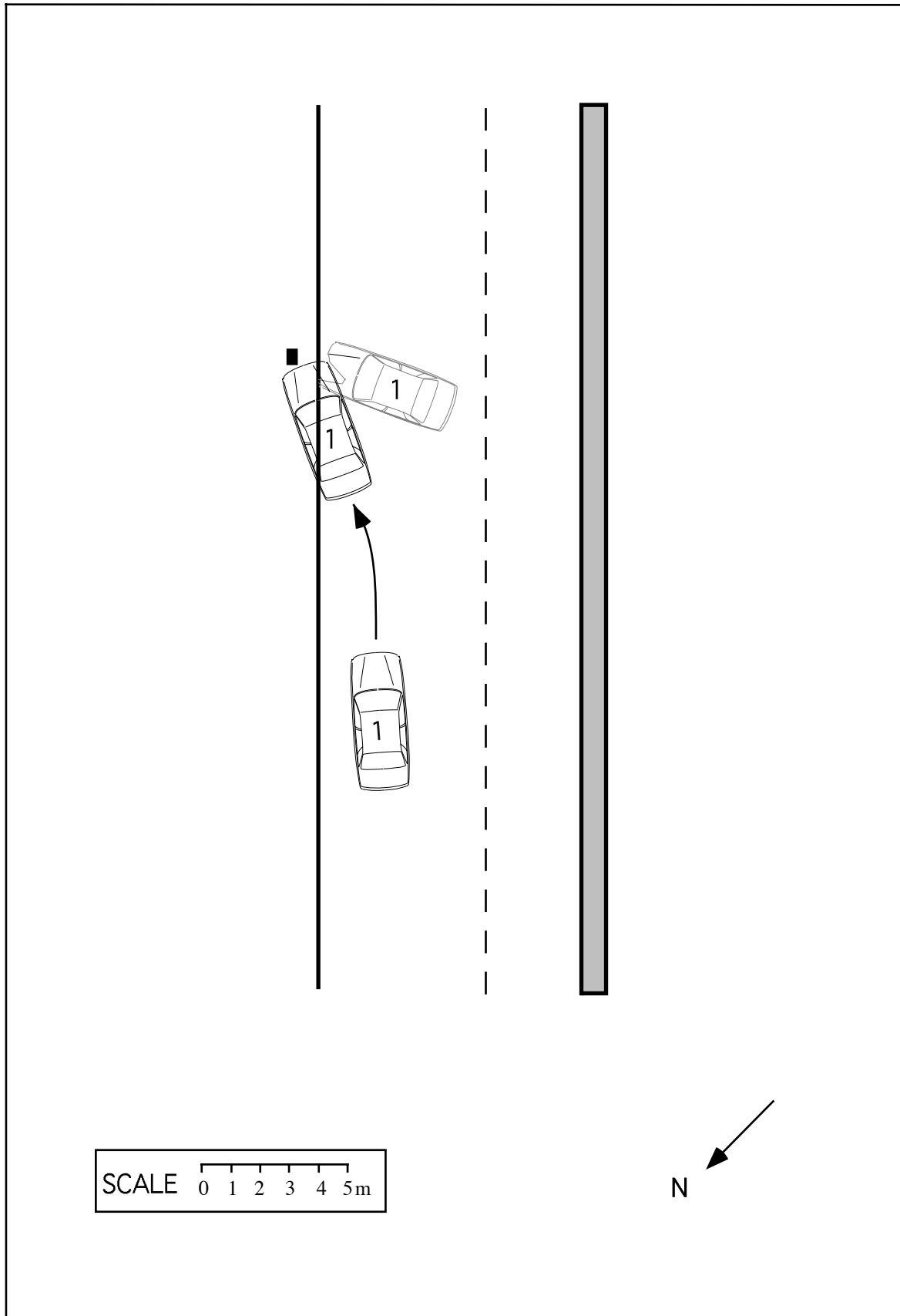
Control Speeds

50	64
65	68

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	63	63
5 km/hour speed reduction	58	58	58
10 km/hour speed reduction	53	53	53
Speed Limit 50 with similar compliance	53	53	53
Speed Limit 60 with total compliance	60	60	60

CN098



CN099

Crash Description

Unit 2 turning right from side street on to main road across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated by private doctor.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (6.5m).

Reconstruction Notes

Not a perfect SMAC run but Units travelling correct distance.

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	45

Control Speeds

56	63
67	68

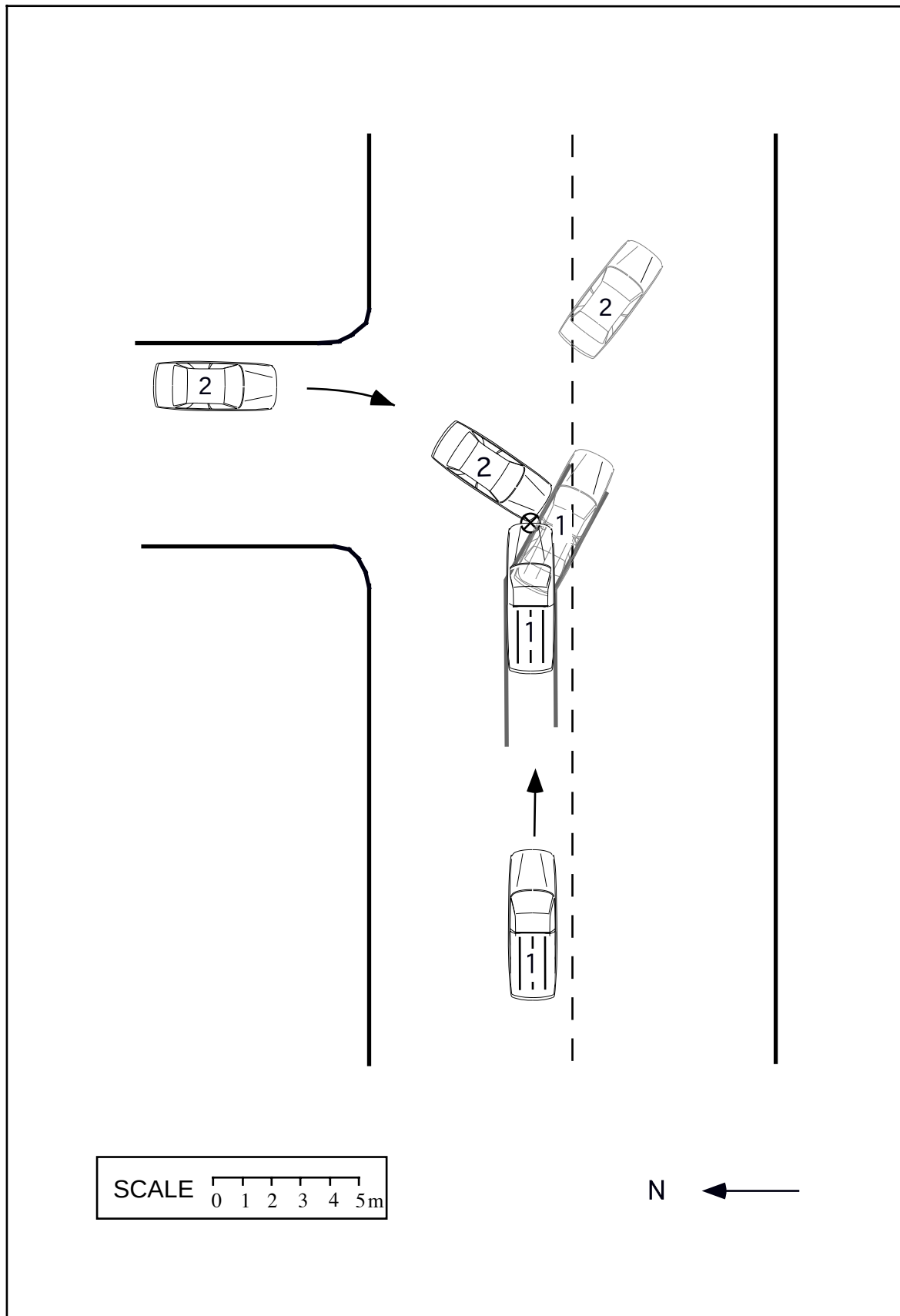
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	45	30
5 km/hour speed reduction	58	32	23
10 km/hour speed reduction	53	11	13
Speed Limit 50 with similar compliance	53	11	13
Speed Limit 60 with total compliance	60	38	26

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	38
5 km/hour speed reduction	30
10 km/hour speed reduction	17
Speed Limit 50 with similar compliance	17
Speed Limit 60 with total compliance	34

CN099



CN100

Crash Description

Unit 1 proceeding along road. Bicyclist travelling in same direction turned right in front of Unit 1. Unit 1 applied brakes and collided with bicyclist.

Injury Outcomes

Bicyclist admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid marks (20m).
Impact speed from post-impact skid marks (1m).

Reconstruction Notes

Bicyclist hit lightly at end of skid (police).
Assumed hit 1m before end of skid (overhang of car).

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	13

Control Speeds

59	61
64	65

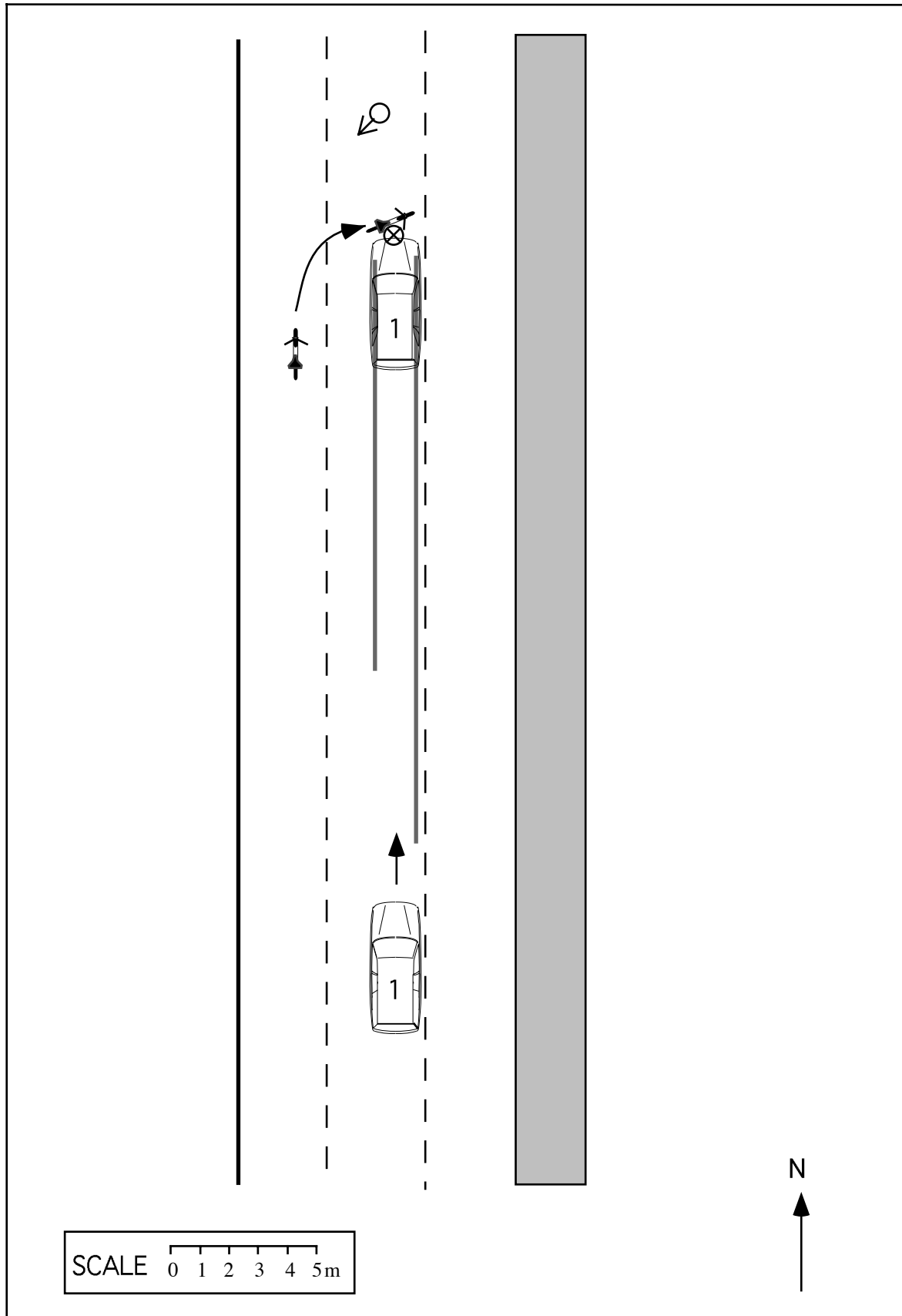
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	13	0
5 km/hour speed reduction	62	0	0
10 km/hour speed reduction	57	0	0
Speed Limit 50 with similar compliance	57	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Bicyclist)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	13
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN100



CN101

Crash Description

Unit 2 went through a red light and clipped back corner of Unit 1. Unit 1 then spun and collided with Unit 3.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 1 and SMAC run.

Reconstruction Notes

Final position of Unit 2 unknown.

Second impact judged as more serious (delta V set to impact velocity)

Case Vehicle Speeds

Free Travelling Speed	50
Impact Speed	50

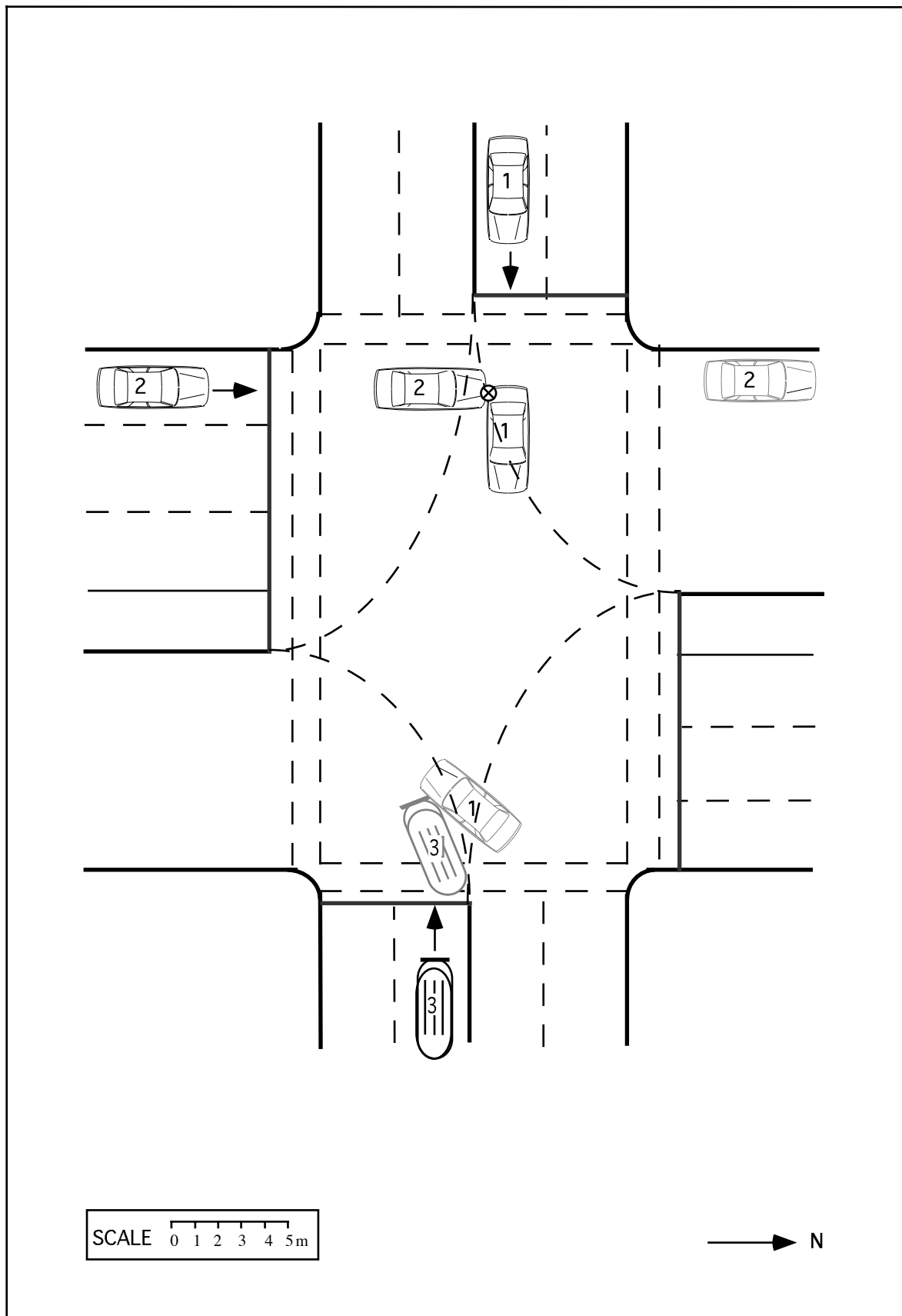
Control Speeds

44	46
53	60

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	50	50	26
5 km/hour speed reduction	45	45	22
10 km/hour speed reduction	40	40	20
Speed Limit 50 with similar compliance	50	50	26
Speed Limit 60 with total compliance	50	50	26

CN101



CN102

Crash Description

Unit 1 applied brakes and then ran into rear of stationary Unit 2.

Injury Outcomes

Unit 1 left front passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (11m).

Reconstruction Notes

Final position of Unit 2 uncertain.

Case Vehicle Speeds

Free Travelling Speed	64
Impact Speed	37

Control Speeds

58	59
61	66

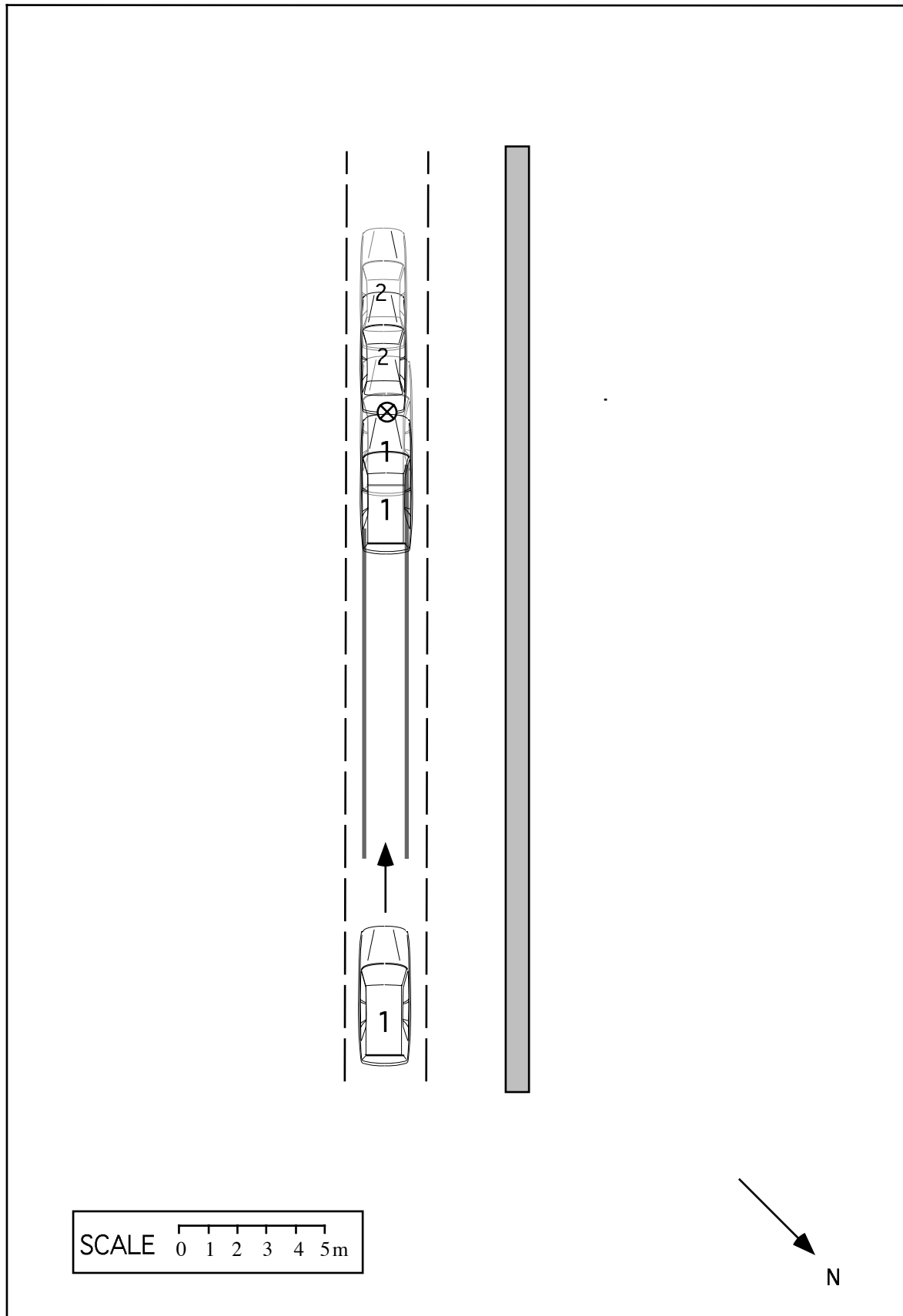
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	64	37	21
5 km/hour speed reduction	59	20	12
10 km/hour speed reduction	54	0	0
Speed Limit 50 with similar compliance	54	0	0
Speed Limit 60 with total compliance	60	22	13

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	27
5 km/hour speed reduction	14
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	15

CN102



CN103

Crash Description

Unit 2 turning right from side street on to main road past stationary traffic in left lane of main road. Unit 1 travelling in right lane of main road. Unit 2 collided with side of Unit 1.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speeds from final positions and SMAC run.

Reconstruction Notes

Not a perfect SMAC run.

Final position of Unit 2 not certain.

Note: delta Vs increase with lower speeds - more time for impact.

Case Vehicle Speeds

Free Travelling Speed	70
Impact Speed	70

Control Speeds

46	47
54	58

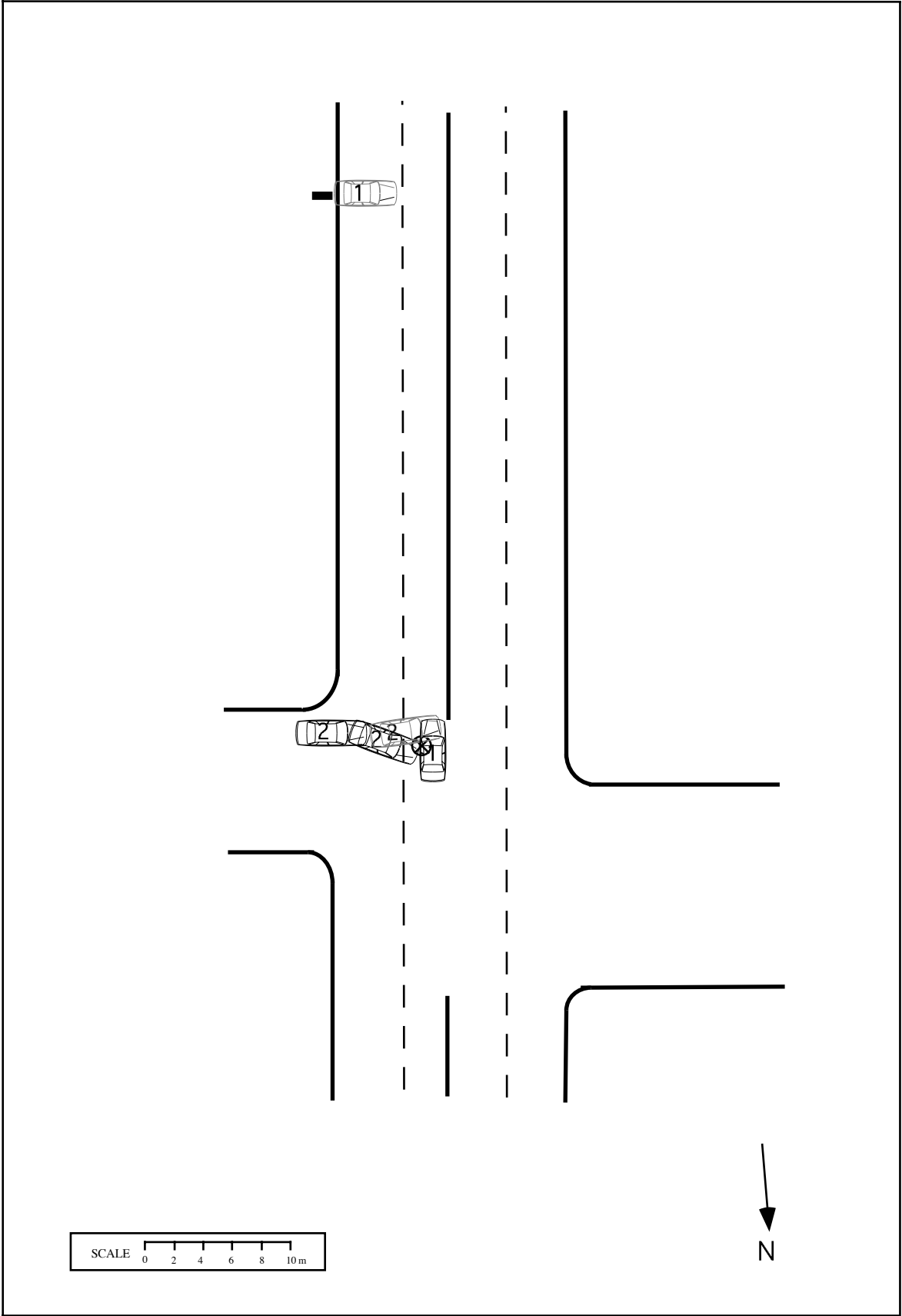
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	70	70	11
5 km/hour speed reduction	65	65	12
10 km/hour speed reduction	60	60	13
Speed Limit 50 with similar compliance	60	60	13
Speed Limit 60 with total compliance	60	60	13

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	12
5 km/hour speed reduction	13
10 km/hour speed reduction	14
Speed Limit 50 with similar compliance	14
Speed Limit 60 with total compliance	14

C N 1 0 3



CN106

Crash Description

Unit 1 travelling in the centre of three lanes on main road. Pedestrian walked in front of Unit 1. Unit 1 applied brakes and collided with pedestrian.

Injury Outcomes

Pedestrian fatally injured.

Type of Road

Main road.

Reconstruction Method

Travelling speed and impact speed from skid marks (36.2m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	90
Impact Speed	90

Control Speeds

60	61
64	65

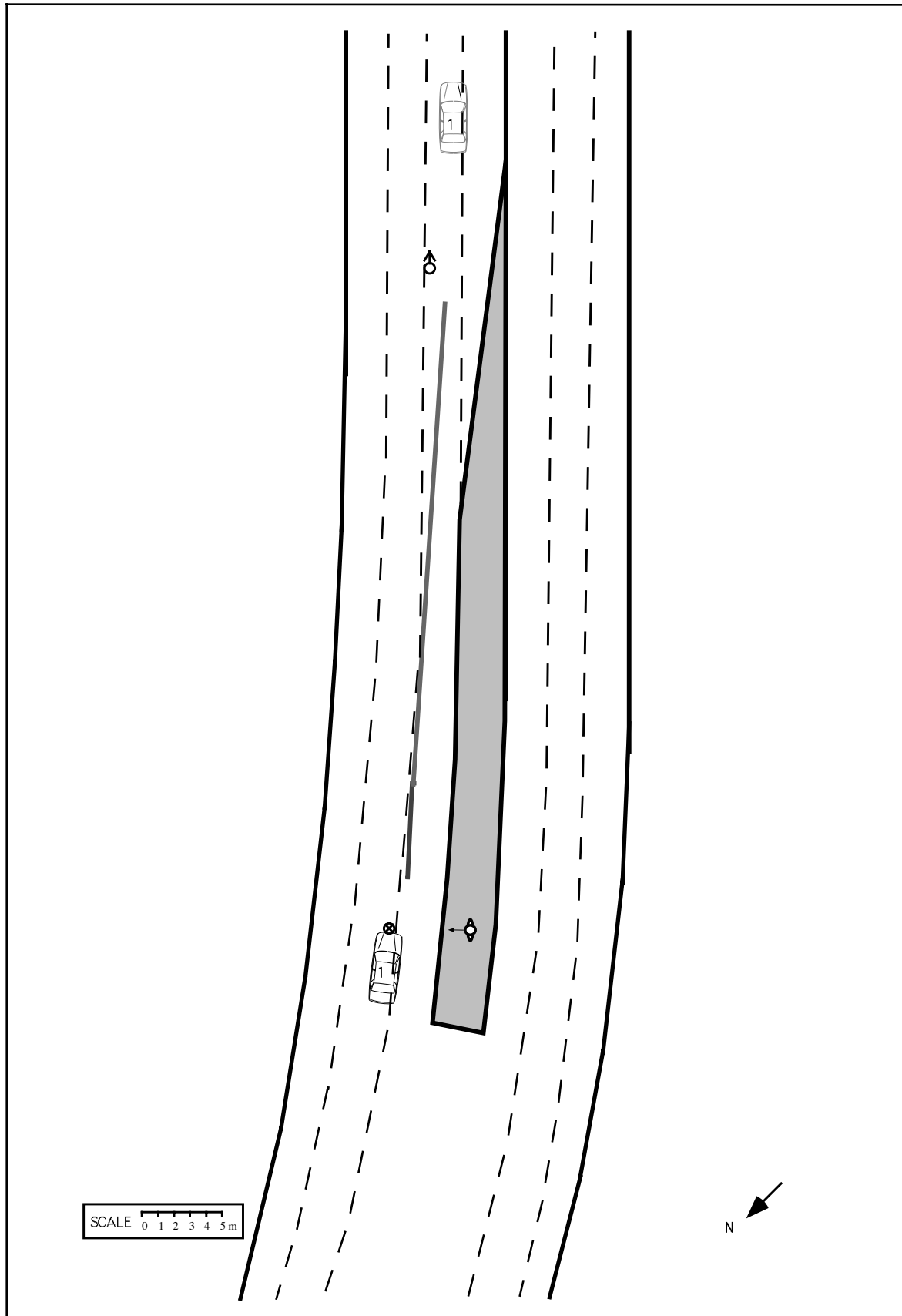
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	90	90	0
5 km/hour speed reduction	85	85	0
10 km/hour speed reduction	80	80	0
Speed Limit 50 with similar compliance	80	80	0
Speed Limit 60 with total compliance	60	60	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	90
5 km/hour speed reduction	85
10 km/hour speed reduction	80
Speed Limit 50 with similar compliance	80
Speed Limit 60 with total compliance	60

CN106



CN107

Crash Description

Unit 2 in minor impact with truck travelling in same direction. Unit 2 then crossed median and collided with side of Unit 1. Unit 1 then collided with stobie pole.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed and impact speed from final positions and SMAC run.

Delta V at 58 is from stobie pole.

Other hypotheticals don't hit pole - delta Vs are those of impact with Unit 2.

Reconstruction Notes

Not enough information to reconstruct Unit 2 initial travelling speed.

Assumed Unit 1 and Unit 2 braking after impact.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	58

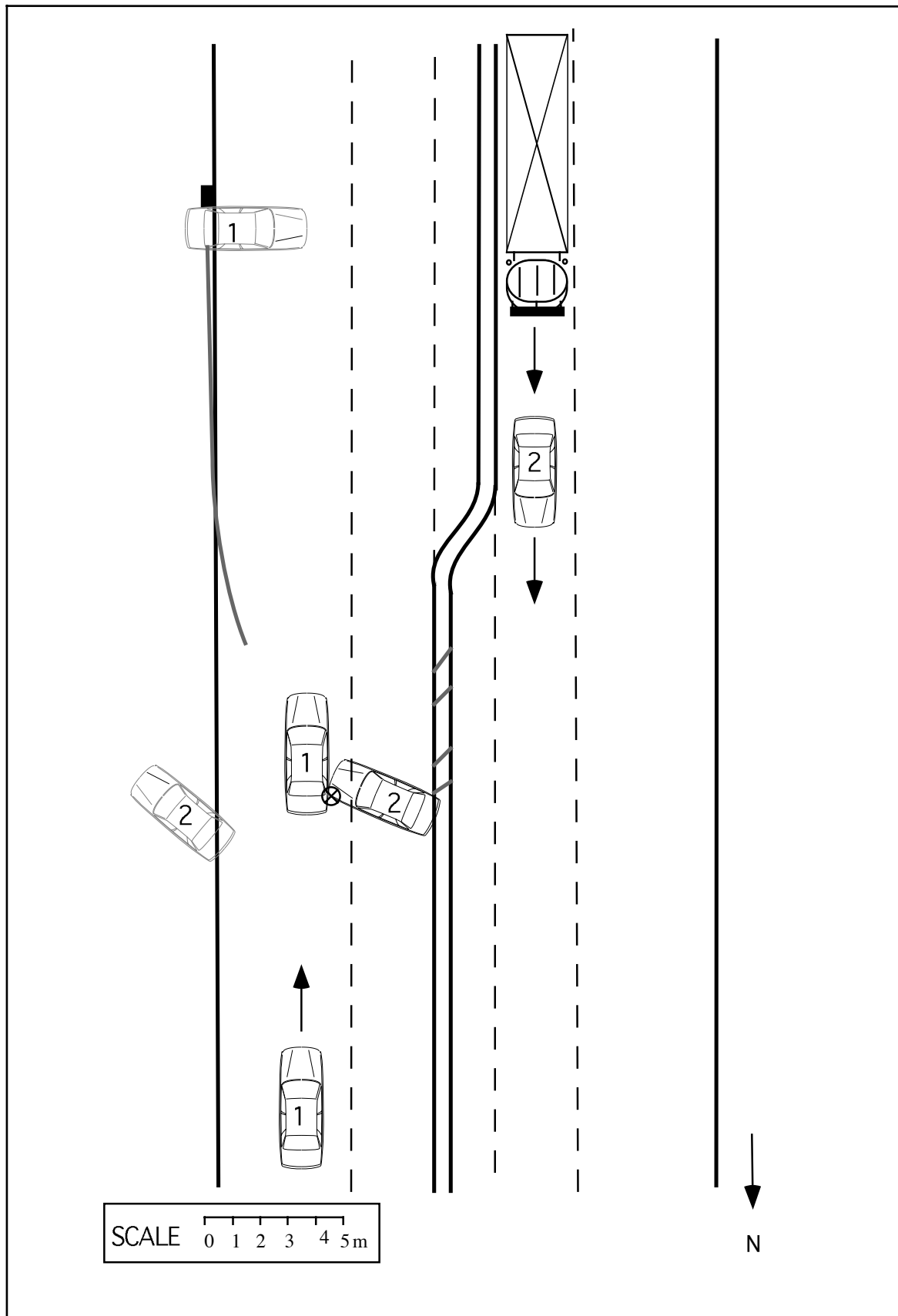
Control Speeds

58	59
62	67

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	58	22
5 km/hour speed reduction	53	53	4
10 km/hour speed reduction	48	48	5
Speed Limit 50 with similar compliance	50	50	5
Speed Limit 60 with total compliance	58	58	22

C N 1 0 7



CN108

Crash Description

Unit 2 crossing main road in front of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (3.3m).

Reconstruction Notes

Can't match final positions of vehicles accurately.
Went for closest match.

Case Vehicle Speeds

Free Travelling Speed	51
Impact Speed	39

Control Speeds

54	55
59	60

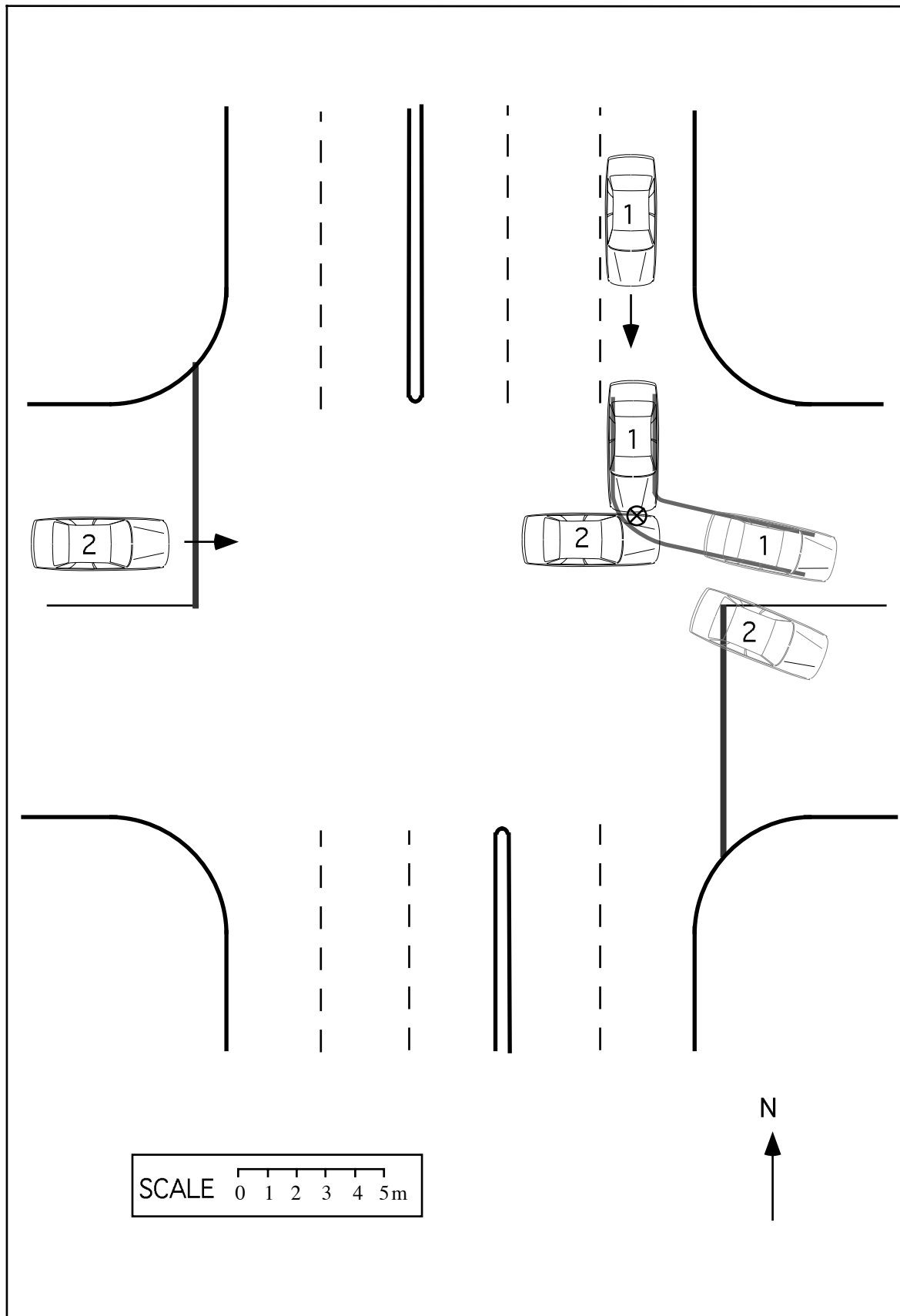
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	51	39	29
5 km/hour speed reduction	46	25	20
10 km/hour speed reduction	41	0	0
Speed Limit 50 with similar compliance	50	36	27
Speed Limit 60 with total compliance	51	39	29

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	23
5 km/hour speed reduction	16
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	21
Speed Limit 60 with total compliance	23

CN108



CN109

Crash Description

Unit 1 travelling along road and saw a road on the left that they wanted to turn down. Unit 1 applied brakes, lost control and collided with a stobie pole.

Injury Outcomes

Unit 1 driver treated at hospital

Type of Road

Local street.

Reconstruction Method

Impact speed from pole impact (300mm deformation).

Travelling speed from skid marks (14.8m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	24

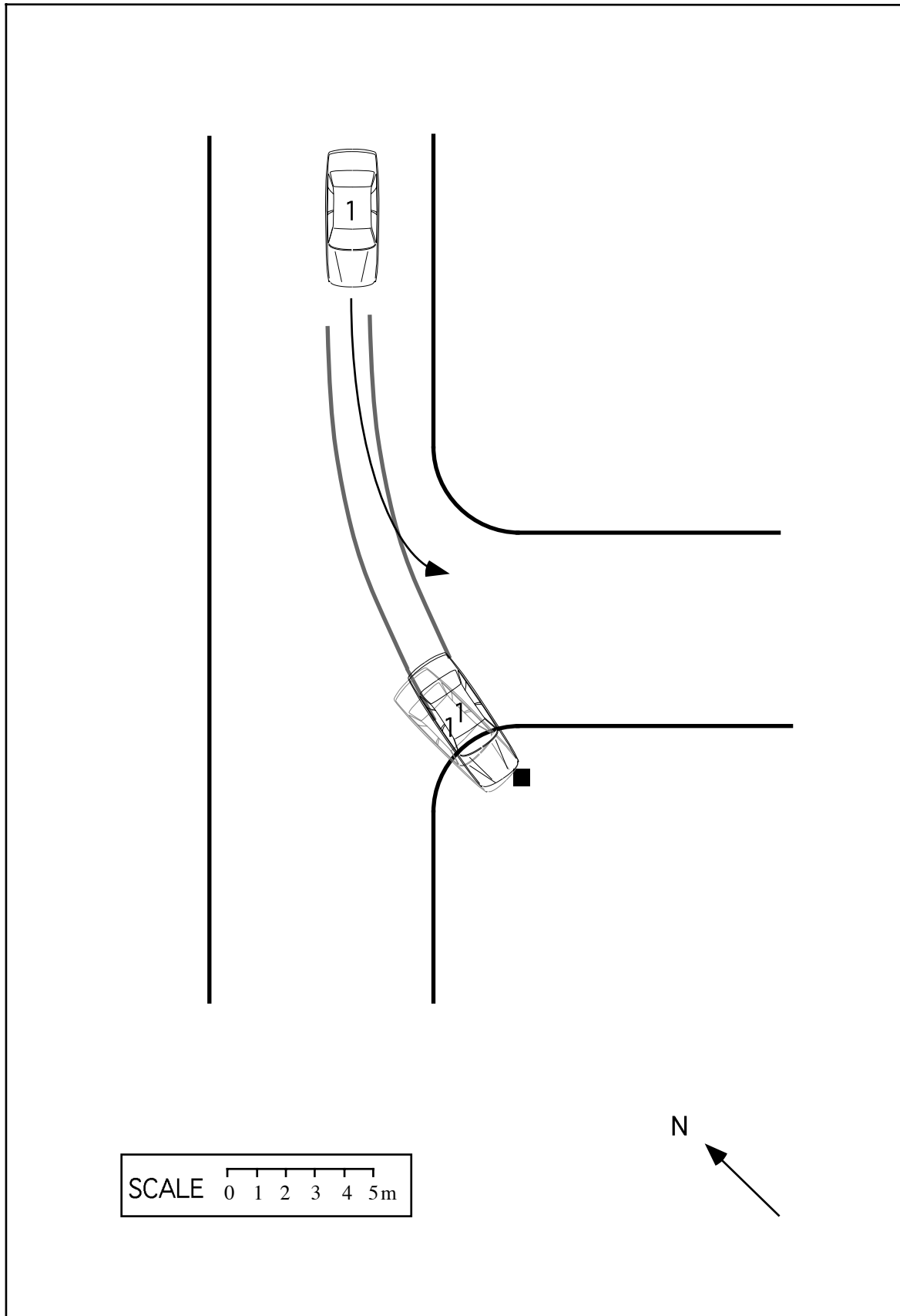
Control Speeds

43	49
55	62

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	24	24
5 km/hour speed reduction	58	0	0
10 km/hour speed reduction	53	0	0
Speed Limit 50 with similar compliance	53	0	0
Speed Limit 60 with total compliance	60	0	0

CN109



CN110

Crash Description

Unit 2 turned right across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from skid marks (10m).

Reconstruction Notes

Final position of Unit 2 unknown.

Final position of Unit 1 assumed to be at end of skid marks.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	40

Control Speeds

45	53
62	72

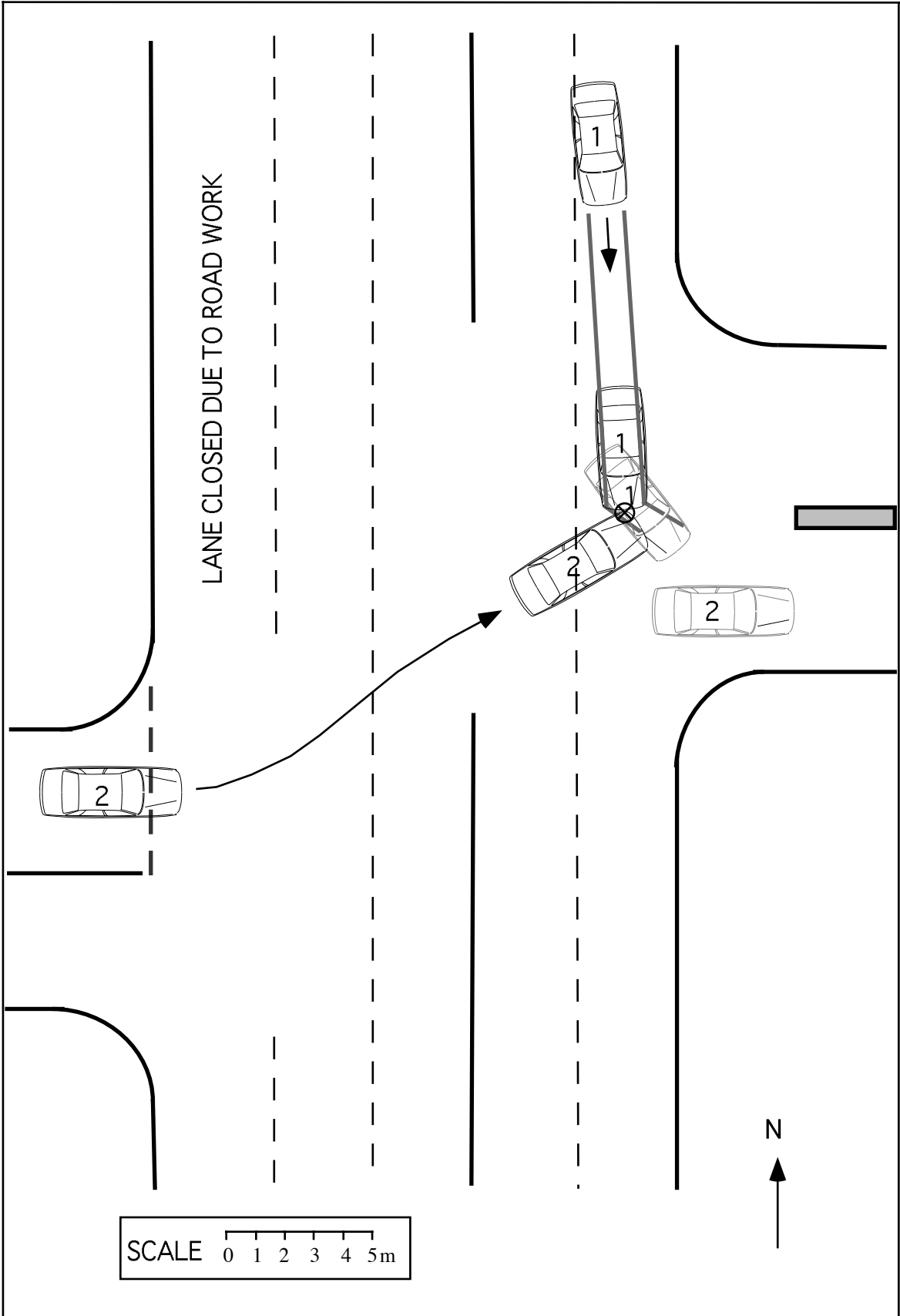
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	40	30
5 km/hour speed reduction	60	25	21
10 km/hour speed reduction	55	0	0
Speed Limit 50 with similar compliance	55	0	0
Speed Limit 60 with total compliance	60	25	21

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	20
5 km/hour speed reduction	13
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	13

C N 1 1 0



CN111

Crash Description

Unit 2 turned right across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (23.1m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	120
Impact Speed	86

Control Speeds

59	60
61	66

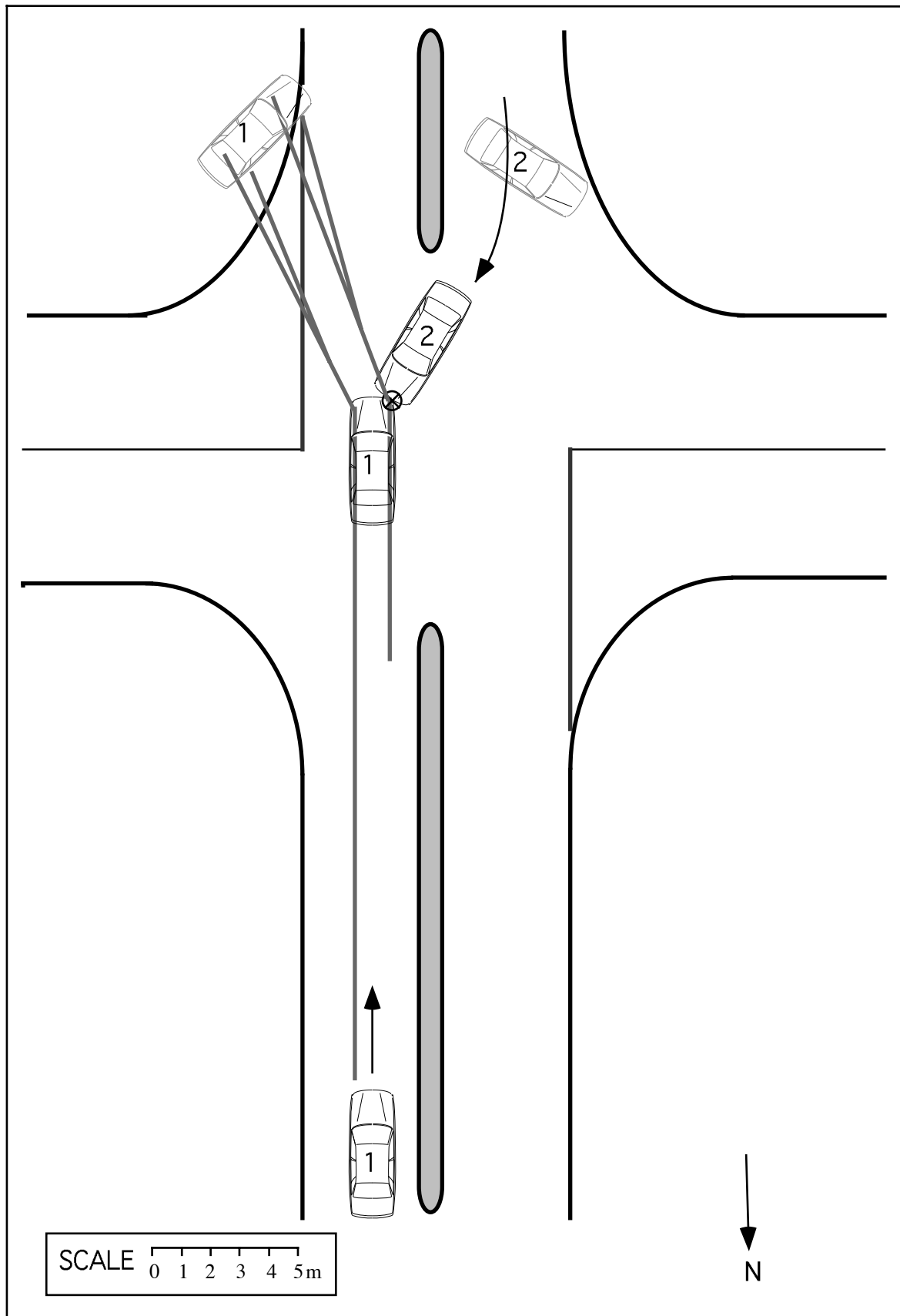
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	120	86	45
5 km/hour speed reduction	115	77	42
10 km/hour speed reduction	110	68	39
Speed Limit 50 with similar compliance	110	68	39
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	39
5 km/hour speed reduction	36
10 km/hour speed reduction	33
Speed Limit 50 with similar compliance	33
Speed Limit 60 with total compliance	0

CN111



CN112

Crash Description

Unit 2 turning right off main road into side street across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2. Unit 2 then collided with Unit 3 which collided with Unit 4.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (2.3m).

Reconstruction Notes

First impact assumed most significant.

Case Vehicle Speeds

Free Travelling Speed	69
Impact Speed	58

Control Speeds

63	64
65	68

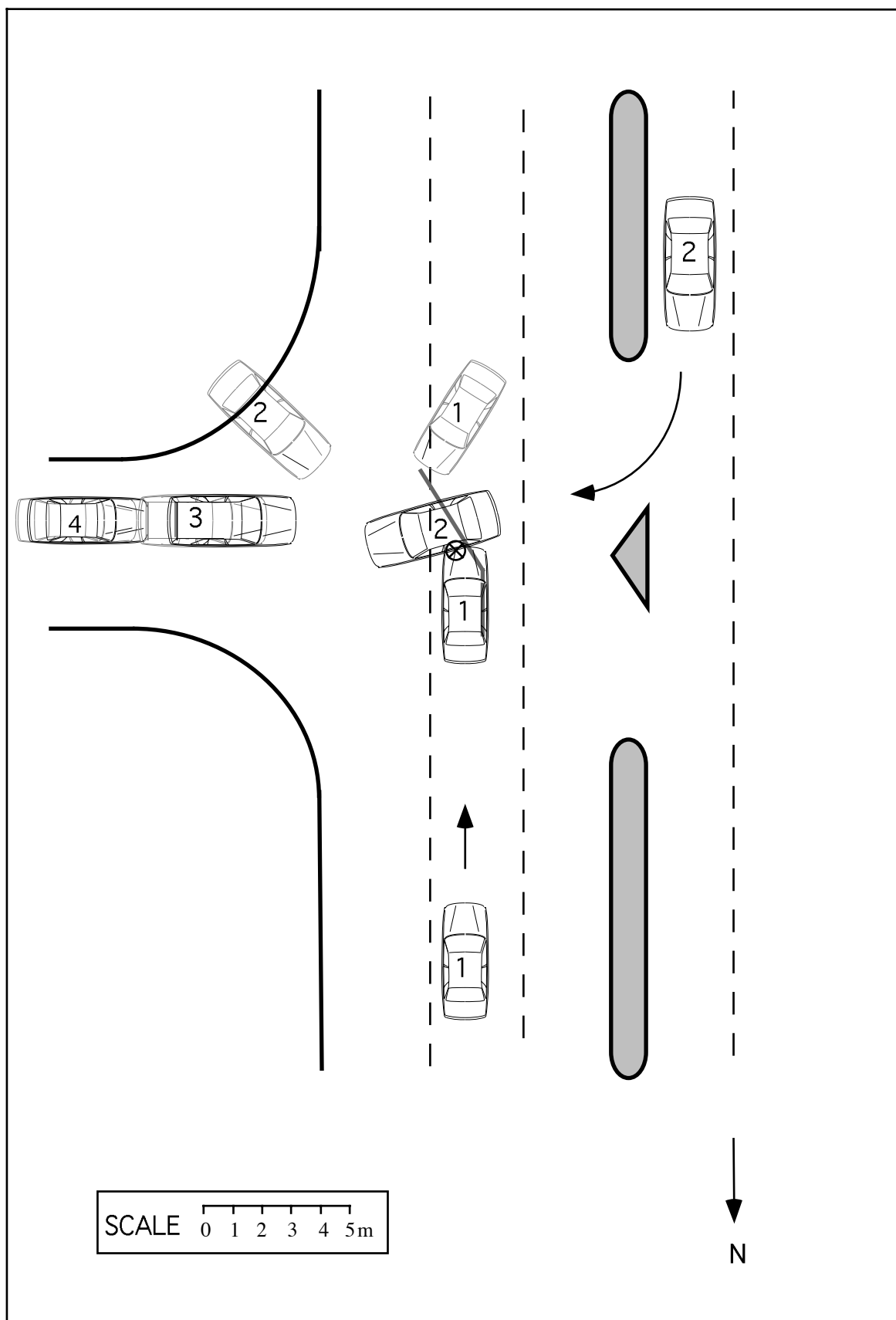
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	69	58	30
5 km/hour speed reduction	64	48	25
10 km/hour speed reduction	59	37	20
Speed Limit 50 with similar compliance	59	37	20
Speed Limit 60 with total compliance	60	40	22

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	25
5 km/hour speed reduction	20
10 km/hour speed reduction	16
Speed Limit 50 with similar compliance	16
Speed Limit 60 with total compliance	18

C N 1 1 2



CN113

Crash Description

Unit 2 turning right in front of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 1 then had a minor collision with Unit 3.

Injury Outcomes

Unit 1 driver admitted to hospital.

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from pre-impact skid marks (4.4m).

Reconstruction Notes

Unit 2 must have accelerated after impact to get to its final position.

Did not model second impact - minimal damage.

Case Vehicle Speeds

Free Travelling Speed	59
Impact Speed	45

Control Speeds

54	55
59	65

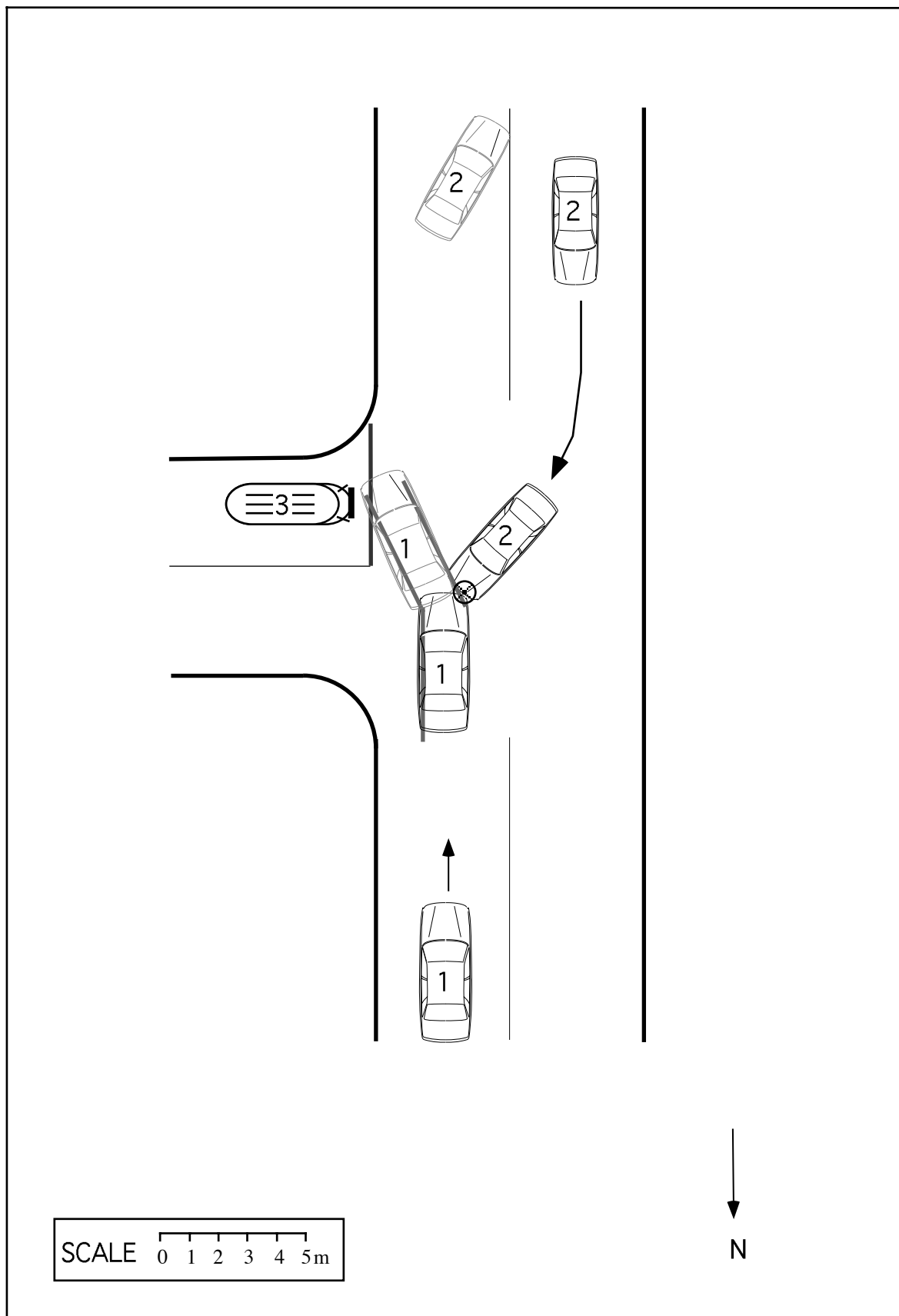
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	59	45	28
5 km/hour speed reduction	54	33	23
10 km/hour speed reduction	49	13	14
Speed Limit 50 with similar compliance	50	18	17
Speed Limit 60 with total compliance	59	45	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	30
5 km/hour speed reduction	25
10 km/hour speed reduction	14
Speed Limit 50 with similar compliance	17
Speed Limit 60 with total compliance	30

CN113



CN114

Crash Description

Unit 2 lost control and crossed to other side of road and had head on collision with Unit 1. Unit 2 was not a case because driver had a positive BAC.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Long travelling distances after impact make reconstruction difficult - matched distance travelled.
Cars also snagged to some extent - used slightly more overlap to simulate.

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	63

Control Speeds

47	58
61	63

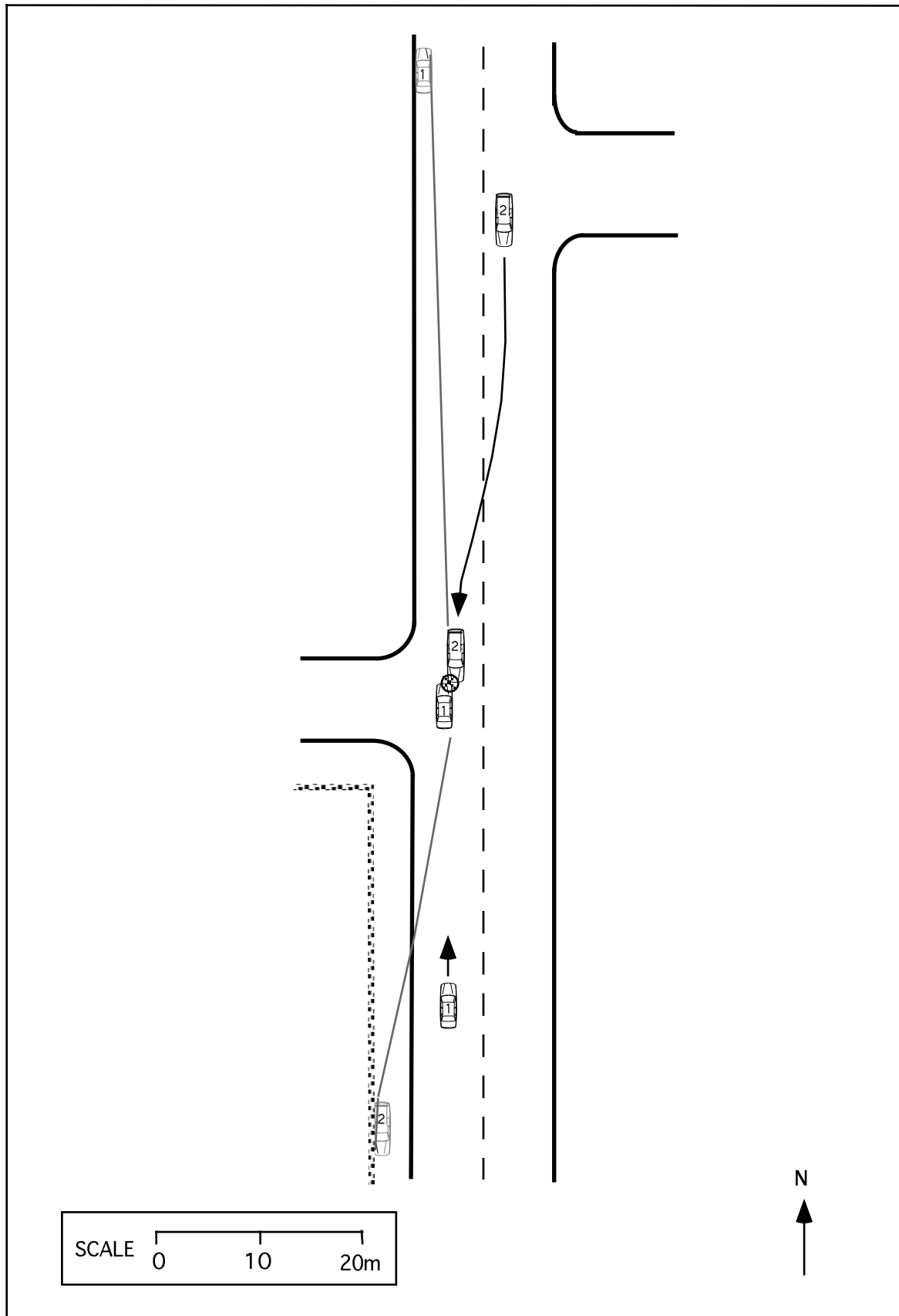
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	63	18
5 km/hour speed reduction	58	58	17
10 km/hour speed reduction	53	53	17
Speed Limit 50 with similar compliance	53	53	17
Speed Limit 60 with total compliance	60	60	18

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	14
5 km/hour speed reduction	14
10 km/hour speed reduction	13
Speed Limit 50 with similar compliance	13
Speed Limit 60 with total compliance	14

CN114



CN115

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (13.5m).

Reconstruction Notes

Final position of Unit 2 uncertain - didn't move far after impact though.

Case Vehicle Speeds

Free Travelling Speed	64
Impact Speed	29

Control Speeds

46	47
53	54

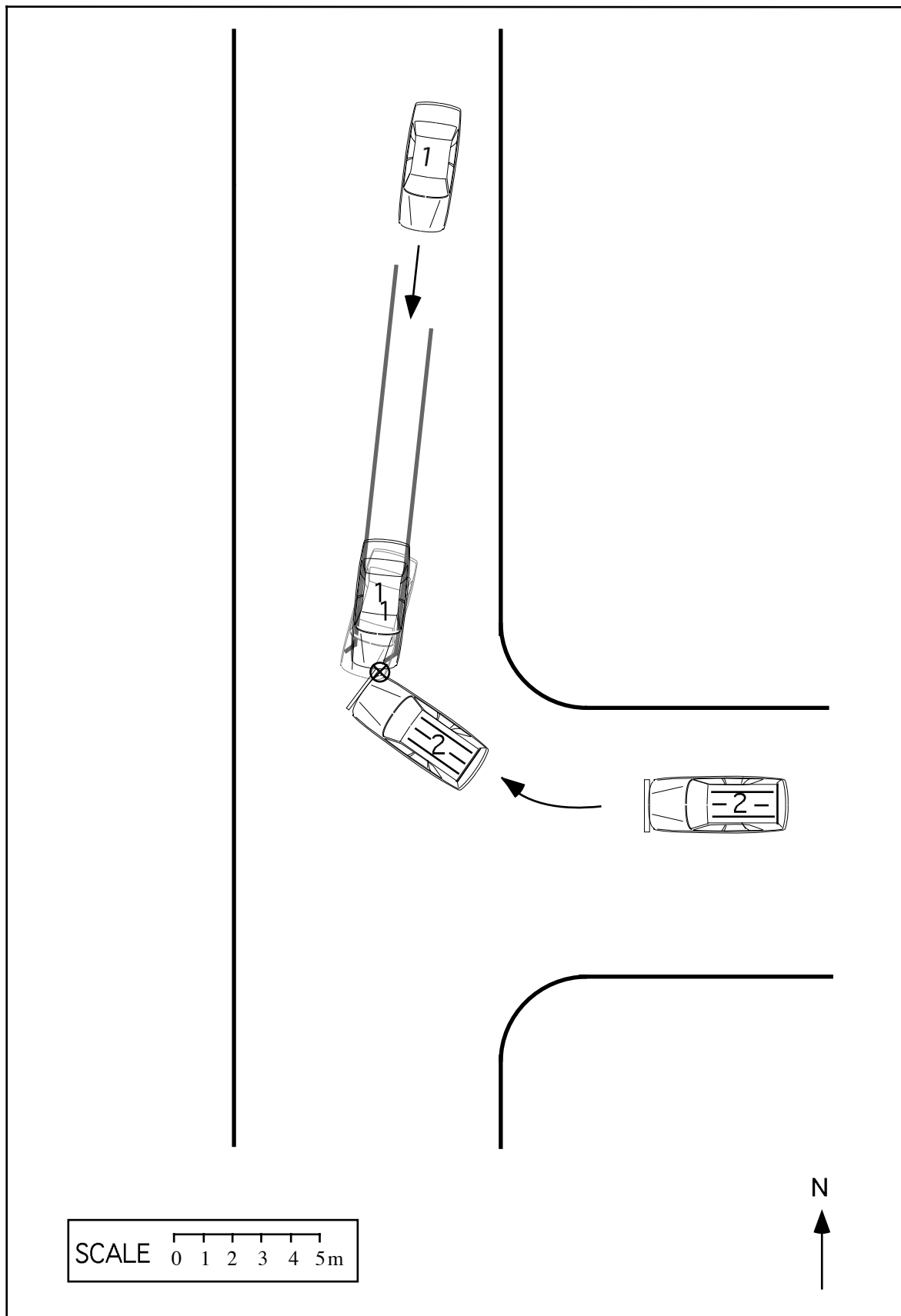
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	64	29	26
5 km/hour speed reduction	59	0	0
10 km/hour speed reduction	54	0	0
Speed Limit 50 with similar compliance	54	0	0
Speed Limit 60 with total compliance	60	11	13

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	11
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	4

CN115



CN119

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (8.7m).

Reconstruction Notes

Not a perfect match for final positions.

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	32

Control Speeds

56	57
62	64

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	32	24
5 km/hour speed reduction	52	10	8
10 km/hour speed reduction	47	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	57	32	24

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	29
5 km/hour speed reduction	10
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	29

CN120

Crash Description

Unit 2 turned right on to main road across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (8.4m).

Reconstruction Notes

Final position angles from drivers.
Positions from radiator fluid.

Case Vehicle Speeds

Free Travelling Speed	59
Impact Speed	36

Control Speeds

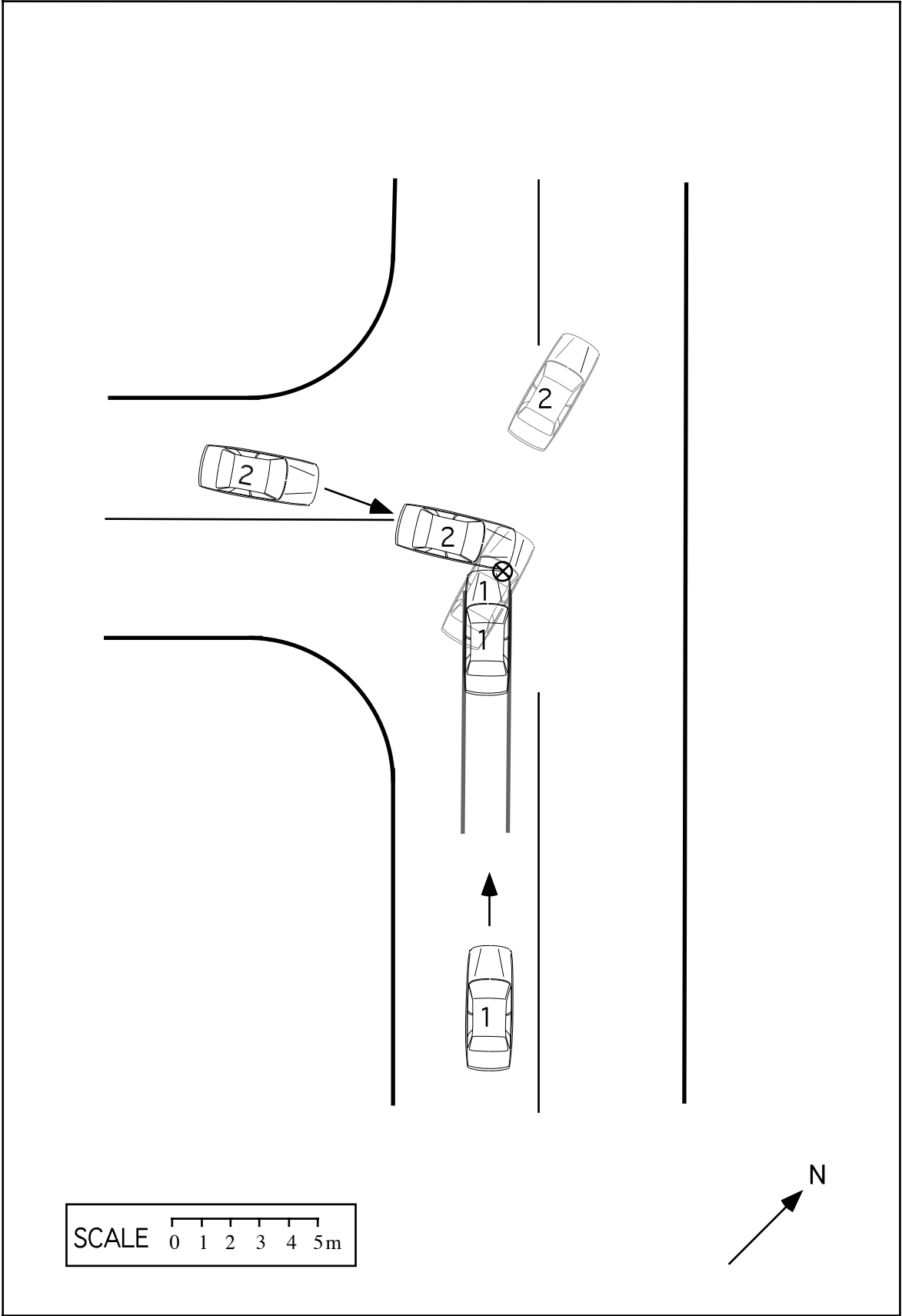
58	62
64	65

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	59	36	23
5 km/hour speed reduction	54	19	13
10 km/hour speed reduction	49	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	59	36	23

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	20
5 km/hour speed reduction	10
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	20



CN121

Crash Description

Pedestrian crossing road past stationary vehicles. Unit 1 applied brakes and collided with pedestrian.

Injury Outcomes

Pedestrian admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid marks (11.2m).
Impact speed from post-impact skid marks (2.1m).

Reconstruction Notes

Uphill grade on road - used $cf=0.8$

Case Vehicle Speeds

Free Travelling Speed	53
Impact Speed	21

Control Speeds

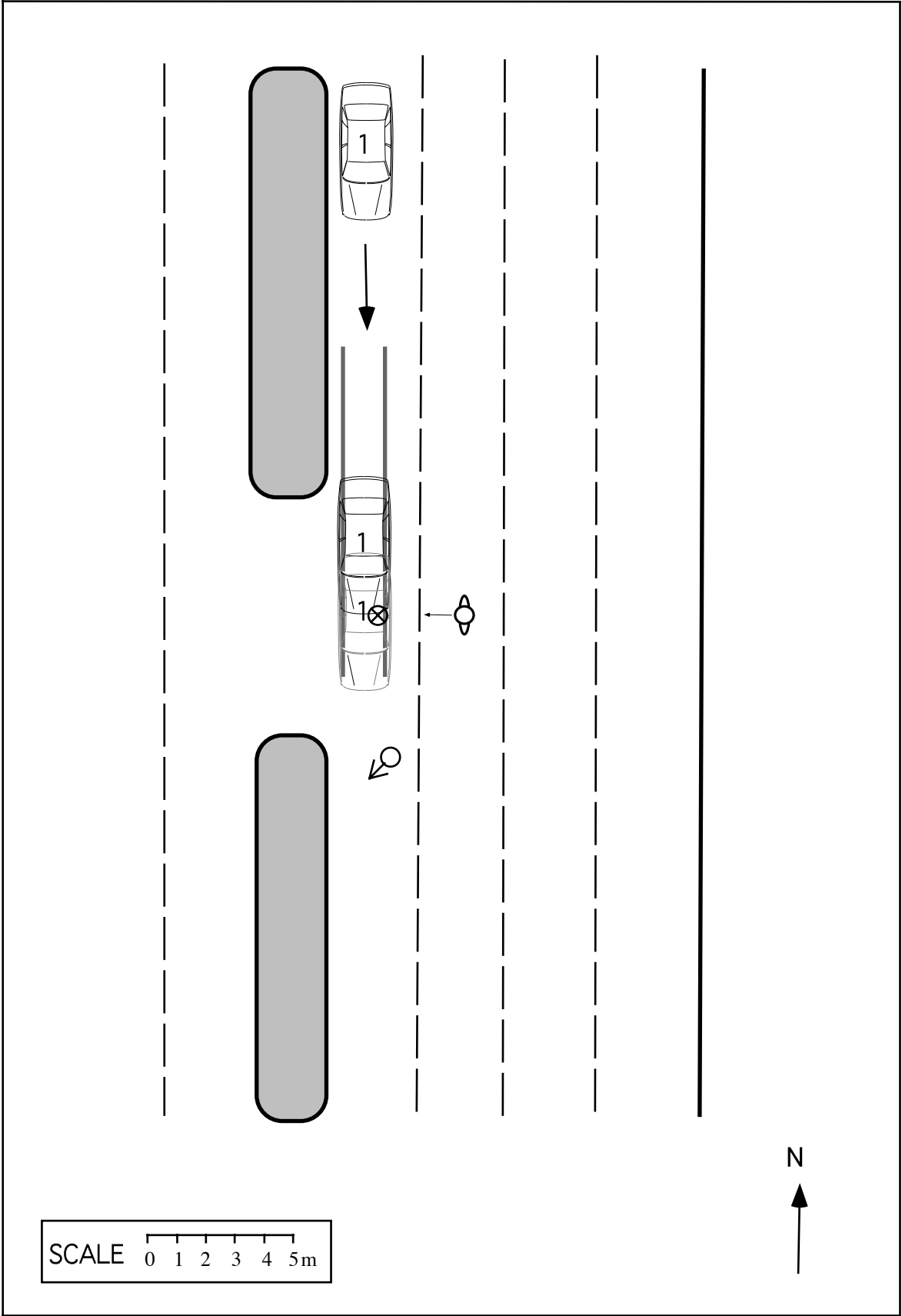
44	55
61	61

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	53	21	0
5 km/hour speed reduction	48	0	0
10 km/hour speed reduction	43	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	53	21	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	21



CN122

Crash Description

Unit 2 turning right on to main road across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (11.2m).

Reconstruction Notes

Not a perfect match.

Case Vehicle Speeds

Free Travelling Speed	67
Impact Speed	40

Control Speeds

58	67
67	70

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	67	40	26
5 km/hour speed reduction	62	24	19
10 km/hour speed reduction	57	0	0
Speed Limit 50 with similar compliance	57	0	0
Speed Limit 60 with total compliance	60	14	14

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	24
5 km/hour speed reduction	17
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	12

The diagram illustrates a vehicle accident scene. A car labeled '1' is positioned vertically in the center. An arrow points to it from a car labeled '2' on the left. Car '2' is also shown in a separate position to the right of car '1'. A scale bar at the bottom left indicates distances from 0 to 5 meters. A north arrow at the bottom right points towards the top right. The diagram includes various road markings such as dashed lines, solid lines, and a U-turn lane.

CN123

Crash Description

Unit 2 turning right at the intersection of two main traffic routes in front of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 2 and SMAC run.

Reconstruction Notes

Unit 1 final position unknown.
Good fit for Unit 2 and damage matches.

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	61

Control Speeds

52	53
56	60

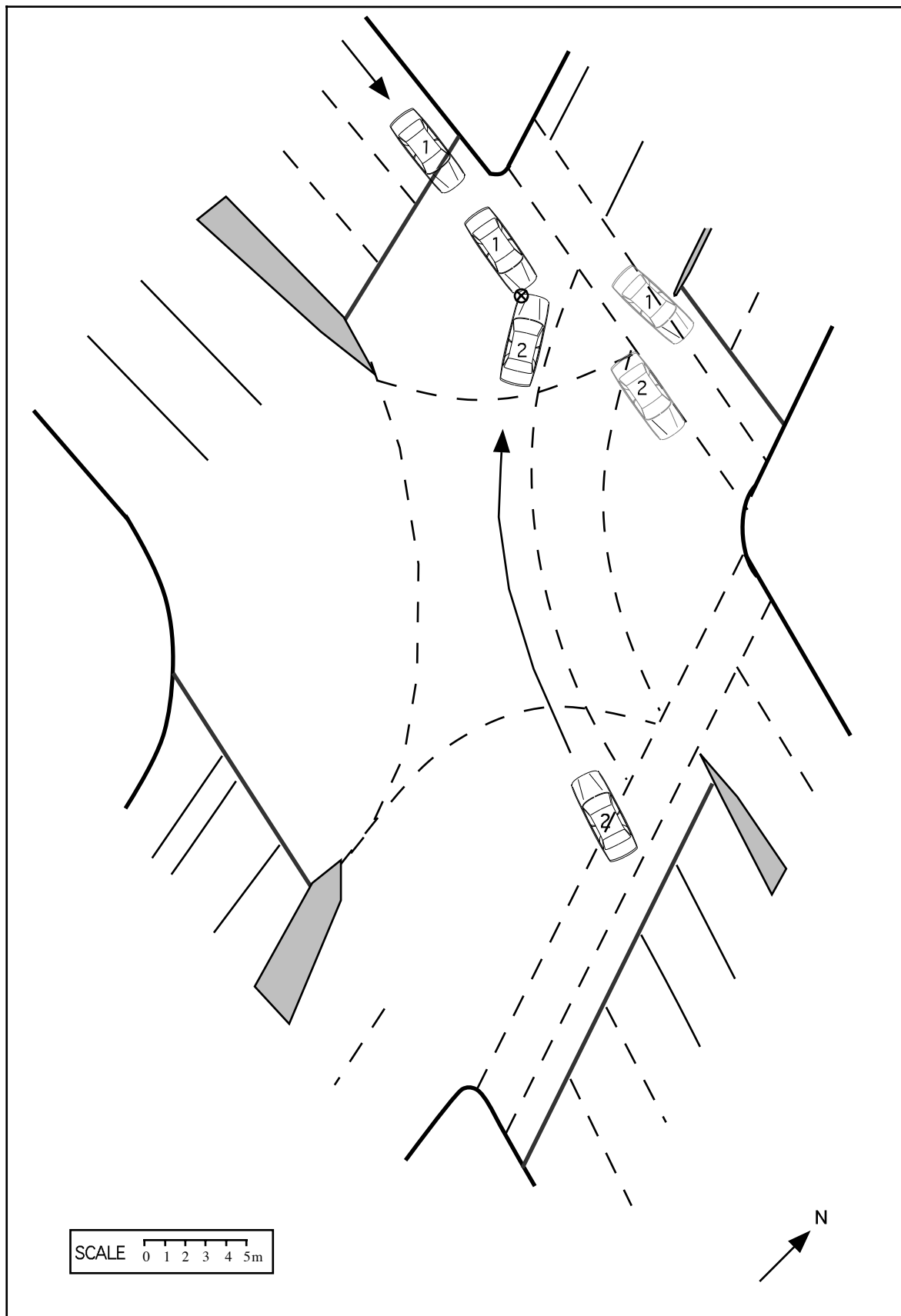
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	61	48
5 km/hour speed reduction	56	56	47
10 km/hour speed reduction	51	51	44
Speed Limit 50 with similar compliance	51	51	44
Speed Limit 60 with total compliance	60	60	48

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	46
5 km/hour speed reduction	45
10 km/hour speed reduction	42
Speed Limit 50 with similar compliance	42
Speed Limit 60 with total compliance	46

CN123



CN124

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 final position based on radiator fluid and police estimate.

Unit 2 final position estimated by police.

Some post-impact steering applied to Unit 2.

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	60

Control Speeds

51	55
56	60

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	60	38
5 km/hour speed reduction	55	55	35
10 km/hour speed reduction	50	50	32
Speed Limit 50 with similar compliance	50	50	32
Speed Limit 60 with total compliance	60	60	38

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	40
5 km/hour speed reduction	36
10 km/hour speed reduction	33
Speed Limit 50 with similar compliance	33
Speed Limit 60 with total compliance	40

CN125

Crash Description

Unit 2 stopped on road behind Unit 3 (waiting to turn right). Unit 1 approaching Unit 2 from behind. Unit 1 attempted to change lanes, applied brakes and then collided with rear of Unit 2.

Injury Outcomes

Unit 2 left rear passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (5.5m).

Reconstruction Notes

Damage to Unit 1 from underrun - looks slightly different in SMAC run.

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	40

Control Speeds

57	58
61	64

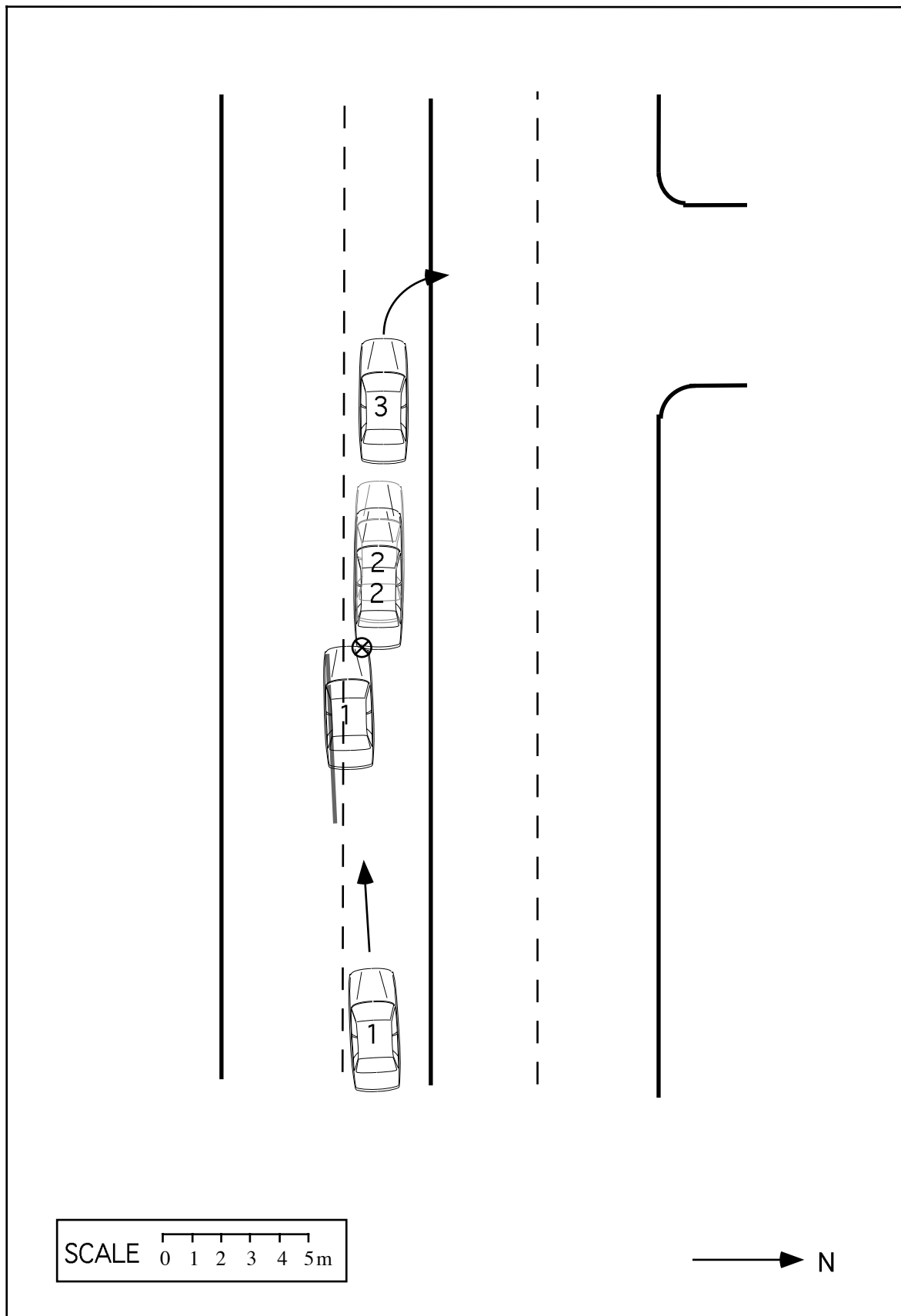
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	40	30
5 km/hour speed reduction	52	26	21
10 km/hour speed reduction	47	0	0
Speed Limit 50 with similar compliance	50	19	16
Speed Limit 60 with total compliance	57	40	30

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	15
5 km/hour speed reduction	9
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	6
Speed Limit 60 with total compliance	15

C N 1 2 5



CN127

Crash Description

Unit 2 crossing main road past stationary traffic. Unit 1 travelling along main road. Unit 2 collided with side of Unit 1. Unit 2 then had minor collision with fence post. Unit 1 also had minor collision with another fence post.

Injury Outcomes

Unit 1 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Assumed acceleration of Unit 2 before and after impact and that it was stopped by fence post.

Case Vehicle Speeds

Free Travelling Speed	54
Impact Speed	54

Control Speeds

56	57
57	63

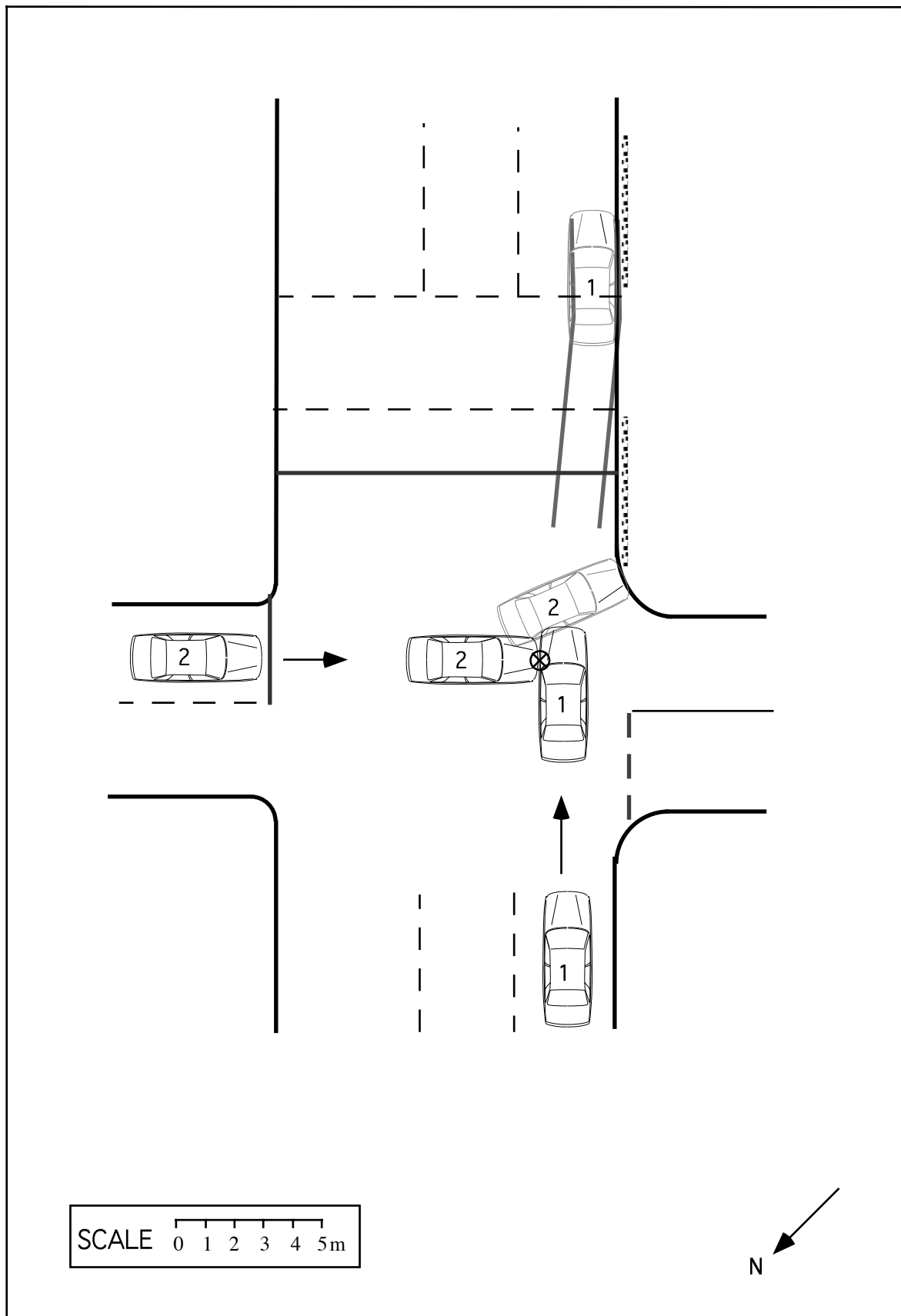
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	54	54	10
5 km/hour speed reduction	49	49	10
10 km/hour speed reduction	44	44	11
Speed Limit 50 with similar compliance	50	50	10
Speed Limit 60 with total compliance	54	54	10

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	13
5 km/hour speed reduction	13
10 km/hour speed reduction	13
Speed Limit 50 with similar compliance	13
Speed Limit 60 with total compliance	13

CN127



CN128

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with front of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling and impact speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	59
Impact Speed	59

Control Speeds

59	61
64	65

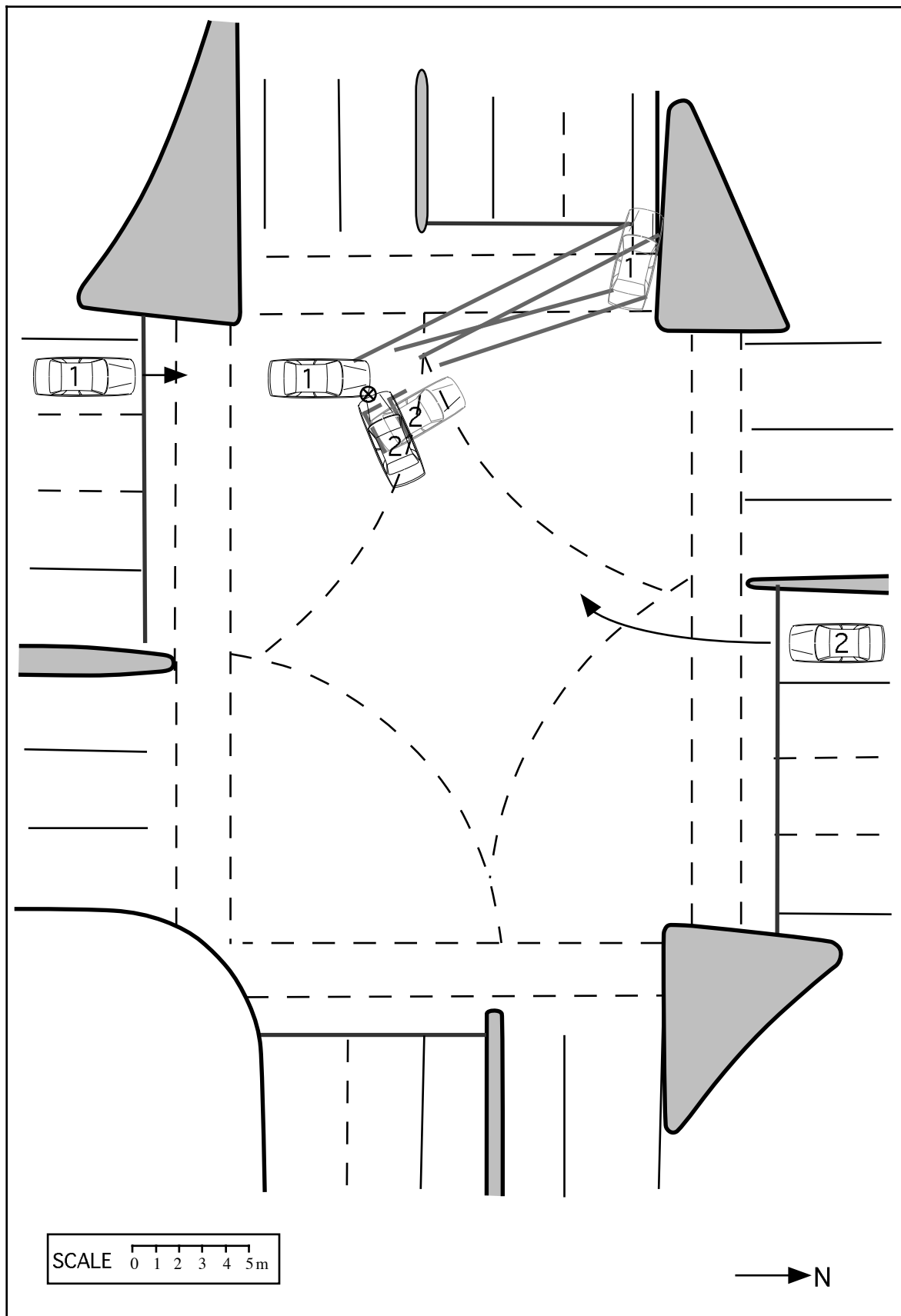
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	59	59	22
5 km/hour speed reduction	54	54	22
10 km/hour speed reduction	49	49	22
Speed Limit 50 with similar compliance	50	50	22
Speed Limit 60 with total compliance	59	59	22

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	26
10 km/hour speed reduction	26
Speed Limit 50 with similar compliance	26
Speed Limit 60 with total compliance	26

CN128



CN129

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (8.1m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	44

Control Speeds

57	59
64	66

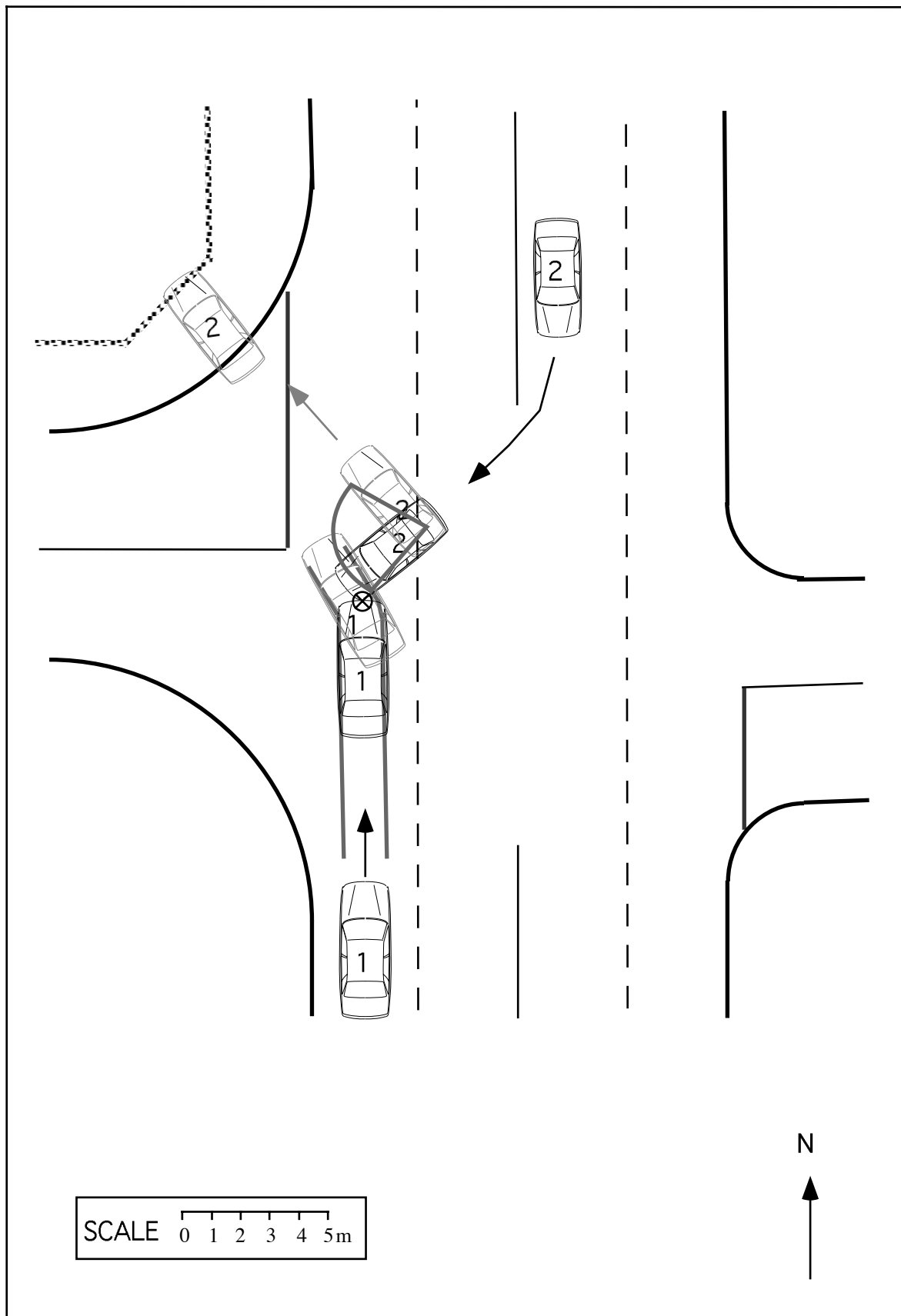
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	44	28
5 km/hour speed reduction	60	31	22
10 km/hour speed reduction	55	0	0
Speed Limit 50 with similar compliance	55	0	0
Speed Limit 60 with total compliance	60	31	22

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	39
5 km/hour speed reduction	30
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	30

C N 1 2 9



CN130

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 collided with side of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 final position not exact match.

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	60

Control Speeds

60	60
68	71

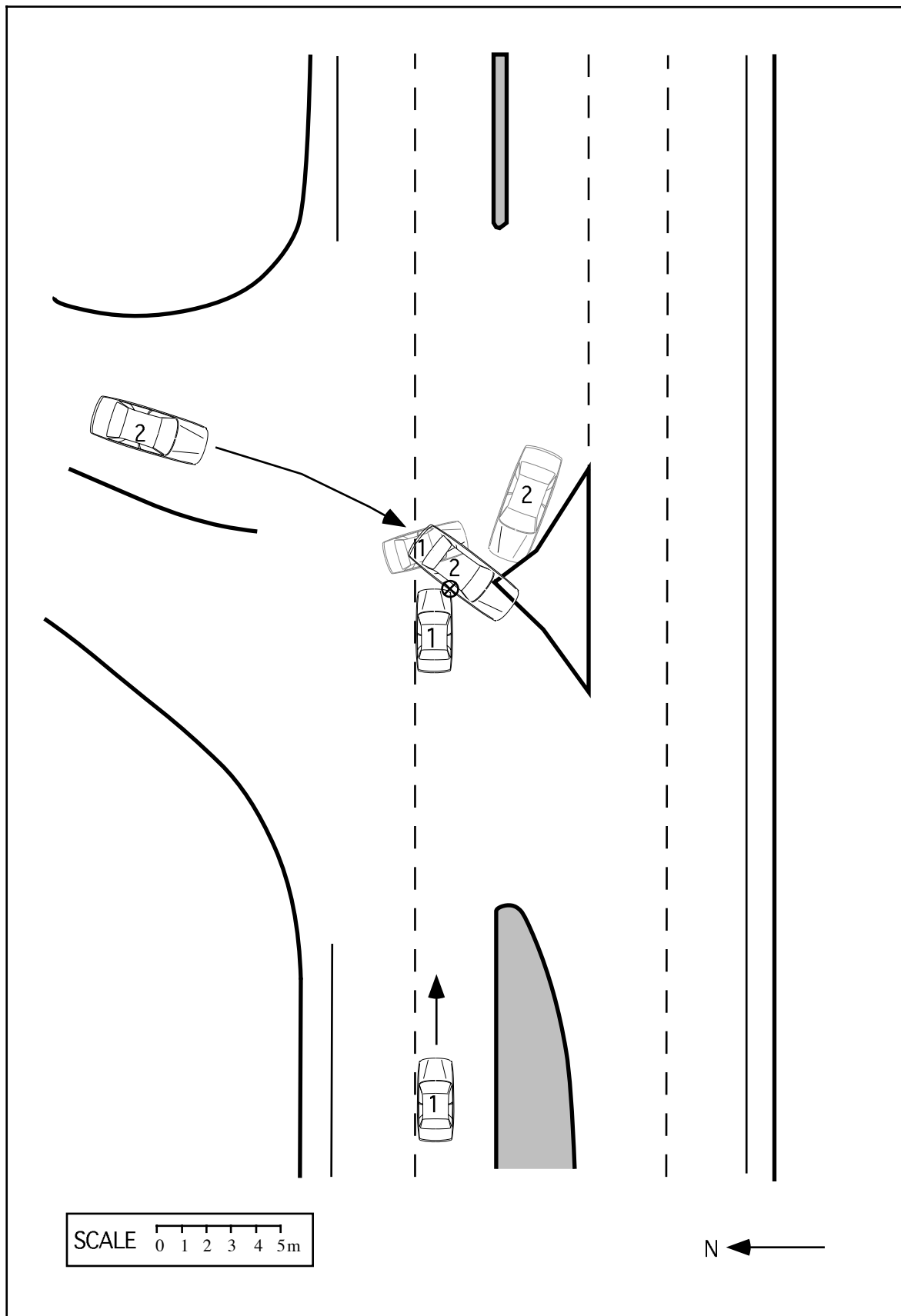
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	60	44
5 km/hour speed reduction	55	55	41
10 km/hour speed reduction	50	50	38
Speed Limit 50 with similar compliance	50	50	38
Speed Limit 60 with total compliance	60	60	44

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	18
5 km/hour speed reduction	17
10 km/hour speed reduction	15
Speed Limit 50 with similar compliance	15
Speed Limit 60 with total compliance	18

CN130



CN132

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with side of Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.
Unit 1 right rear passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (12m).

Reconstruction Notes

Unit 2 must have accelerated for some time after impact.

Case Vehicle Speeds

Free Travelling Speed	81
Impact Speed	56

Control Speeds

59	61
63	64

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	81	56	48
5 km/hour speed reduction	76	45	40
10 km/hour speed reduction	71	31	30
Speed Limit 50 with similar compliance	71	31	30
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	36
5 km/hour speed reduction	30
10 km/hour speed reduction	22
Speed Limit 50 with similar compliance	22
Speed Limit 60 with total compliance	0

CN133

Crash Description

Unit 2 turning from side street on to main road across path of Unit 1. Unit 2 collided with side of Unit 1.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Had to assume full braking on back wheels and some braking on blown left front wheel for Unit 1 to behave correctly.

Damage not fully matched.

Case Vehicle Speeds

Free Travelling Speed	64
Impact Speed	64

Control Speeds

54	59
63	67

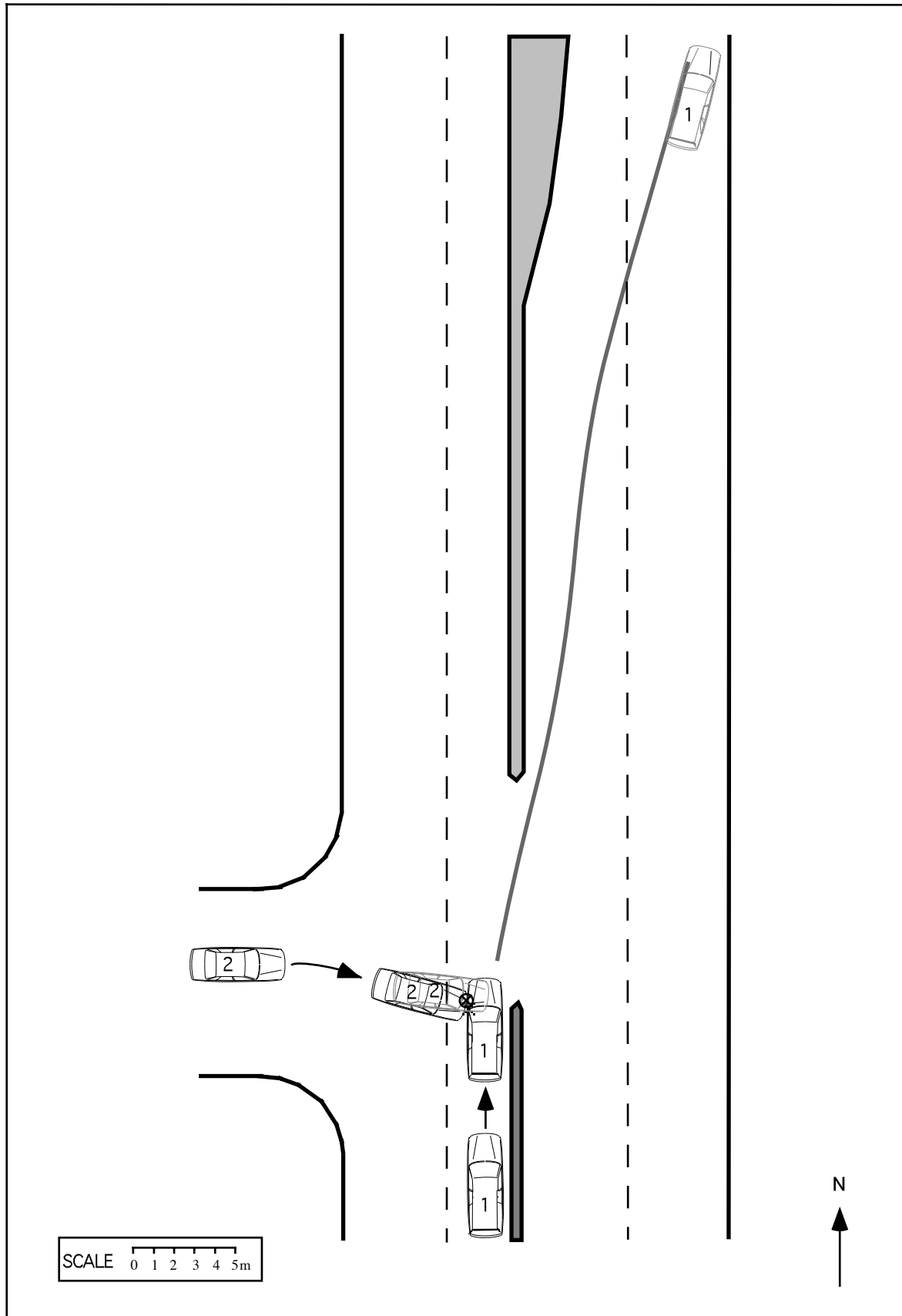
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	64	64	8
5 km/hour speed reduction	59	59	9
10 km/hour speed reduction	54	54	9
Speed Limit 50 with similar compliance	54	54	9
Speed Limit 60 with total compliance	60	60	9

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	7
5 km/hour speed reduction	7
10 km/hour speed reduction	7
Speed Limit 50 with similar compliance	7
Speed Limit 60 with total compliance	7

CN133



CN135

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.
Unit 2 passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	62
Impact Speed	62

Control Speeds

49	51
57	65

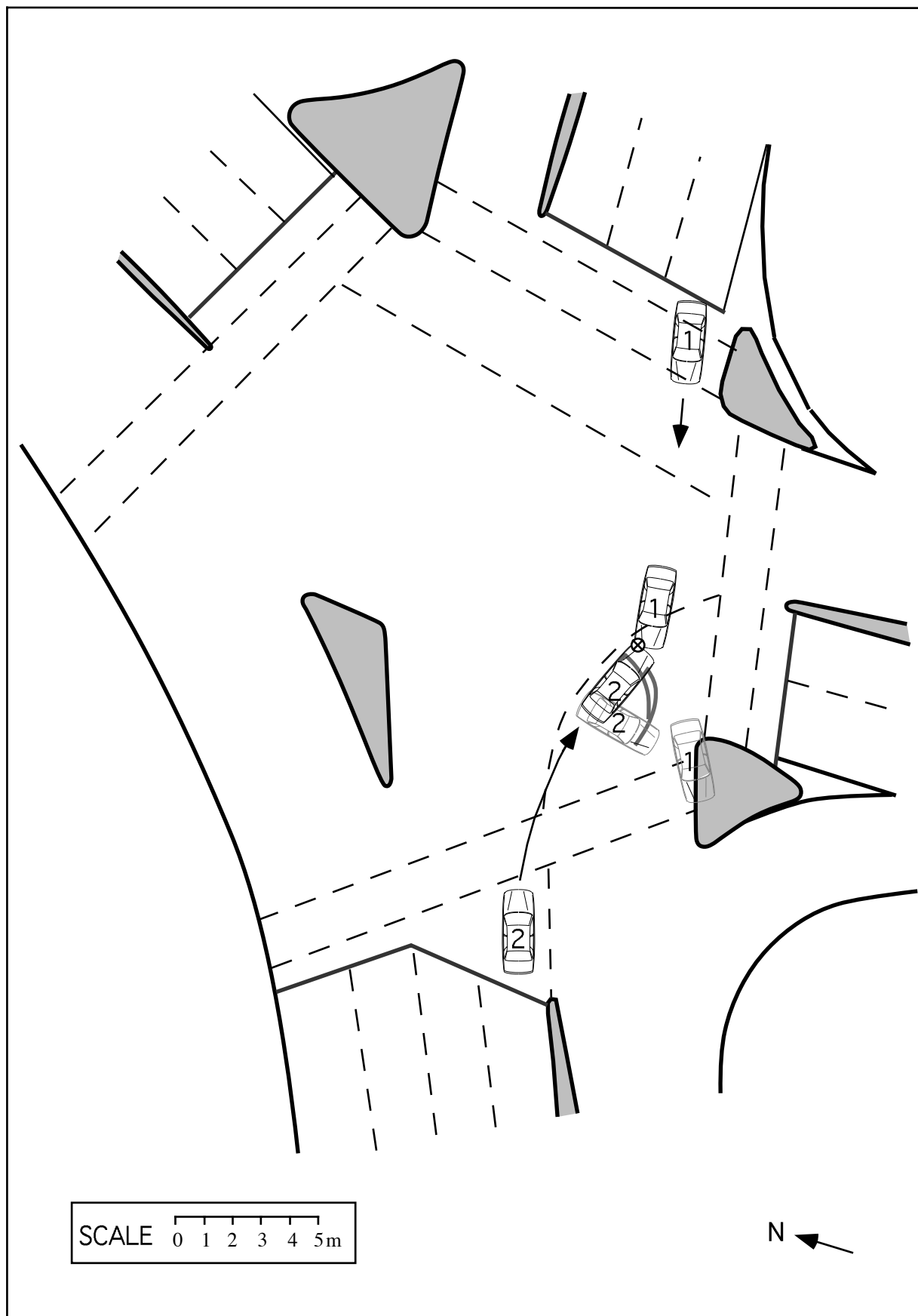
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	62	62	50
5 km/hour speed reduction	57	57	47
10 km/hour speed reduction	52	52	45
Speed Limit 50 with similar compliance	52	52	45
Speed Limit 60 with total compliance	60	60	49

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	48
5 km/hour speed reduction	45
10 km/hour speed reduction	43
Speed Limit 50 with similar compliance	43
Speed Limit 60 with total compliance	46

C N 135



CN136

Crash Description

Unit 2 turning right down side street across path of Unit 1. Unit 2 applied brakes before impact. Unit 1 collided with front of Unit 2.

Injury Outcomes

Unit 1 driver transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Final position of Unit 2 deduced from radiator fluid.
Not a perfect reconstruction.

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	60

Control Speeds

53	55
58	62

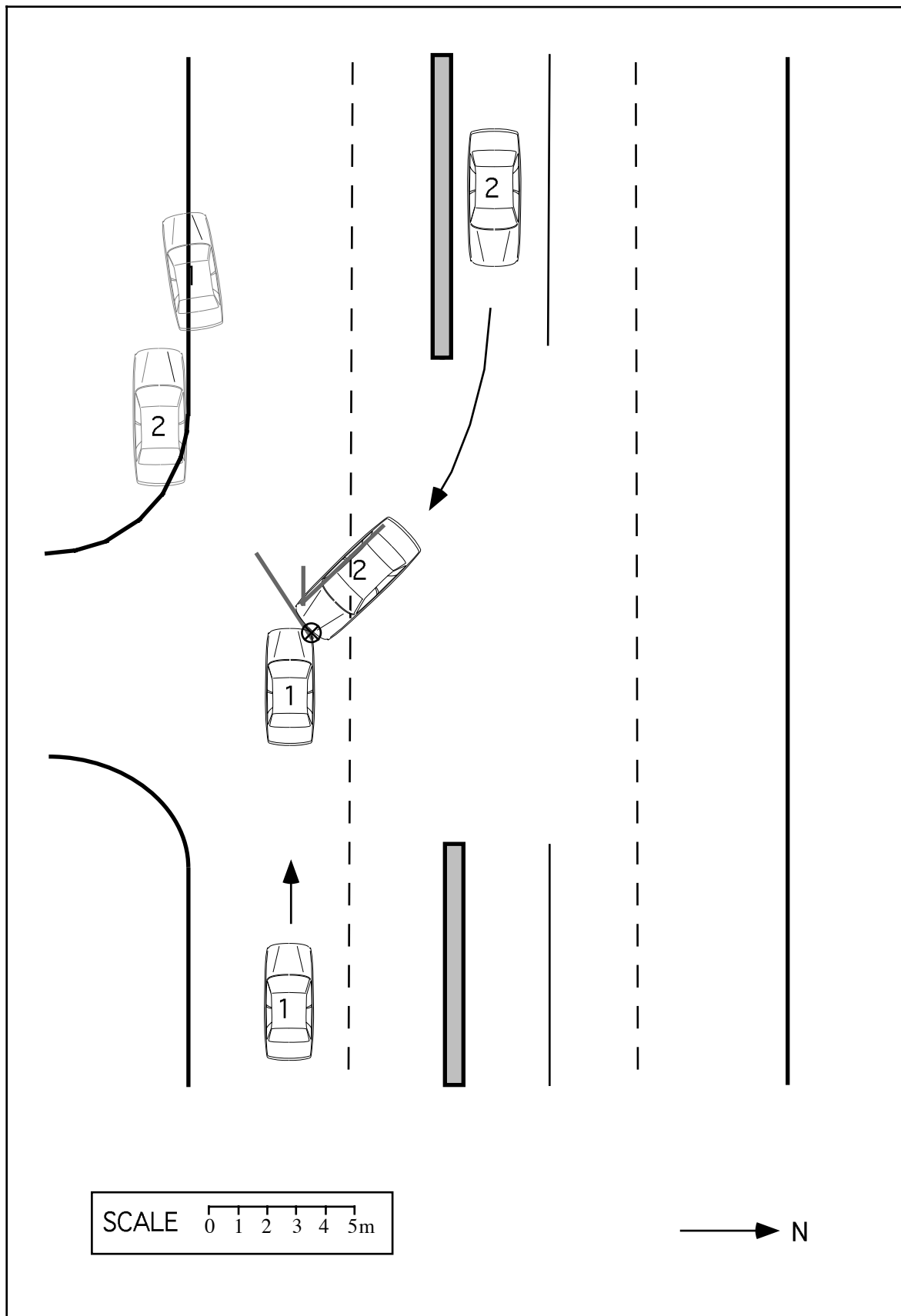
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	60	32
5 km/hour speed reduction	55	55	31
10 km/hour speed reduction	50	50	29
Speed Limit 50 with similar compliance	50	50	29
Speed Limit 60 with total compliance	60	60	32

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	25
5 km/hour speed reduction	24
10 km/hour speed reduction	23
Speed Limit 50 with similar compliance	23
Speed Limit 60 with total compliance	25

C N 1 3 6



CN140

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with side of Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 1 left front passenger treated at hospital.
Unit 1 left rear passenger transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	38
Impact Speed	38

Control Speeds

55	61
62	62

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	38	38	26
5 km/hour speed reduction	33	33	23
10 km/hour speed reduction	28	28	20
Speed Limit 50 with similar compliance	38	38	26
Speed Limit 60 with total compliance	38	38	26

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	30
5 km/hour speed reduction	27
10 km/hour speed reduction	23
Speed Limit 50 with similar compliance	30
Speed Limit 60 with total compliance	30

The diagram illustrates a collision between two vehicles at a T-junction. Vehicle 1, a sedan, is traveling straight through the junction. Vehicle 2, a hatchback, is turning left across the path of Vehicle 1. The point of impact is marked with an 'X' on the hood of Vehicle 1 and the rear of Vehicle 2. A scale bar at the bottom left indicates a distance of 0 to 5 meters. A North arrow at the bottom right points towards the upper right of the diagram.

CN141

Crash Description

Unit 2 turning right into local street across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 2 right rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (6m).

Reconstruction Notes

Assumed Unit 2 accelerating during impact.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	40

Control Speeds

53	55
71	72

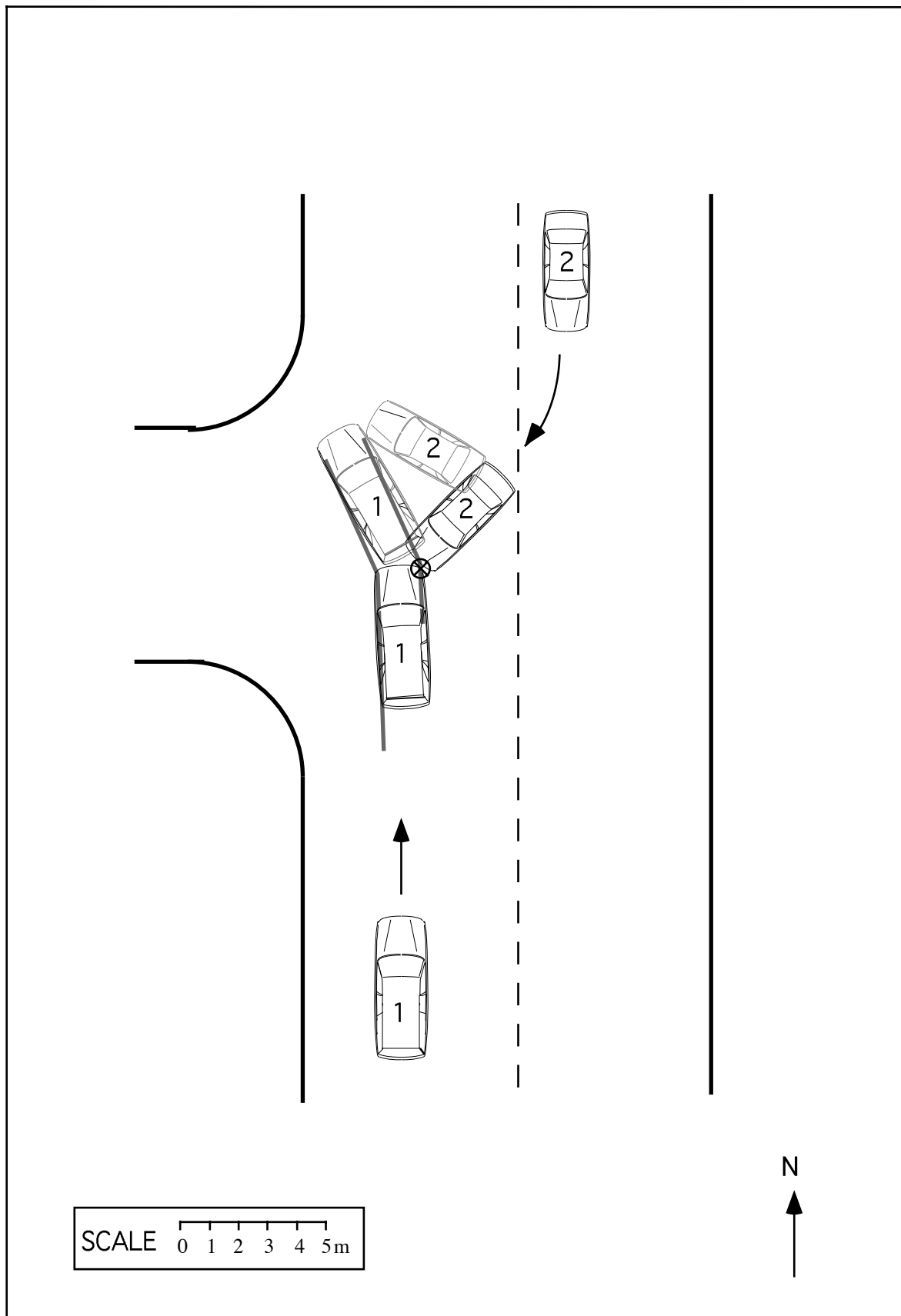
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	40	20
5 km/hour speed reduction	53	26	16
10 km/hour speed reduction	48	0	0
Speed Limit 50 with similar compliance	50	13	11
Speed Limit 60 with total compliance	58	40	20

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	16
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	2
Speed Limit 60 with total compliance	21

CN141



CN142

Crash Description

Unit 2 turning right on to main road across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from pre-impact skid marks (6m).

Reconstruction Notes

Unit 2 final position unknown.

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	43

Control Speeds

57	57
60	61

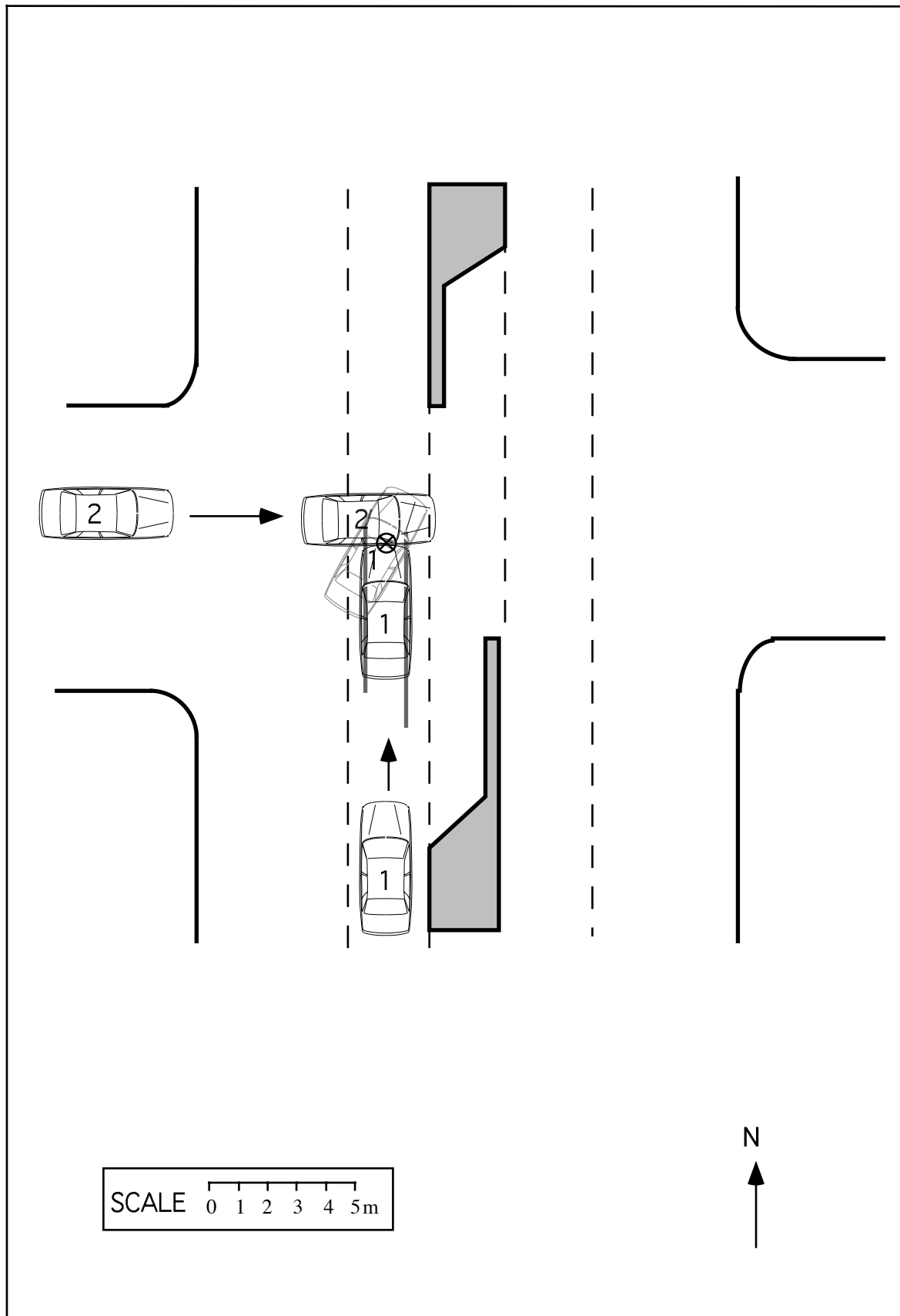
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	43	30
5 km/hour speed reduction	55	30	22
10 km/hour speed reduction	50	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	60	43	30

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	18
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	26

CN142



CN143

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with side of Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (11m).

Reconstruction Notes

Unit 2 final position unknown.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	27

Control Speeds

48	49
50	64

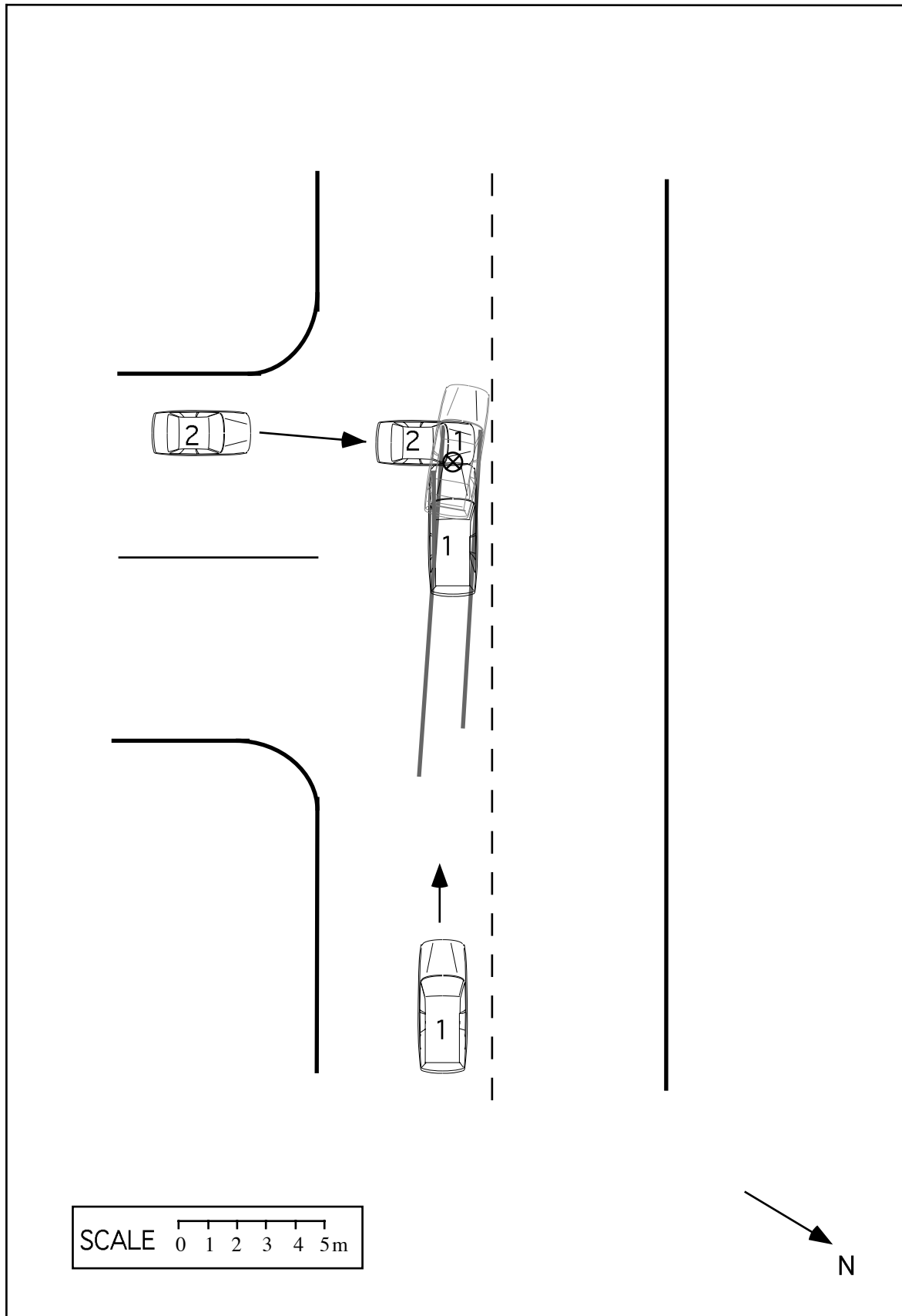
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	27	13
5 km/hour speed reduction	53	0	0
10 km/hour speed reduction	48	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	58	27	13

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	20
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	20

CN143



CN144

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 2 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (9.5m).

Reconstruction Notes

Unit 2 final position unknown.

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	36

Control Speeds

50	61
65	65

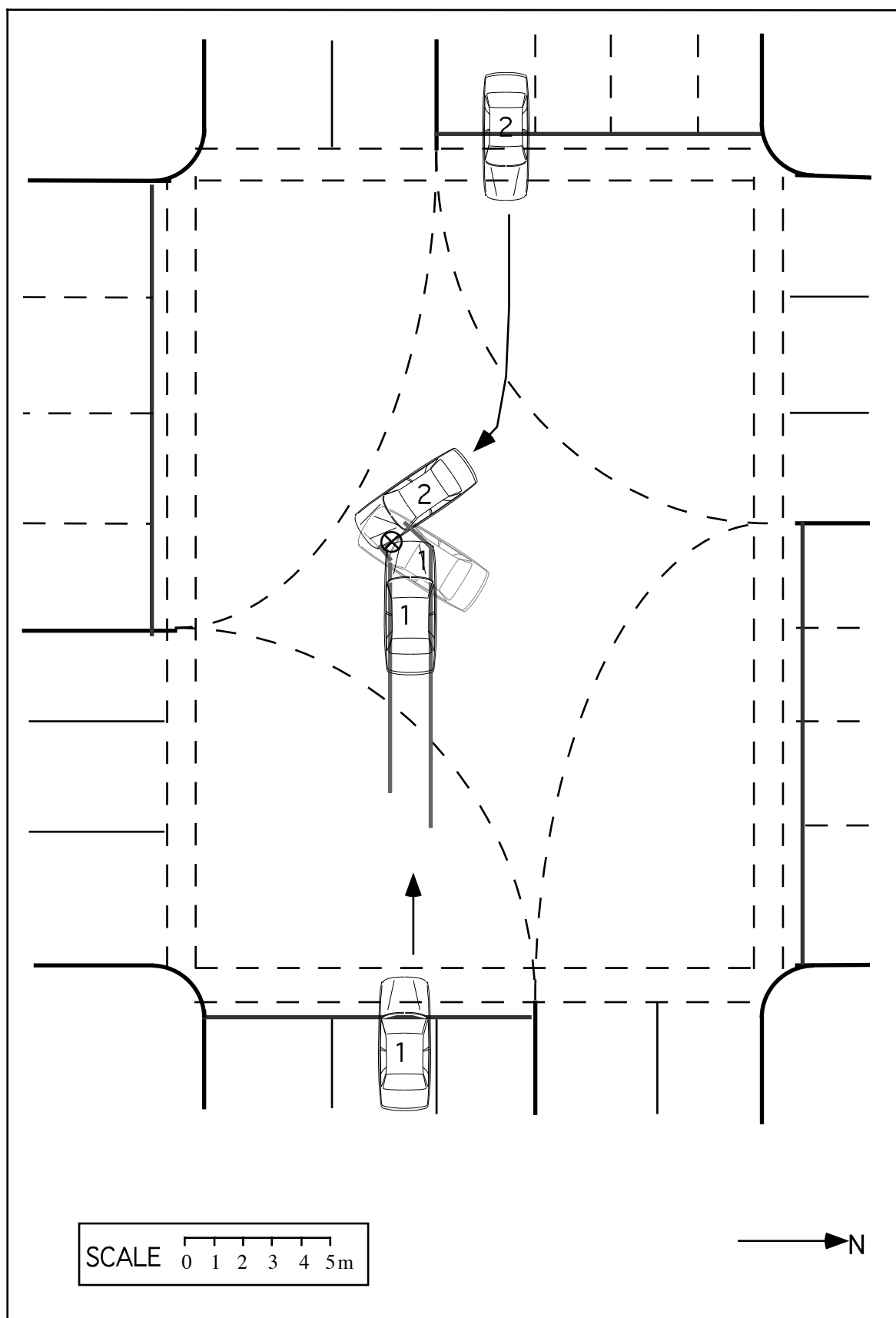
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	36	25
5 km/hour speed reduction	56	18	13
10 km/hour speed reduction	51	0	0
Speed Limit 50 with similar compliance	51	0	0
Speed Limit 60 with total compliance	60	33	24

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	11
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	24

C N 1 4 4



CN145

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Not a perfect match.

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	63

Control Speeds

50	54
58	64

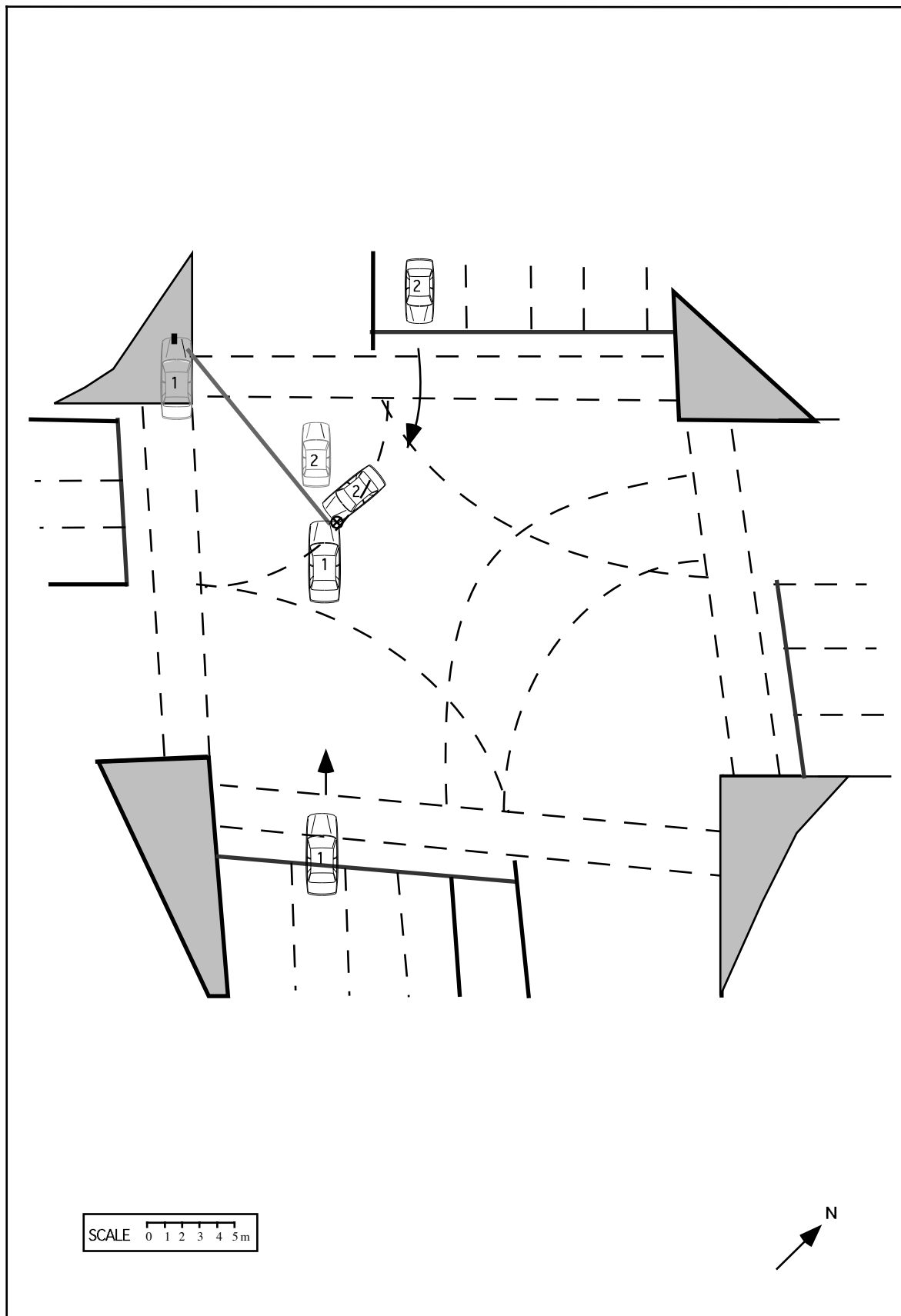
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	63	41
5 km/hour speed reduction	58	58	40
10 km/hour speed reduction	53	53	38
Speed Limit 50 with similar compliance	53	53	38
Speed Limit 60 with total compliance	60	60	40

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	51
5 km/hour speed reduction	50
10 km/hour speed reduction	47
Speed Limit 50 with similar compliance	47
Speed Limit 60 with total compliance	50

CN145



CN146

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (8.7m).

Reconstruction Notes

Assumed Unit 2 drove forward after crash to clear roadway.
Assumed Unit 1 steered slightly after impact.

Case Vehicle Speeds

Free Travelling Speed	62
Impact Speed	39

Control Speeds

56	57
61	62

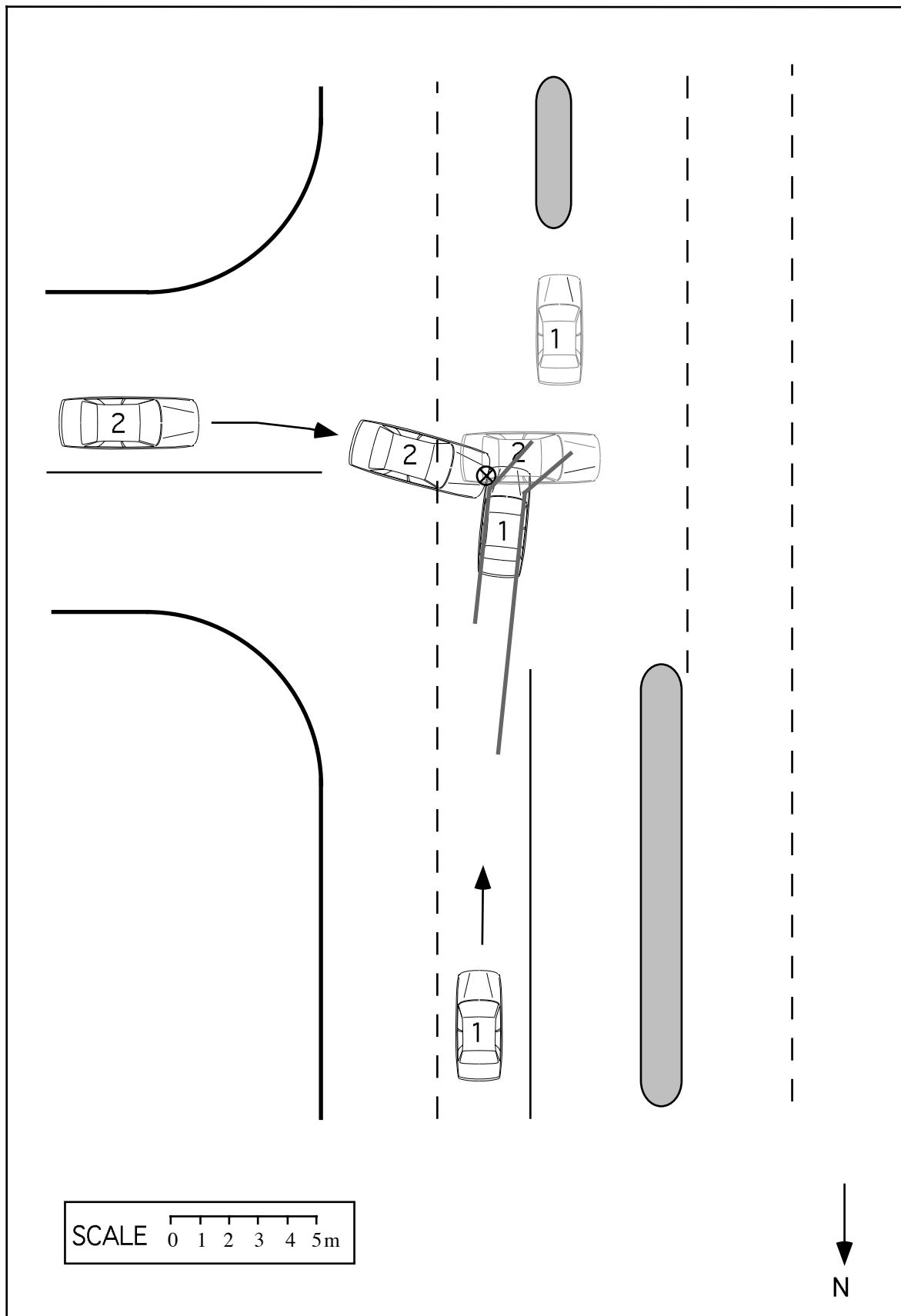
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	62	39	14
5 km/hour speed reduction	57	24	11
10 km/hour speed reduction	52	0	0
Speed Limit 50 with similar compliance	52	0	0
Speed Limit 60 with total compliance	60	34	16

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	9
5 km/hour speed reduction	8
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	9

C N 1 4 6



CN147

Crash Description

Unit 2 doing U-turn across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (9m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	75
Impact Speed	54

Control Speeds

59	63
65	66

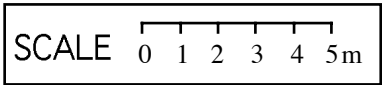
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	75	54	29
5 km/hour speed reduction	70	43	24
10 km/hour speed reduction	65	29	18
Speed Limit 50 with similar compliance	65	29	18
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	18
10 km/hour speed reduction	12
Speed Limit 50 with similar compliance	12
Speed Limit 60 with total compliance	0

C N 1 4 7



CN148

Crash Description

Pedestrian walked across path of Unit 1. Unit 1 applied brakes and struck pedestrian with right side mirror.

Injury Outcomes

Pedestrian treated at hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid mark length (15.1m).

Impact speed from post-impact skid mark (1m).

Reconstruction Notes

Uncertain about pedestrian impact point.

Does not affect travelling speed estimate.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	13

Control Speeds

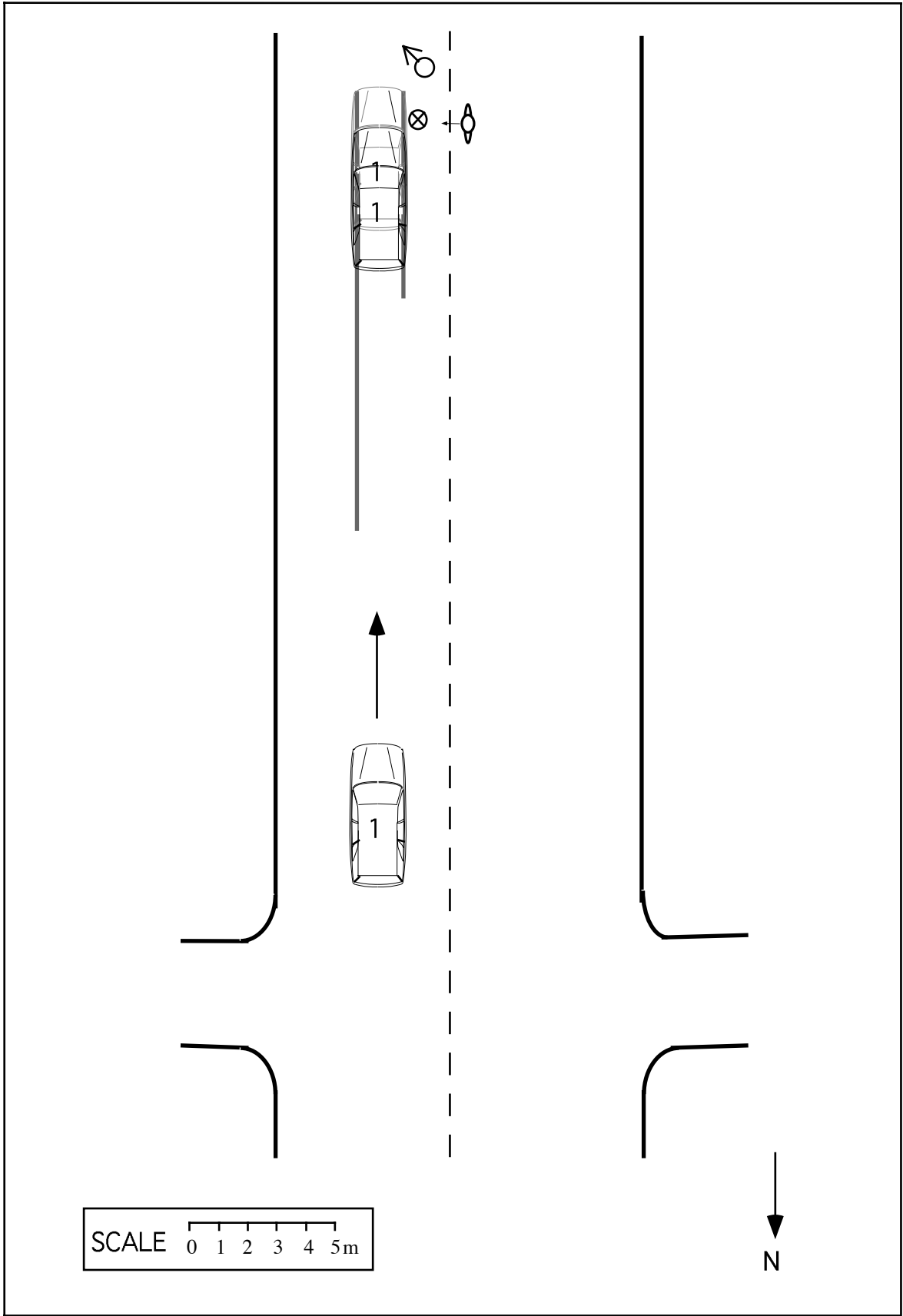
59	51
53	62

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	13	0
5 km/hour speed reduction	53	0	0
10 km/hour speed reduction	48	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	58	13	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	13
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	13



CN149

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver injured but not treated or transported.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (12.7m)

Reconstruction Notes

Weight of Unit 1 estimated (loaded with cargo of unknown but significant mass).
Not a perfect match.

Case Vehicle Speeds

Free Travelling Speed	73
Impact Speed	45

Control Speeds

57	52
63	56

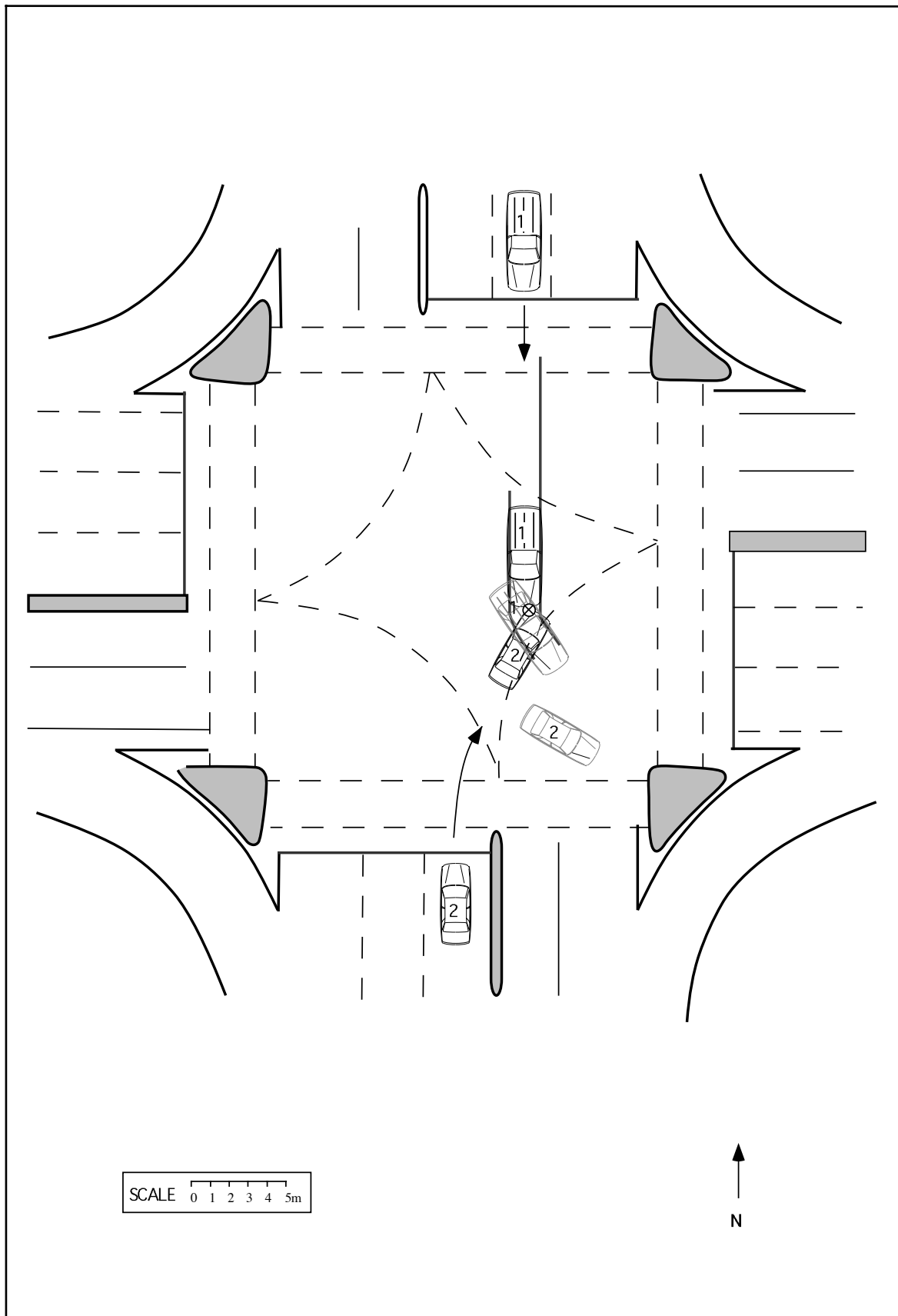
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	73	45	26
5 km/hour speed reduction	68	31	21
10 km/hour speed reduction	63	0	0
Speed Limit 50 with similar compliance	63	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	47
5 km/hour speed reduction	37
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN149



CN150

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (32.8m)

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	103
Impact Speed	51

Control Speeds

55	64
58	62

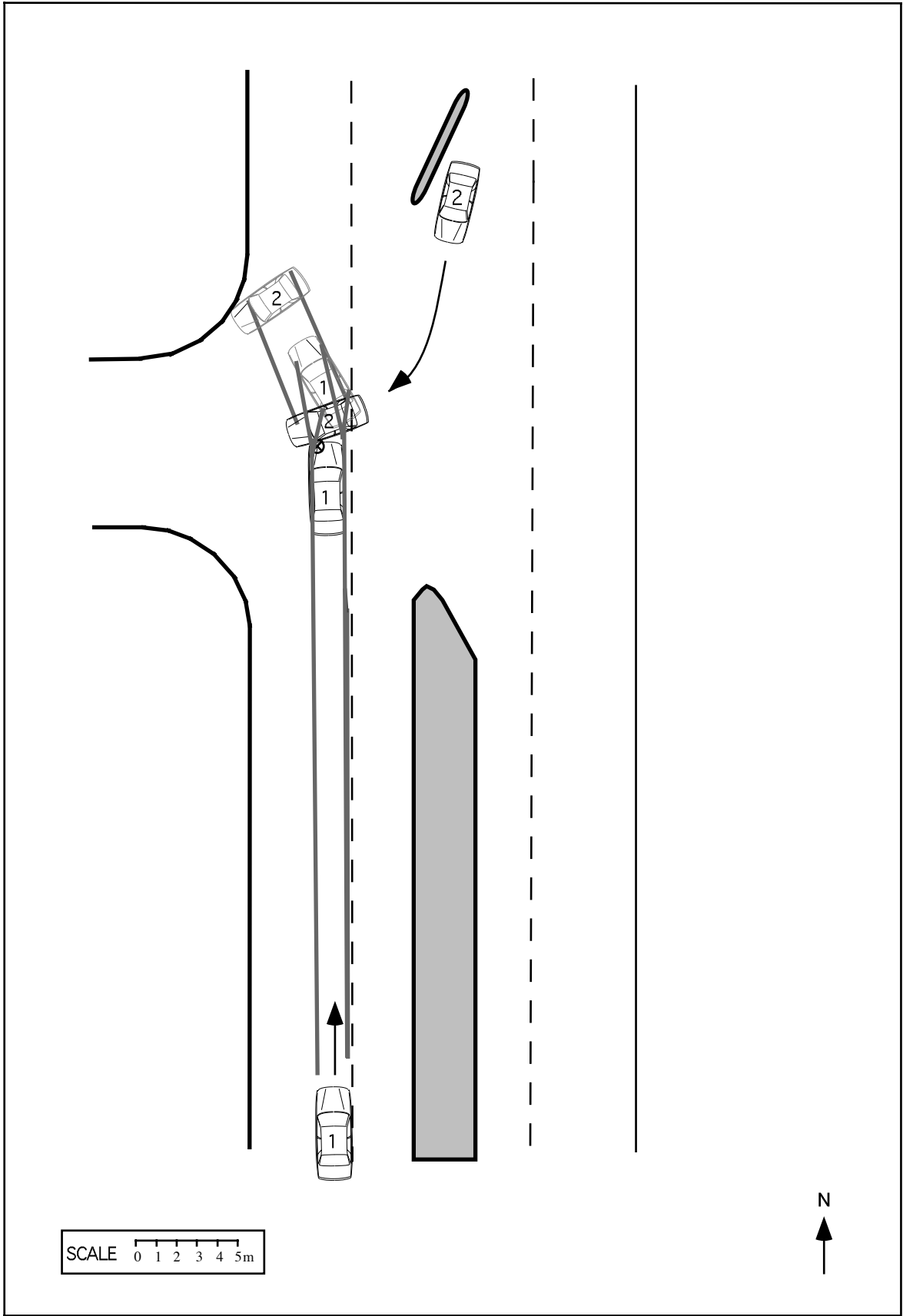
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	103	51	28
5 km/hour speed reduction	98	36	21
10 km/hour speed reduction	93	8	6
Speed Limit 50 with similar compliance	93	8	6
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	26
10 km/hour speed reduction	5
Speed Limit 50 with similar compliance	5
Speed Limit 60 with total compliance	0

CN150



CN151

Crash Description

Unit 2 forced to steer and brake to avoid collision with a vehicle that suddenly braked in front of it and travelled over the dividing line of a main road into the path of Unit 1. Unit 1 saw that a collision was imminent and applied brakes but still collided head-on with Unit 2. Both Units qualify as cases.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver admitted to hospital.
Unit 2 left front passenger treated at hospital.
Unit 2 right rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed of Unit 1 from skid marks (4m)
Travelling speed of Unit 2 from skid marks (5.4m)

Reconstruction Notes

Case Vehicle 1 Speeds

Free Travelling Speed	60
Impact Speed	47

Control 1 Speeds

60	62
61	57

Case Vehicle 2 Speeds

Free Travelling Speed	66
Impact Speed	50

Control 2 Speeds

66	58
61	61

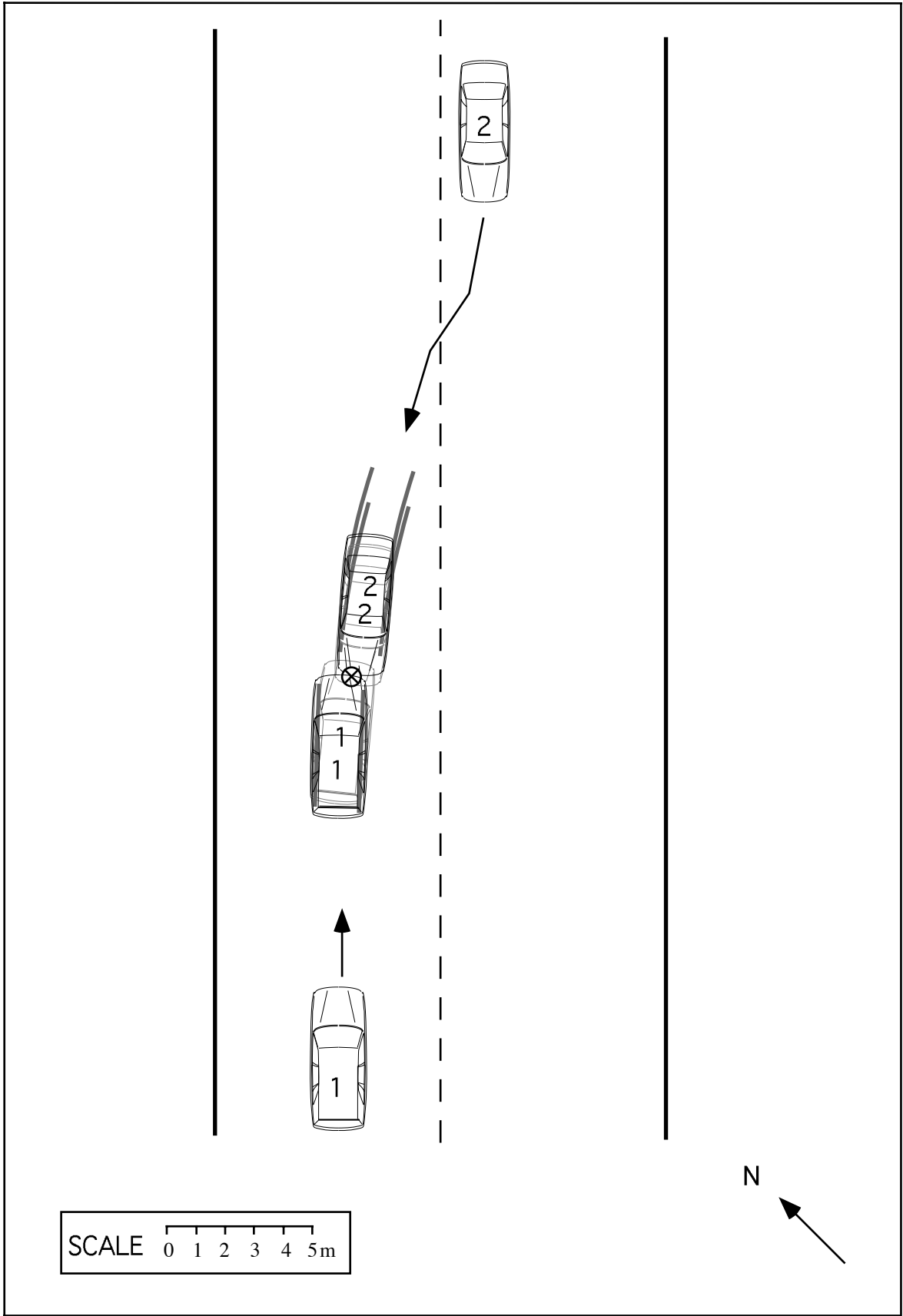
Hypothetical Scenarios (Case Vehicle 1)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	47	51
5 km/hour speed reduction	55	35	41
10 km/hour speed reduction	50	19	25
Speed Limit 50 with similar compliance	50	19	25
Speed Limit 60 with total compliance	60	46	46

Hypothetical Scenarios (Case Vehicle 2)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	50	54
5 km/hour speed reduction	61	39	43
10 km/hour speed reduction	56	23	26
Speed Limit 50 with similar compliance	56	23	26
Speed Limit 60 with total compliance	60	37	47

CN151



CN153

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Road works on road Unit 2 was on blocked the 2 right lanes so Unit 2 forced to do a right hand turn from the left most lane.

Injury Outcomes

Unit 2 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (9.4m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	60
Impact Speed	35

Control Speeds

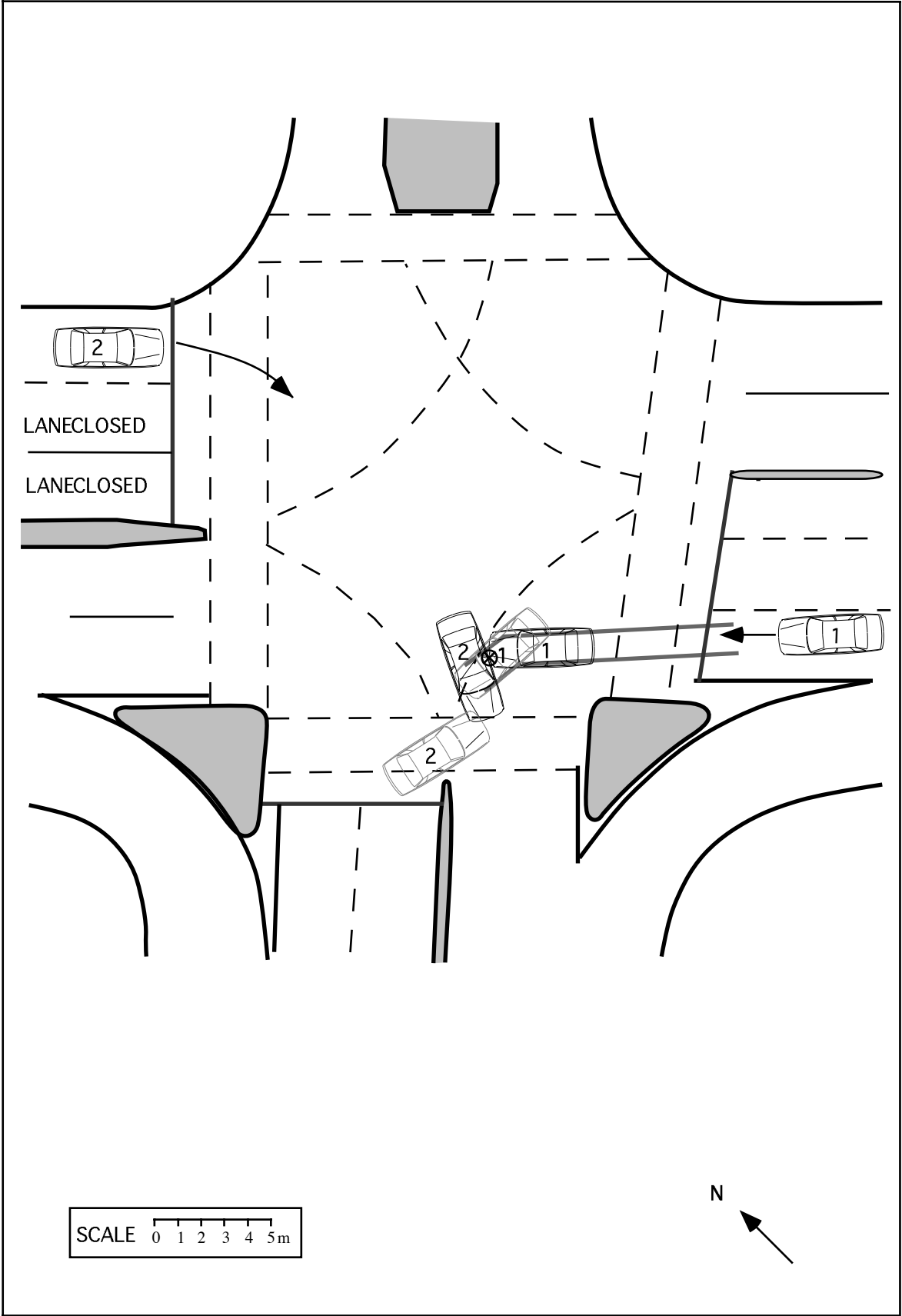
67	58
59	63

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	60	35	24
5 km/hour speed reduction	55	17	13
10 km/hour speed reduction	50	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	60	35	24

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	18
5 km/hour speed reduction	9
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	18



CN154

Crash Description

Pedestrian crossed from median strip to footpath across path of Unit 1. Unit 1 applied brakes and struck pedestrian.

Injury Outcomes

Pedestrian admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid mark length (21m).
Impact speed from post-impact skid mark length (10m).

Reconstruction Notes

Some uncertainty about where pedestrian was hit.
Does not affect travelling speed estimate.

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	42

Control Speeds

60	57
67	56

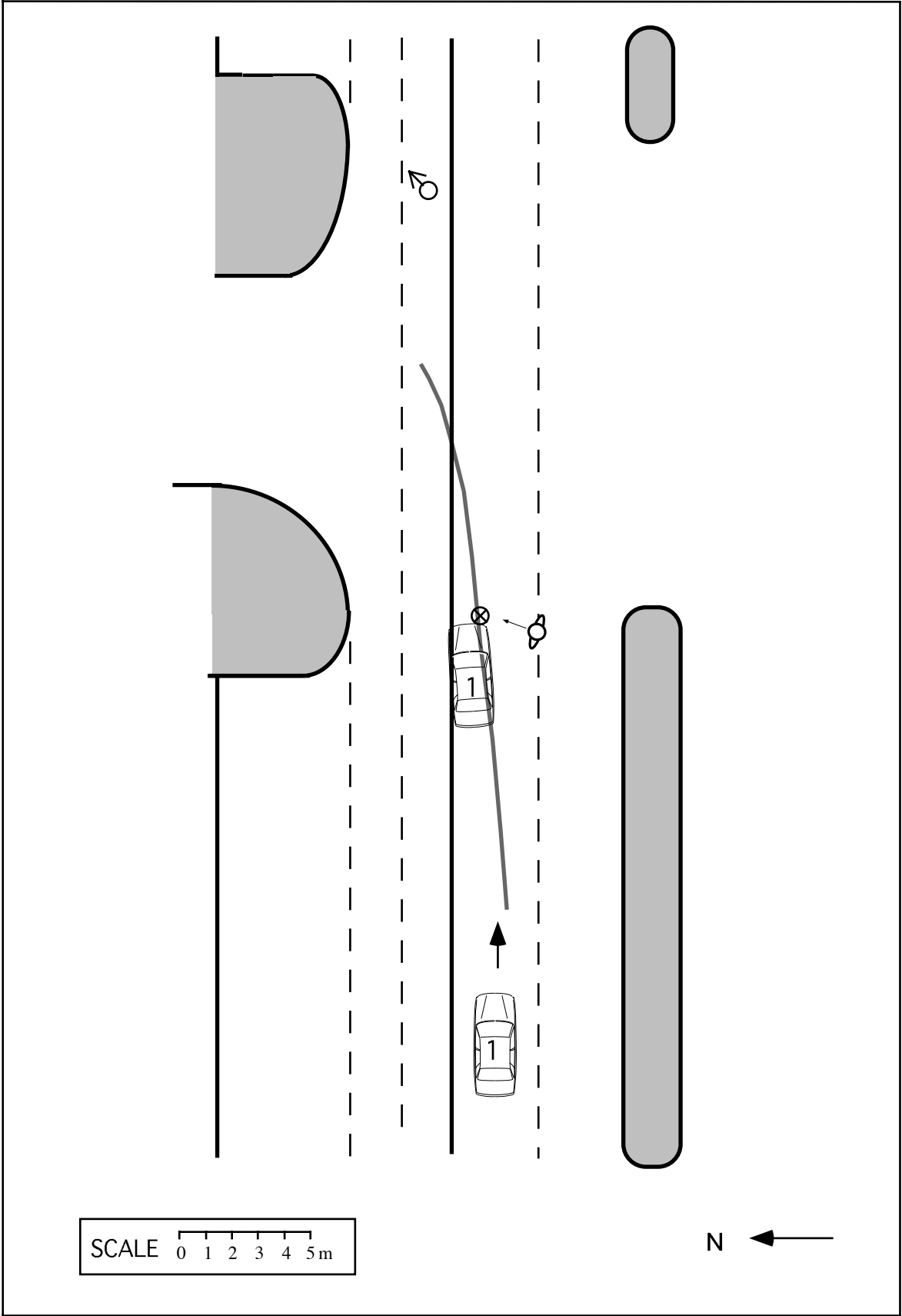
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	42	0
5 km/hour speed reduction	63	27	0
10 km/hour speed reduction	58	0	0
Speed Limit 50 with similar compliance	58	0	0
Speed Limit 60 with total compliance	60	11	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	42
5 km/hour speed reduction	27
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	11

C N 154



CN155

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 2 came to a stop after a further minor collision with a traffic pole.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 2 and SMAC run.

Travelling speed from pre-impact skid marks (11m).

Reconstruction Notes

Final position of Unit 1 unknown.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	38

Control Speeds

66	53
59	47

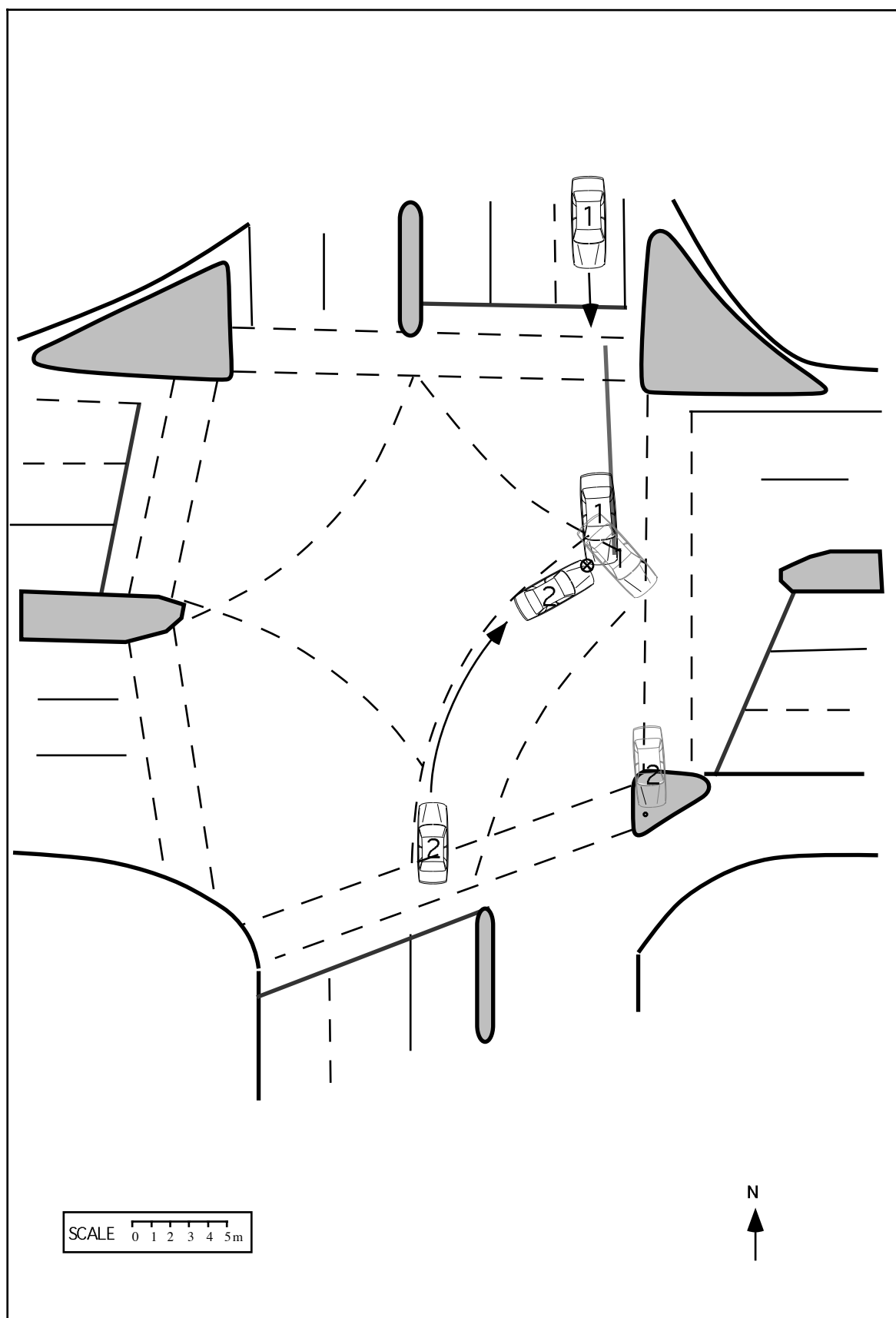
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	38	20
5 km/hour speed reduction	60	21	15
10 km/hour speed reduction	55	0	0
Speed Limit 50 with similar compliance	55	0	0
Speed Limit 60 with total compliance	60	21	15

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	29
5 km/hour speed reduction	22
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	22

CN155



CN156

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (12.3m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	71
Impact Speed	43

Control Speeds

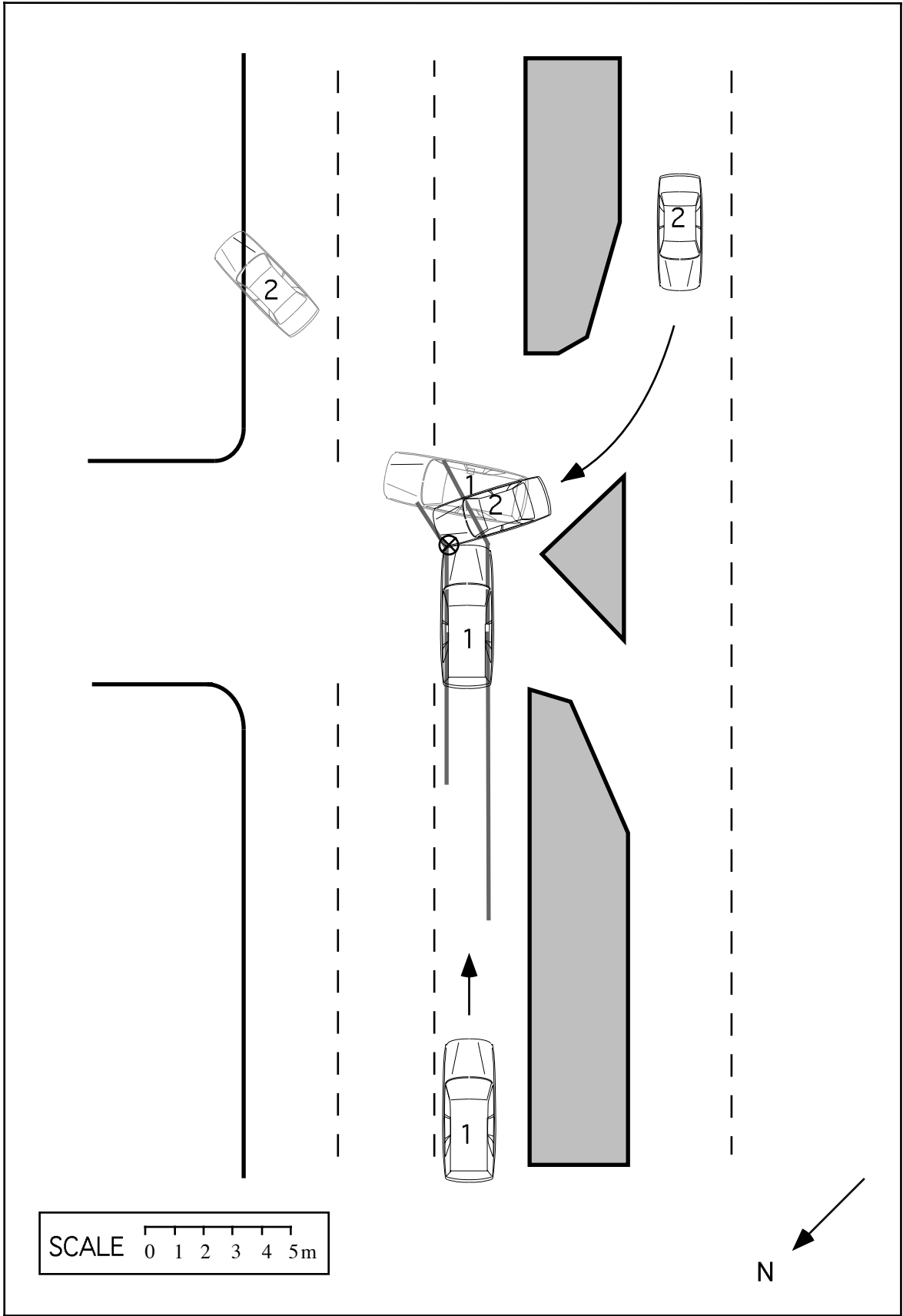
57	60
63	64

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	71	43	25
5 km/hour speed reduction	66	29	19
10 km/hour speed reduction	61	0	0
Speed Limit 50 with similar compliance	61	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	26
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0



CN158

Crash Description

Unit 2 disobeyed a traffic light and travelled across path of Unit 1. Unit 1 applied brakes and collided with Unit 2 at a right angle. Unit 2 subsequently rolled over due to impact.

Injury Outcomes

Unit 2 driver admitted to hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from pre-impact skid mark (5.6m).

Reconstruction Notes

Final position of Unit 2 unable to be matched using SMAC due to it rolling over.

Case Vehicle Speeds

Free Travelling Speed	55
Impact Speed	38

Control Speeds

63	59
64	47

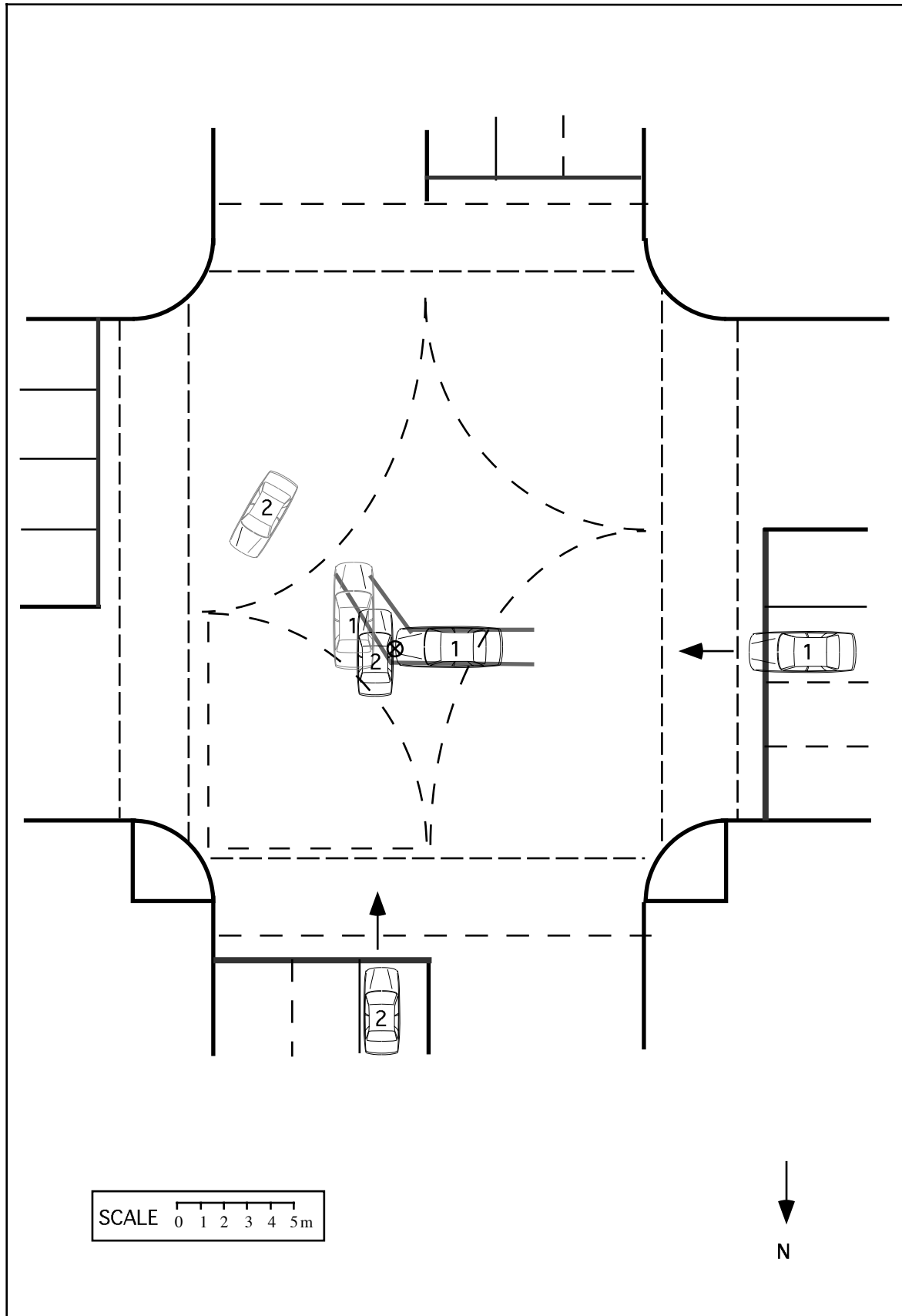
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	55	38	17
5 km/hour speed reduction	50	23	11
10 km/hour speed reduction	45	0	0
Speed Limit 50 with similar compliance	50	23	11
Speed Limit 60 with total compliance	55	38	17

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	16
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	16
Speed Limit 60 with total compliance	26

CN158



CN159

Crash Description

Unit 1 travelling on main road and struck rear right corner of a parked heavy truck.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 1 and SMAC run.

Reconstruction Notes

High stiffness value given to truck.

Higher delta V for lower impact speed due to longer contact time.

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	58

Control Speeds

61	59
58	55

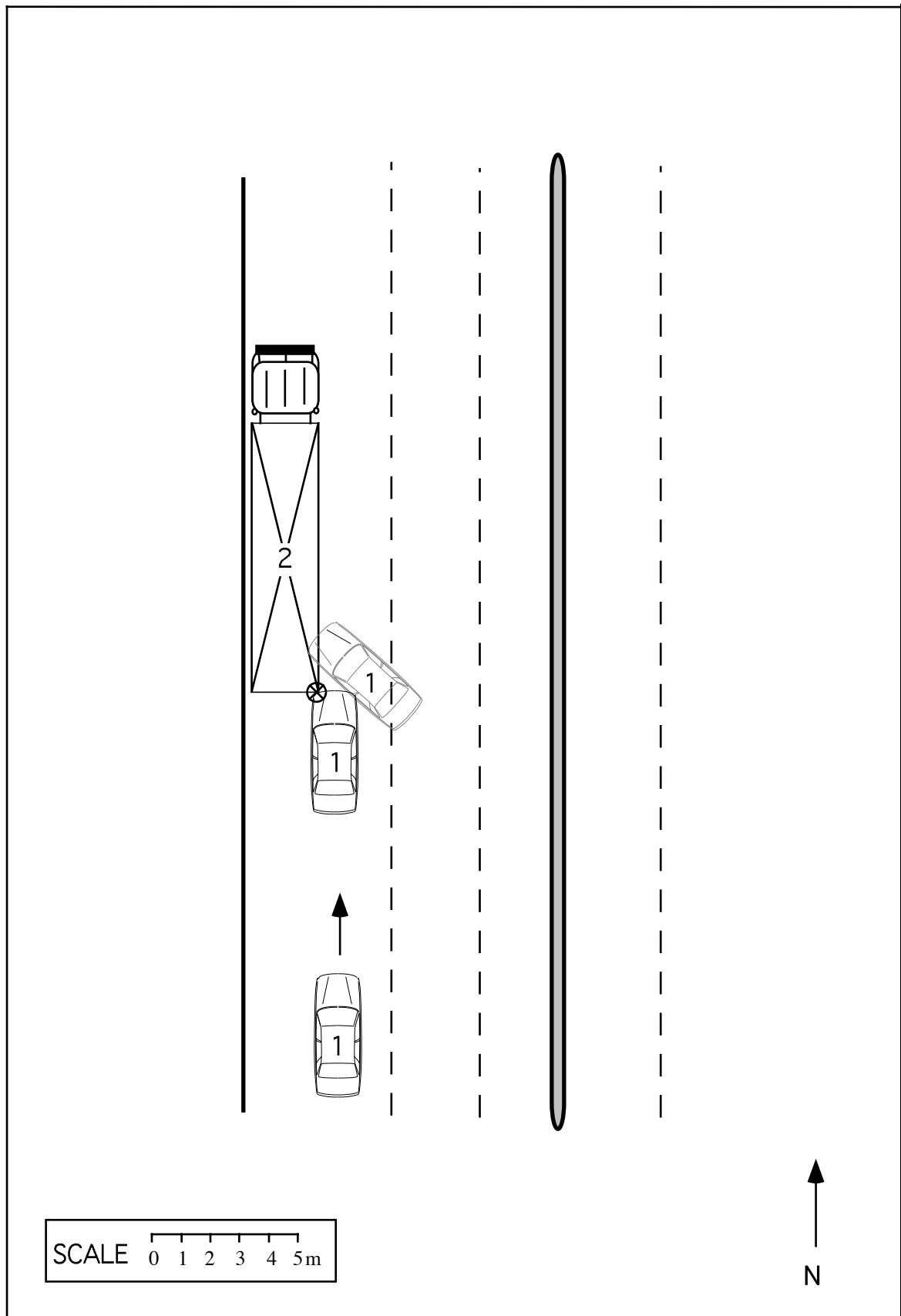
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	58	47
5 km/hour speed reduction	53	53	49
10 km/hour speed reduction	48	48	46
Speed Limit 50 with similar compliance	50	50	47
Speed Limit 60 with total compliance	58	58	47

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	2
5 km/hour speed reduction	2
10 km/hour speed reduction	1
Speed Limit 50 with similar compliance	1
Speed Limit 60 with total compliance	1

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CN160

Crash Description

Unit 2 attempted a U-Turn in front of Unit 1. Unit 1 applied brakes and then collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (5.5m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	43
Impact Speed	22

Control Speeds

60	56
53	71

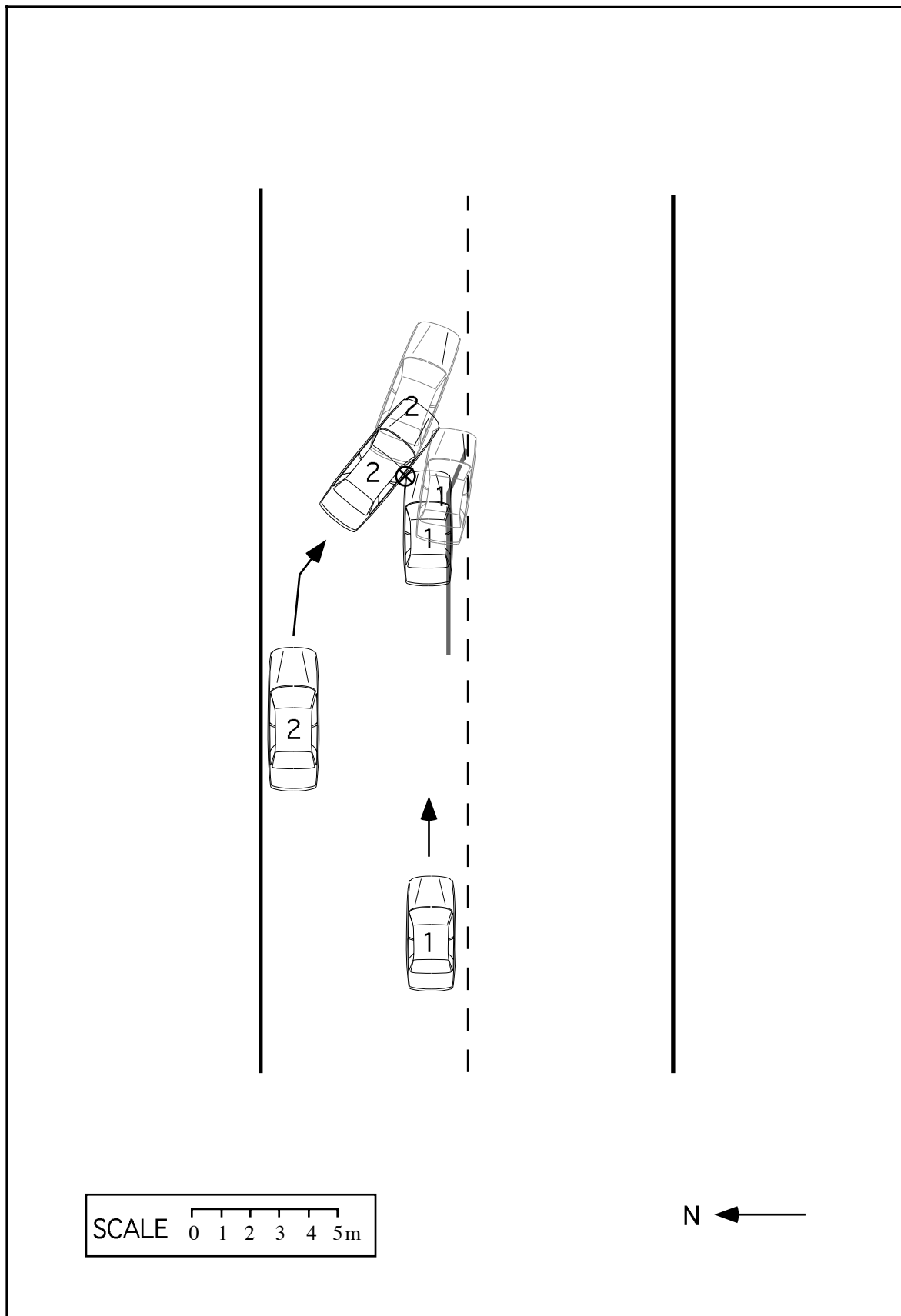
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	43	22	12
5 km/hour speed reduction	38	0	0
10 km/hour speed reduction	33	0	0
Speed Limit 50 with similar compliance	43	22	12
Speed Limit 60 with total compliance	43	22	12

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	3
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	3
Speed Limit 60 with total compliance	3

CN160



CN161

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 had ABS so pre-impact braking could not be determined.
Unlikely that any pre-impact braking was significant.

Case Vehicle Speeds

Free Travelling Speed	56
Impact Speed	56

Control Speeds

54	63
61	51

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	56	56	34
5 km/hour speed reduction	51	51	32
10 km/hour speed reduction	46	46	30
Speed Limit 50 with similar compliance	56	56	34
Speed Limit 60 with total compliance	56	56	34

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	41
5 km/hour speed reduction	38
10 km/hour speed reduction	35
Speed Limit 50 with similar compliance	41
Speed Limit 60 with total compliance	41

The diagram illustrates a road intersection with a central dashed line. A vehicle labeled '1' is shown entering from the bottom left, moving towards the center. A vehicle labeled '2' is shown entering from the top right, moving towards the center. The paths of both vehicles are indicated by dashed lines. A shaded area represents the collision zone, which is a rectangular area in the center of the intersection. A scale bar at the bottom left indicates a distance of 0 to 5 meters. A north arrow at the bottom right points towards the top right of the diagram.

CN162

Crash Description

Unit 2 travelling in left lane went to turn left into a driveway and swung out into the right lane. Unit 1 applied brakes and struck the rear left corner of Unit 2. Unit 2 subsequently forced into driveway and into fence.

Injury Outcomes

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid mark (14m).

Reconstruction Notes

Unit 2 final position not perfect. Assume some sort of post impact acceleration.

Case Vehicle Speeds

Free Travelling Speed	70
Impact Speed	38

Control Speeds

59	61
61	61

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	70	38	12
5 km/hour speed reduction	65	20	5
10 km/hour speed reduction	60	0	0
Speed Limit 50 with similar compliance	60	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	12
5 km/hour speed reduction	3
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

The diagram illustrates a collision between two vehicles at a T-junction. Vehicle 1, a car, is traveling straight through the junction. Vehicle 2, a car, is turning right across the path of vehicle 1. The diagram shows the positions of the vehicles before and after the collision, with a dashed line indicating the path of vehicle 1. A scale bar at the bottom left indicates 0 to 5 meters. A north arrow at the bottom right points upwards.

CN165

Crash Description

Unit 2 stationary behind a stationary turning Unit 3. Unit 1 applied brakes and collided with rear of Unit 2 and forced it into the rear of Unit 3.

Injury Outcomes

Unit 1 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from pre-impact skid marks (9.0m)

Reconstruction Notes

Final position of Unit 2 uncertain.

Case Vehicle Speeds

Free Travelling Speed	75
Impact Speed	54

Control Speeds

50	59
55	64

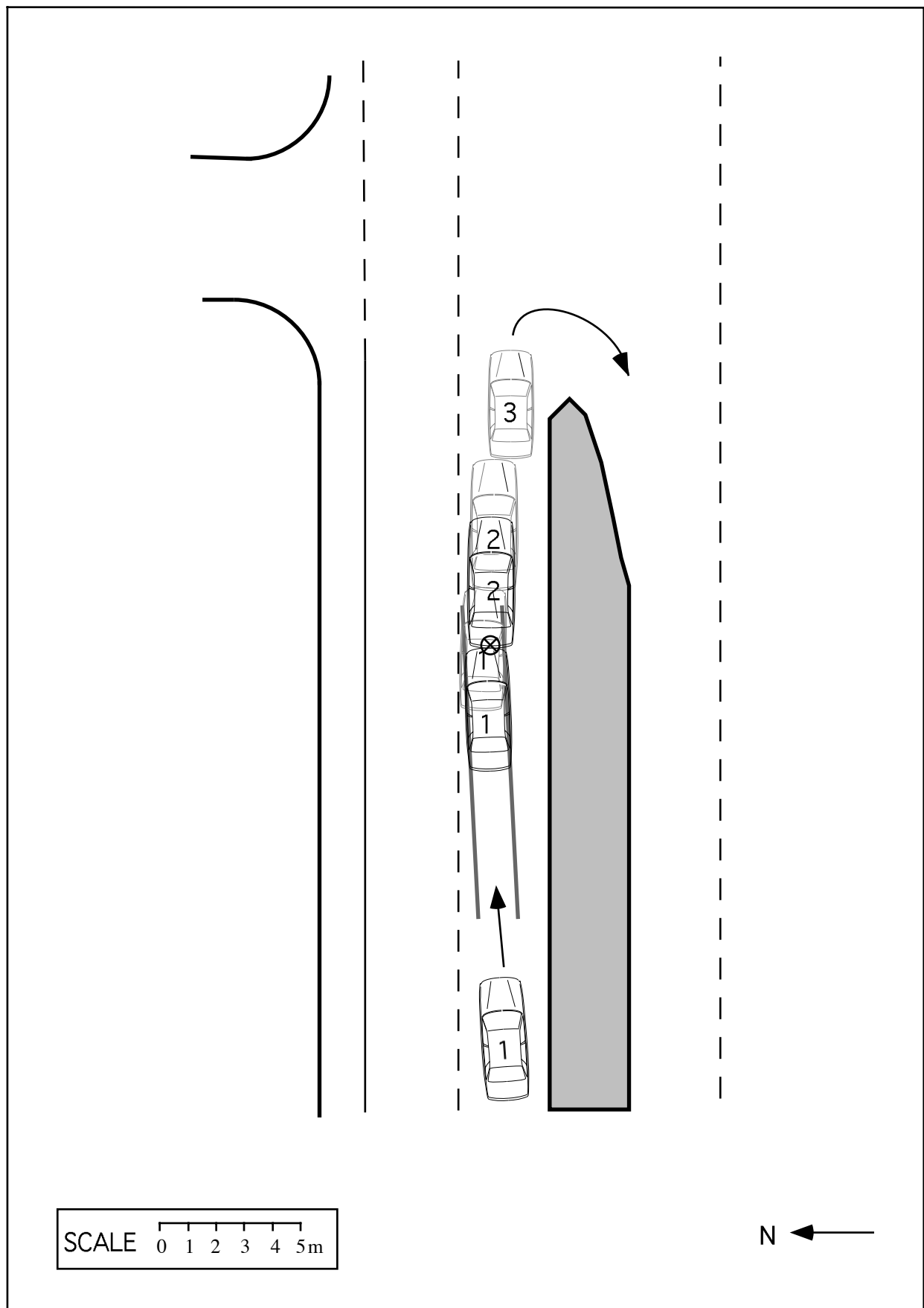
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	75	54	40
5 km/hour speed reduction	70	43	33
10 km/hour speed reduction	65	29	23
Speed Limit 50 with similar compliance	65	29	23
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	28
5 km/hour speed reduction	22
10 km/hour speed reduction	15
Speed Limit 50 with similar compliance	15
Speed Limit 60 with total compliance	0

C N 165



CN166

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 2 then had minor collision with Unit 3.

Injury Outcomes

Unit 1 left front passenger treated at hospital.
Unit 2 left front passenger admitted to hospital.
Unit 2 rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid mark (5.9m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	58
Impact Speed	41

Control Speeds

63	56
60	59

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	58	41	28
5 km/hour speed reduction	53	27	20
10 km/hour speed reduction	48	0	0
Speed Limit 50 with similar compliance	50	11	11
Speed Limit 60 with total compliance	58	41	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	25
5 km/hour speed reduction	16
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	8
Speed Limit 60 with total compliance	25

The diagram illustrates a vehicle accident scene at a T-junction. A car labeled '1' is on the main road, and a car labeled '2' is on the side road. A car labeled '3' is parked on the side road. A scale bar indicates 0 to 5 meters, and a north arrow points upwards.

CN168

Crash Description

Unit 1 travelling on a main road. Unit 2 turned right out of a side street across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 2 spun around and re-hit Unit 1.

Injury Outcomes

Unit 1 left front passenger treated by private doctor.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (17.6m)

Reconstruction Notes

Assumed that Unit 2 accelerated out of side street and was still accelerating after initial impact and re-hit was a result of this.

Case Vehicle Speeds

Free Travelling Speed	80
Impact Speed	45

Control Speeds

62	58
60	64

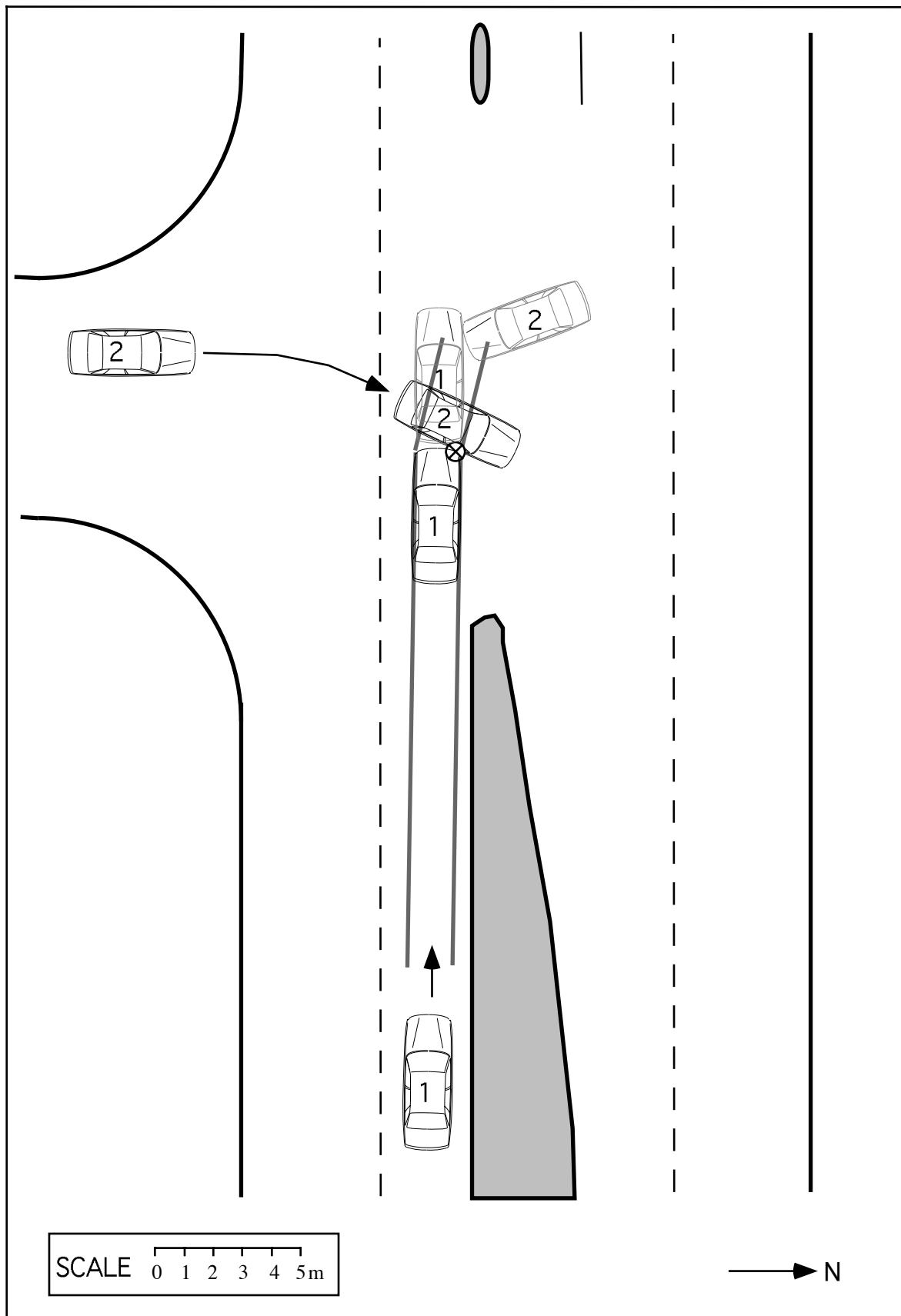
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	80	45	25
5 km/hour speed reduction	75	30	18
10 km/hour speed reduction	70	0	0
Speed Limit 50 with similar compliance	70	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	28
5 km/hour speed reduction	18
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN168



CN170

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and then collided with Unit 2. Unit 2 then had minor collision with Unit 3.

Injury Outcomes

Unit 2 driver admitted to hospital.
Unit 2 left front passenger fatally injured.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from pre-impact skid marks (20m).

Reconstruction Notes

Unit 2 accelerated after impact so did not have meaningful final position.

Case Vehicle Speeds

Free Travelling Speed	90
Impact Speed	54

Control Speeds

61	64
65	67

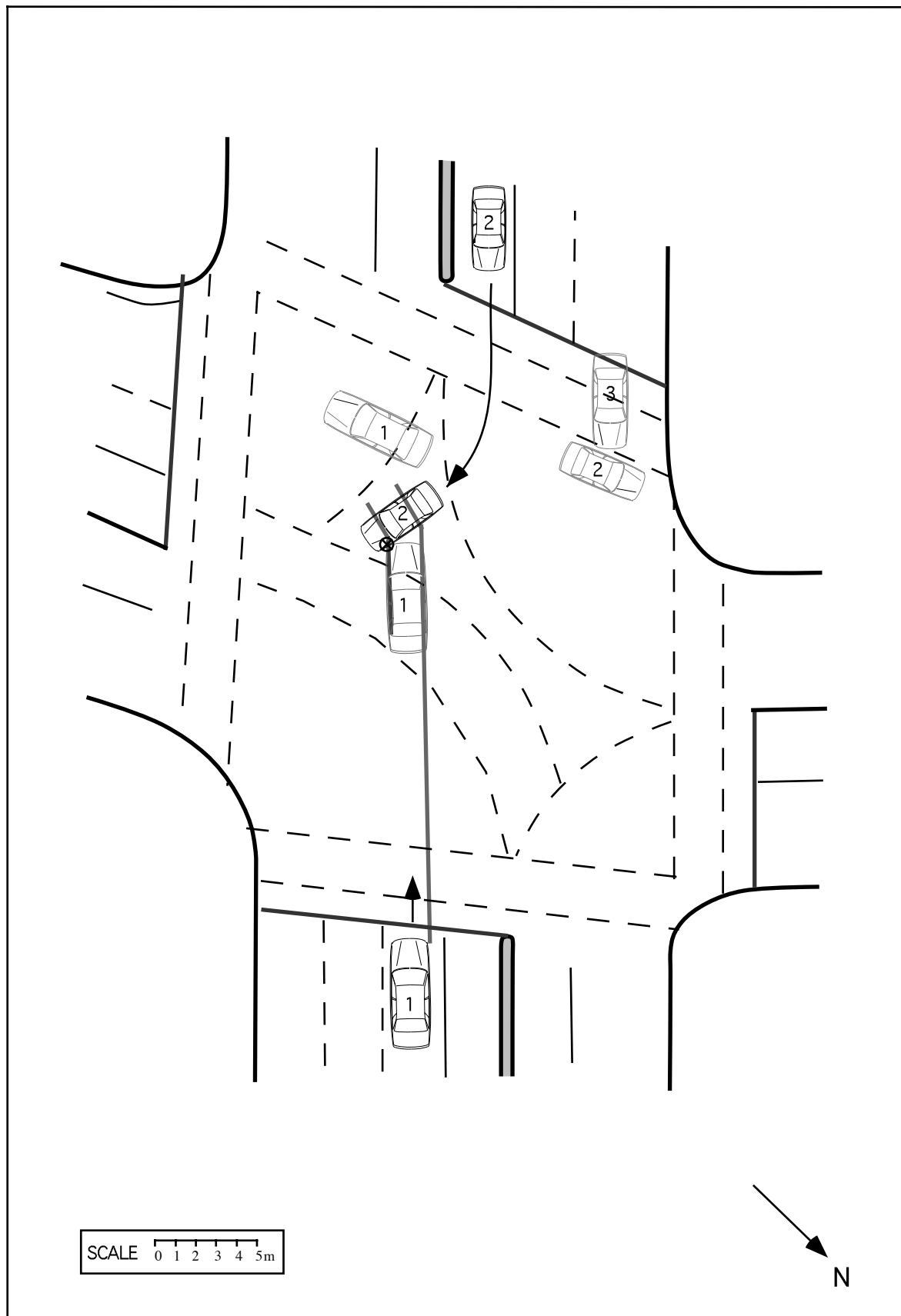
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	90	54	26
5 km/hour speed reduction	85	42	21
10 km/hour speed reduction	80	24	14
Speed Limit 50 with similar compliance	80	24	14
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	42
5 km/hour speed reduction	33
10 km/hour speed reduction	19
Speed Limit 50 with similar compliance	19
Speed Limit 60 with total compliance	0

CN170



CN171

Crash Description

Unit 1 lost control and mounted curb and then skidded into stobie pole.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from pole impact (450mm = 33kph).
Travelling speed from skid marks (18.8m).

Reconstruction Notes

Assumed CF of 0.7 for whole skid.

Case Vehicle Speeds

Free Travelling Speed	74
Impact Speed	33

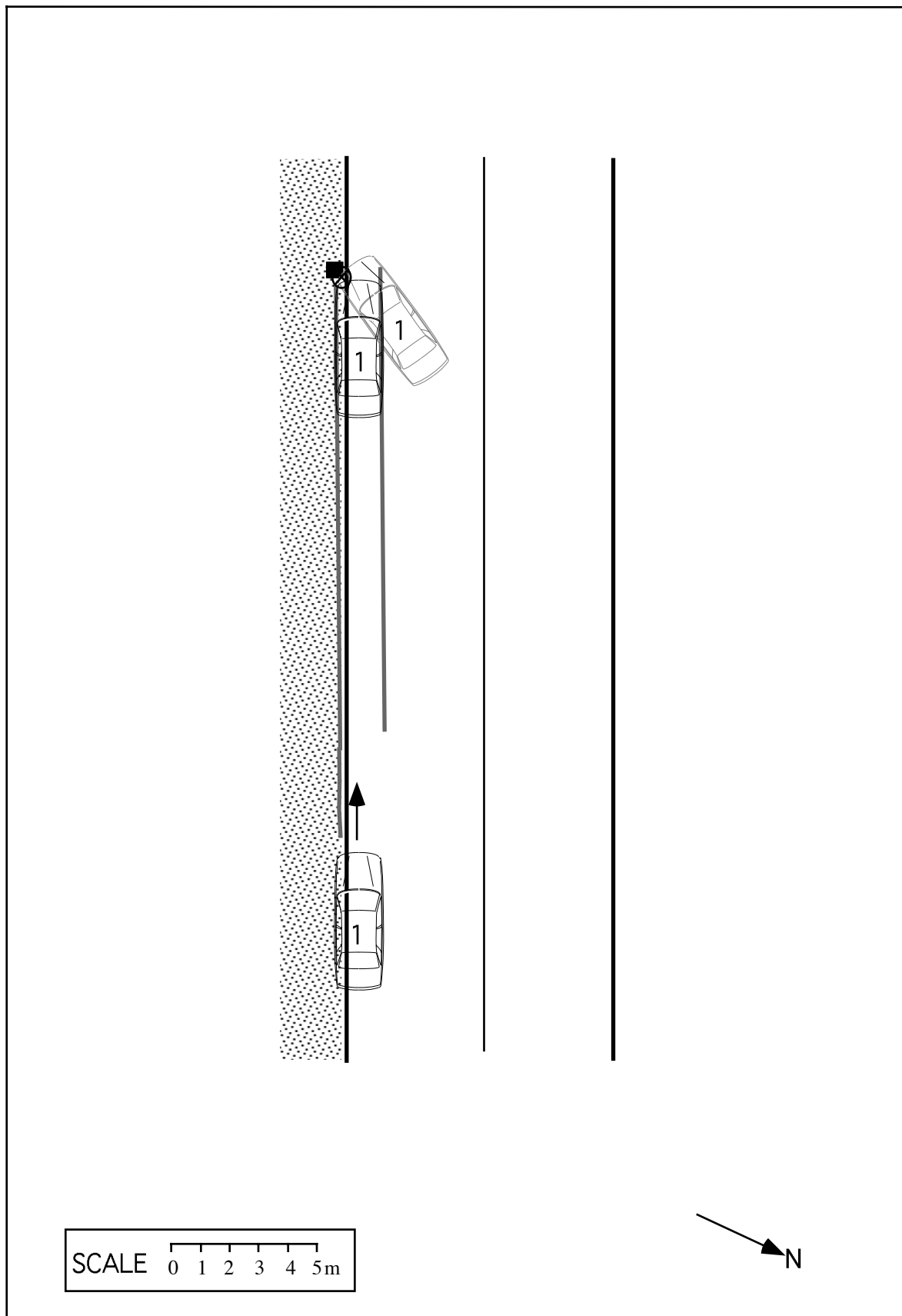
Control Speeds

48	54
56	63

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	74	33	33
5 km/hour speed reduction	69	5	5
10 km/hour speed reduction	64	0	0
Speed Limit 50 with similar compliance	64	0	0
Speed Limit 60 with total compliance	60	0	0

CN171



CN172

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (10m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	75
Impact Speed	52

Control Speeds

54	56
61	74

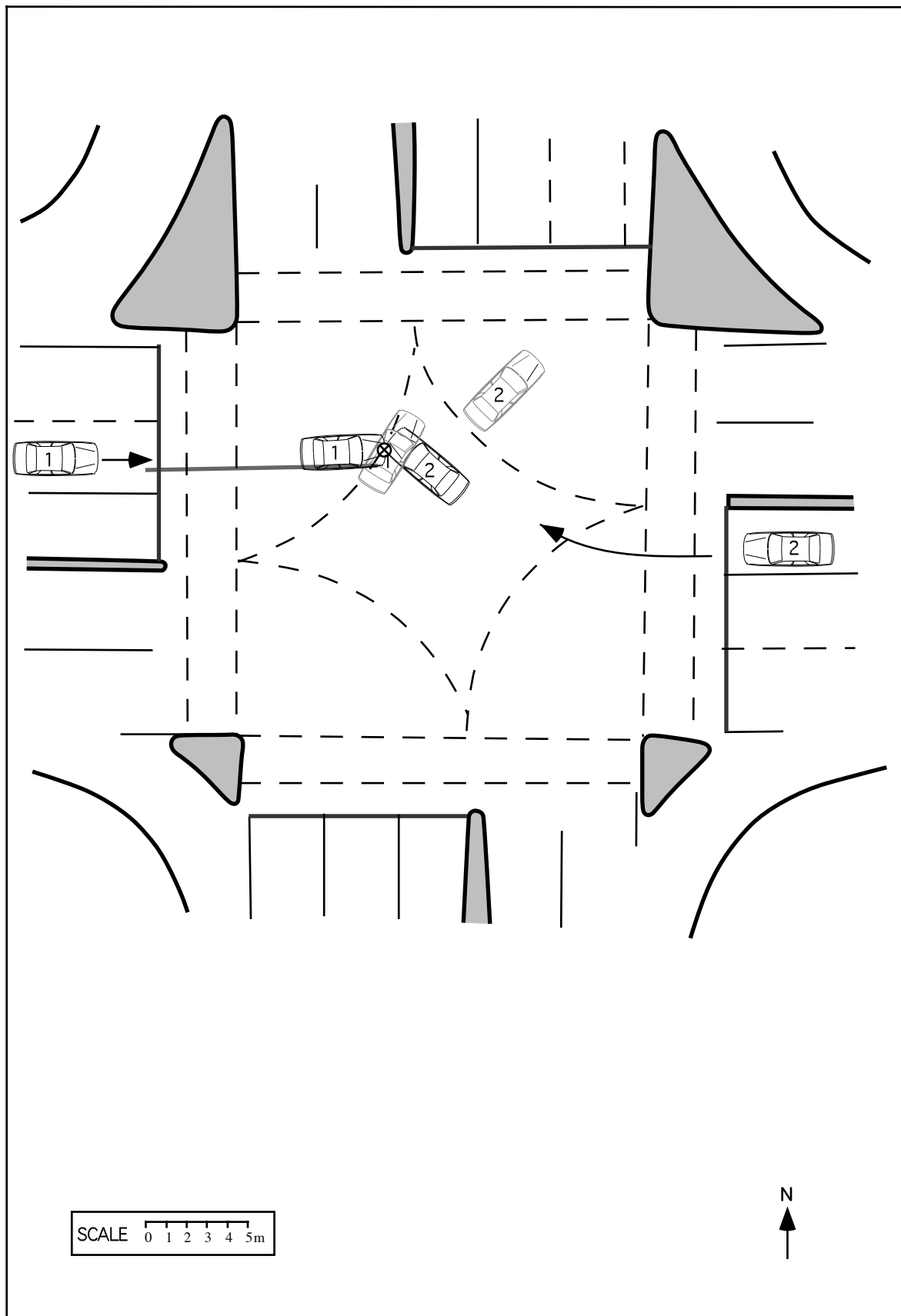
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	75	52	40
5 km/hour speed reduction	70	40	33
10 km/hour speed reduction	65	25	24
Speed Limit 50 with similar compliance	65	25	24
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	38
5 km/hour speed reduction	31
10 km/hour speed reduction	23
Speed Limit 50 with similar compliance	23
Speed Limit 60 with total compliance	0

CN172



CN178

Crash Description

Unit 2 turned across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.
Travelling speed from skid marks (17m).

Reconstruction Notes

Unit 2 final position not perfect match.

Case Vehicle Speeds

Free Travelling Speed	85
Impact Speed	52

Control Speeds

66	48
56	61

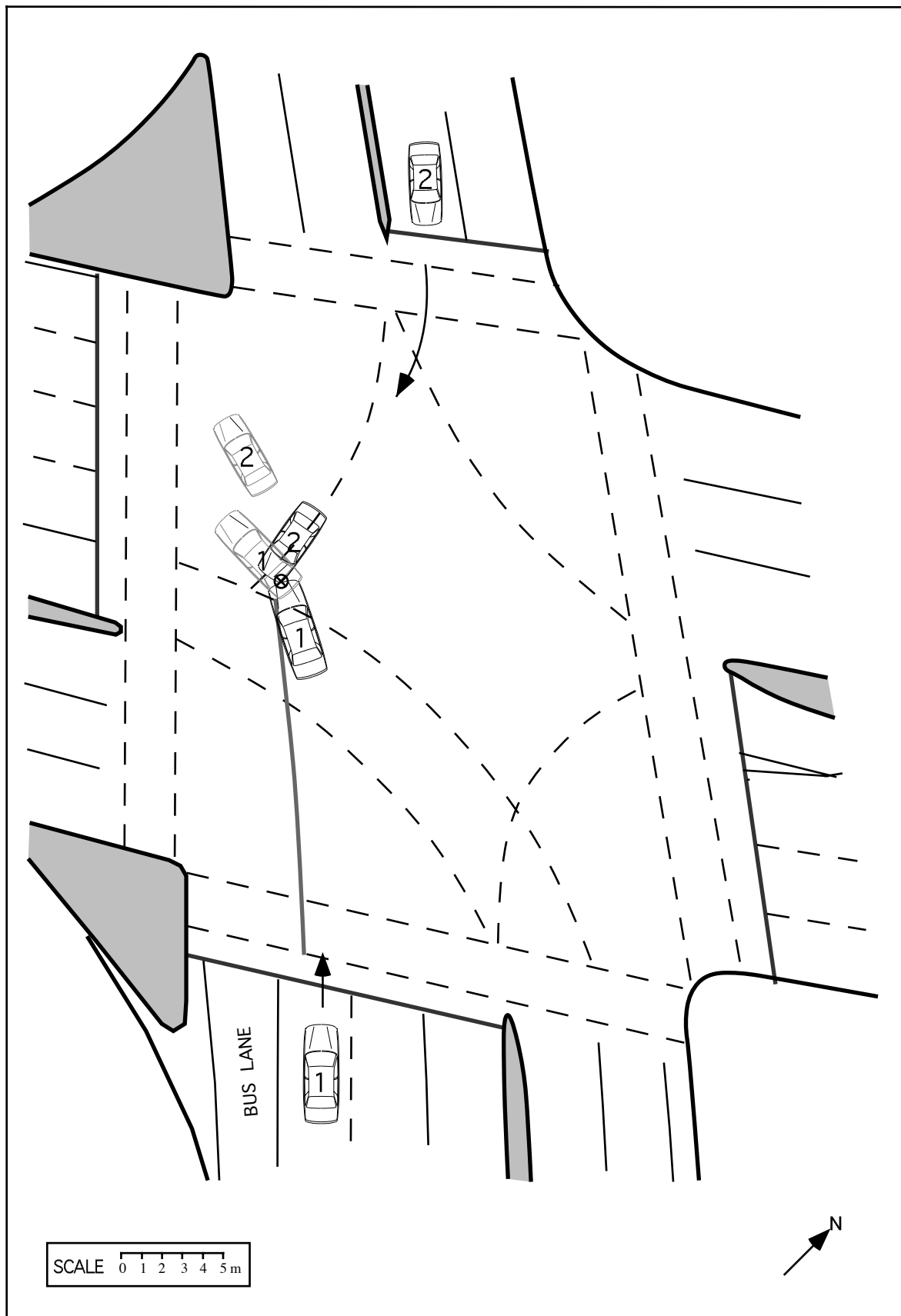
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	85	52	29
5 km/hour speed reduction	80	39	23
10 km/hour speed reduction	75	21	15
Speed Limit 50 with similar compliance	75	21	15
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	37
5 km/hour speed reduction	29
10 km/hour speed reduction	18
Speed Limit 50 with similar compliance	18
Speed Limit 60 with total compliance	0

CN178



CN179

Crash Description

Unit 2 stopped at stop sign and then proceeded through intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.

Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (9m).

Reconstruction Notes

Assumed Unit 1 coasted for a while after impact.

Case Vehicle Speeds

Free Travelling Speed	78
Impact Speed	57

Control Speeds

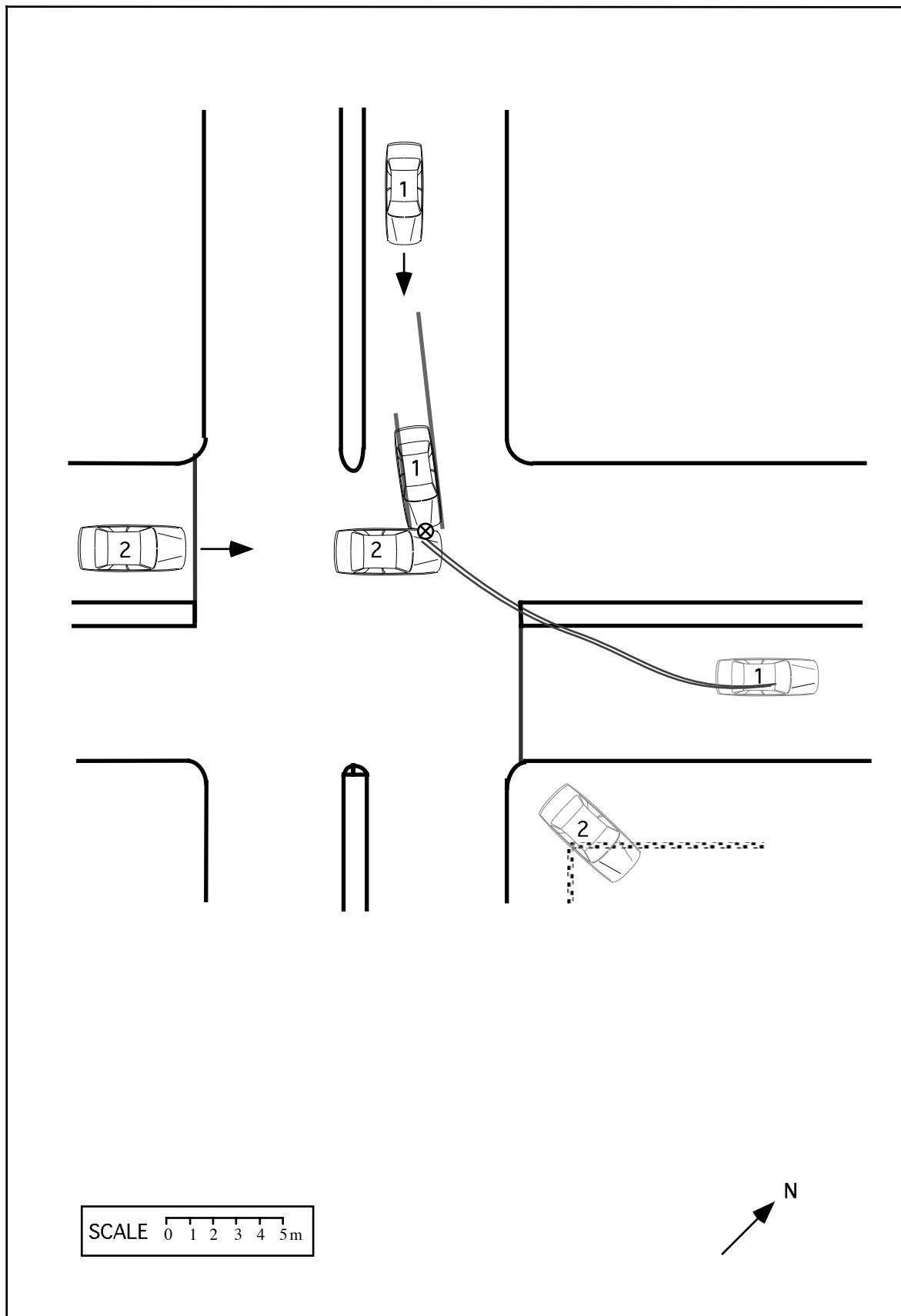
48	54
55	66

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	78	57	41
5 km/hour speed reduction	73	46	35
10 km/hour speed reduction	68	33	27
Speed Limit 50 with similar compliance	68	33	27
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	22
5 km/hour speed reduction	18
10 km/hour speed reduction	14
Speed Limit 50 with similar compliance	14
Speed Limit 60 with total compliance	0



CN180

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 2 driver treated by private doctor.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from pre-impact skid marks (6.8m).

Reconstruction Notes

Not a perfect reconstruction.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	47

Control Speeds

48	56
61	64

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	47	43
5 km/hour speed reduction	60	35	37
10 km/hour speed reduction	55	16	25
Speed Limit 50 with similar compliance	55	16	25
Speed Limit 60 with total compliance	60	35	37

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	33
5 km/hour speed reduction	28
10 km/hour speed reduction	19
Speed Limit 50 with similar compliance	19
Speed Limit 60 with total compliance	28

CN181

Crash Description

Unit 2 turned right out of a side street across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Final position of Unit 2 not certain - direction of travel after impact known.
May have been non-skid braking before impact.

Case Vehicle Speeds

Free Travelling Speed	45
Impact Speed	45

Control Speeds

61	55
61	54

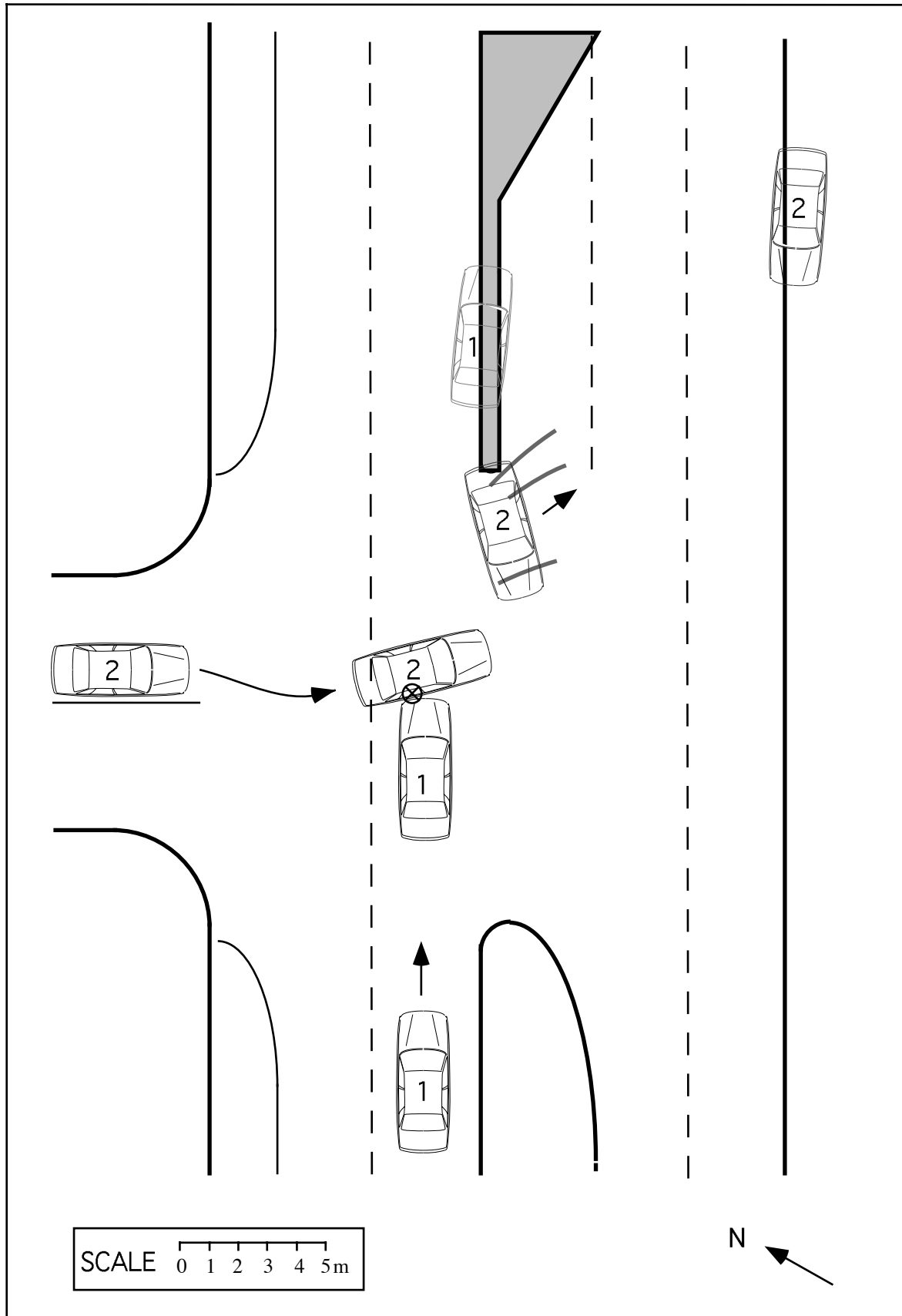
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	45	45	23
5 km/hour speed reduction	40	40	20
10 km/hour speed reduction	35	35	17
Speed Limit 50 with similar compliance	45	45	23
Speed Limit 60 with total compliance	45	45	23

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	25
5 km/hour speed reduction	22
10 km/hour speed reduction	19
Speed Limit 50 with similar compliance	25
Speed Limit 60 with total compliance	25

CN181



CN182

Crash Description

Unit 2 doing U-turn in front of Unit 1. Unit 1 applied brakes and collided with side of Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final position of Unit 1 and direction of travel of Unit 2 and SMAC run.
Travelling speed from pre-impact skid marks (6.4m).

Reconstruction Notes

Final position of Unit 2 unknown.

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	38

Control Speeds

61	61
63	70

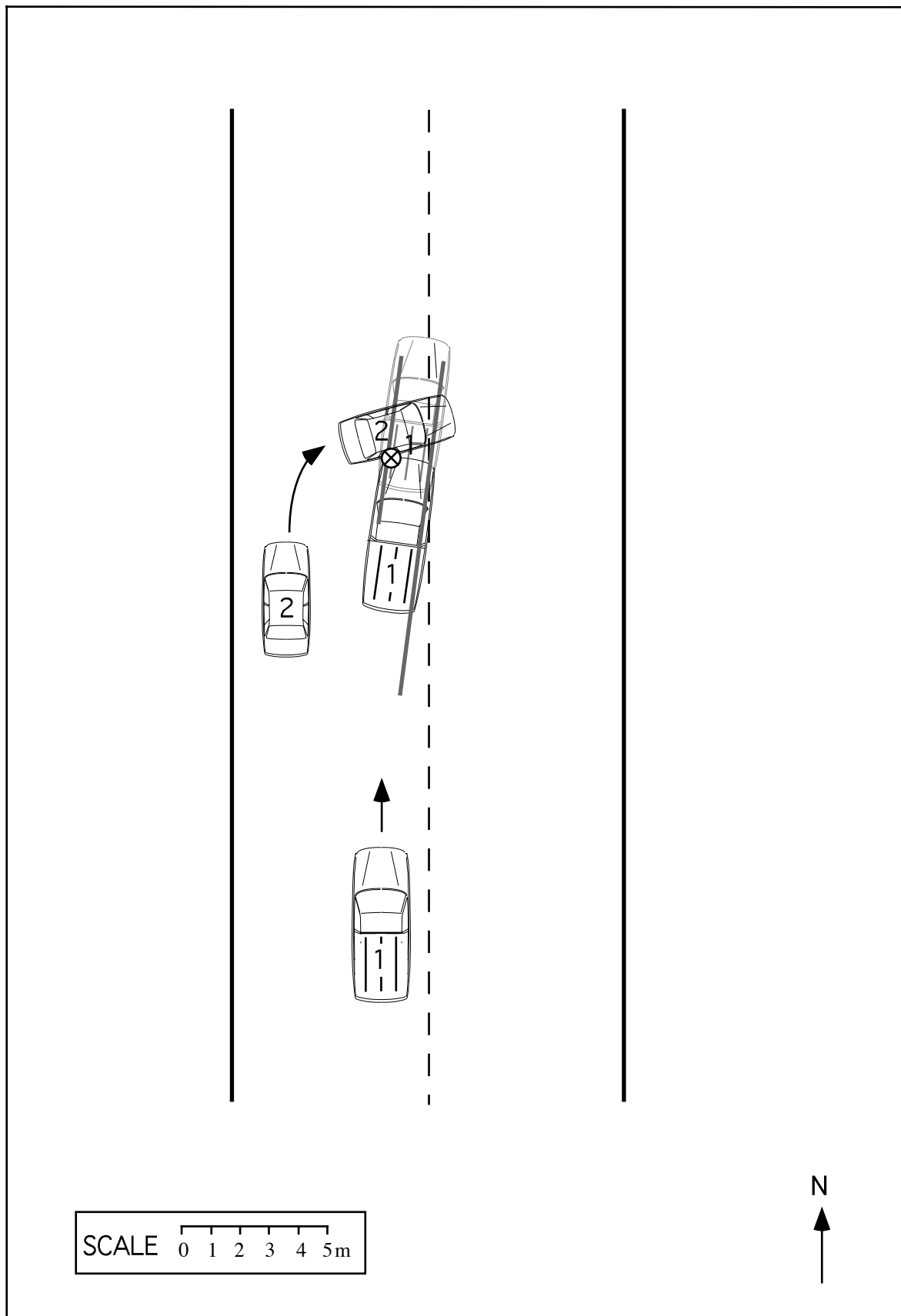
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	38	17
5 km/hour speed reduction	52	23	9
10 km/hour speed reduction	47	0	0
Speed Limit 50 with similar compliance	50	14	5
Speed Limit 60 with total compliance	57	38	17

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	19
5 km/hour speed reduction	9
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	3
Speed Limit 60 with total compliance	19

CN182



CN183

Crash Description

Unit 1 lost control on left hand bend in road, applied brakes, crossed to other side of road and had head on collision with Unit 2. Unit 2 not at a case since not doing a free speed.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 1 left front passenger admitted to hospital.
Unit 2 driver treated at hospital.
Unit 2 left front passenger treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (10m).

Reconstruction Notes

Skid mark length estimated (rained before could be marked).

Case Vehicle Speeds

Free Travelling Speed	74
Impact Speed	58

Control Speeds

59	63
67	72

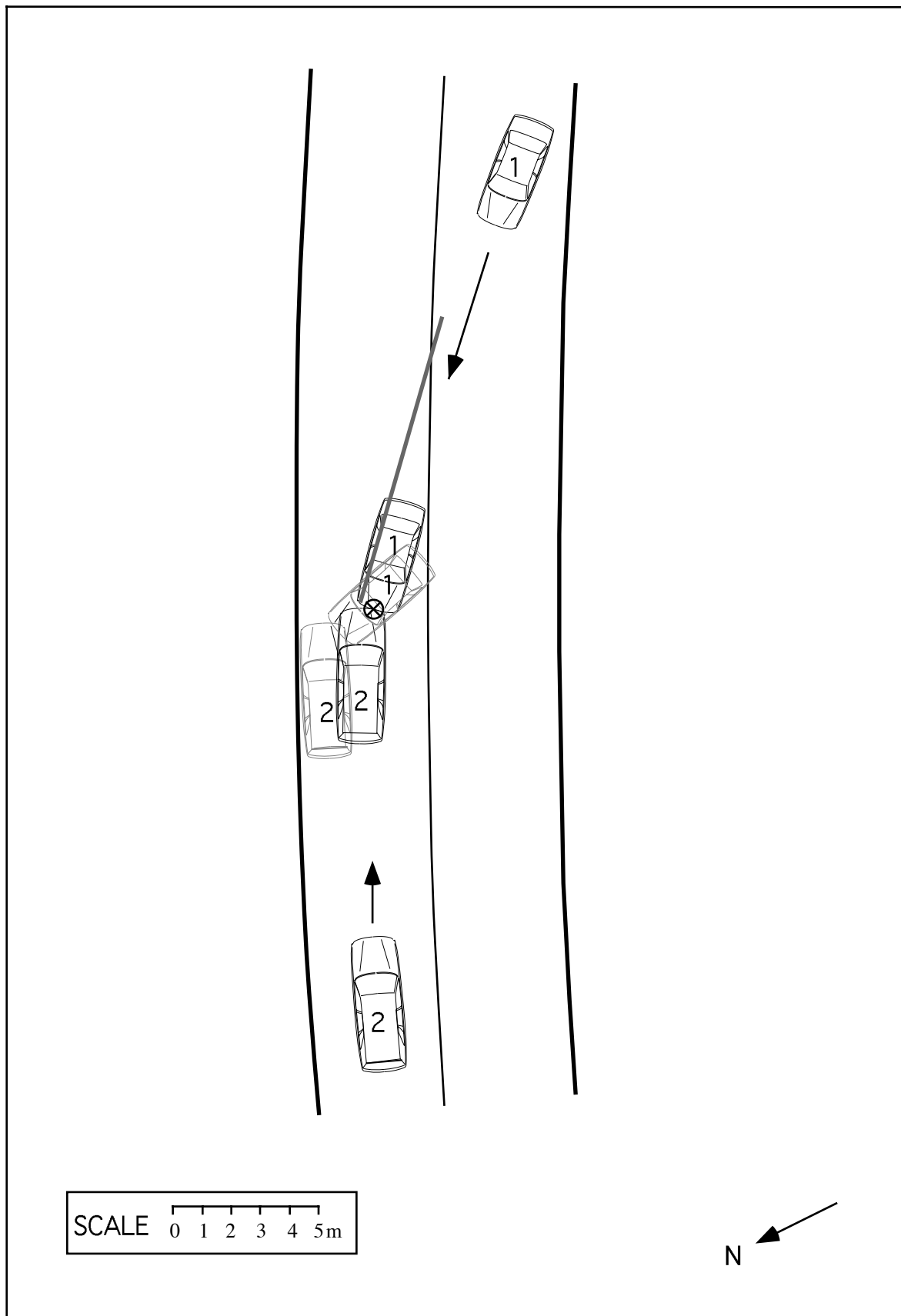
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	74	58	61
5 km/hour speed reduction	69	48	55
10 km/hour speed reduction	64	36	47
Speed Limit 50 with similar compliance	64	36	47
Speed Limit 60 with total compliance	60	20	36

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	40
5 km/hour speed reduction	35
10 km/hour speed reduction	30
Speed Limit 50 with similar compliance	30
Speed Limit 60 with total compliance	24

C N 1 8 3



CN184

Crash Description

Unit 2 turned right across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 centre rear passenger injured but not treated.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (6.2m).

Reconstruction Notes

Final positions estimated from photos and police.
Direction of Unit 1 known from post-impact skid marks.

Case Vehicle Speeds

Free Travelling Speed	56
Impact Speed	38

Control Speeds

51	53
56	64

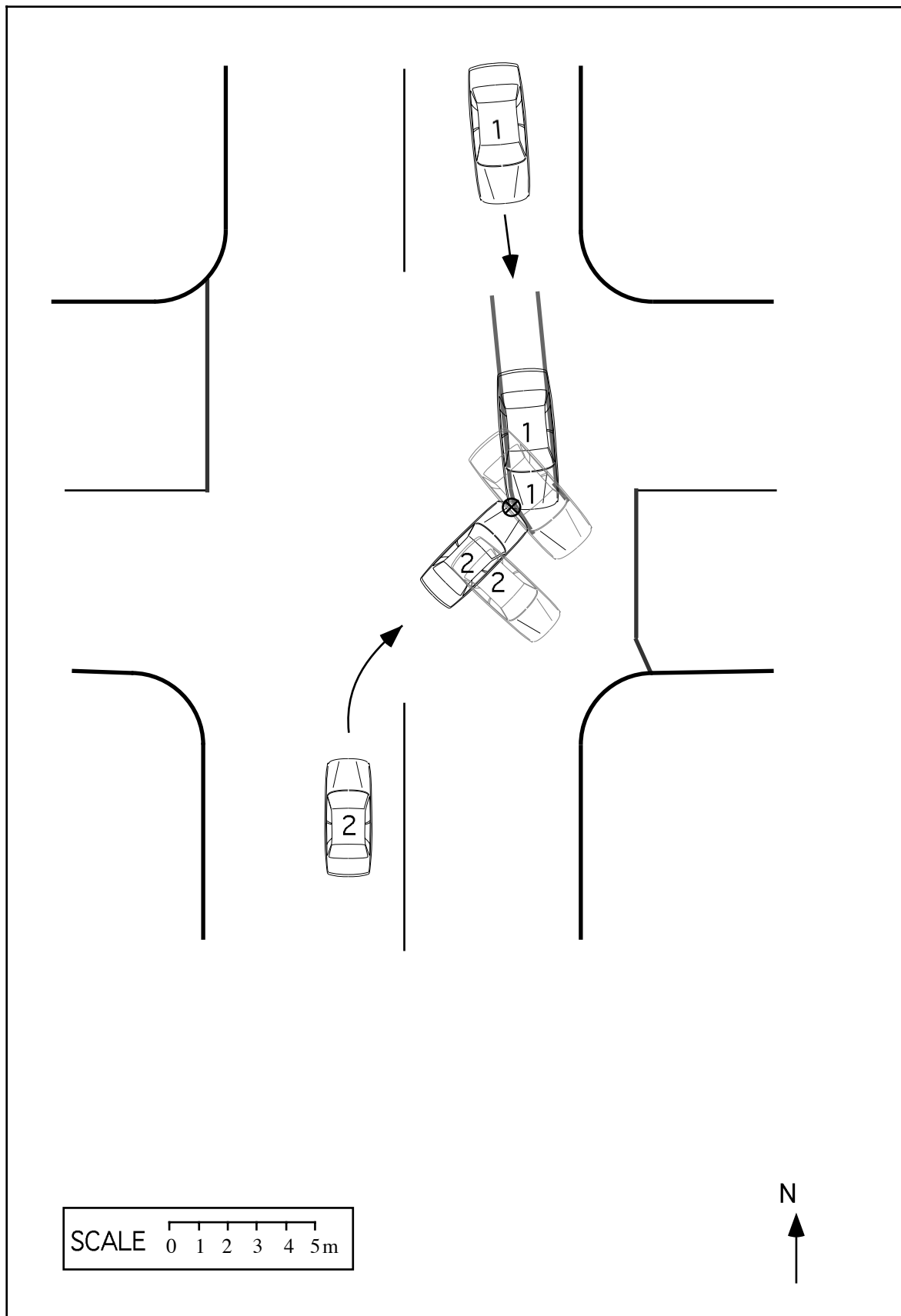
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	56	38	21
5 km/hour speed reduction	51	23	17
10 km/hour speed reduction	46	0	0
Speed Limit 50 with similar compliance	50	16	14
Speed Limit 60 with total compliance	56	38	21

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	33
5 km/hour speed reduction	25
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	22
Speed Limit 60 with total compliance	33

C N 1 8 4



CN185

Crash Description

Unit 2 doing U-turn into parking space. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (2.4m).

Reconstruction Notes

Not a perfect match.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	54

Control Speeds

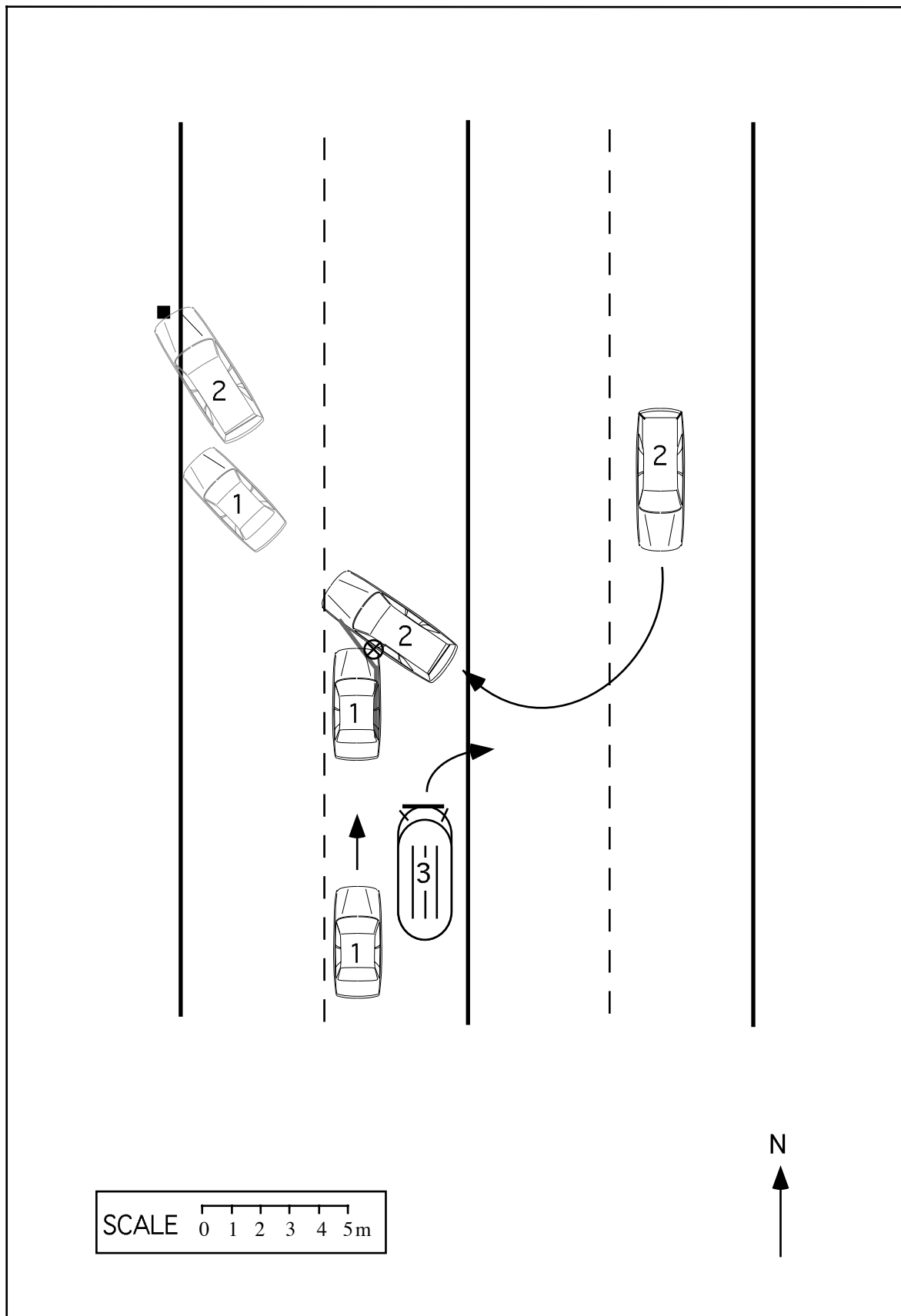
46	54
57	57

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	54	33
5 km/hour speed reduction	60	44	26
10 km/hour speed reduction	55	31	17
Speed Limit 50 with similar compliance	55	31	17
Speed Limit 60 with total compliance	60	44	26

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	17
5 km/hour speed reduction	13
10 km/hour speed reduction	8
Speed Limit 50 with similar compliance	8
Speed Limit 60 with total compliance	13



CN186

Crash Description

Unit 2 failed to stop at a stop sign controlled intersection and crossed the path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger treated by private doctor.

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from pre-impact skid marks (6.3m).

Reconstruction Notes

Final position of Unit 1 at slightly wrong angle - distance OK.

Case Vehicle Speeds

Free Travelling Speed	63
Impact Speed	43

Control Speeds

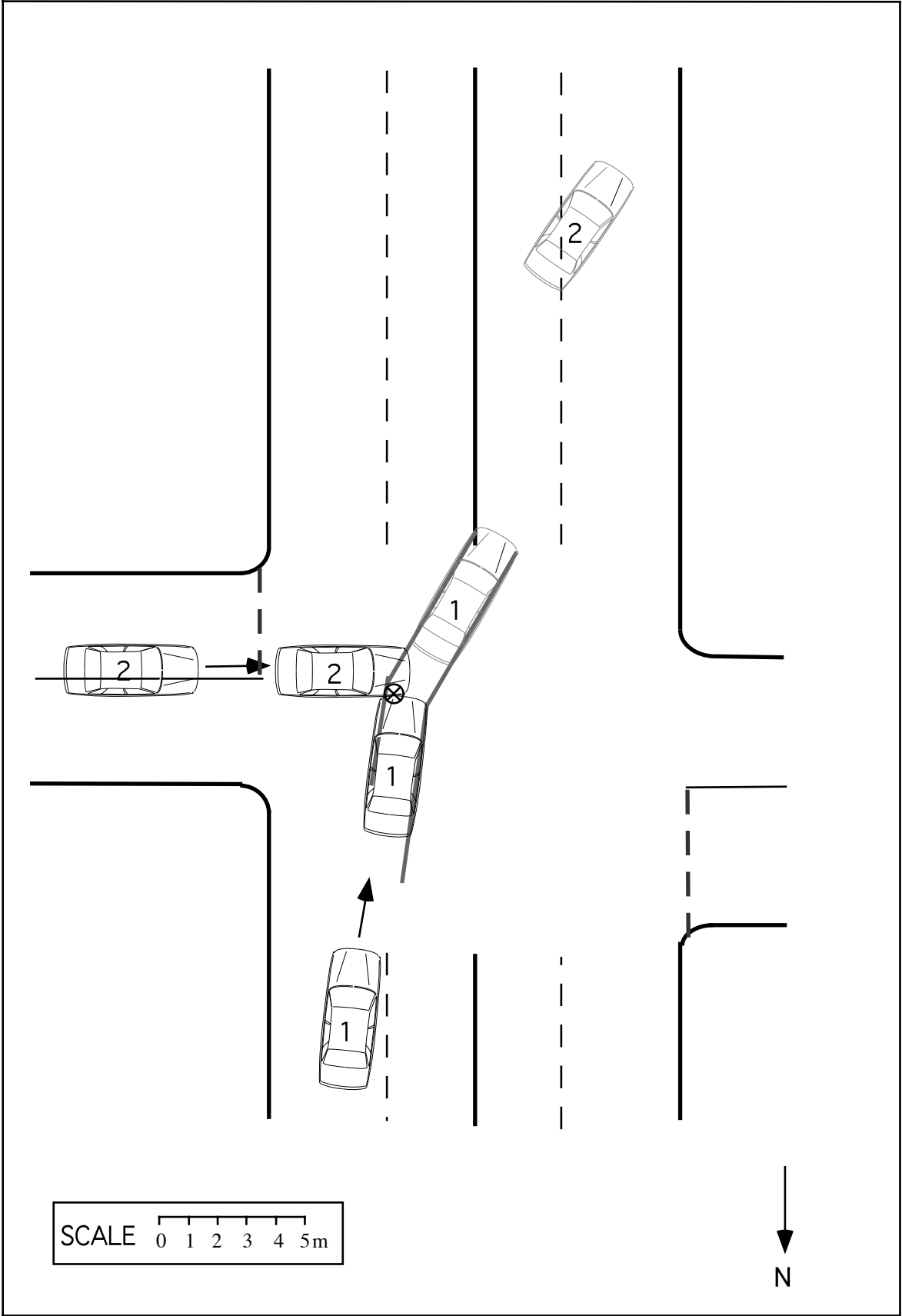
57	58
61	67

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	63	43	19
5 km/hour speed reduction	58	30	14
10 km/hour speed reduction	53	0	0
Speed Limit 50 with similar compliance	53	0	0
Speed Limit 60 with total compliance	60	35	16

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	16
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	18



CN187

Crash Description

Unit 2 went through a red traffic light. Unit 1 applied brakes and was hit by Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (4.9m).

Reconstruction Notes

Not a perfect match for final orientations (long post impact travel distance).

Case Vehicle Speeds

Free Travelling Speed	69
Impact Speed	54

Control Speeds

48	51
52	59

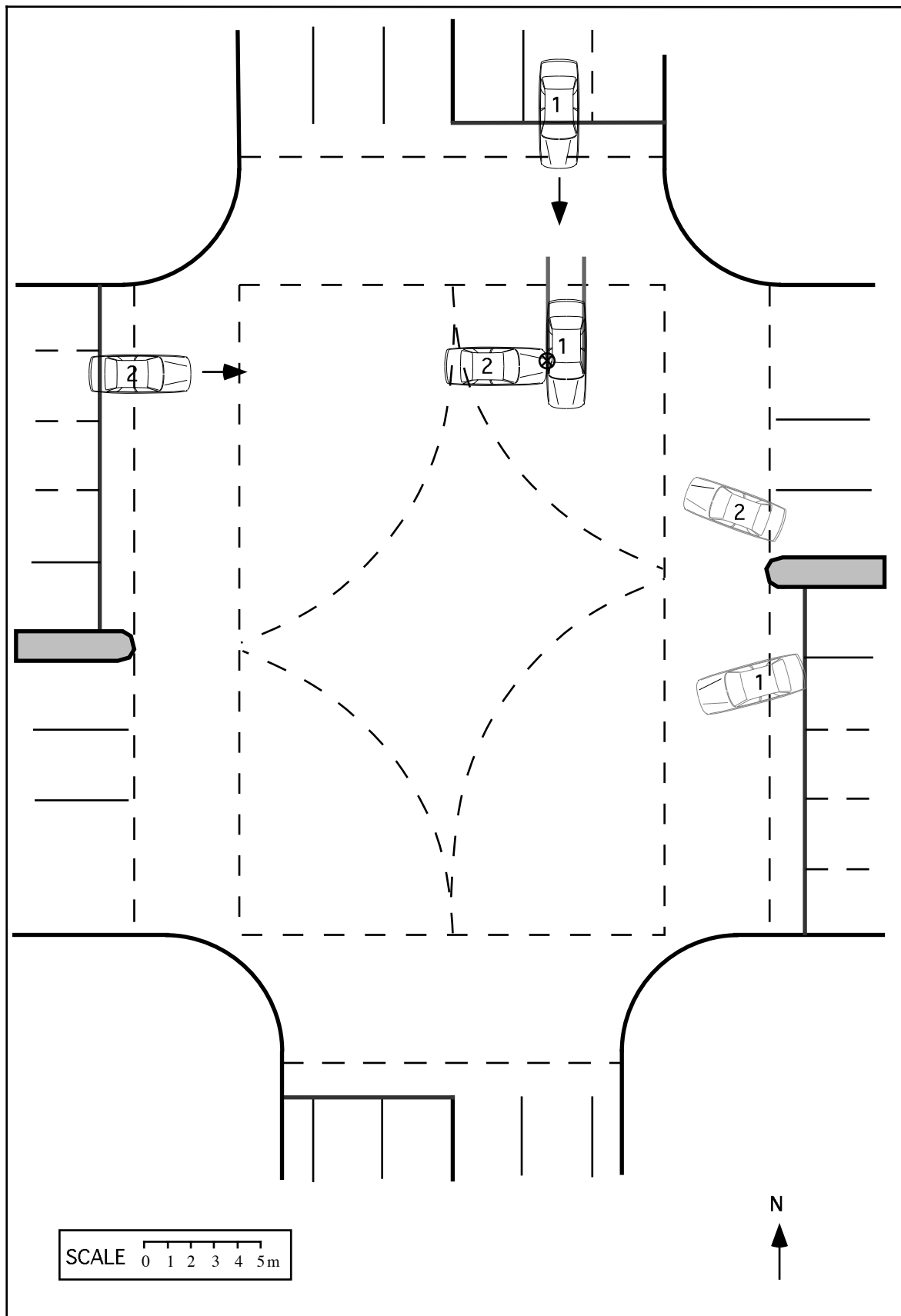
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	69	54	34
5 km/hour speed reduction	64	44	34
10 km/hour speed reduction	59	30	34
Speed Limit 50 with similar compliance	59	30	34
Speed Limit 60 with total compliance	60	34	34

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	39
5 km/hour speed reduction	39
10 km/hour speed reduction	39
Speed Limit 50 with similar compliance	39
Speed Limit 60 with total compliance	39

CN187



CN188

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with side of Unit 2.

Injury Outcomes

Unit 1 driver injured but not treated.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (12m).

Reconstruction Notes

Unit 1 orientation slightly off - position OK.

Case Vehicle Speeds

Free Travelling Speed	91
Impact Speed	67

Control Speeds

47	56
57	57

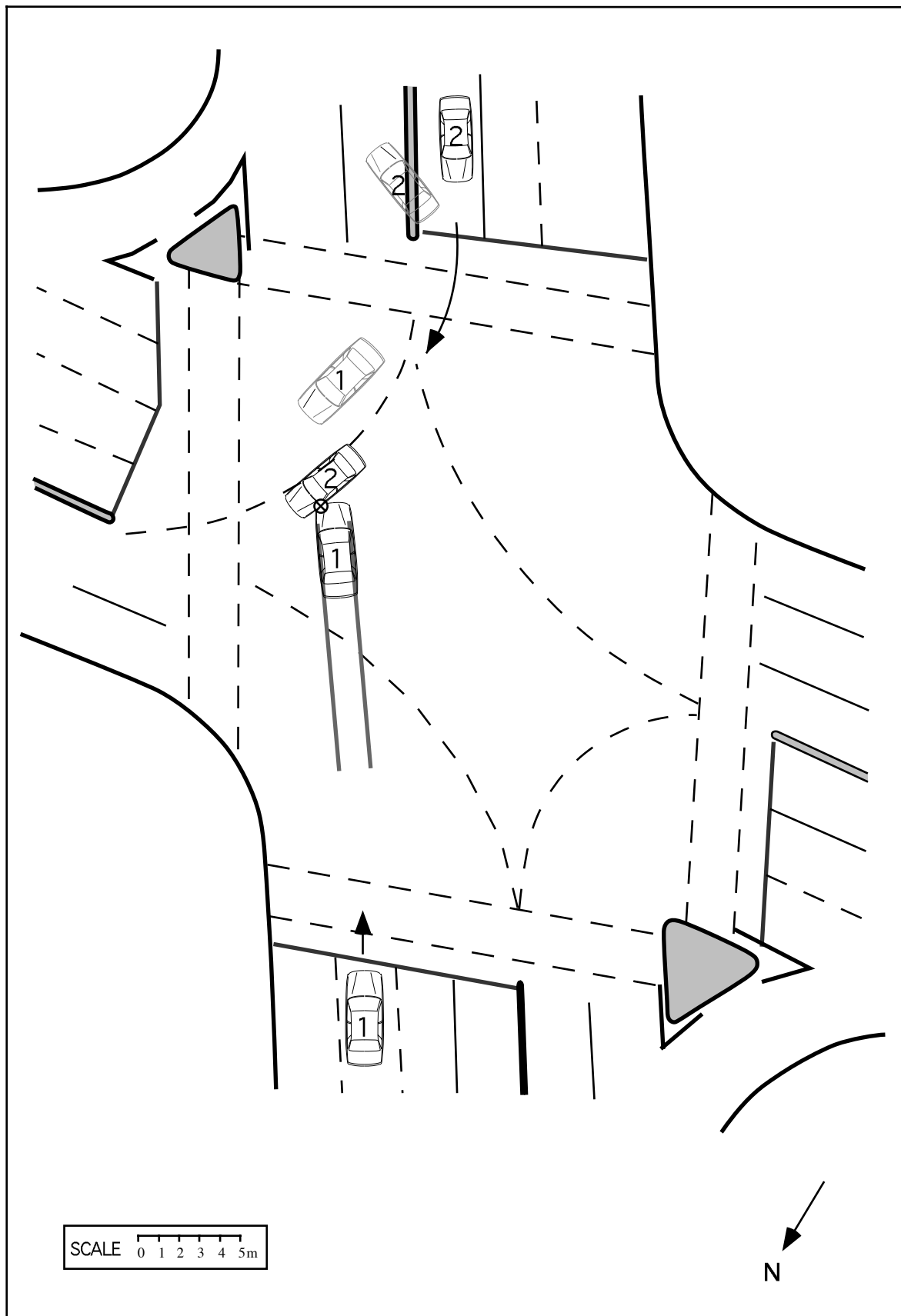
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	91	67	34
5 km/hour speed reduction	86	57	30
10 km/hour speed reduction	81	46	25
Speed Limit 50 with similar compliance	81	46	25
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	45
5 km/hour speed reduction	39
10 km/hour speed reduction	32
Speed Limit 50 with similar compliance	32
Speed Limit 60 with total compliance	0

CN188



CN189

Crash Description

Unit 2 disobeyed stop sign and crossed path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (6.8m).

Reconstruction Notes

May have been snagging between vehicles.

Case Vehicle Speeds

Free Travelling Speed	61
Impact Speed	42

Control Speeds

42	44
58	58

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	61	42	28
5 km/hour speed reduction	56	28	20
10 km/hour speed reduction	51	0	0
Speed Limit 50 with similar compliance	51	0	0
Speed Limit 60 with total compliance	60	40	27

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	28
5 km/hour speed reduction	19
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	27

Diagram illustrating a vehicle collision at a T-junction. A car labeled '2' is shown approaching from the left, indicated by an arrow. Two cars, labeled '1' and '2', are shown in the center of the junction, having collided. A car labeled '1' is shown moving away from the collision point towards the bottom. A scale bar at the bottom left indicates distances from 0 to 5 meters. A north arrow at the bottom right points towards the top right.

CN190

Crash Description

Unit 1 lost control and skidded into a stobie pole sideways.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from pole impact deformation (900mm).

Travelling speed from pre-impact skid marks (13.8m).

Reconstruction Notes

Ignored pole bending.

Case Vehicle Speeds

Free Travelling Speed	84
Impact Speed	56

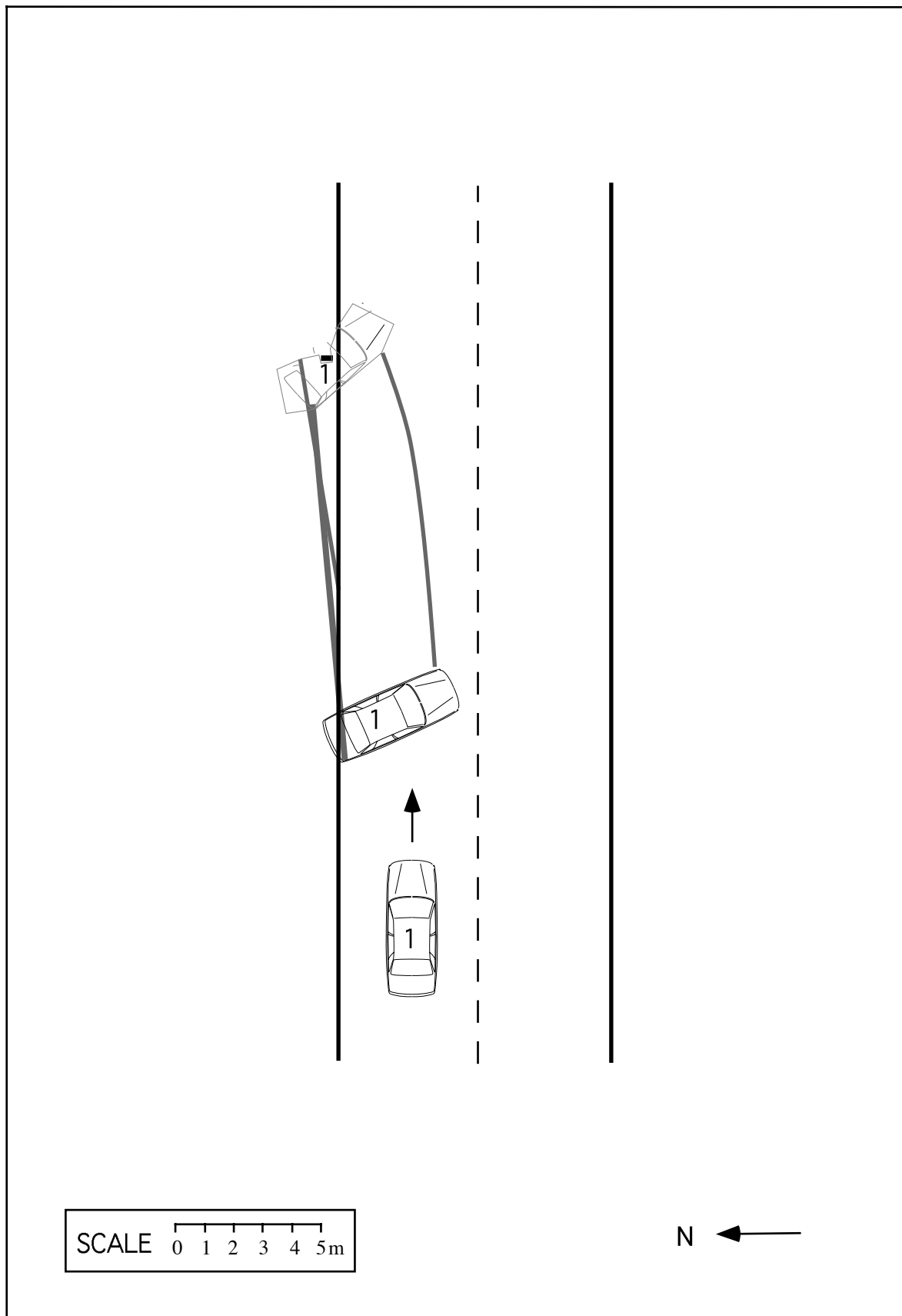
Control Speeds

52	54
59	67

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	84	56	56
5 km/hour speed reduction	79	45	45
10 km/hour speed reduction	74	30	30
Speed Limit 50 with similar compliance	74	30	30
Speed Limit 60 with total compliance	60	0	0

CN190



CN191

Crash Description

Unit 2 turned right across the path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Unit 1 may have braked without skidding before impact (no evidence of this).

Case Vehicle Speeds

Free Travelling Speed	47
Impact Speed	47

Control Speeds

59	64
51	52

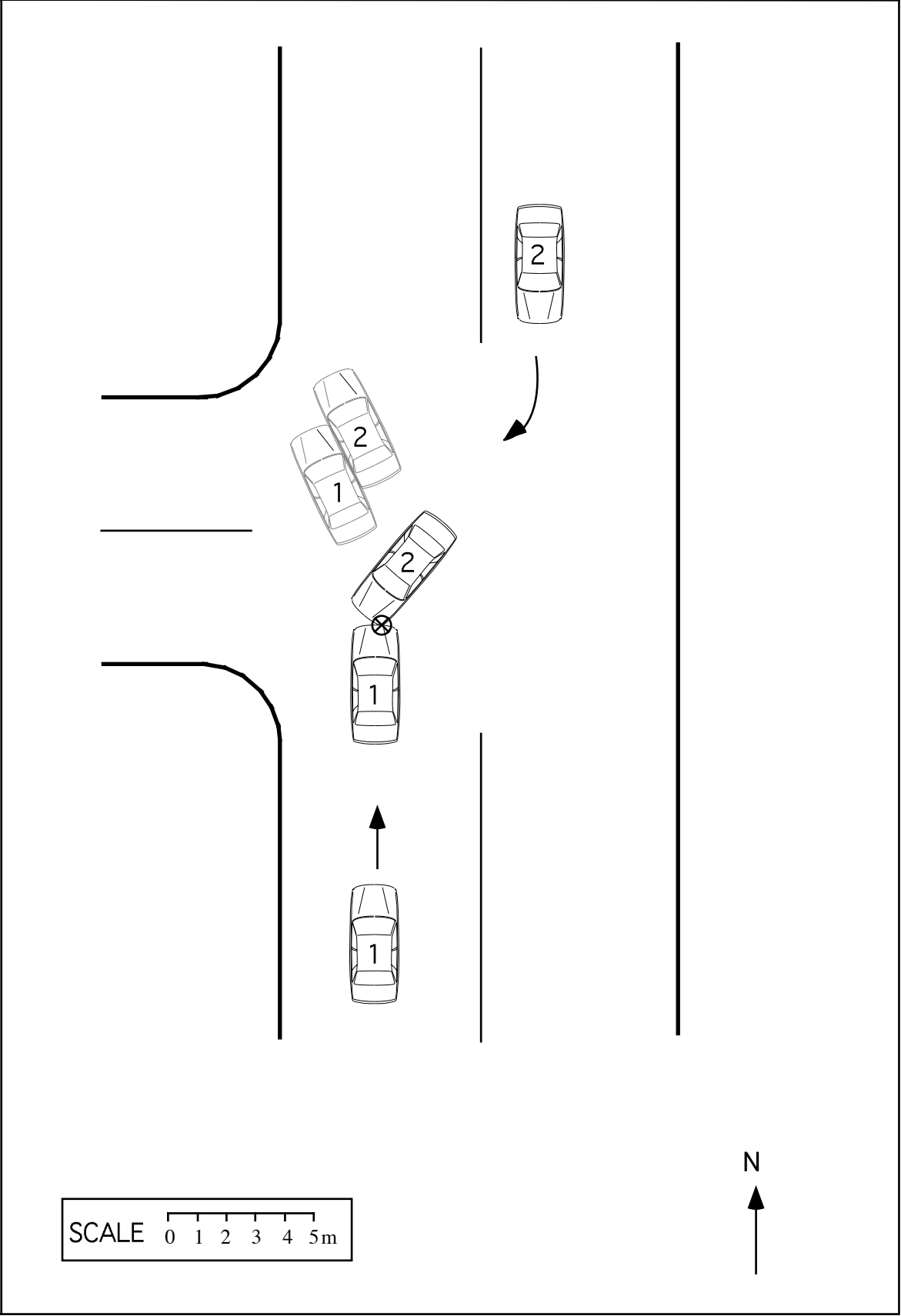
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	47	47	32
5 km/hour speed reduction	42	42	30
10 km/hour speed reduction	37	37	27
Speed Limit 50 with similar compliance	47	47	32
Speed Limit 60 with total compliance	47	47	32

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	34
5 km/hour speed reduction	32
10 km/hour speed reduction	29
Speed Limit 50 with similar compliance	34
Speed Limit 60 with total compliance	34

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CN192

Crash Description

Unit 2 turning right out of a side street across the path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 left front passenger treated at hospital.
Unit 2 right rear passenger treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (9.1m)

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	54
Impact Speed	27

Control Speeds

44	47
47	42

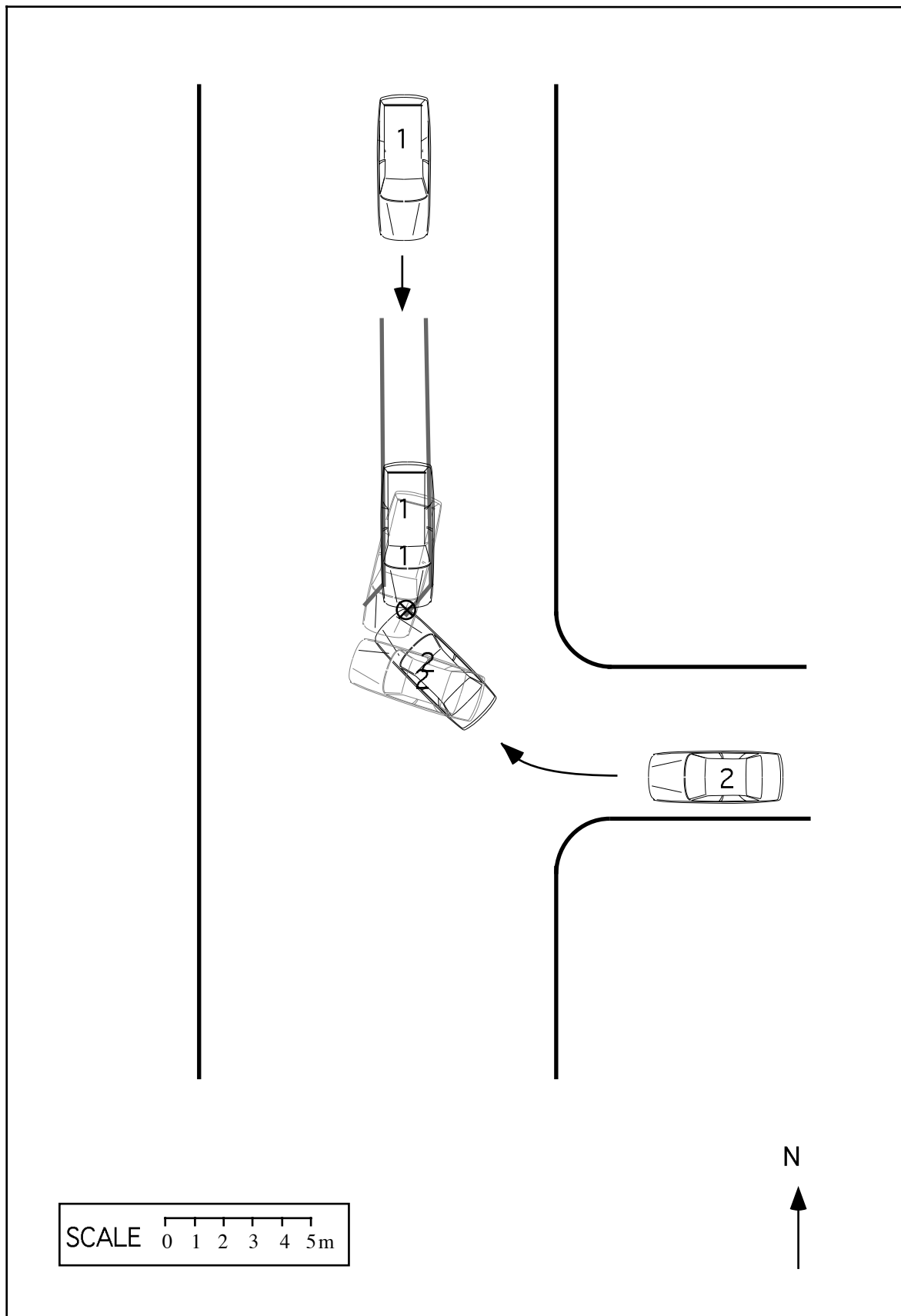
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	54	27	21
5 km/hour speed reduction	49	0	0
10 km/hour speed reduction	44	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	54	27	21

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	21

CN192



CN193

Crash Description

Unit 1 collided with rear of stationary Unit 2. Unit 2 pushed forward into two pedestrians standing in front of Unit 2.

Injury Outcomes

Pedestrian 1 admitted to hospital.

Pedestrian 2 treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final position of Unit 2 and SMAC run.

Pedestrian impact speed from impact position of pedestrian and SMAC run.

Reconstruction Notes

Unknown if any pre-impact braking without skidding.

Pedestrian impact points not precise.

Case Vehicle Speeds

Free Travelling Speed	50
Impact Speed	50

Control Speeds

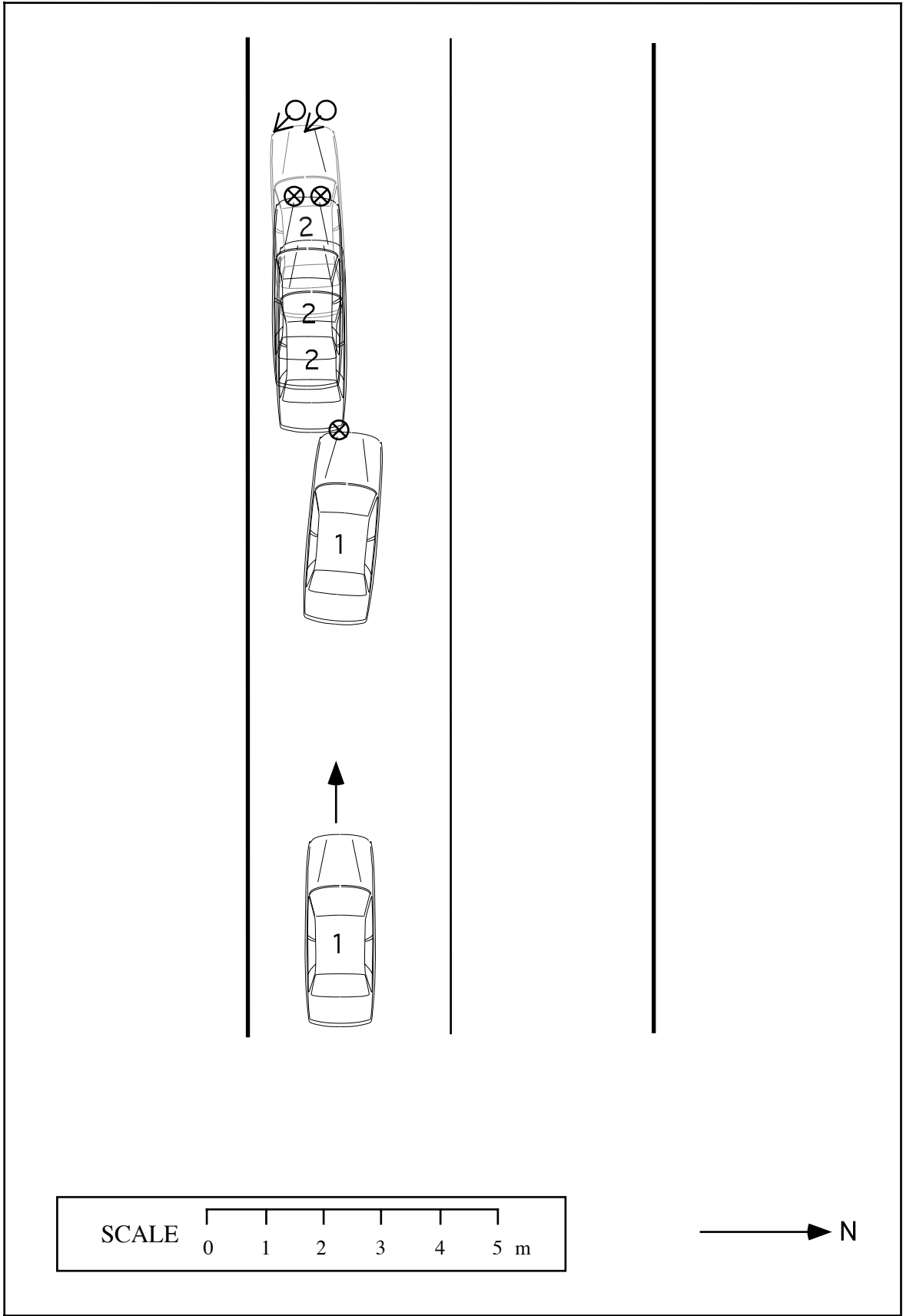
46	58
62	73

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	50	50	0
5 km/hour speed reduction	45	45	0
10 km/hour speed reduction	40	40	0
Speed Limit 50 with similar compliance	50	50	0
Speed Limit 60 with total compliance	50	50	0

Hypothetical Scenarios (Pedestrians)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	13
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	13
Speed Limit 60 with total compliance	13



CN194

Crash Description

Unit 1 collided with rear of stationary Unit 2. Unit 2 collided with pedestrian in front of Unit 2.

Injury Outcomes

Pedestrian treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.
Pedestrian impact speed from impact position of pedestrian and SMAC run.

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	54
Impact Speed	54

Control Speeds

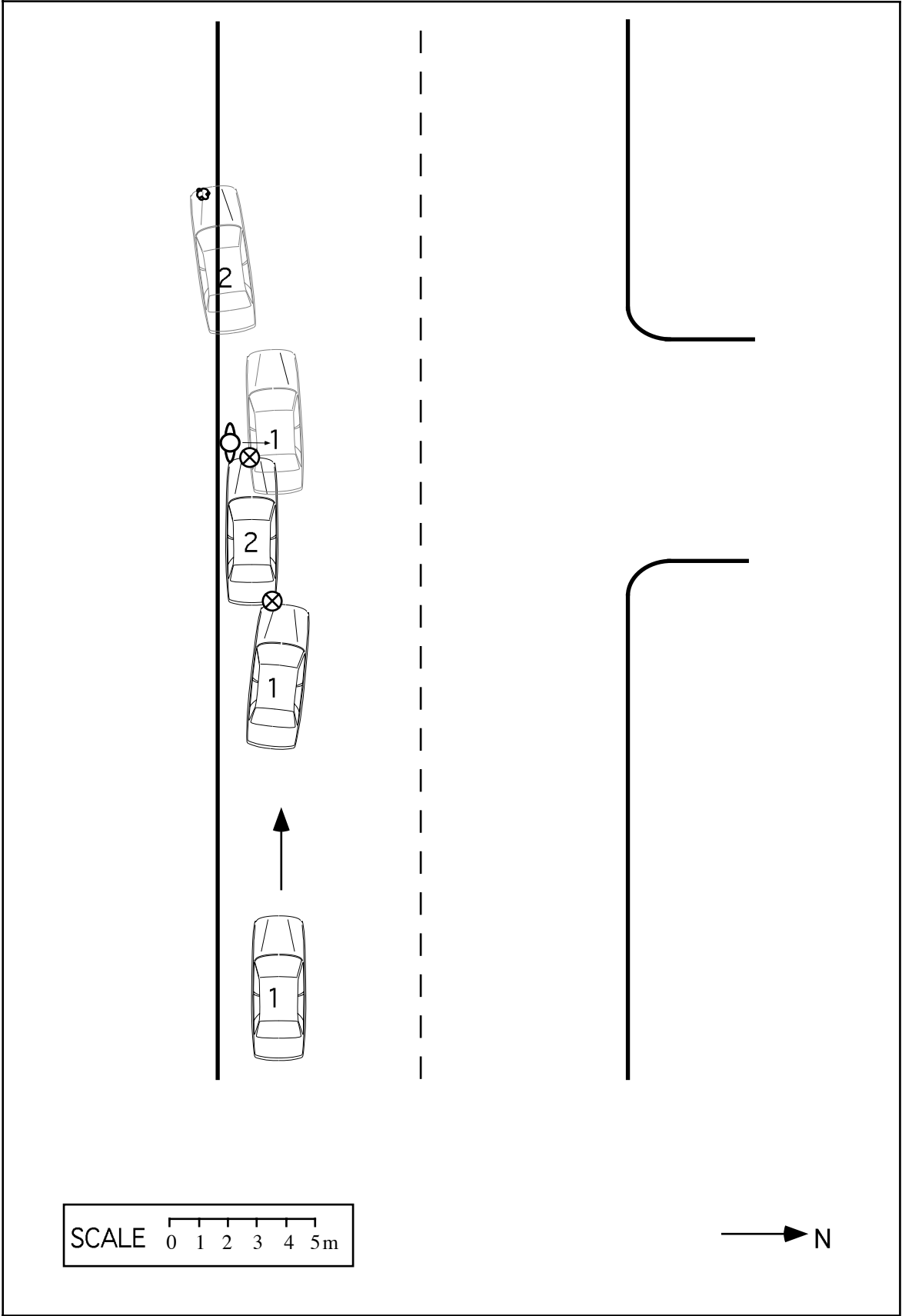
47	47
50	50

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	54	54	31
5 km/hour speed reduction	49	49	29
10 km/hour speed reduction	44	44	26
Speed Limit 50 with similar compliance	50	50	29
Speed Limit 60 with total compliance	54	54	31

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	24
10 km/hour speed reduction	21
Speed Limit 50 with similar compliance	24
Speed Limit 60 with total compliance	26



CN195

Crash Description

Unit 1 was racing against another vehicle when it lost control and collided with a stobie pole sideways, splitting the car into many pieces.

Injury Outcomes

Unit 1 driver fatally injured.

Type of Road

Main road.

Reconstruction Method

Impact speed from pole impact calculation and stobie pole damage.
Travelling speed from pre-impact skid marks (16.8m).

Reconstruction Notes

Hard to reconstruct because of extensive damage to vehicle.
Impact speed is best guess based on damage and witness estimates.

Case Vehicle Speeds

Free Travelling Speed	147
Impact Speed	120

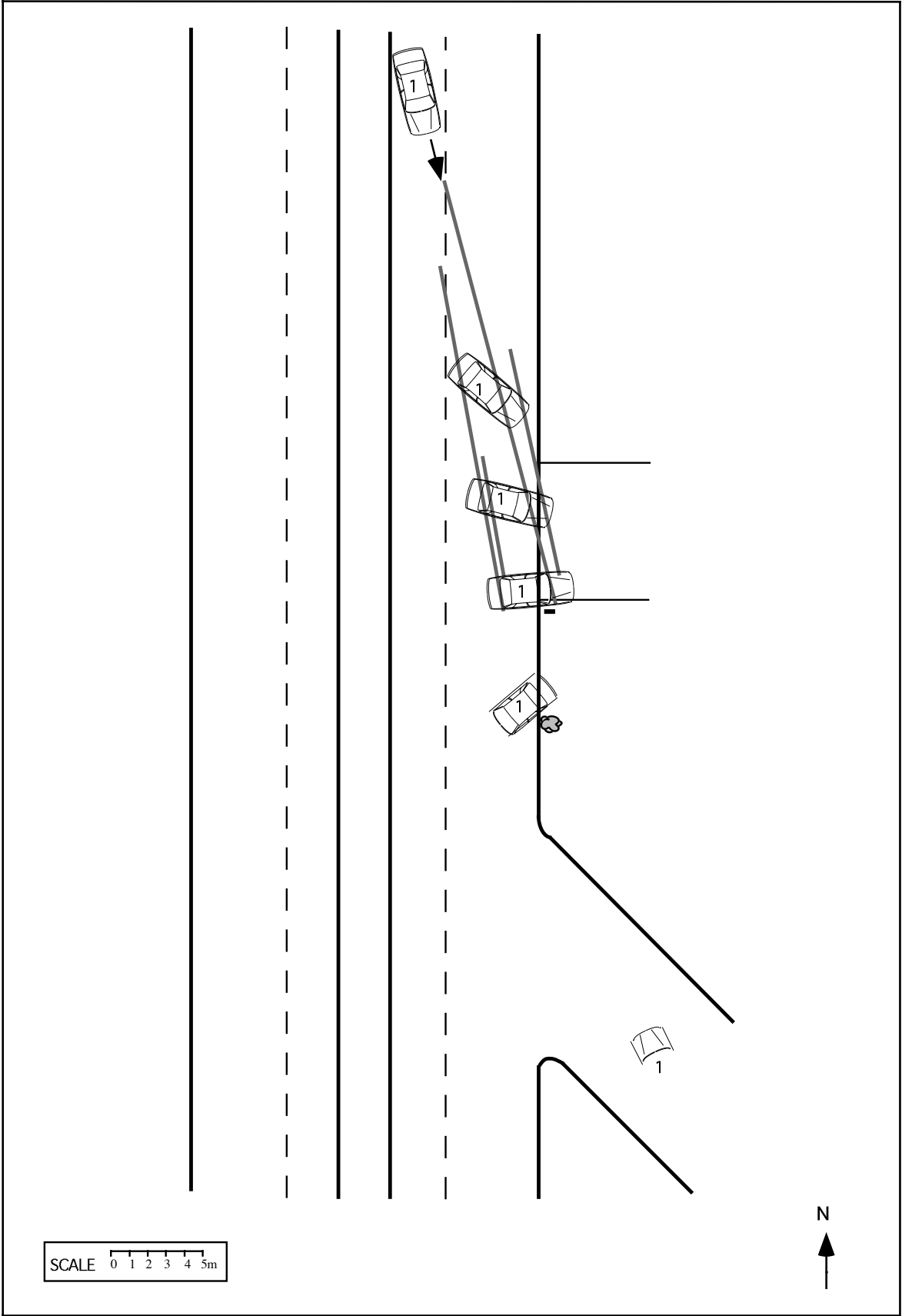
Control Speeds

58	60
65	67

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	147	120	120
5 km/hour speed reduction	142	113	113
10 km/hour speed reduction	137	106	106
Speed Limit 50 with similar compliance	137	106	106
Speed Limit 60 with total compliance	60	0	0

C N 1 9 5



CN196

Crash Description

Unit 1 lost control, skidded and collided with a tree on the other side of the road.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Pole impact calculation based on (450mm) crush = 32kph.

Assume 10kph lost through car uprooting small tree.

Impact speed = 42kph.

Travelling speed from pre-impact skid marks (22.5m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	85
Impact Speed	42

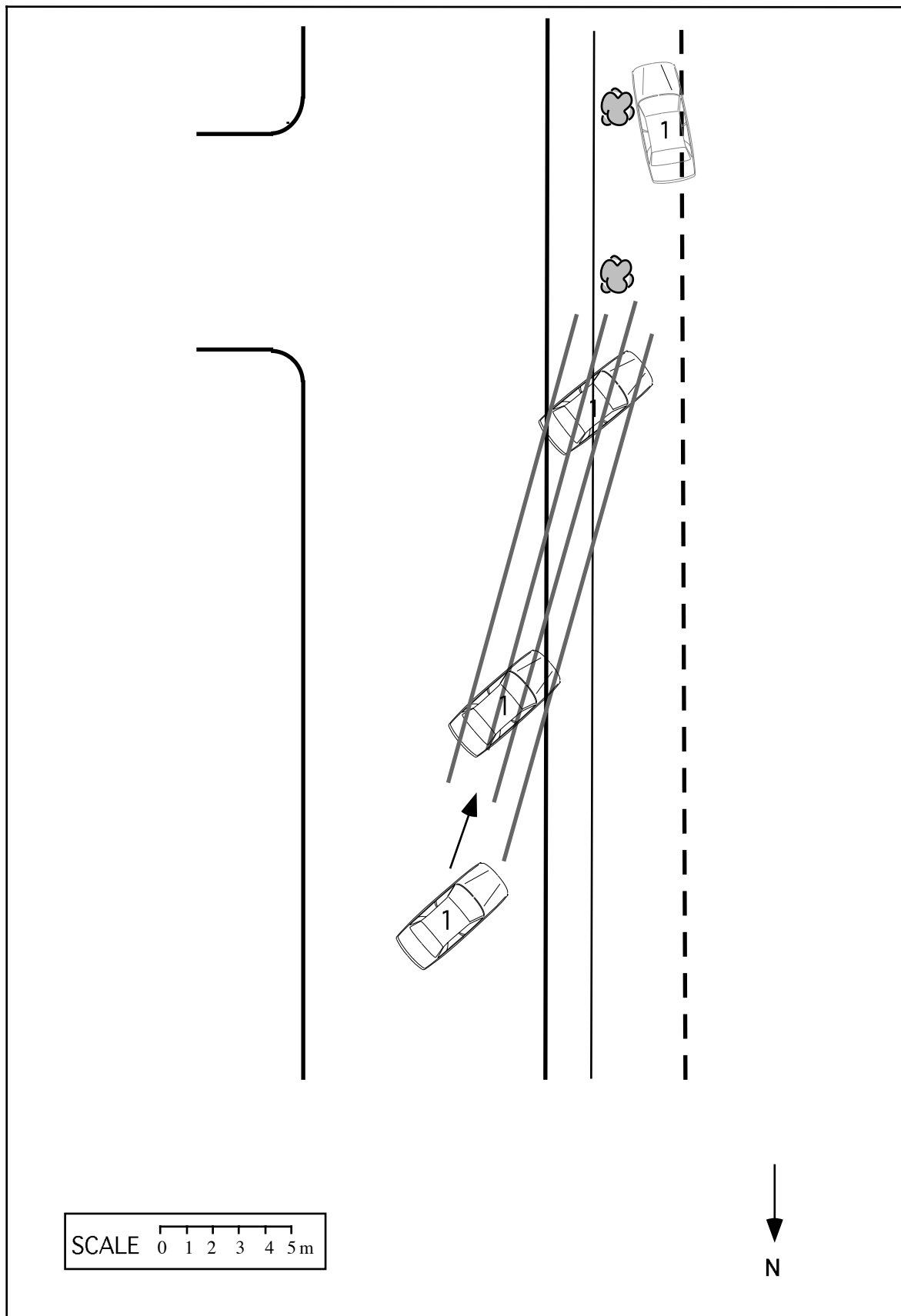
Control Speeds

60	70
62	49

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	85	42	42
5 km/hour speed reduction	80	25	25
10 km/hour speed reduction	75	0	0
Speed Limit 50 with similar compliance	75	0	0
Speed Limit 60 with total compliance	60	0	0

C N 1 9 6



CN197

Crash Description

Unit 2 doing a U-turn across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 driver admitted to hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (15.2m).

Reconstruction Notes

Final positions not perfectly matched.

Case Vehicle Speeds

Free Travelling Speed	73
Impact Speed	40

Control Speeds

42	35
42	63

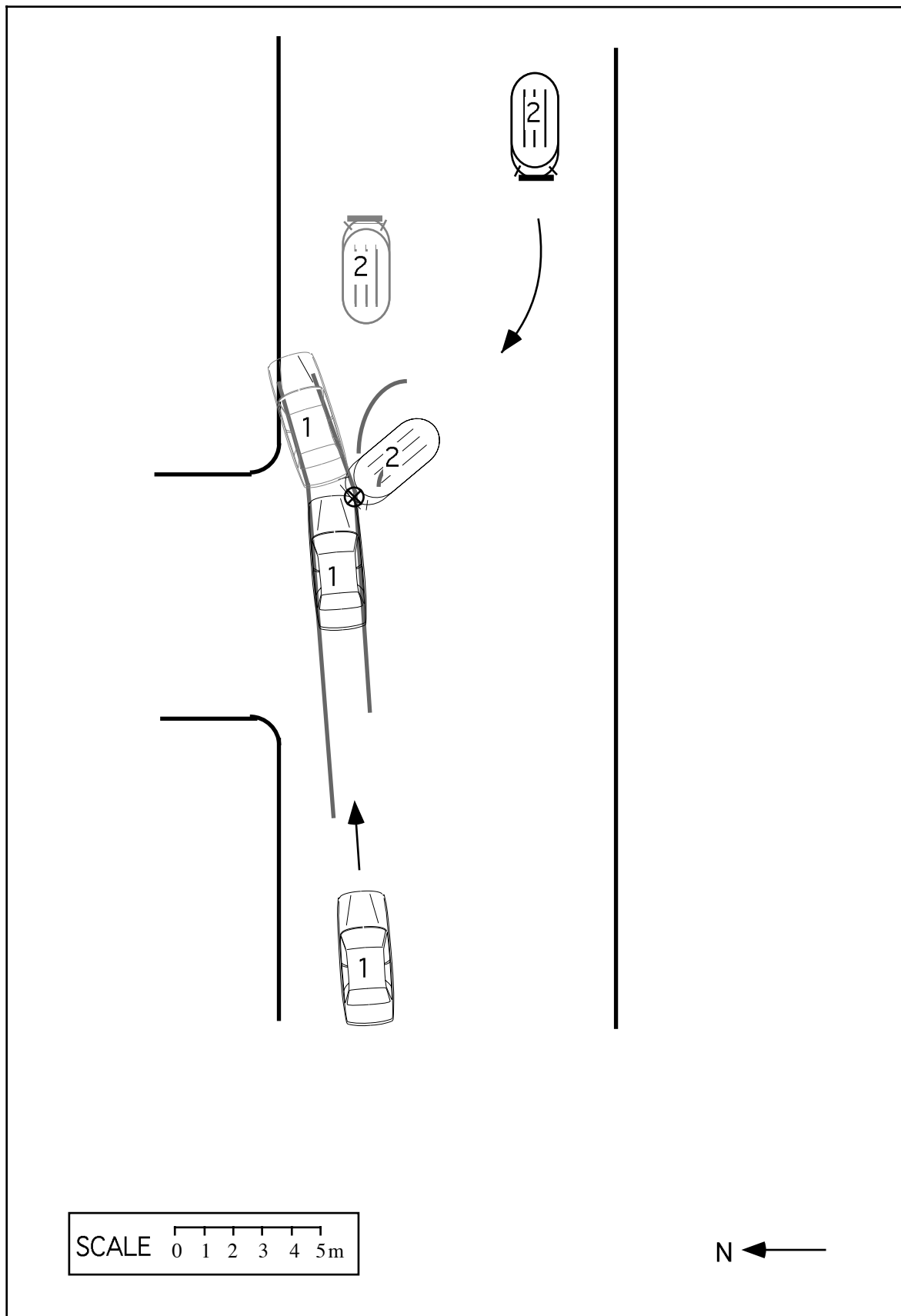
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	73	40	22
5 km/hour speed reduction	68	23	17
10 km/hour speed reduction	63	0	0
Speed Limit 50 with similar compliance	63	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	27
5 km/hour speed reduction	20
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN197



CN198

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 left front passenger treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (9.2m)

Reconstruction Notes

Unit 1 was towing a trailer - trailer mass was added to vehicle mass.
Unit 1 probably went through at end of amber phase.

Case Vehicle Speeds

Free Travelling Speed	71
Impact Speed	49

Control Speeds

63	62
71	60

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	71	49	33
5 km/hour speed reduction	66	37	27
10 km/hour speed reduction	61	19	17
Speed Limit 50 with similar compliance	61	19	17
Speed Limit 60 with total compliance	60	13	14

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	34
5 km/hour speed reduction	27
10 km/hour speed reduction	17
Speed Limit 50 with similar compliance	17
Speed Limit 60 with total compliance	14

CN200

Crash Description

Unit 1 lost control and ran off left side of road and struck tree. Tree was uprooted and Unit 1 continued over it.

Injury Outcomes

Unit 1 driver treated at hospital.

Unit 1 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Post impact speed from distance travelled over tree (2m) = 20kph.

Impact speed with tree from delta V and pole impact calculation (450mm) + 33kph.

Reconstruction Notes

Estimated coefficient of friction for riding over tree root as 0.8.

Case Vehicle Speeds

Free Travelling Speed	53
Impact Speed	53

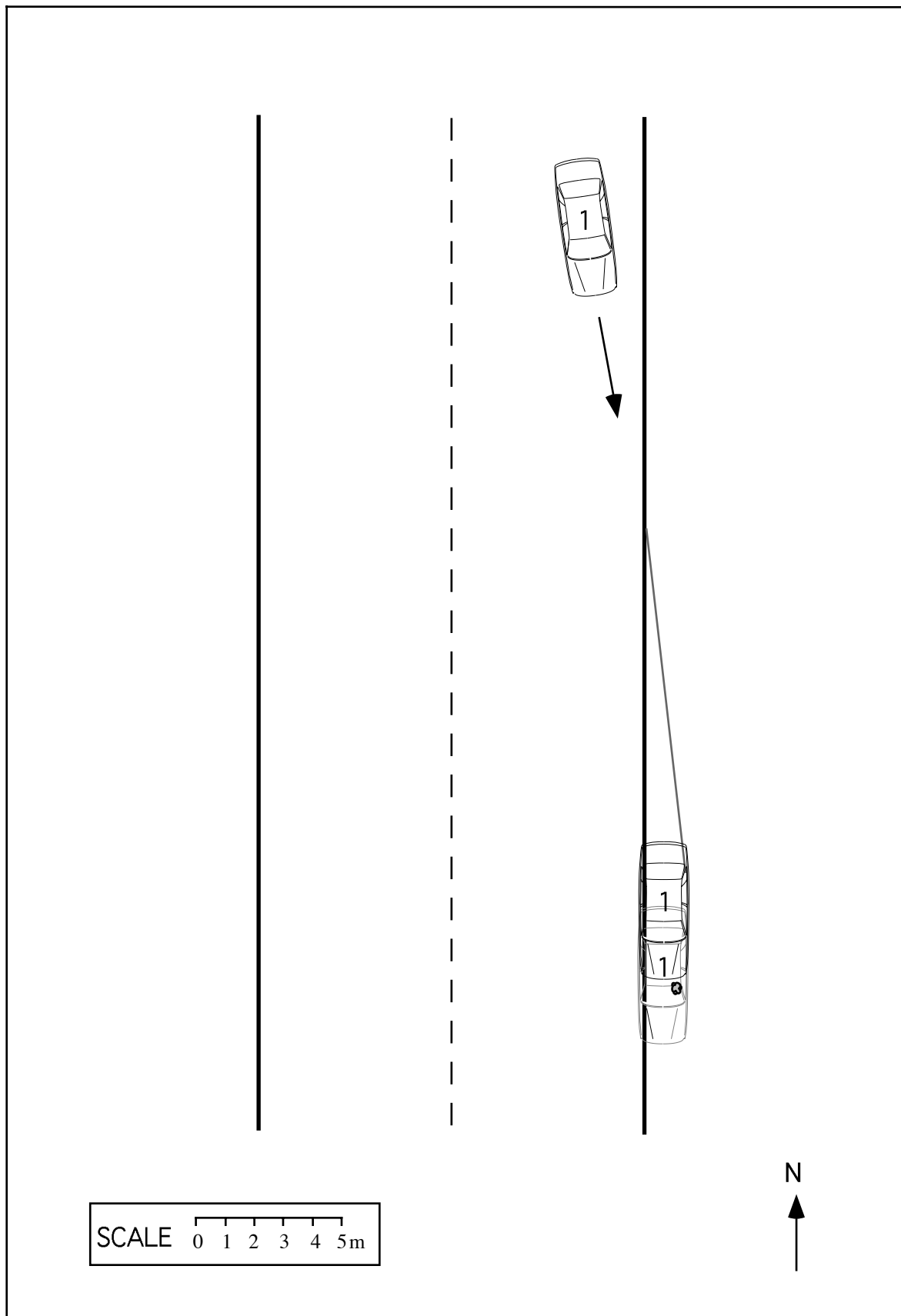
Control Speeds

57	60
64	70

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	53	53	53
5 km/hour speed reduction	48	48	48
10 km/hour speed reduction	43	43	43
Speed Limit 50 with similar compliance	50	50	50
Speed Limit 60 with total compliance	53	53	53

CN200



CN201

Crash Description

Unit 2 went through give-way sign into path of Unit 1. Unit 1 collided with side of Unit 2.

Injury Outcomes

Unit 2 left front passenger treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Unit 2 final position not a perfect match.

Assumed braking for both cars from impact onwards (to get correct trajectory).

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	57

Control Speeds

34	35
45	58

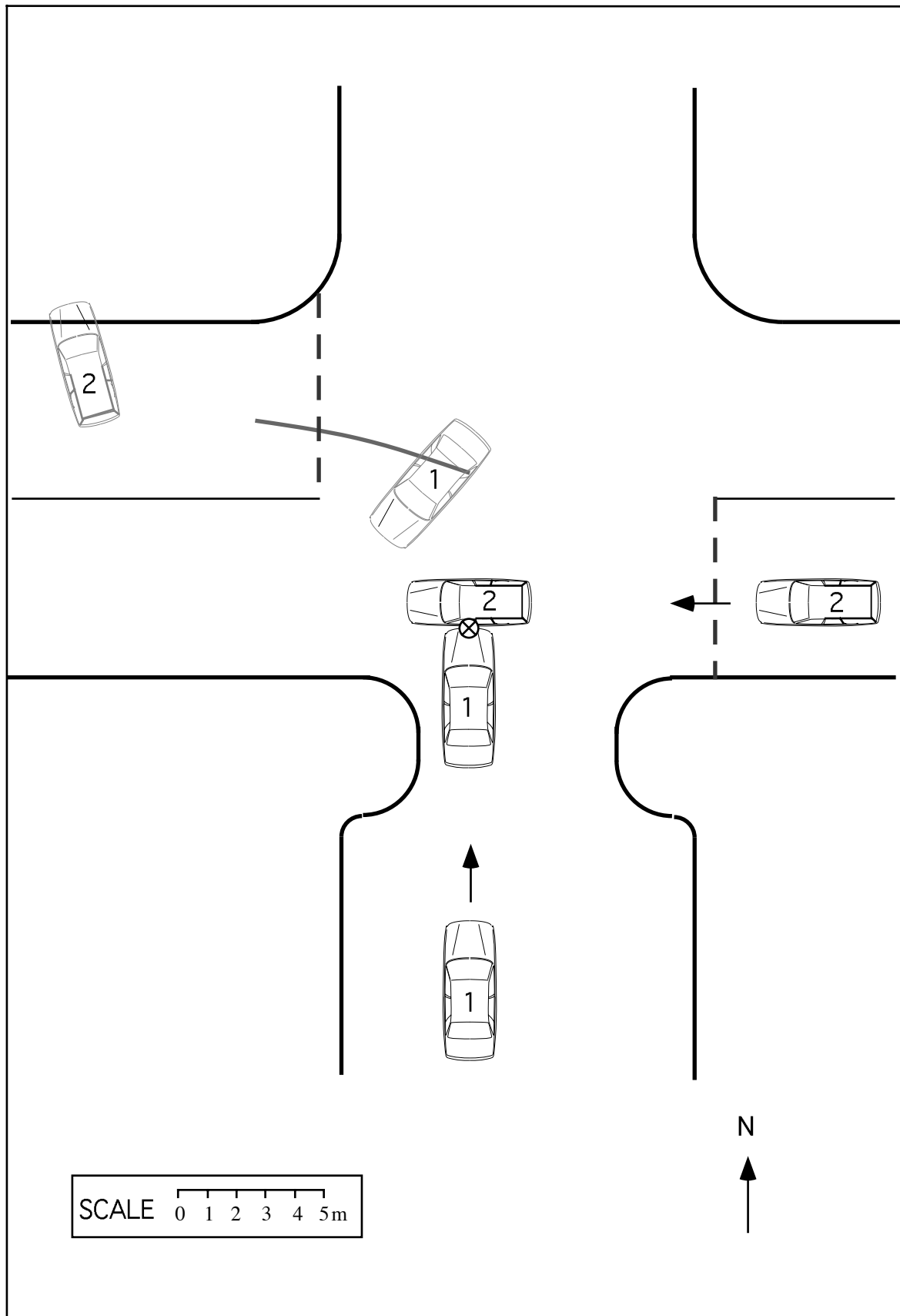
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	57	30
5 km/hour speed reduction	52	52	28
10 km/hour speed reduction	47	47	26
Speed Limit 50 with similar compliance	50	50	27
Speed Limit 60 with total compliance	57	57	30

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	38
5 km/hour speed reduction	36
10 km/hour speed reduction	32
Speed Limit 50 with similar compliance	34
Speed Limit 60 with total compliance	38

C N 2 0 1



CN203

Crash Description

Unit 2 turning right into a driveway across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Vehicle snagged to some extent (simulation has them travelling correct distance).

Case Vehicle Speeds

Free Travelling Speed	56
Impact Speed	56

Control Speeds

52	54
57	60

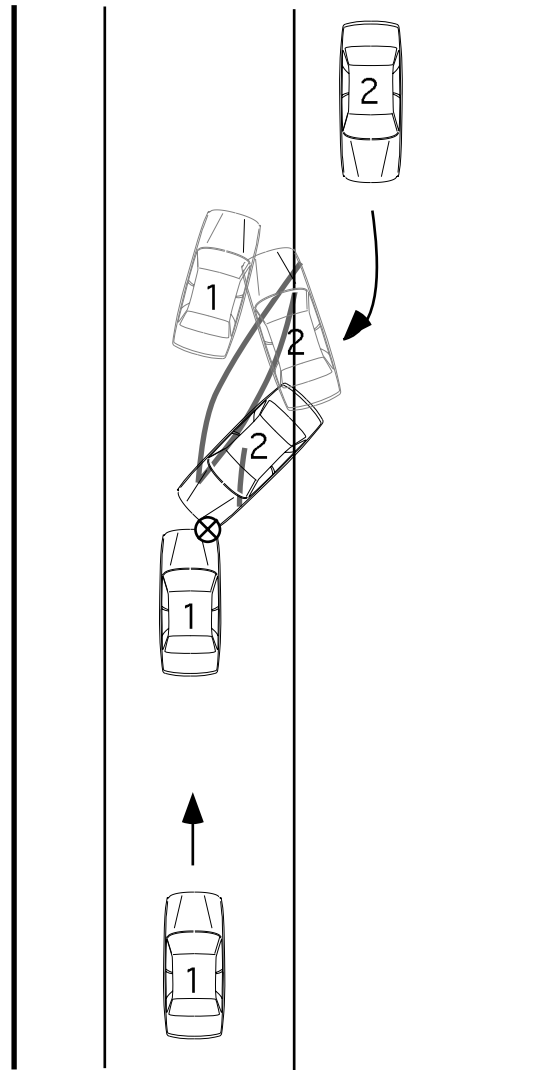
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	56	56	34
5 km/hour speed reduction	51	51	32
10 km/hour speed reduction	46	46	29
Speed Limit 50 with similar compliance	50	50	31
Speed Limit 60 with total compliance	56	56	34

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	28
5 km/hour speed reduction	25
10 km/hour speed reduction	23
Speed Limit 50 with similar compliance	25
Speed Limit 60 with total compliance	28

CN203



SCALE 0 1 2 3 4 5m

N ←

CN204

Crash Description

Unit 2 stationary preparing to turn right. Unit 1 saw Unit 2, applied brakes and then collided with rear of Unit 2.

Injury Outcomes

Unit 2 driver admitted to hospital.

Unit 2 left front passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from pre-impact skid marks (14.6m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	73
Impact Speed	36

Control Speeds

57	60
63	64

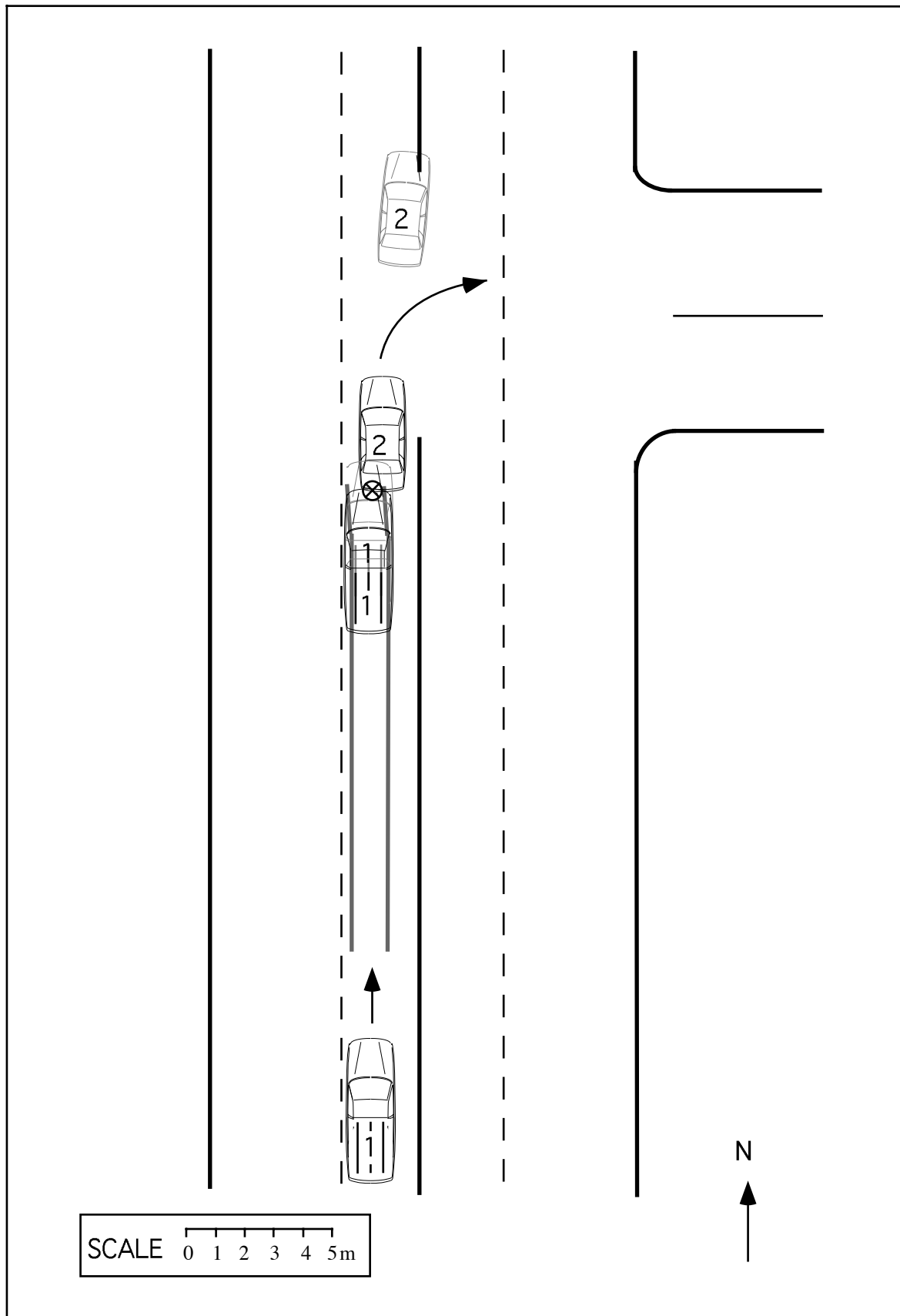
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	73	36	21
5 km/hour speed reduction	68	13	9
10 km/hour speed reduction	63	0	0
Speed Limit 50 with similar compliance	63	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	24
5 km/hour speed reduction	8
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN204



CN205

Crash Description

Unit 2 starting to turning right. Unit 1 collided with rear of Unit 2.

Injury Outcomes

Unit 1 driver treated by private doctor.
Unit 1 left rear passenger treated by private doctor.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Assumed that Unit 1 was travelling at a constant speed and applied brakes sometime after colliding with Unit 2.
Assumed Unit 2 was taking off to turn right (thus accelerating) and then applied brakes.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	65

Control Speeds

52	56
61	65

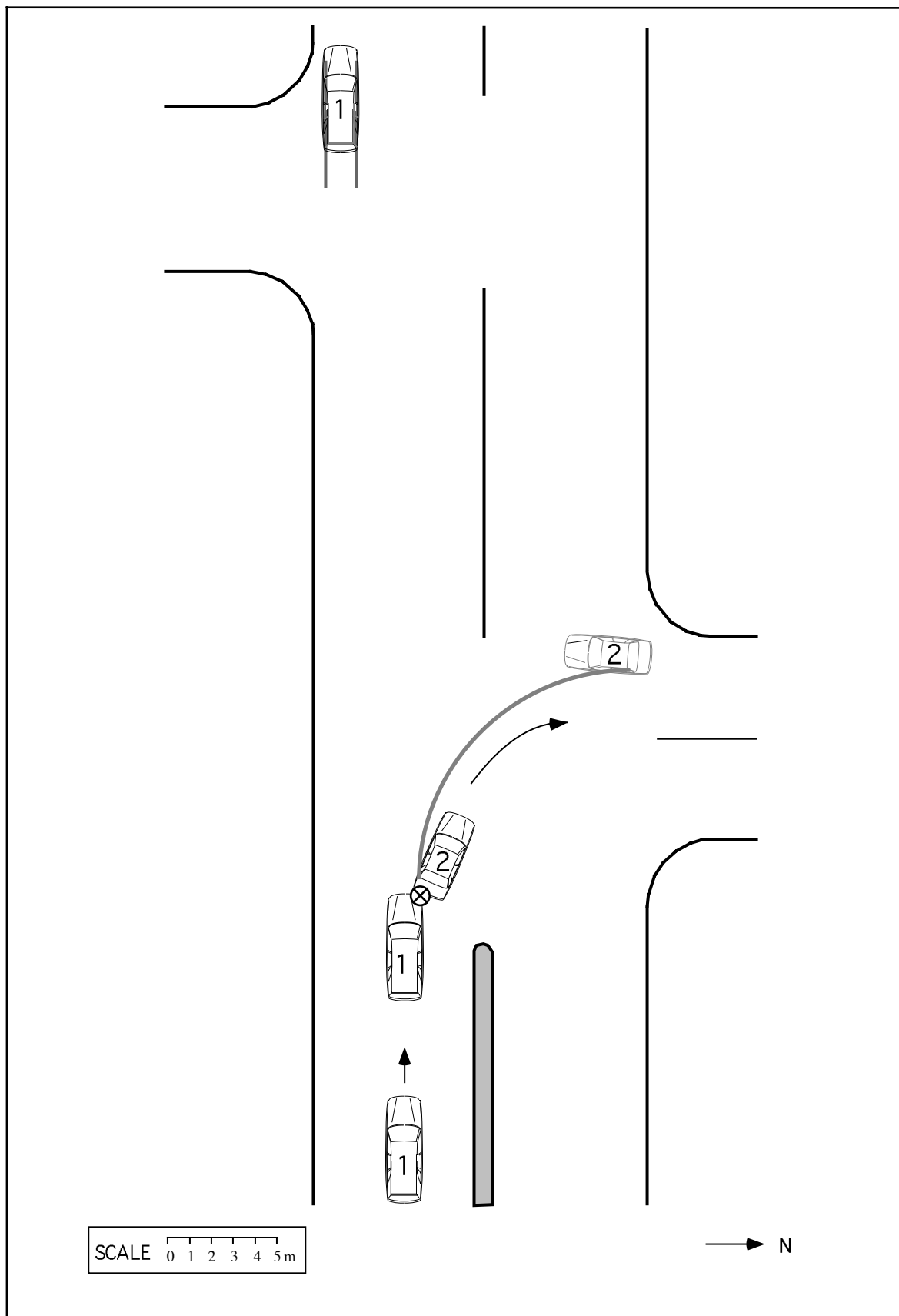
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	65	23
5 km/hour speed reduction	60	60	21
10 km/hour speed reduction	55	55	20
Speed Limit 50 with similar compliance	55	55	20
Speed Limit 60 with total compliance	60	60	21

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	31
5 km/hour speed reduction	29
10 km/hour speed reduction	26
Speed Limit 50 with similar compliance	26
Speed Limit 60 with total compliance	29

CN205



CN206

Crash Description

Unit 2 crossed median strip and travelled onto the other side of the road into the path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver admitted to hospital.
Unit 2 driver admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (7m).

Reconstruction Notes

Unit 2 travelling speed could not be reconstructed.

Case Vehicle Speeds

Free Travelling Speed	65
Impact Speed	46

Control Speeds

62	64
64	64

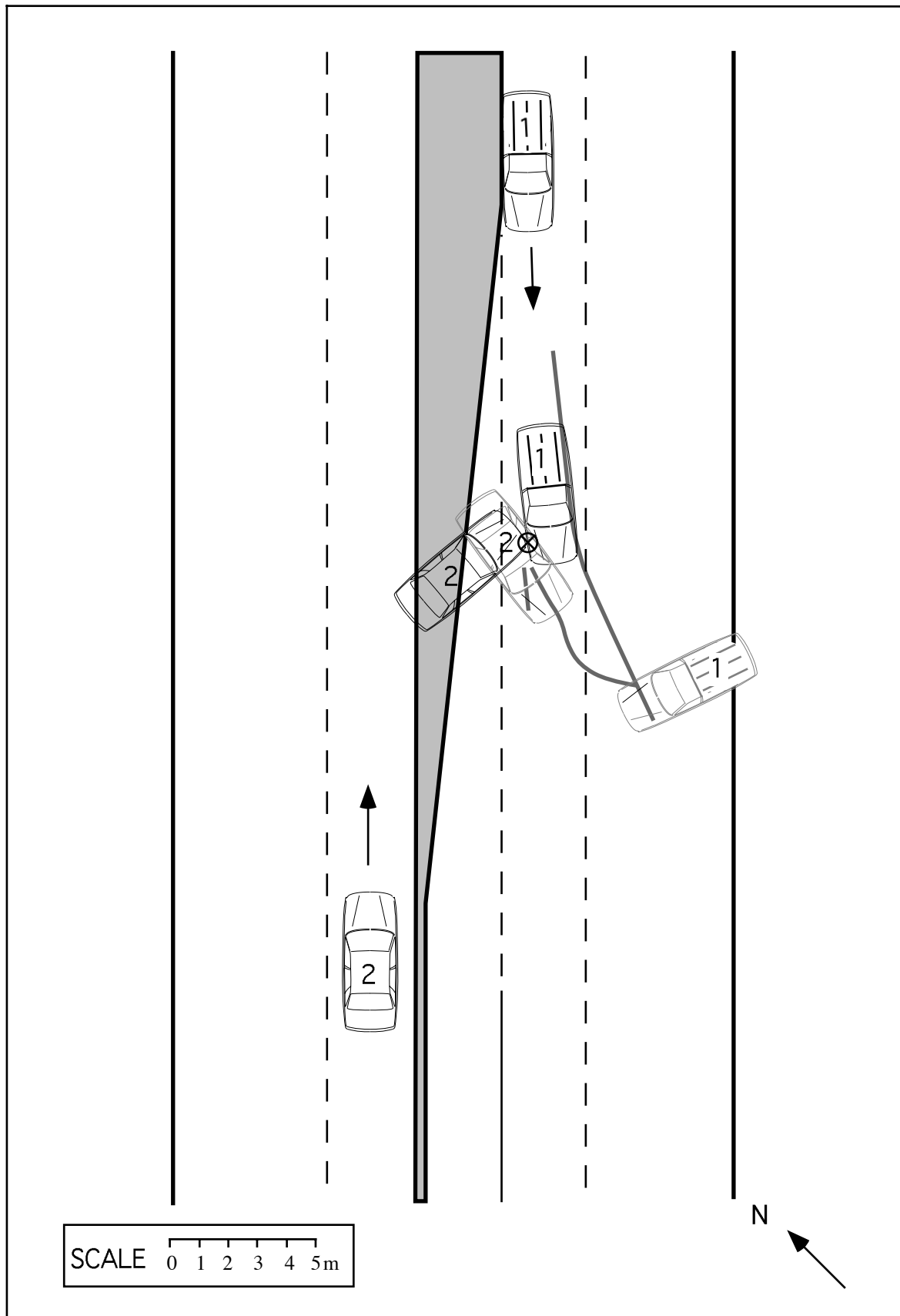
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	65	46	29
5 km/hour speed reduction	60	34	27
10 km/hour speed reduction	55	14	20
Speed Limit 50 with similar compliance	55	14	20
Speed Limit 60 with total compliance	60	34	27

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	26
5 km/hour speed reduction	25
10 km/hour speed reduction	20
Speed Limit 50 with similar compliance	20
Speed Limit 60 with total compliance	25

CN206



CN207

Crash Description

Pedestrian crossed road into path of Unit 1. Unit 1 applied brakes and collided with pedestrian.

Injury Outcomes

Pedestrian admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid mark length (14.5m).
Impact speed from post-impact skid marks (2m).

Reconstruction Notes

Pedestrian impact point is an estimate.

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	19

Control Speeds

50	56
58	61

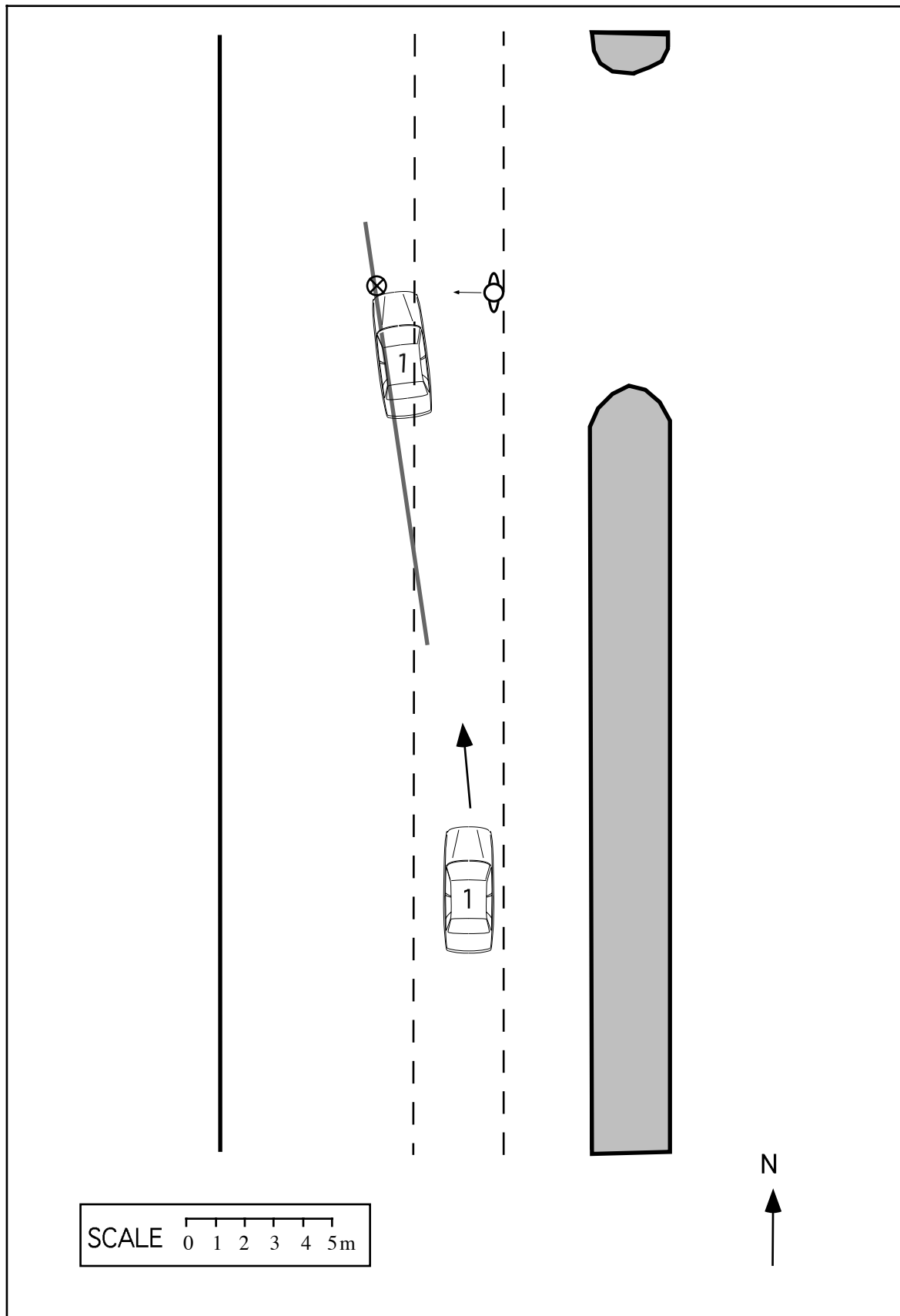
Hypothetical Scenarios (Unit 1)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	19	0
5 km/hour speed reduction	52	0	0
10 km/hour speed reduction	47	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	57	19	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	19
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	19

CN207



CN208

Crash Description

Unit 1 applied brakes and collided with rear of stationary Unit 2 (Bus).

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Local street.

Reconstruction Method

Impact speed from final position of Unit 1 and SMAC run.

Travelling speed from pre-impact skid marks (9.5m).

Reconstruction Notes

Hard to model accurately since there was not much movement after impact.

Damage looks right though.

Case Vehicle Speeds

Free Travelling Speed	72
Impact Speed	50

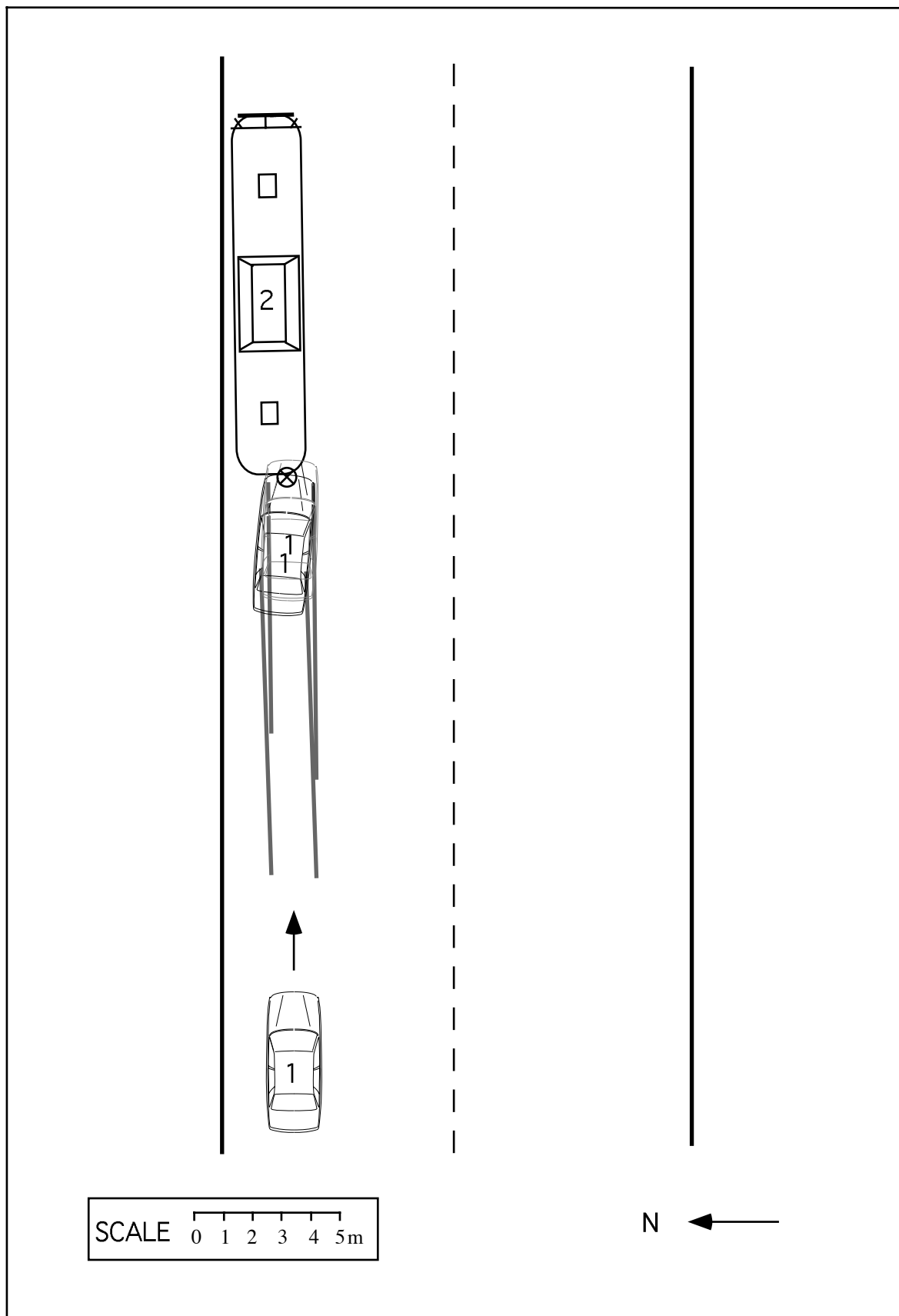
Control Speeds

46	47
50	52

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	72	50	56
5 km/hour speed reduction	67	38	43
10 km/hour speed reduction	62	21	24
Speed Limit 50 with similar compliance	62	21	24
Speed Limit 60 with total compliance	60	0	0

CN208



CN209

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 left front passenger treated at hospital.
Unit 2 left rear passenger treated at hospital.
Unit 2 right rear passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (13m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	77
Impact Speed	49

Control Speeds

52	59
68	68

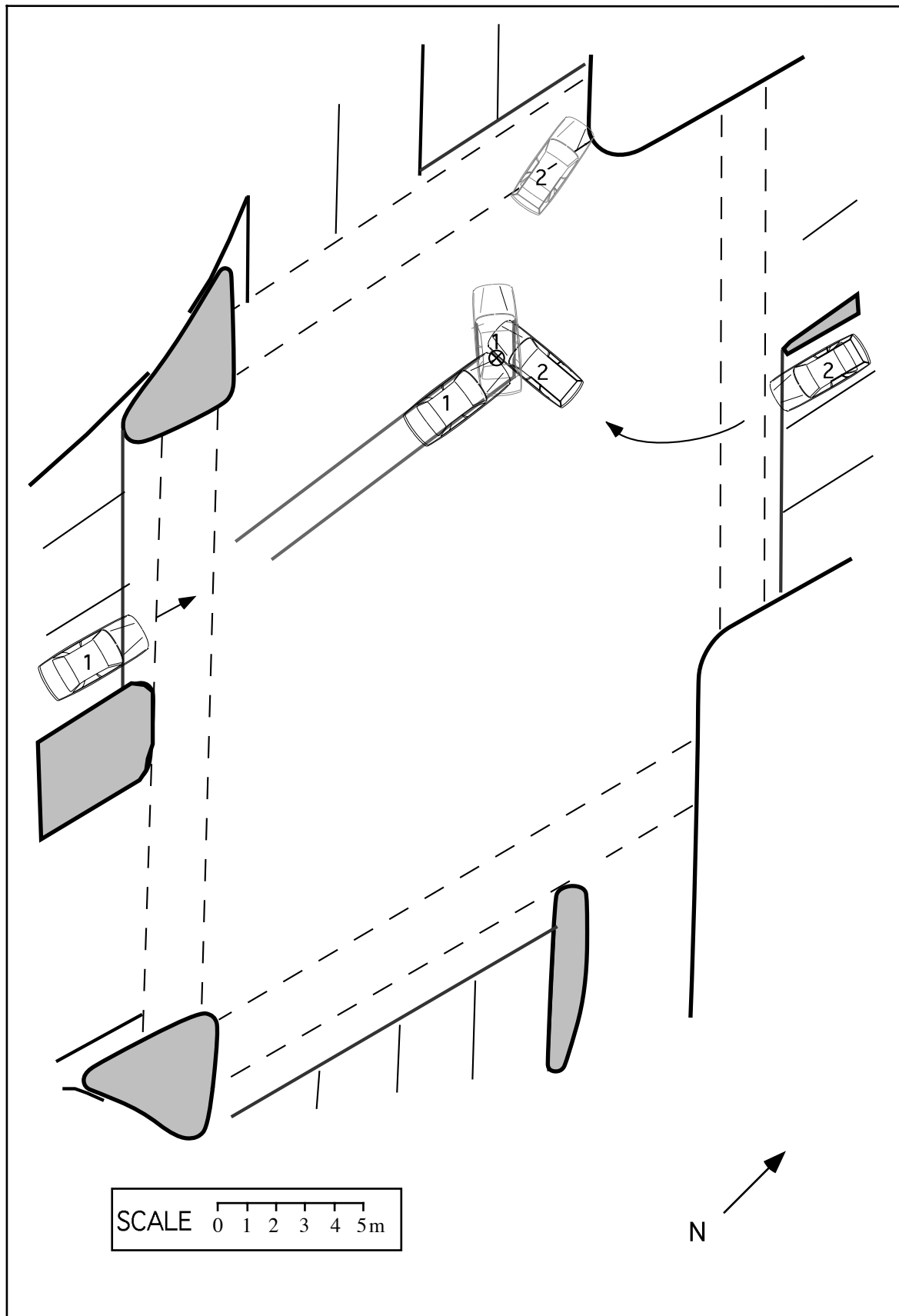
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	77	49	34
5 km/hour speed reduction	72	36	27
10 km/hour speed reduction	67	17	14
Speed Limit 50 with similar compliance	67	17	14
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	31
5 km/hour speed reduction	23
10 km/hour speed reduction	11
Speed Limit 50 with similar compliance	11
Speed Limit 60 with total compliance	0

CN209



CN210

Crash Description

Unit 2 turned right in front of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (18.5m).

Reconstruction Notes

Final position of Unit 2 estimated by driver.

Case Vehicle Speeds

Free Travelling Speed	78
Impact Speed	39

Control Speeds

56	57
62	65

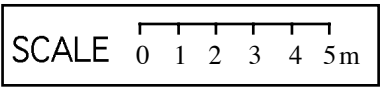
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	78	39	13
5 km/hour speed reduction	73	21	2
10 km/hour speed reduction	68	0	0
Speed Limit 50 with similar compliance	68	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	10
5 km/hour speed reduction	1
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

C N 2 1 0



CN211

Crash Description

Unit 2 crossing intersection through give way sign across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (23m)

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	82
Impact Speed	36

Control Speeds

56	57
58	64

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	82	36	23
5 km/hour speed reduction	77	13	10
10 km/hour speed reduction	72	0	0
Speed Limit 50 with similar compliance	72	0	0
Speed Limit 60 with total compliance	60	0	0

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	24
5 km/hour speed reduction	9
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	0

CN212

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.
Unit 2 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact and travelling speed from final positions and SMAC run.

Reconstruction Notes

Final positions from police estimates.

Case Vehicle Speeds

Free Travelling Speed	68
Impact Speed	68

Control Speeds

57	61
62	64

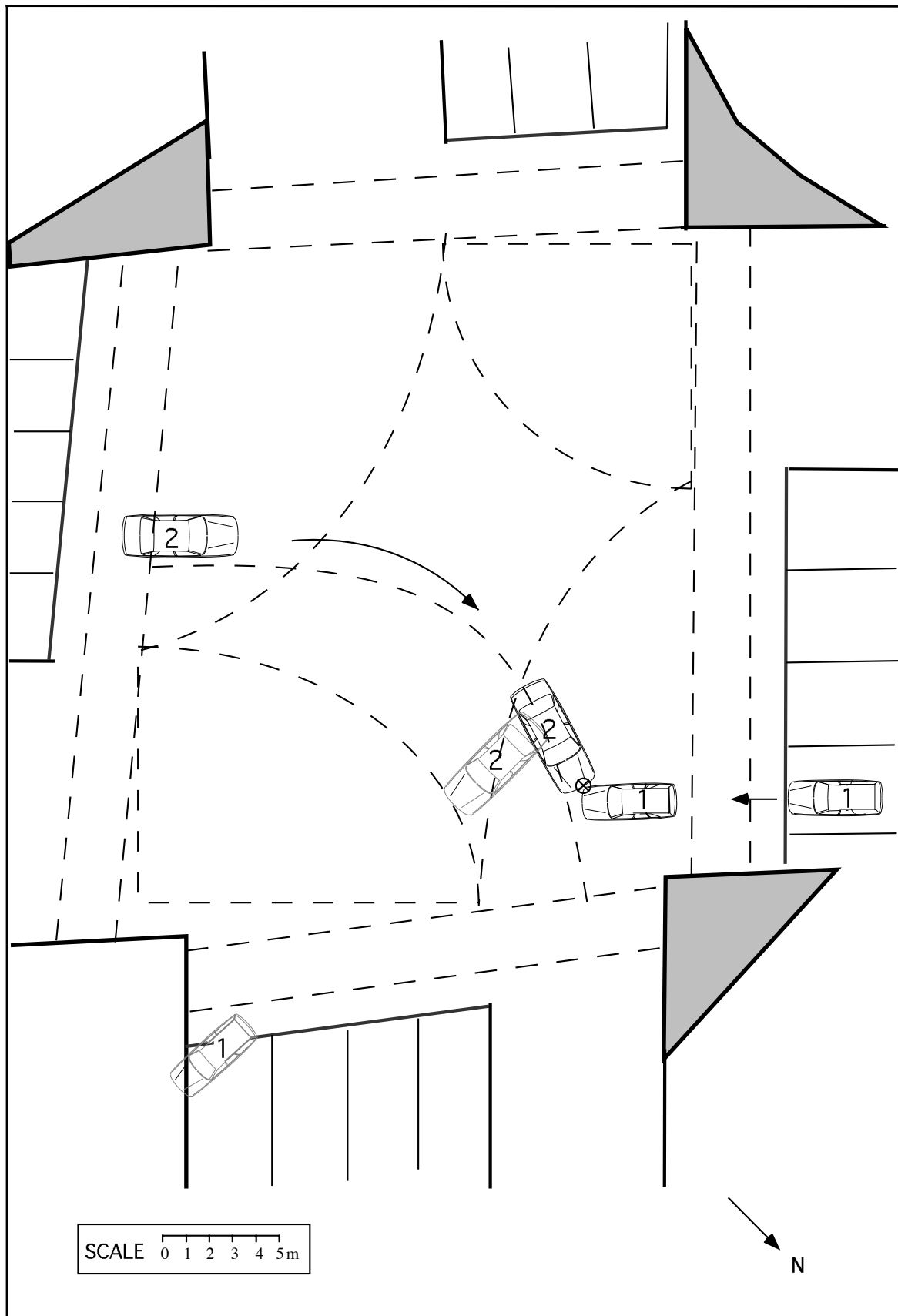
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	68	68	37
5 km/hour speed reduction	63	63	36
10 km/hour speed reduction	58	58	35
Speed Limit 50 with similar compliance	58	58	35
Speed Limit 60 with total compliance	60	60	35

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	23
5 km/hour speed reduction	23
10 km/hour speed reduction	22
Speed Limit 50 with similar compliance	22
Speed Limit 60 with total compliance	22

C N 2 1 2



CN213

Crash Description

Unit 2 turning right across path of Unit 1. Unit 1 applied brakes, ran off left side off road and collided with tree.

Injury Outcomes

Unit 1 driver transported by ambulance.
Unit 1 left front treated at hospital.
Unit 1 centre rear treated at hospital.
Unit 1 left rear treated at hospital.
Unit 1 right rear treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed with tree from pole impact deformation (500mm).
Travelling speed from skid marks (77m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	136
Impact Speed	34

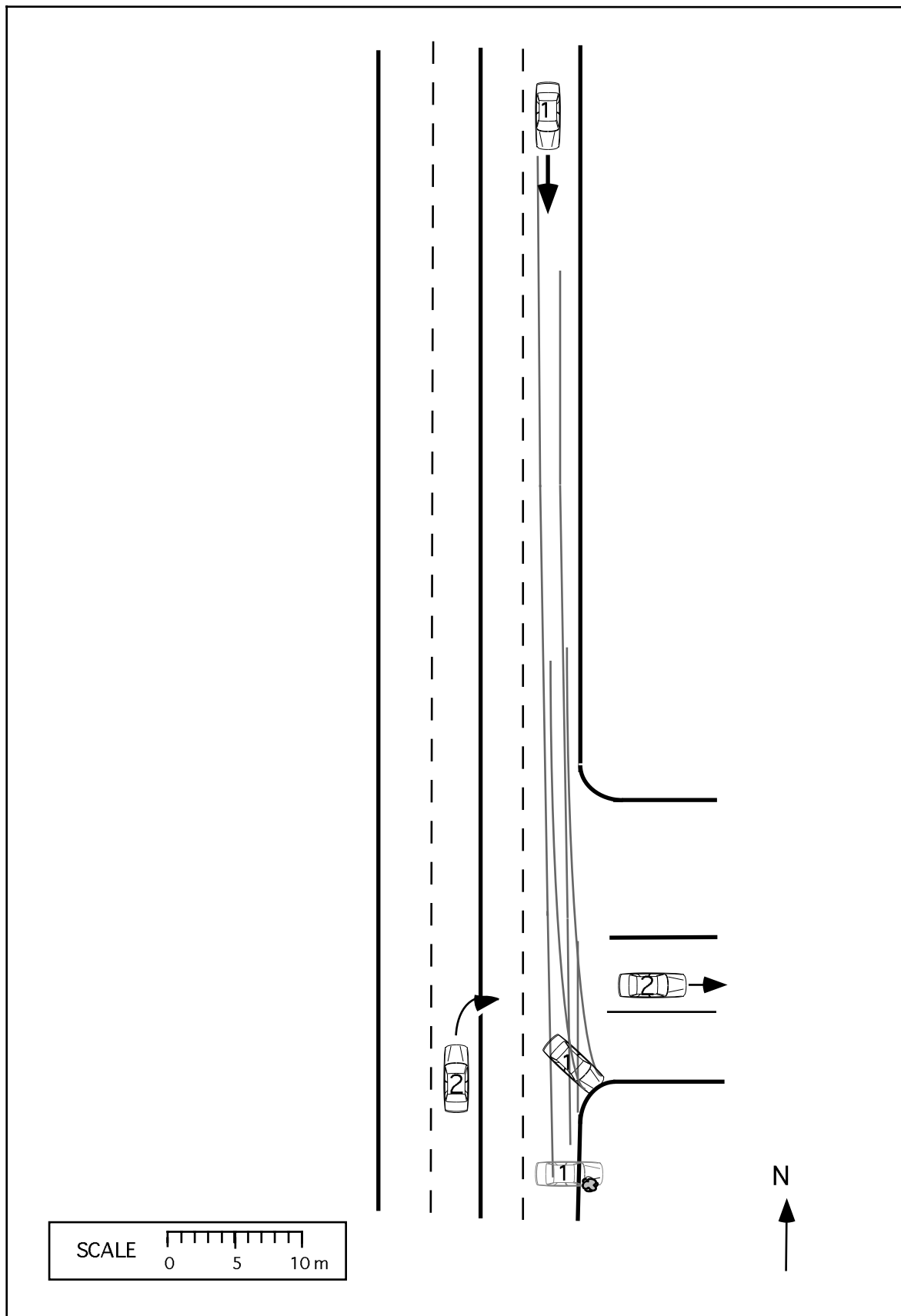
Control Speeds

59	60
62	62

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	136	34	34
5 km/hour speed reduction	131	0	0
10 km/hour speed reduction	126	0	0
Speed Limit 50 with similar compliance	126	0	0
Speed Limit 60 with total compliance	60	0	0

C N 2 1 3



CN214

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 2 left rear passenger admitted to hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from pre-impact skid marks (11m).

Reconstruction Notes

Final position of Unit 1 inferred from post-impact skid marks.

Case Vehicle Speeds

Free Travelling Speed	57
Impact Speed	25

Control Speeds

56	59
60	65

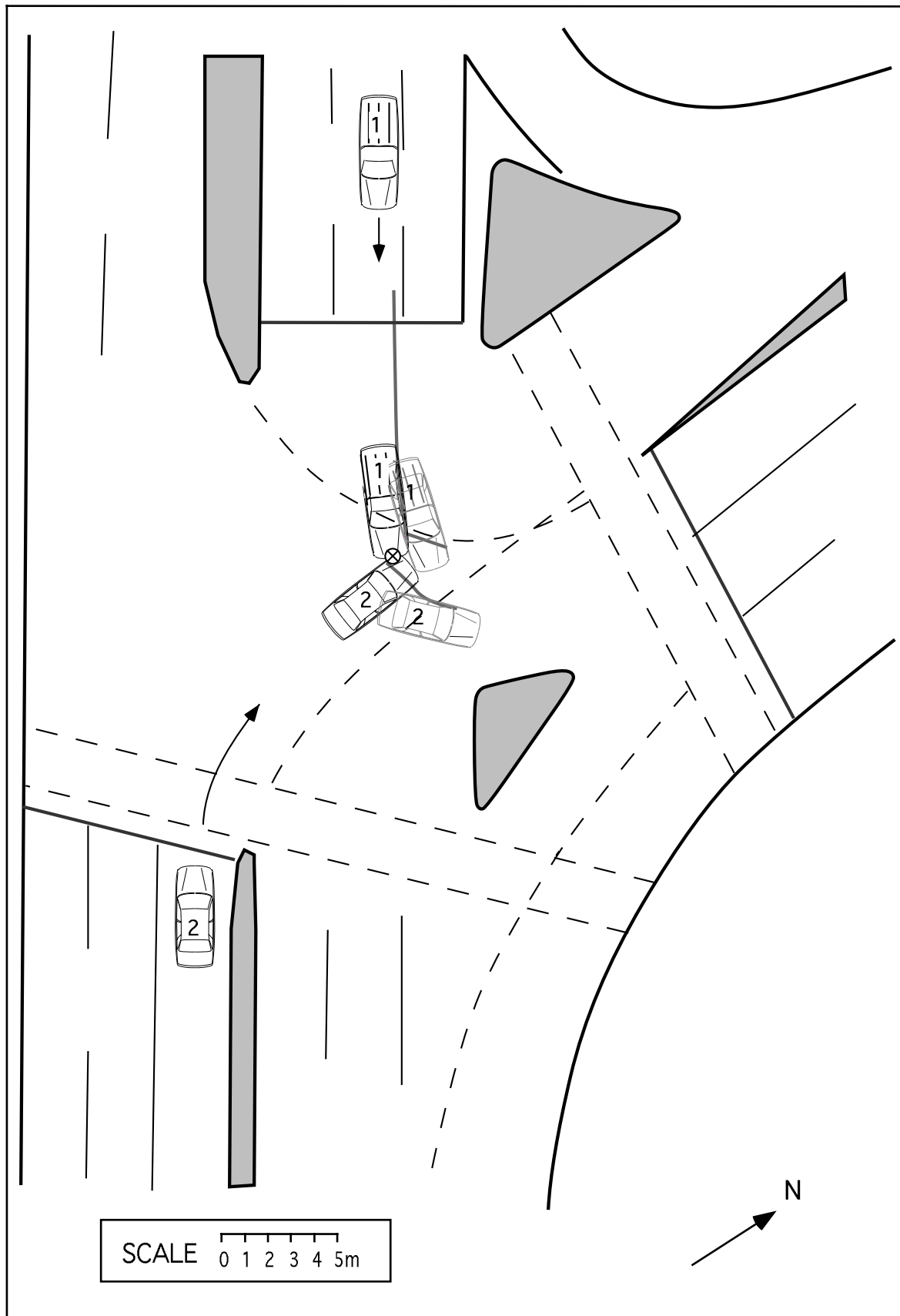
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	57	25	16
5 km/hour speed reduction	52	0	0
10 km/hour speed reduction	47	0	0
Speed Limit 50 with similar compliance	50	0	0
Speed Limit 60 with total compliance	57	25	16

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	21
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	21

CN214



CN215

Crash Description

Unit 2 stopped at intersection due to banked traffic. Unit 1 applied brakes and collided with trailer being towed by Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.

Travelling speed from skid marks (7m).

Reconstruction Notes

Modelled Unit 2 and trailer as one lumped vehicle with low stiffness.

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	47

Control Speeds

53	56
60	65

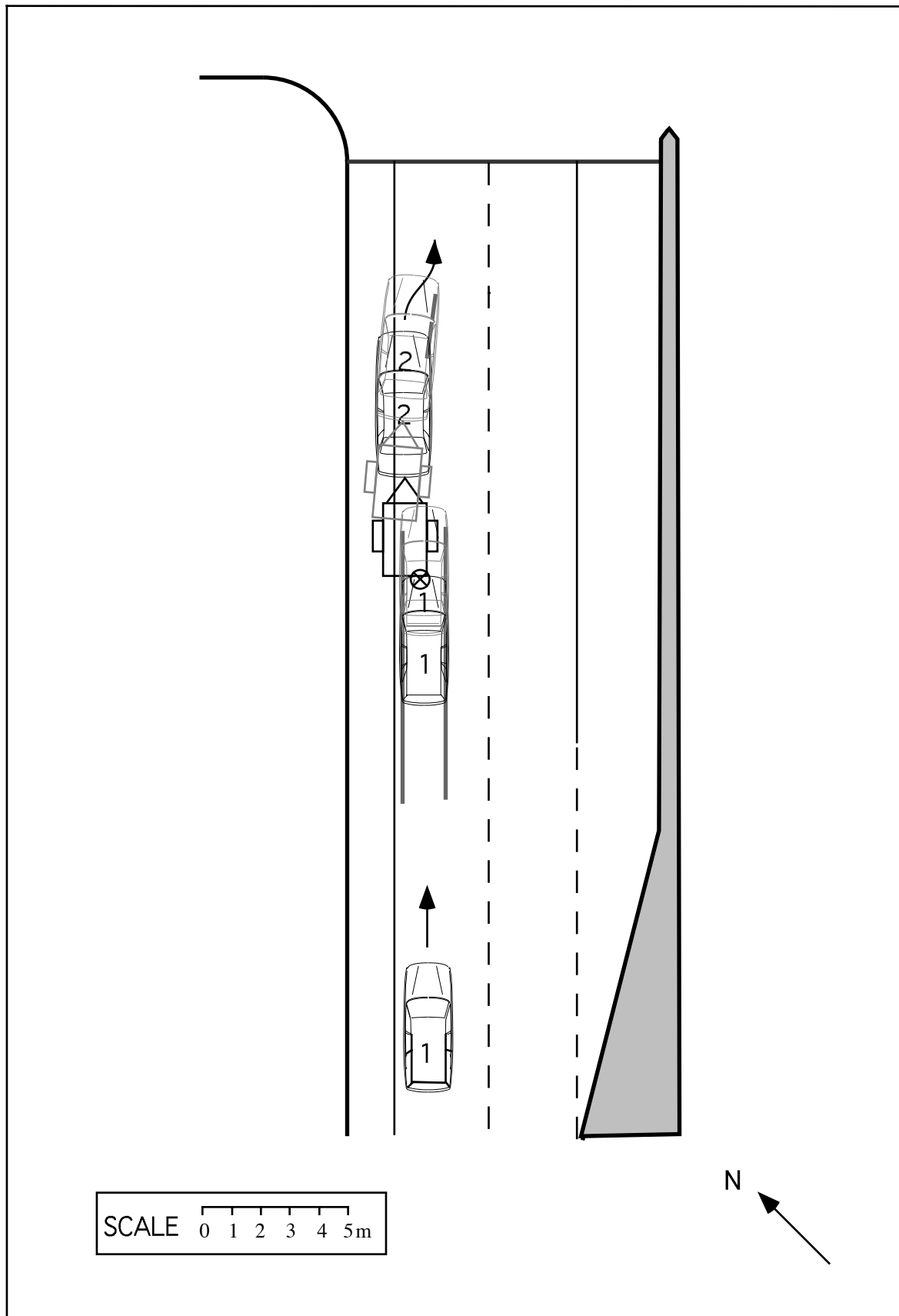
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	47	37
5 km/hour speed reduction	61	35	29
10 km/hour speed reduction	56	16	15
Speed Limit 50 with similar compliance	56	16	15
Speed Limit 60 with total compliance	60	33	28

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	17
5 km/hour speed reduction	12
10 km/hour speed reduction	4
Speed Limit 50 with similar compliance	4
Speed Limit 60 with total compliance	12

CN215



CN216

Crash Description

Unit 2 making right turn in to local street across path of Unit 1. Unit 1 applied brakes and collided with Unit 2. Unit 2 then collided with Unit 3.

Injury Outcomes

Unit 2 driver treated at hospital.
Unit 2 left front passenger treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (8.5m).

Reconstruction Notes

Assumed first impact on Unit 2 was most significant based on damage to Unit 2.

Case Vehicle Speeds

Free Travelling Speed	52
Impact Speed	25

Control Speeds

50	56
58	58

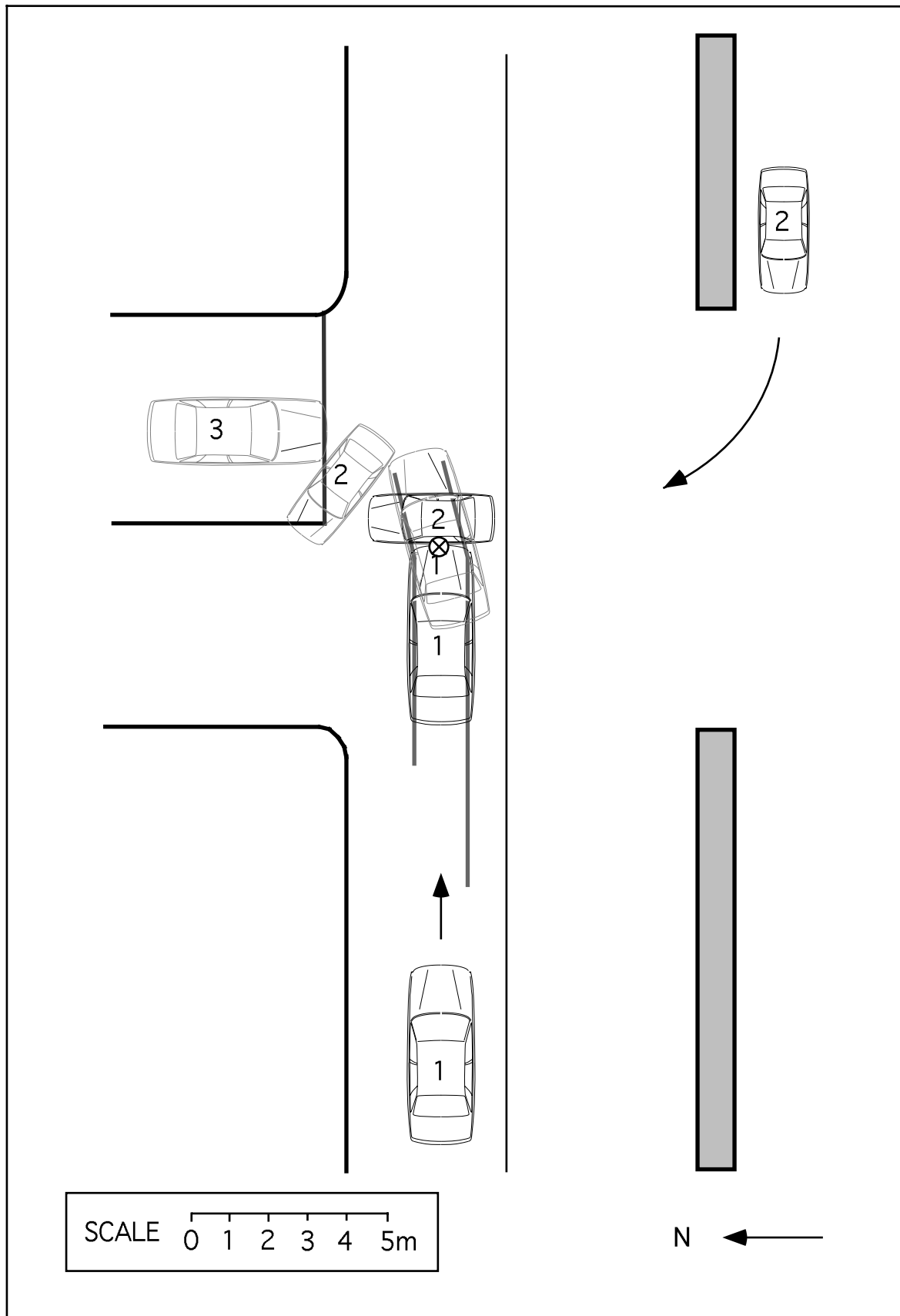
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	52	25	11
5 km/hour speed reduction	47	0	0
10 km/hour speed reduction	42	0	0
Speed Limit 50 with similar compliance	50	18	8
Speed Limit 60 with total compliance	52	25	11

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	18
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	12
Speed Limit 60 with total compliance	18

CN216



CN218

Crash Description

Unit 1 moved from right lane to left lane to pass a slow moving vehicle. Unit 1 applied brakes and collided with a pedestrian.

Injury Outcomes

Pedestrian transported by ambulance.

Type of Road

Main road.

Reconstruction Method

Travelling speed from total skid marks (11.1m).

Impact speed from post-impact skid marks (4.6m).

Reconstruction Notes

Driver estimated 60 but not indicated by skid marks.

Case Vehicle Speeds

Free Travelling Speed	50
Impact Speed	29

Control Speeds

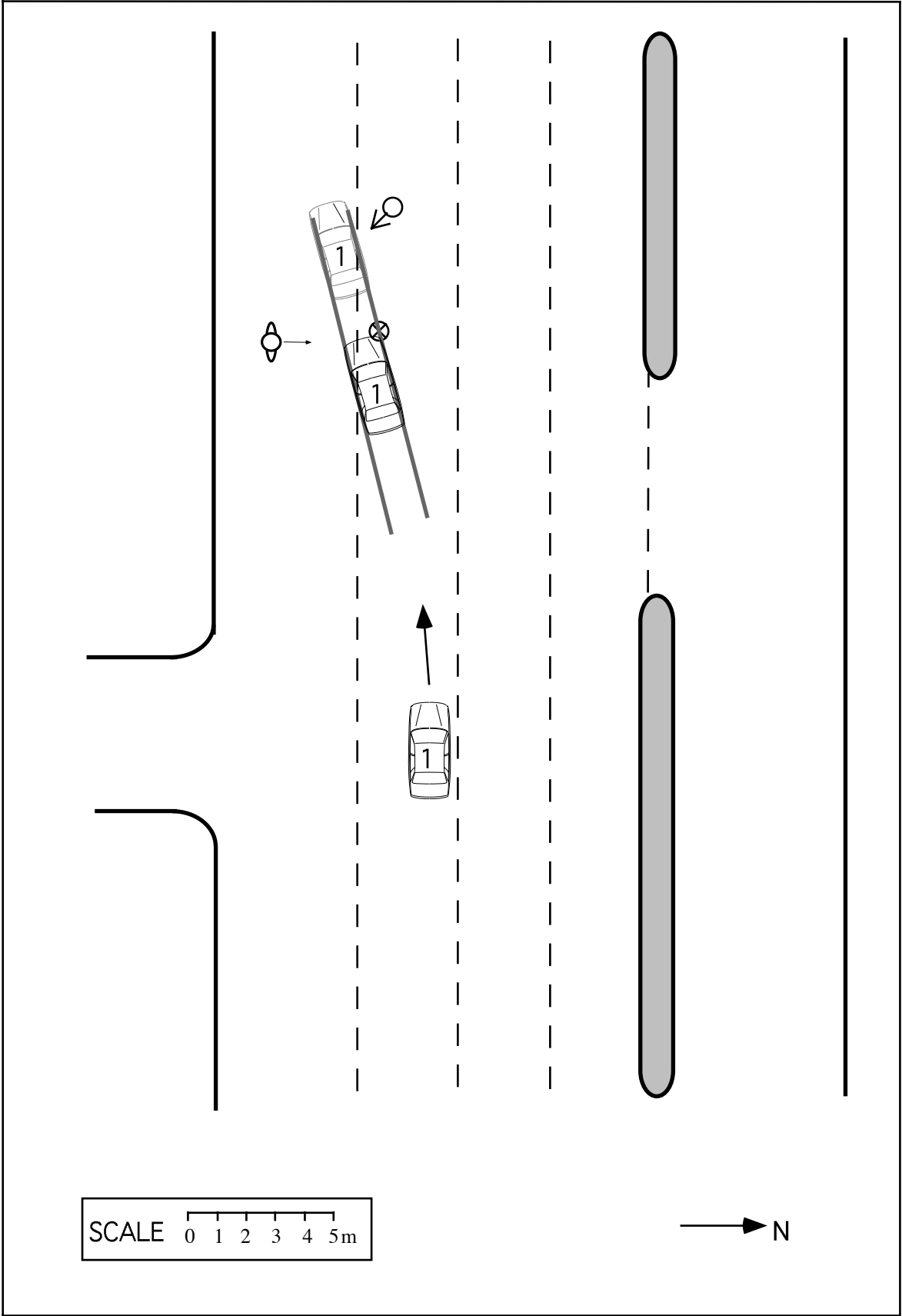
50	51
54	56

Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	50	29	0
5 km/hour speed reduction	45	0	0
10 km/hour speed reduction	40	0	0
Speed Limit 50 with similar compliance	50	29	0
Speed Limit 60 with total compliance	50	29	0

Hypothetical Scenarios (Pedestrian)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	29
5 km/hour speed reduction	0
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	29
Speed Limit 60 with total compliance	29



CN219

Crash Description

Unit 2 turning right at intersection across path of Unit 1. Unit 1 applied brakes and collided with Unit 2.

Injury Outcomes

Unit 1 driver treated at hospital.

Type of Road

Main road.

Reconstruction Method

Impact speed from final positions and SMAC run.
Travelling speed from skid marks (12m).

Reconstruction Notes

Case Vehicle Speeds

Free Travelling Speed	66
Impact Speed	36

Control Speeds

57	60
62	63

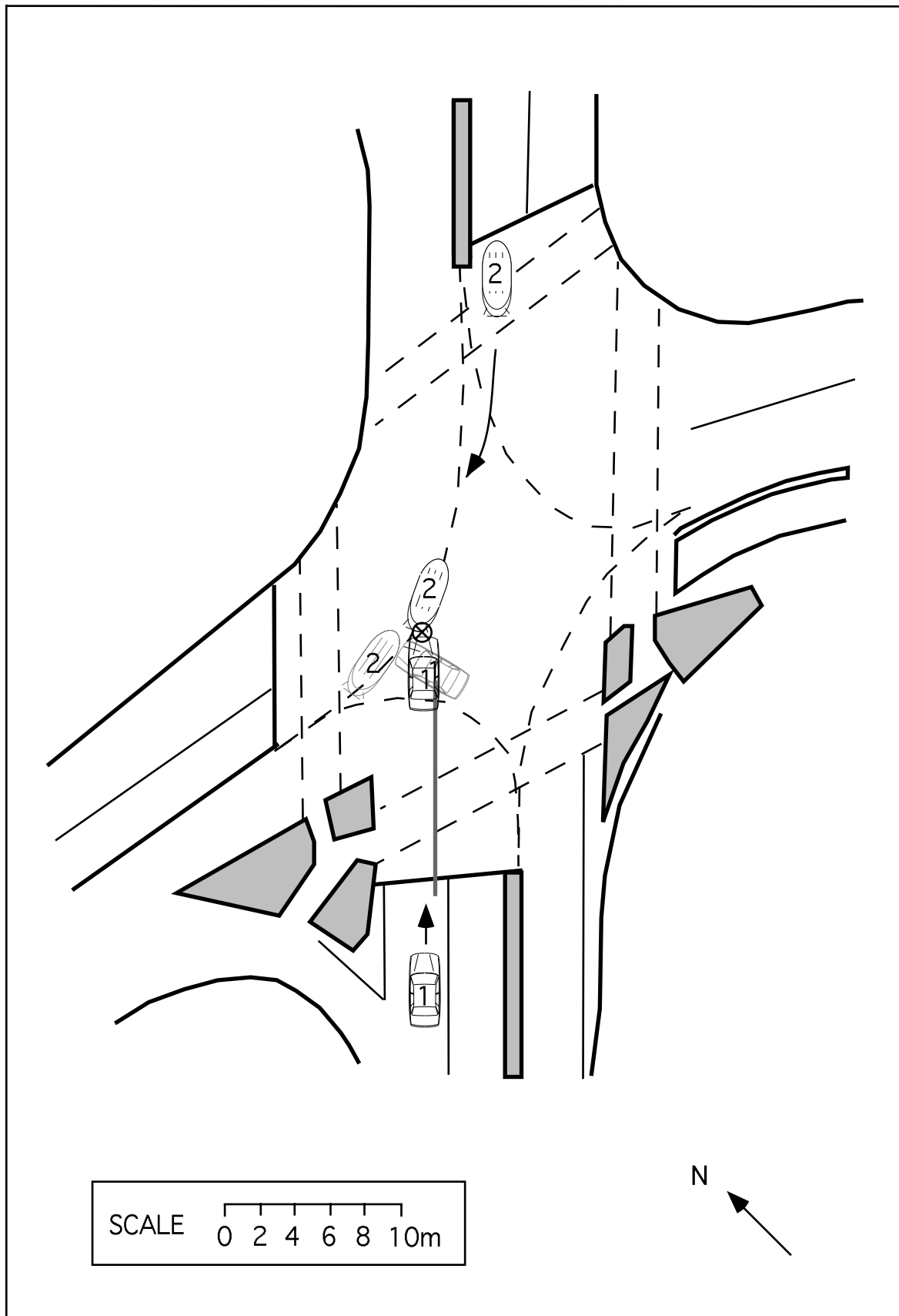
Hypothetical Scenarios (Case Vehicle)

<i>Scenario</i>	<i>Travelling Speed</i>	<i>Impact Speed</i>	<i>Delta V</i>
Actual Calculated	66	36	45
5 km/hour speed reduction	61	17	33
10 km/hour speed reduction	56	0	0
Speed Limit 50 with similar compliance	56	0	0
Speed Limit 60 with total compliance	60	14	31

Hypothetical Scenarios (Unit 2)

<i>Scenario</i>	<i>Delta V</i>
Actual Calculated	29
5 km/hour speed reduction	21
10 km/hour speed reduction	0
Speed Limit 50 with similar compliance	0
Speed Limit 60 with total compliance	20

CN219



1. CRASH RECONSTRUCTION METHOD

This section explains in detail the crash reconstruction methods used in the study to arrive at estimates of the free travelling speeds for the case vehicles. Refer to Volume 1 of this report for other information on this study.

1.1 Data Collection Procedure

Upon arriving at a crash site it was important to establish the final or rest positions of the crashed vehicles. Photographs were taken to provide a record of the positions of the cars in the event that the cars were moved prior to the team marking their positions. In the cases where the cars had been moved from their rest positions, the police or witnesses gave the team reasonable indications of the final vehicle positions, which were usually confirmed by the presence of skid marks, scuff marks, radiator fluid stains or crash debris. The impact points were ascertained in a similar manner.

A crash survey form was completed from data collected by measurement, observation and interview to record information such as:

- Car occupant details
- Blood alcohol concentrations (BAC) of drivers
- Driver or witness estimates of vehicle travelling speeds
- Year, make, model and type of vehicles involved
- Registration numbers of vehicles
- Details of any vehicle modifications and cargo
- Road inspection and measurements
- Vehicle inspection and measurements

Basic identification of the make and model of each vehicle was required so that further information such as vehicle mass, wheel base, length, width and track (necessary for reconstruction purposes) could be measured or derived from appropriate sources (Vehicle Specifications Data Sheets). The registration details were needed to obtain copies of police accident reports, which contained information on BACs and injured participants.

Often the BACs of the uninjured drivers were obtained from the police at the crash site. In situations where the research team was unable to obtain BAC results from the police at the site, the uninjured drivers were asked to submit to a breath alcohol test by one of the members of the team. Immediate knowledge of the driver's BAC was necessary to establish whether the collision met the criteria for the study. In cases where the drivers were injured the police

reports contained the results of the BAC analysis of the compulsory blood sample taken at the treating hospital.

Details of vehicle modifications, any cargo, and the weights of the occupants were needed to estimate the total mass of the vehicle. Driver or witness statements were used to determine whether the cars were travelling at free speeds. Road inspection (through evidence of obvious skid marks) allowed us to determine whether there was any pre-impact or post impact braking. Vehicle inspection and damage measurement was important in determining the extent of the deformation and whether it was significant enough to influence the vehicle's post impact behaviour. In some cases the vehicle deformation affected the driver's ability to retain steering control or in other ways affected the post impact motions of the vehicle.

After collecting all necessary information, a sketch of the site was prepared with all relevant dimensions and site details recorded on it (impact point, skid marks, scuff marks and final positions of the vehicles). From the site sketch a scale site diagram was prepared for further analysis.

1.2 Vehicle-Vehicle Crash Reconstruction Using M-SMAC

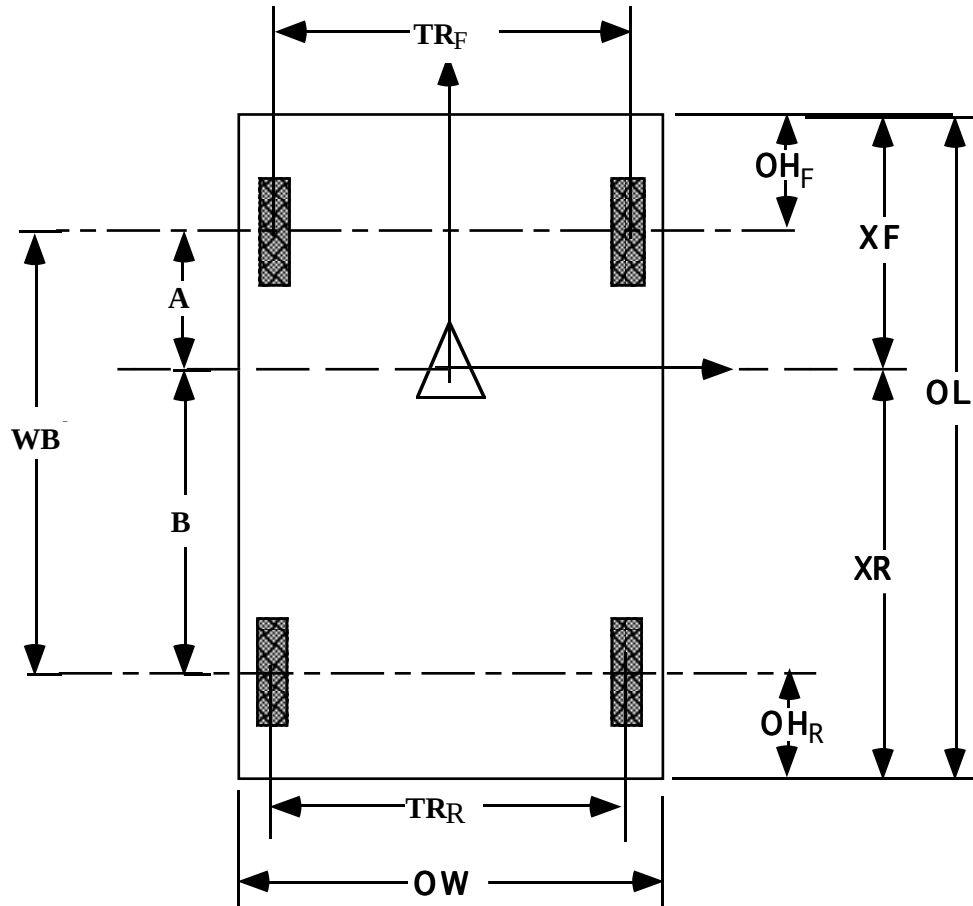
Most of the crash reconstruction was performed using the M-SMAC Program (Simulation Model of Automobile Collisions) (McHenry, 1973; McHenry and McHenry, 1988; McHenry Software, 1996). The M-SMAC program uses a reconstruction procedure where dimensional, inertial, crush and tyre properties of the vehicles, the initial speeds, angles and driver control inputs are specified by the user. The M-SMAC program is a time-domain mathematical model where vehicles are represented by differential equations derived from Newtonian mechanics, combined with empirical relationships for components such as crush properties and tyres, that are solved for successive time increments by digital integration. The program produces detailed time-histories of the vehicle trajectories and the collision response which are then compared to the 'real' trajectory and collision response by matching the M-SMAC predicted final vehicle positions and predicted deformation with the actual measured final vehicle positions and measured deformation. The run is repeated varying impact speeds, heading angles and control inputs until a reasonable correlation with the physical evidence is achieved.

1.2.1 Required M-SMAC Information

The input data required includes the centres of gravity of the two colliding vehicles and their heading angles (at impact) as well as other vehicle dimensions and estimates of the colliding

vehicles' impact speeds The program models a car as a deformable rectangular box having characteristics similar to those of the real crashed 'car'.

Figure 1.1
Required Dimensions for M-SMAC Program



The following dimensions are required by the M-SMAC program (see Figure 1.1).

WB = wheelbase (mm)

A = distance from the centre of gravity to the front wheel centre line (mm)

= *weight distribution on rear wheels* $\times$ *wheelbase*

= $\frac{\text{weight on rear wheels}}{\text{total weight}} \times \text{wheelbase}$

= $\frac{W_R}{W_T} WB$

$$\begin{aligned}
B &= \text{distance from the centre of gravity to the rear wheel centre line (mm)} \\
&= \text{weight distribution on front wheels} \times \text{wheelbase} \\
&= \frac{\text{weight on front wheels}}{\text{total weight}} \times \text{wheelbase} \\
&= \frac{W_F}{W_T} WB
\end{aligned}$$

As the centre of gravity of a vehicle is difficult to measure directly without special equipment the following assumptions were made:

For front wheel drive vehicles the weight distribution was assumed to be 59% and 41% for the front and rear wheels respectively.

For rear wheel drive vehicles the weight distribution was assumed to be 52% and 48% for the front and rear wheels respectively.

$$\begin{aligned}
TR &= \text{average track width (mm)} \\
&= \frac{TR_F + TR_R}{2}
\end{aligned}$$

$$OL = \text{overall length (mm)}$$

$$OW = \text{overall vehicle width (mm)}$$

$$\begin{aligned}
OH_T &= \text{total overhang length (mm)} \\
&= OL - WB
\end{aligned}$$

$$OH_F = \text{front overhang, scaled from vehicle photographs (mm)}$$

$$OH_R = \text{overhang rear, scaled from vehicle photographs (mm)}$$

$$\begin{aligned}
XF &= \text{distance from the vehicle's centre of gravity to the front end (mm)} \\
&= A + OH_F
\end{aligned}$$

$$\begin{aligned}
XR &= \text{distance from the vehicle's centre of gravity to the rear end (mm)} \\
&= B + OH_R
\end{aligned}$$

$$\begin{aligned}
M &= \text{total vehicle mass (kg)} \\
&\quad (\text{includes estimate of vehicle occupant mass and cargo mass})
\end{aligned}$$

$$\begin{aligned}
I &= \text{total moment of inertia in yaw, kgm}^2 \\
&\quad (\text{derived using rectangular prism approximation}) \\
&= \text{vehicle mass} \left(\frac{OL^2 + OW^2}{12} \right)
\end{aligned}$$

$$\begin{aligned}
\text{CSTF}_F &= \text{linear cornering stiffness of front tyres (NRad}^{-1}\text{)} \\
&\quad (\text{approximated as 16\% of the weight on the front tyres}) \\
&= -\frac{1}{2} \times \frac{16}{100} \times \frac{360}{2\pi} W_F g \text{ (per wheel)}
\end{aligned}$$

$$\begin{aligned}
\text{CSTF}_R &= \text{linear cornering stiffness of rear tyres (NRad}^{-1}\text{)} \\
&\quad (\text{approximated as 16\% of the weight on the rear tyres}) \\
&= -\frac{1}{2} \times \frac{16}{100} \times \frac{360}{2\pi} W_R g \text{ (per wheel)}
\end{aligned}$$

Wheel Drag Approximations:

For a vehicle under full braking (ie. all 4 wheels locked), the wheel drag was assumed to be the force that equalled or exceeded the vehicle weight.

$$\text{Rear wheel force} = -\frac{1}{2} W_R \mu g \text{ (N) (per wheel)}$$

$$\text{Front wheel force} = -\frac{1}{2} W_F \mu g \text{ (N) (per wheel)}$$

Where no braking was evident, engine braking was assumed to be 15% of the vehicle weight applied at the drive wheels from the time of impact to rest.

$$\text{Engine braking} = -\frac{1}{2} \times \frac{15}{100} W_T \text{ (N) (for each driving wheel)}$$

In situations where neither full braking nor engine braking occurred, and it was evident that a vehicle was accelerating at impact, an appropriate estimate of acceleration was applied to the drive wheels (as positive force).

Force values were entered on a time history table, so force values could be applied to the vehicle from the beginning to the end of the collision or anytime in between. If the braking or wheel lock was damage-induced the force was applied at the time at which it appeared that the vehicle deformation had such an effect on the vehicle's movements.

In certain cases where vehicles involved in a collision were engaged in a turning manoeuvre, a time history table for steer was set-up for the front wheels, the inputs were in degrees in accordance with the estimated turning angles. Steer angles were also applied in situations where the steer was damage induced, once again at the time at which it appeared that vehicle deformation had an effect on the vehicle's steering performance.

Vehicle stiffness values were selected between the range of 50 - 150 Ncm⁻², the value of the stiffness being dependent on the location of the deformation on the vehicle and comparative damage profiles.

1.2.2 Iterating M-SMAC

The M-SMAC program works on a system of manual iteration. An M-SMAC run is first set-up using an existing template, calculated properties of the vehicles and impact positions based on the crash scene and vehicle damage. A primary run is then executed to establish whether the reconstructed collision matches the data from the actual crash.

One or more of the following characteristics are then adjusted as necessary between runs:

- Speeds of the vehicles
- Headings of the vehicles
- Stiffnesses of the vehicles
- Braking or acceleration of the individual vehicle wheels
- Steering of the vehicles before and after impact

The iterations of the program continue until the output accurately predicts the following observed outcomes:

- Final positions of the vehicles and their post-impact trajectories
- Damage profiles of the vehicles
- Multiple impacts between vehicles

As indicated above, the M-SMAC program also calculates and displays the nature and extent of the vehicle deformation in the crash. This was used to verify the estimated impact positions, and further to this allowed a reconstruction to be judged based on how well the damage was replicated compared with the physical damage. M-SMAC also displayed a time-history table of a vehicle's dynamic response (speeds, position, acceleration etc.) so in situations where there was a secondary collision with another vehicle or other object (eg. a fence, a pole, median strip or the kerb) the time history table could be analysed and the information used to determine whether the vehicle speeds at the point of the secondary collision were consistent with the observed secondary damage or post secondary collision vehicle behaviour.

1.2.3 Estimating Travelling Speed from Impact Speed

The M-SMAC program gave best estimates of impact speeds and the change in velocity in the crash (ΔV). In situations where there was no obvious pre-impact braking (ie. no pre-impact skid marks) it was assumed that the impact speed calculated using M-SMAC was also the travelling speed of the vehicle. Where there was obvious pre-impact braking, the free travelling speed of the vehicle was calculated using:

$$v_t = \sqrt{\frac{v_i^2 + 2\mu ga}{L}}$$

where:

v_t = travelling speed (ms^{-1})

v_i = impact speed (ms^{-1})

μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)

g = acceleration due to gravity (ms^{-2})
= 9.812

a = distance from the start of skid marks to impact point (m)

L = percentage of energy remaining immediately prior to the wheels locking under braking
= 80% (Reed and Keskin, 1989)

Reed and Keskin (1989) determined that a vehicle loses about 20% of its kinetic energy from the moment when the brakes are first applied to when a skid mark commences on the road. The 'L' term in the above equations takes this into account when calculating speeds from skid marks.

1.2.4 Limitations of the M-SMAC program

There are a number of limitations which need to be noted in the use of the M-SMAC program for crash reconstruction:

- Vehicle motions are limited to a horizontal plane in which the effects of pitch and roll are neglected
- The terrain surface is assumed to be flat and horizontal
- The effects of camber and roll steer are neglected
- Only 2 vehicles can be simulated in any collision reconstruction (although multiple collisions can be simulated one at a time if they are distinct events)
- The program assumes a uniform stiffness for the vehicles (although this stiffness could be altered based on observed impact location)

- The program cannot simulate any change in the dynamic characteristics of a vehicle due to gross deformations in the crash
- Head on crashes with little post impact movement of vehicles can be reconstructed at a range of different speeds with essentially the same results although the range can be narrowed by matching predicted and actual damage profiles (given the limited crash test data on some of the vehicles in this study)

Considerable judgment on the part of the persons running the reconstruction was required in cases where such limitations presented themselves. In some of these cases the input data were forwarded to Brian McHenry for advice.

1.3 Damage Only Crash Reconstruction

In circumstances where only vehicle damage information was available a CRASH 3 damage only reconstruction was performed to determine the impact speeds and delta V's (NHTSA, 1982). CRASH 3 calculates delta V's based on the damage profiles of the vehicles involved in a collision. Previous use of this program has suggested that it is not particularly accurate and tends to underestimate delta Vs. Thus, in a majority of the crashes where only damage was available from two car collisions it was deemed necessary to reject them on the basis of lack of information.

1.4 Vehicle-Pole Crash Reconstruction

A formula based on pole impact data was used to estimate impact speeds in collisions with poles. The pole impact formula used is based on 19 staged frontal pole crash tests and has an rms error in speed prediction of 1.8 mph (2.9 km/h) (Nystrom and Kost, 1993).

$$v_i = v_n + C_m(K_1 - K_2 W)$$

where:

$$v_i = \text{impact speed (km/h)}$$

$$v_n = \text{speed at which no crush occurs (km/h)}$$

$$= 8$$

$$C_m = \text{maximum crush on the vehicle (mm)}$$

$$K_1 = \text{constant term}$$

$$= 0.06072$$

$$K_2 = \text{constant term}$$

$$= 4.874 \times 10^{-6}$$

$$W = \text{mass of vehicle (kg)}$$

In situations where there was no obvious pre-impact braking (ie. no pre-impact skid marks) it was assumed that the impact speed calculated using the pole impact formula was also the travelling speed of the vehicle. Where there was obvious pre-impact braking, the travelling speed of the vehicle was calculated using the equations presented in Section 1.2.3.

For situations where the vehicle and the pole were significantly deformed (ie. the pole did not act strictly like a rigid structure) the pole deformation was considered additive to the vehicles' maximum crush.

For side impacts with poles or trees a similar method was applied. Staged crash data (Hansen, Hargrave and Hinch, 1989) was compared with the side impact crashes attended by RARU to obtain an estimate of impact speed. This verified that the pole impact formulae above also gave reasonable estimates of impact speed for side impacts.

1.5 Vehicle-Pedestrian and Pedal Cycle Crash Reconstruction

In each of the collisions with a pedestrian or a pedal cycle in this study the crash vehicle had come to rest at the end of its skid marks. It was assumed that the energy lost by the vehicle due to the collision with pedestrian or cyclist was negligible since the mass of the striking vehicle was very much greater than that of the pedestrian or cyclist and in a majority of the cases the damage to the colliding vehicle was minimal.

When the vehicle began skidding only after impact and skidded to a complete stop, the impact and travelling speeds were equal and calculated using:

$$v_t = \sqrt{\frac{2\mu ga}{L}}$$

where:

v_t = travelling speed (ms⁻¹)

μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)

g = acceleration due to gravity (ms⁻²)
= 9.812

a = distance from the start of skid marks to impact point (m)

L = percentage of energy remaining immediately prior to the wheels locking
= 80% (Reed and Keskin, 1989)

The above equation was also used to calculate the travelling speed for cases where the vehicle started skidding before impact but the following equation was used to calculate the impact

speed with the pedestrian (note 'L' is omitted because the wheels are already locked at the time of impact):

$$v_i = \sqrt{2\mu ga}$$

where:

v_i = impact speed (ms⁻¹)

μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)

g = acceleration due to gravity (ms⁻²)
= 9.812

a = distance from the start of skid marks to impact point (m)

In cases where any skid marks left by the colliding vehicles were indistinct, and the pedestrian throw distance (distance from the point of impact to the final position of the pedestrian) was known, the maximum and minimum impact speeds were calculated using the following equations (Searle and Searle, 1983):

$$v_{\min} = \sqrt{\frac{2\mu gs}{1 + \mu^2}}$$

$$v_{\max} = \sqrt{2\mu gs}$$

where:

μ = coefficient of friction between tyres and road surface
= 0.66 (for a pedestrian on level bitumen road)

g = acceleration due to gravity (ms⁻²)
= 9.812

s = throw distance (m)
(distance from impact point to rest position of pedestrian)

The minimum and maximum impact speeds were then averaged.

$$v_{\text{mean}} = \frac{v_{\min} + v_{\max}}{2}$$

The mean speed was then compared to the speed calculated using the indistinct skid mark and if they correlated well the skid mark was considered 'verified' and accepted. In these situations driver or witness estimates of impact speed or travelling speed were also considered in arriving at a final estimate of the impact speed.

1.6 Reconstruction using Yaw Marks

When a vehicle is attempting to turn or negotiate a curve at too high a speed, the wheels will slip sideways and leave a yaw mark on the road. This is easily distinguished from a skid mark since the striations will be perpendicular to the direction of travel.

By measuring points on the yaw mark, its radius of curvature can be calculated and this can be used to calculate the critical speed for yaw mark formation. This gives the speed of the vehicle while it was yawing.

The critical speed for taking a curve is calculated using:

$$v_{crit} = 11.27\sqrt{R_C\mu}$$

where:

v_{crit} = critical speed for curve (km/h)

R_C = radius of curvature of the yaw mark (m)

μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)

2. HYPOTHETICAL SPEED CALCULATIONS

In an attempt to examine the effects of lowering travelling speeds, the cases in this study were submitted to a set of hypothetical changes in travelling speed and the resulting collisions were compared with the actual calculated collisions. The results can be found in Volume 1 of this report. This section details the scenarios tested and the assumptions and calculations used.

2.1 Scenarios Tested

The following hypothetical scenarios were examined:

1. Uniform 5 km/h speed reduction by all case vehicles
2. Uniform 10 km/h speed reduction by all case vehicles
3. Speed limit 50 km/h with similar compliance to that at present
4. Speed limit 50 km/h with similar compliance (only cases on local streets)
5. Speed limit 60 km/h with total compliance (no vehicles travelling faster than 60 km/h)

Under Scenario 1, all case vehicles were assumed to have a travelling speed of 5 km/h less than their calculated travelling speed.

Under Scenario 2, all case vehicles were assumed to have a travelling speed of 10 km/h less than their calculated travelling speed.

Under Scenario 3, all vehicles that were calculated as travelling over 60 km/h were assumed to be travelling 10 km/h slower; all vehicles calculated as travelling between 50 and 60 km/h were assumed to be travelling at 50 km/h; and all vehicles calculated as travelling under 50 km/h did not have their speeds changed. This scenario was intended as a first approximation estimate of the effect of a change in speed limit from 60 to 50 km/h.

Scenario 4 was the same as Scenario 3 except that the reductions were only applied to crashes occurring on a local street; crashes on main roads did not have their speeds altered. This scenario was intended as a first approximation estimate of the effect of a change in speed limit from 60 to 50 km/h on local streets only.

Under Scenario 5, all case vehicles with a calculated travelling speed above 60 km/h were assumed to be travelling at 60 km/h.

2.2 Calculations and Assumptions

Consider the following sequence of events in a crash between a vehicle travelling at a free speed and some object where the impact speed is known from a crash reconstruction:

1. The driver of the vehicle becomes aware that a crash is going to take place
2. The driver of the vehicle decides to apply the brakes and applies pressure to the brake pedal
3. The brake system slows the wheels and the speed of the vehicle
4. The wheels lock and a skid mark is left on the road
5. The vehicle collides with the object

The free travelling speed can be calculated from the skid mark length and impact speed using:

$$v_t = \sqrt{\frac{v_i^2 + 2\mu ga}{L}}$$

where:

v_t = travelling speed (ms^{-1})

v_i = impact speed (ms^{-1})

μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)

g = acceleration due to gravity (ms^{-2})
= 9.812

a = distance from the start of skid marks to impact point (m)

L = percentage of energy remaining immediately prior to the wheels locking
= 80% (Reed and Keskin, 1989)

By working backward in time from the moment of collision, it is possible to calculate the distance that the vehicle was from the impact point when the driver of the vehicle first became aware that a crash was going to take place using the following formulas:

$$S_t = S_r + S_l + S_s$$

where:

S_t = total distance from awareness to impact point (m)

S_r = distance travelled during driver reaction time (m)

S_l = distance travelled while wheels were locking up (m)

S_s = distance travelled while wheels were skidding (m)

It was assumed that sex, age and task complexity are negligible factors in determining the reaction time of a driver (see McLean et. al., 1994) so the reaction distance is calculated using:

$$S_r = v_t t_r$$

where:

$$\begin{aligned} S_t &= \text{total distance from awareness to impact point (m)} \\ v_t &= \text{travelling speed (ms}^{-1}\text{)} \\ t_r &= \text{driver reaction time (s)} \\ &= 1.5 \text{ (Olson, 1991; Bell, Loomis and Cervone, 1982)} \end{aligned}$$

The distance travelled from the point of brake application to the wheels locking is calculated using:

$$S_l = \frac{1 + \sqrt{L}}{2} v_t t_l$$

where:

$$\begin{aligned} S_l &= \text{distance travelled while wheels where locking up (m)} \\ L &= \text{percentage of energy remaining immediately prior to the wheels locking} \\ &= 80\% \text{ (Reed and Keskin, 1989)} \\ v_t &= \text{travelling speed (ms}^{-1}\text{)} \\ t_l &= \text{time for wheels to lock up (s)} \\ &= 0.5 \text{ (Reed and Keskin, 1989)} \end{aligned}$$

The distance travelled while skidding was taken to be the length of the longest skid mark observed at the site.

The hypothetical distance between the impact point and the start of the hypothetical skid is calculated using the hypothetical impact speed and the actual total distance from awareness to impact:

$$S_{sh} = S_t - v_{th} t_r - \frac{1 + \sqrt{L}}{2} v_{th} t_l$$

where:

$$\begin{aligned} S_{sh} &= \text{hypothetical distance available for skidding (m)} \\ S_t &= \text{actual total distance from awareness to impact point (m)} \\ v_{th} &= \text{hypothetical travelling speed (ms}^{-1}\text{)} \\ t_r &= \text{driver reaction time (s)} \\ &= 1.5 \text{ (Olson, 1991; Bell, Loomis and Cervone, 1982)} \\ L &= \text{percentage of energy remaining immediately prior to the wheels locking} \\ &= 80\% \text{ (Reed and Keskin, 1989)} \\ t_l &= \text{time for wheels to lock up (s)} \\ &= 0.5 \text{ (Reed and Keskin, 1989)} \end{aligned}$$

The hypothetical impact speed can then be calculated from the hypothetical distance available for skidding and the hypothetical reduced travelling speed:

$$v_{ih} = \sqrt{v_{th}^2 L - 2\mu g S_{sh}}$$

where:

- v_{ih} = hypothetical impact speed (ms⁻¹)
- v_{th} = hypothetical travelling speed (ms⁻¹)
- L = percentage of energy remaining immediately prior to the wheels locking
= 80% (Reed and Keskin, 1989)
- μ = coefficient of friction between tyres and road surface
= 0.7 (typically for dry level bitumen road)
- g = acceleration due to gravity (ms⁻²)
= 9.812
- S_{sh} = hypothetical distance available for skidding (m)

In hypothetical scenarios where $2\mu g S_{sh} \geq v_{th}^2 L$ the vehicle would not have reached the impact point before stopping so no collision would have occurred.

In cases where there the driver of the free speed vehicle did not appear to react before impact, the travelling speed was set to the impact speed and the hypothetical impact speed was set to the hypothetical travelling speed.

2.3 Method

If a collision occurred under the scenario being considered, the original simulation was then run again from the moment of impact onwards using the calculated hypothetical impact speed. All other crash simulation parameters were held constant. The hypothetical delta V experienced by any injured parties was then calculated from the hypothetical crash simulation.

If no collision occurred under the scenario being considered, the impact speed and delta V were set to zero.

The results of individual cases can be found in this Volume and the overall results are reported in Volume 1 of this report.

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