



Social cost of road crashes and injuries 2017 update

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Ministry of **Transport**

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Executive summary

- Road crashes impose intangible, financial and economic costs to society. These costs include reduced quality of life; reduced productivity; medical and other resource costs. The Ministry of Transport updates the social cost of road crashes and injuries annually to allow comparison of the costs and benefits of any road safety actions in current dollars.
- The update report provides estimates of average social costs per injury, after accounting for inflationary effects. For the average social cost per crash, it also accounts for any changes in the mix of crashes by area and severity, and the average number of injuries involved in a crash.
- The loss of life and life quality component represents over 90 percent of the total social cost of road injuries. A willingness-to-pay valuation technique is used to express pain and suffering from loss of life or life quality in dollar terms. The resulting estimate is referred as the willingness-to-pay based value of statistical life or VOSL. The VOSL was established at \$2 million in 1991 and is regularly indexed to the average hourly earnings to express the value in current dollars. The updated VOSL is \$4.21 million per fatality, at June 2017 prices.
- The updated average social cost per fatality is \$4,242,000. This estimate includes the updated VOSL, reduced productivity; medical and other resource costs. Apart from fatalities, not all serious and minor injuries are reported to New Zealand Police. A simple way to incorporate the costs associated with non-reported cases is to scale up the average social cost estimates to include the share of costs attributable to non-reported cases. With such an adjustment, the average social cost per reported serious injury is estimated at \$786,000 and \$82,000 per reported minor injury.
- In per-crash terms, the updated average social cost is estimated at \$4,916,000 per fatal crash, \$923,000 per reported serious injury crash and \$104,000 per reported minor injury crash. The estimates for serious and minor injury crashes have been scaled up to account for non-reported cases.
- The total social cost of motor vehicle injury crashes in 2016 is estimated at \$4.17 billion, at June 2017 prices. This represents an increase of \$0.3 billion (or 7.8 percent) compared to the previous year (from \$3.87 billion in 2015).

Part 1 The 2017 update

1.1 Introduction

This is an annual update of the Social Cost of Road Crashes and Injuries statistics published by the Ministry of Transport. This update provides estimates of the average social costs per injury and per crash at June 2017 prices. The update accounts for any changes in the mix of crashes and severities by area and is based on crash and injury data from 2014 to 2016.

To ensure limited road safety resources are utilised efficiently, the cost of any safety interventions should be evaluated against the resulting benefit expressed in terms of social cost. When there are different solutions or options to a transport problem, social cost information also facilitates consistent comparison between solutions or options, especially when these solutions have different impacts on injury and crash risks.

Updated social cost estimates are incorporated into the NZ Transport Agency's Crash Analysis System to facilitate consistent appraisal of the safety benefits from the prevention of road crashes and injuries.

1.2 Estimation of injury and crash costs

The social cost of a road crash or a road injury is defined as the total cost that occurs as a result of the road crash or injury. Its value depends on the number of cost components¹ estimated and the estimation methods adopted.

In New Zealand, the social cost of a road crash or a road injury includes the following components:

- loss of life and life quality
- loss of output due to temporary incapacitation
- medical costs
- legal costs
- vehicle damage costs

These social cost components are either measurable or can be estimated in dollar terms. A willingness-to-pay valuation technique is used to express pain and suffering from loss of life or life quality in dollar terms (that is, the willingness-to-pay based value of statistical life or VOSL). Various methodologies have been developed to estimate the value of other social cost components. For a description of the methodology used to update the social cost components, please refer to the Appendix.

Estimation of the social cost of road crashes and injuries requires two stages of analysis. The first stage involves estimating the total number of crashes and injuries. While all fatal crashes are recorded by New Zealand Police in the official Traffic Crash Reports (TCRs), only some of the serious and minor injury crashes are. Hospitalisation data and Accident Compensation Corporation's (ACC) motor vehicle claims data are used in conjunction with TCRs to obtain the best estimates of the total numbers of road crashes and injuries. The estimated total numbers of crashes and injuries for the years 2014 to 2016 are given in Table 10. For the three years to 2016, only 55 percent of all serious injuries and 30 percent of all minor injuries are recorded in TCRs.

¹ The social cost estimates do not include transfer payments such as taxes or insurance premiums. Current estimates also exclude the costs associated with insurance administration, traffic delays due to road crashes and collateral damage (other than vehicle damage). While these costs can be very high in some specific cases, they are unlikely to materially affect the average cost estimates obtained at the aggregated level.

The second stage involves calculating the impacts in monetary terms. Individual social cost components are updated to current prices using the price indices tabulated in Table 11. Adding all the social cost components gives the average social cost per incident (that is, crash or injury). To take into account the non-reported cases, a simple way is to scale up the average social cost estimates to include the share of costs attributable to non-reported cases. The average social cost obtained after such an adjustment is referred to as the average social cost per reported crash (or injury).

1.3 Average social cost per injury and per crash

The updated value of statistical life is \$4.21 million per fatality, at June 2017 prices. Adding the other social cost components gives an updated average social cost per fatality of \$4,242,100. For non-fatal injuries, the updated average social cost is estimated at \$446,000 per serious injury and \$23,800 per minor injury. After scaling up the estimates to account for non-reported cases, the average social cost estimates increase to \$786,000 per reported serious injury and \$82,000 per reported minor injury.

These per-injury estimates are useful for assessing interventions that aim to reduce the number of injuries but not crashes. They are also useful for establishing the social cost of a specific crash considering the number of injuries sustained in that crash.

This report also provides estimates in per-crash terms to allow assessment of the potential safety benefits from interventions that aim to reduce the number of crashes.

The updated average social cost is estimated at \$4.92 million per fatal crash, \$513,000 per serious injury crash and \$29,000 per minor injury crash. This is adjusted to \$923,000 per reported serious injury crash and \$104,000 per reported minor injury crash, after scaling up the estimates to account for non-reported cases. Because each crash can result in multiple injuries of various injury severity, the average social cost per crash is higher than the average social cost per injury in all cases.

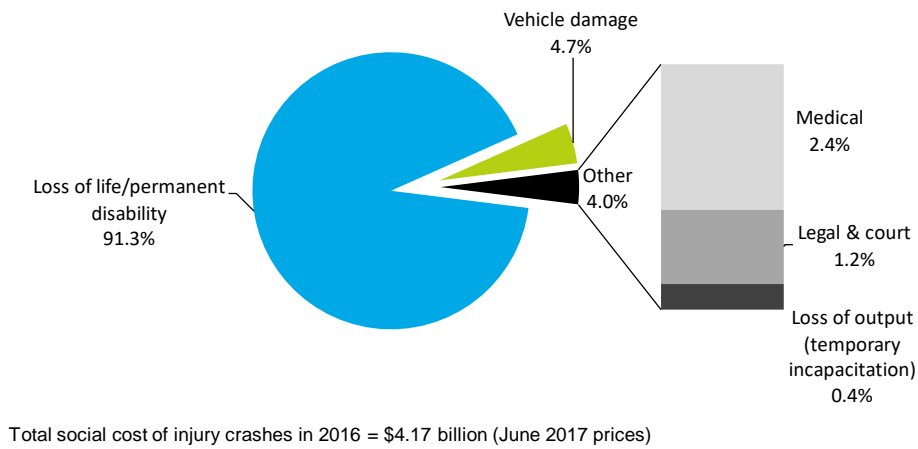
1.4 Total social cost of road injury crashes in 2016

The total social cost of motor vehicle injury crashes in 2016 is estimated at approximately \$4.17 billion, at June 2017 prices. This represents an increase of \$0.3 billion (or 7.8 percent) compared to the previous year (\$3.87 billion in 2015). This increase reflects a 2.5 percent increase in the total number of fatalities (from 319 in 2015 to 327 in 2016) and a 17 percent increase in the estimated total number of serious injuries (from 3,775 in 2015 to 4,410 in 2016). There was a small reduction (2 percent) in the estimated total number of minor injuries (from 34,817 in 2015 to 34,133 in 2016)².

Figure 1 shows loss of life and/or life quality due to permanent impairment accounted for approximately 91 percent of the total social cost of injury crashes. Vehicle damage accounted for around five percent, and other cost components made up the remaining four percent.

² This report uses information recorded by NZ Police, hospitals and ACC to estimate the total numbers of serious and minor injuries that occurred on New Zealand roads. Estimates for 2015 have been revised using the latest information obtained.

Figure 1: Share of total social cost of injury crashes in 2016 by cost component

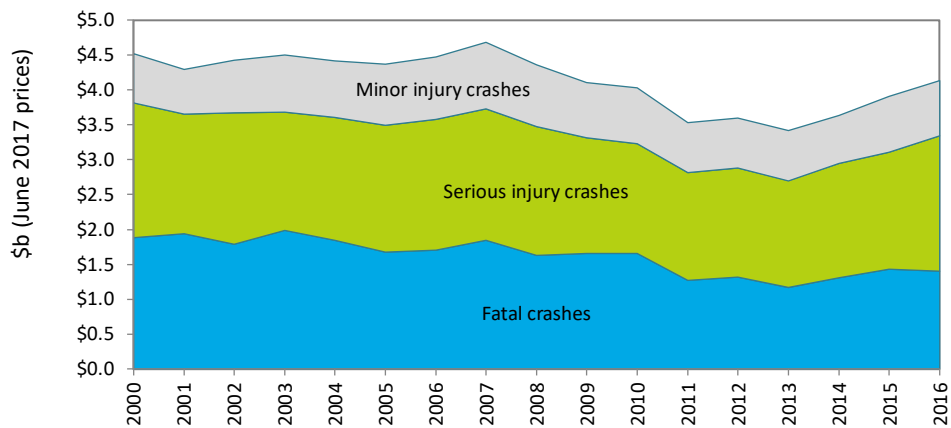


In addition, there are an estimated 228,250 non-injury crashes³, valued at a further \$0.70 billion. This gives a total social cost of all motor vehicle crashes in 2016 of \$4.87 billion (increased from \$4.57 billion in 2015). These estimates include the costs associated with both reported and non-reported cases.

1.5 Annual total social cost of road crashes for the years from 2000 to 2016

Figure 2 shows the trend of the estimated annual total social cost of injury crashes for the years from 2000 to 2016.

Figure 2: Estimated annual total social cost of injury crashes, by crash severity (\$ billion, at June 2017 prices)



Note: This chart includes allowances for non-reported cases.

³ Guria (1995) estimated that the number of non-injury crashes is 8.4 times the number of minor injury crashes. This analysis assumes this relativity remains the same. [Guria (1995), "Estimates of vehicle damage costs", Wellington, Land Transport Safety Authority.]

1.6 Social cost of injury crashes by area and region from 2014 to 2016

On average, around 58 percent of the total social cost of road injury crashes relates to crashes that occurred on open roads⁴. The regional distributions by area are plotted in Figures 3 and 4.

Figure 3: Total social cost of road injury crashes on open roads, by region (\$ million, at June 2017 prices)

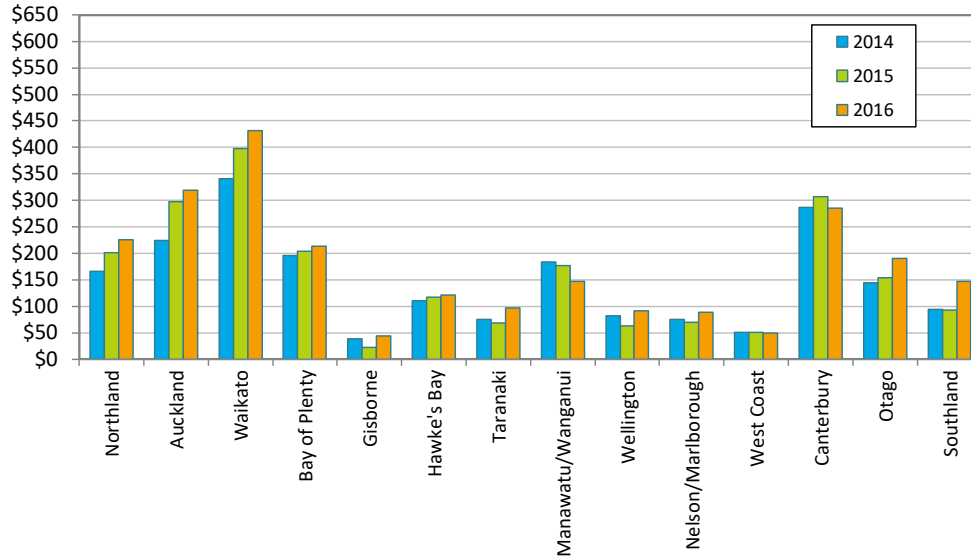
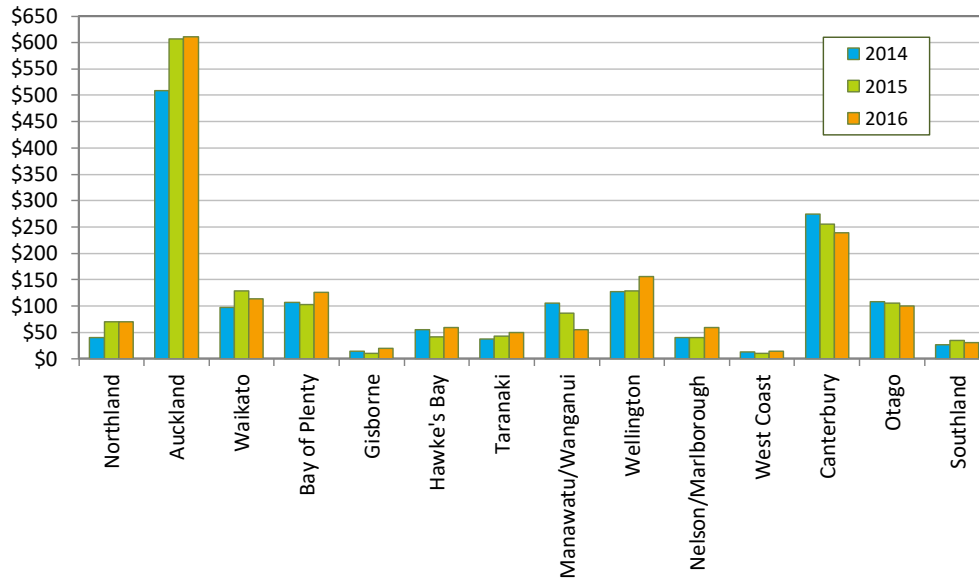


Figure 4: Total social cost of road injury crashes on urban roads, by region (\$ million, at June 2017 prices)



⁴ In this report, open roads are defined as roads with a legal speed limit of over 70 kilometres per hour (km/h). Urban roads are defined as roads with a legal speed limit of 70 km/h or less.

Part 2 The social cost estimates

2.1 Average social cost by cost component

Tables 1 and 2 provide the estimates of average social costs per crash and per injury, including breakdowns by cost component. Table 3 provides the estimates of average social costs per non-injury crash by area. These estimates do not include adjustment for under-reporting and are suitable only for cases where the total number of crashes and injuries are known.

Table 1: Average social cost per crash, by cost component

Cost components	Crash type		
	Fatal	Serious	Minor
	June 2017 prices (\$)		
Loss of life/permanent disability	4,865,300	482,000	20,500
Loss of output (temporary disability)	700	1,900	400
Medical –			
Hospital/medical	7,800	10,500	200
Emergency/pre-hospital	4,000	1,500	800
Follow-on	1,800	5,100	100
Legal and court	24,200	4,500	1,000
Vehicle damage	12,000	7,500	6,100
Total	4,915,900	513,000	29,000

Notes:

1. Figures may not add to totals due to rounding.
2. These estimates have not been adjusted for the level of non-reporting.

Table 2: Average social cost per injury, by cost component

Cost components	Injury type		
	Fatal	Serious	Minor
	June 2017 prices (\$)		
Loss of life/permanent disability	4,208,400	420,800	16,800
Loss of output (temporary disability)	0	1,600	300
Medical –			
Hospital/medical	3,700	9,200	100
Emergency/pre-hospital	3,000	1,100	700
Follow-on	0	4,500	100
Legal and court	20,100	3,700	800
Vehicle damage	7,000	5,100	5,000
Total	4,242,100	446,000	23,800

Notes:

1. Figures may not add to totals due to rounding.
2. These estimates have not been adjusted for the level of non-reporting.

Table 3: Average social cost per non-injury crash

Per non-injury crash	June 2017 prices (\$)		
	All areas	Open roads	Urban roads
Non-injury crash – vehicle damage	3,100	3,300	2,900

Note: These estimates have not been adjusted for the level of non-reporting.

2.2 Average social cost per reported incident, by severity

Tables 4 to 6 provide the estimates of average social costs per reported crash and per reported injury, after adjusting for the level of non-reporting. The estimates for a combination of crash or injury types (fatal and serious, serious and minor, and all three) are useful for assessing safety risks that could cause severe injury to road users but have a low probability of occurrence (for example, in situations where the crash or injury numbers are small). If a programme is expected to reduce the number of injuries, but not the number of crashes, use the estimates from Table 6. Otherwise, use the estimates from Tables 4 and 5, depending on data availability and the purpose of the analysis.

Table 4: Average social cost per reported crash, by severity

Crash severity	June 2017 prices (\$)		
	All	Open roads	Urban roads
Fatal	4,916,000	5,045,000	4,557,000
Serious	923,000	984,000	867,000
Minor	104,000	111,000	100,000
Serious and minor	271,000	322,000	236,000
Fatal and serious	1,441,000	1,738,000	1,127,000
Fatal, serious and minor	408,000	569,000	293,000

Table 5: Average social cost per reported injury, by severity

Injury severity	June 2017 prices (\$)		
	All	Open roads	Urban roads
Fatal	4,242,000	4,242,000	4,242,000
Serious	786,000	777,000	796,000
Minor	82,000	81,000	82,000
Serious and minor	213,000	235,000	196,000
Fatal and serious	1,210,000	1,354,000	1,032,000
Fatal, serious and minor	316,000	404,000	243,000

Table 6: Average social cost per reported injury, excluding associated vehicle damage costs, by severity

Injury severity	June 2017 prices (\$)		
	All	Open roads	Urban roads
Fatal	4,235,000	4,235,000	4,235,000
Serious	778,000	768,000	788,000
Minor	65,000	63,000	66,000
Serious and minor	198,000	219,000	181,000
Fatal and serious	1,201,000	1,345,000	1,023,000
Fatal, serious and minor	300,000	389,000	228,000

2.3 Average social cost per reported injury crash, by vehicle movement

Table 7 provides estimates of the average social cost per reported crash by vehicle movement, using crash data from 2012 to 2016. These estimates have been adjusted for the level of non-reporting and are suitable for analysing policies or programmes that focus on specific vehicle movement classifications (for example, head-on crashes).

Table 7: Average social cost per reported injury crash (fatal, serious and minor), by vehicle movement

Vehicle movement classification	June 2017 prices (\$)		
	All	Open roads	Urban roads
Overtaking or lane change	434,000	594,000	239,000
Head-on, not overtaking	1,080,000	1,460,000	498,000
Lost control, straight roads	403,000	452,000	329,000
Cornering	447,000	466,000	404,000
Collision with obstruction	279,000	398,000	238,000
Rear-end collision	179,000	221,000	148,000
Turning versus same direction	294,000	466,000	208,000
Crossing, no turns	308,000	754,000	238,000
Crossing, vehicle turning	315,000	640,000	223,000
Vehicles merging	233,000	402,000	203,000
Right turn against	304,000	671,000	243,000
Vehicle manoeuvring	281,000	585,000	225,000
Pedestrian crossing road	394,000	1,510,000	351,000
Pedestrian other	571,000	1,429,000	460,000
Miscellaneous	649,000	781,000	531,000

2.4 Average social cost by local government region

Due to differences in physical locations, sizes of regions, the availability of facilities, and for other reasons, the proportions of injury crashes that are reported to New Zealand Police differ across regions. The mix of open roads and urban roads crashes also differs across regions. As a result, there are regional variations in the average social costs per reported injury and per crash.

Tables 8 and 9 provide the regional average social costs per reported crash and per reported injury respectively, using crash data from 2014 to 2016. These estimates have been adjusted for the level of non-reporting and are useful for the evaluation of regional programmes or policies.

Table 8: Average social cost per reported injury crash, by local government region

Region	Crash severity					
	Fatal	Serious	Minor	Serious and minor	Fatal and serious	Fatal, serious and minor
June 2017 prices (\$)						
All areas						
Northland	4,970,000	1,044,000	107,000	370,000	1,619,000	581,000
Auckland	4,516,000	855,000	103,000	228,000	1,155,000	291,000
Waikato	5,106,000	584,000	105,000	207,000	1,507,000	461,000
Bay of Plenty	5,114,000	1,527,000	101,000	361,000	2,313,000	592,000
Gisborne	5,887,000	1,351,000	105,000	390,000	1,718,000	499,000
Hawke's Bay	4,832,000	1,048,000	104,000	325,000	1,581,000	491,000
Taranaki	5,169,000	1,196,000	110,000	377,000	1,773,000	569,000
Manawatu-Wanganui	4,833,000	746,000	105,000	248,000	1,416,000	440,000
Wellington	4,921,000	702,000	99,000	217,000	1,008,000	287,000
Nelson-Marlborough	4,347,000	1,209,000	102,000	350,000	1,553,000	457,000
West Coast	4,895,000	851,000	108,000	294,000	1,557,000	525,000
Canterbury	4,914,000	1,012,000	104,000	310,000	1,462,000	442,000
Otago	5,023,000	930,000	110,000	294,000	1,376,000	420,000
Southland	5,067,000	1,251,000	111,000	340,000	1,874,000	519,000
New Zealand	4,916,000	923,000	104,000	271,000	1,441,000	408,000

Table 8 continued

Region	Average social cost per reported crash June 2017 prices (\$)					
	Fatal	Serious	Crash severity		Fatal and serious	Fatal, serious and minor
			Minor	Serious and minor		
Open roads						
Northland	5,138,000	1,070,000	113,000	395,000	1,725,000	649,000
Auckland	4,551,000	917,000	110,000	238,000	1,383,000	336,000
Waikato	5,180,000	604,000	109,000	227,000	1,685,000	566,000
Bay of Plenty	5,341,000	1,634,000	107,000	447,000	2,743,000	871,000
Gisborne	5,887,000	1,552,000	107,000	468,000	2,143,000	674,000
Hawke's Bay	4,939,000	1,111,000	113,000	423,000	1,819,000	721,000
Taranaki	4,788,000	1,220,000	114,000	446,000	1,841,000	703,000
Manawatu-Wanganui	5,027,000	768,000	114,000	295,000	1,599,000	592,000
Wellington	5,109,000	745,000	111,000	251,000	1,378,000	426,000
Nelson-Marlborough	4,358,000	1,279,000	111,000	441,000	1,683,000	601,000
West Coast	4,966,000	862,000	112,000	299,000	1,641,000	557,000
Canterbury	4,970,000	1,082,000	111,000	407,000	1,788,000	696,000
Otago	5,216,000	1,012,000	117,000	355,000	1,636,000	570,000
Southland	5,095,000	1,288,000	113,000	398,000	2,104,000	690,000
New Zealand	5,045,000	984,000	111,000	322,000	1,738,000	569,000
Urban roads						
Northland	4,287,000	981,000	98,000	319,000	1,332,000	433,000
Auckland	4,490,000	833,000	100,000	224,000	1,065,000	273,000
Waikato	4,732,000	539,000	100,000	176,000	1,047,000	281,000
Bay of Plenty	4,301,000	1,415,000	96,000	298,000	1,738,000	374,000
Gisborne (Note)	4,557,000	1,095,000	104,000	309,000	1,095,000	309,000
Hawke's Bay	4,260,000	952,000	98,000	242,000	1,156,000	286,000
Taranaki	6,440,000	1,155,000	106,000	306,000	1,651,000	424,000
Manawatu-Wanganui	4,254,000	711,000	99,000	204,000	1,104,000	288,000
Wellington	4,653,000	686,000	94,000	205,000	854,000	242,000
Nelson-Marlborough	4,318,000	1,108,000	95,000	269,000	1,352,000	326,000
West Coast	4,541,000	816,000	101,000	280,000	1,282,000	427,000
Canterbury	4,750,000	957,000	101,000	263,000	1,168,000	312,000
Otago	4,461,000	840,000	105,000	246,000	1,062,000	298,000
Southland	4,244,000	1,170,000	108,000	263,000	1,231,000	275,000
New Zealand	4,557,000	867,000	100,000	236,000	1,127,000	293,000

Table 9: Average social cost per reported injury, by local government region

Region	Injury severity					
	Fatal	Serious	Minor	Serious and minor	Fatal and serious	Fatal, serious and minor
June 2017 prices (\$)						
All areas						
Northland	4,242,000	869,000	81,000	278,000	1,323,000	428,000
Auckland	4,242,000	761,000	83,000	184,000	1,027,000	234,000
Waikato	4,242,000	487,000	79,000	161,000	1,200,000	344,000
Bay of Plenty	4,242,000	1,174,000	82,000	284,000	1,775,000	454,000
Gisborne	4,242,000	1,061,000	83,000	304,000	1,329,000	384,000
Hawke's Bay	4,242,000	878,000	81,000	249,000	1,319,000	373,000
Taranaki	4,242,000	1,077,000	82,000	281,000	1,567,000	422,000
Manawatu-Wanganui	4,242,000	648,000	81,000	196,000	1,188,000	336,000
Wellington	4,242,000	644,000	83,000	183,000	909,000	240,000
Nelson-Marlborough	4,242,000	1,021,000	83,000	279,000	1,325,000	363,000
West Coast	4,242,000	686,000	79,000	218,000	1,241,000	380,000
Canterbury	4,242,000	870,000	82,000	243,000	1,241,000	342,000
Otago	4,242,000	748,000	81,000	219,000	1,089,000	306,000
Southland	4,242,000	1,010,000	81,000	244,000	1,512,000	369,000
New Zealand	4,242,000	786,000	82,000	213,000	1,210,000	316,000
Open roads						
Northland	4,242,000	859,000	82,000	288,000	1,352,000	459,000
Auckland	4,242,000	754,000	83,000	180,000	1,140,000	252,000
Waikato	4,242,000	486,000	79,000	169,000	1,295,000	402,000
Bay of Plenty	4,242,000	1,125,000	81,000	315,000	1,912,000	592,000
Gisborne	4,242,000	1,048,000	84,000	347,000	1,441,000	491,000
Hawke's Bay	4,242,000	867,000	79,000	289,000	1,425,000	488,000
Taranaki	4,242,000	1,069,000	82,000	317,000	1,606,000	498,000
Manawatu-Wanganui	4,242,000	639,000	80,000	219,000	1,258,000	417,000
Wellington	4,242,000	636,000	82,000	192,000	1,136,000	317,000
Nelson-Marlborough	4,242,000	1,017,000	82,000	313,000	1,365,000	427,000
West Coast	4,242,000	685,000	80,000	215,000	1,296,000	393,000
Canterbury	4,242,000	858,000	80,000	292,000	1,408,000	490,000
Otago	4,242,000	741,000	80,000	243,000	1,180,000	380,000
Southland	4,242,000	999,000	81,000	274,000	1,640,000	470,000
New Zealand	4,242,000	777,000	81,000	235,000	1,354,000	404,000

Table 9 continued

Urban roads		Average social cost per reported injury June 2017 prices (\$)				
Region	Fatal	Serious	Injury severity		Fatal and serious	Fatal, serious and minor
			Minor	Serious and minor		
Northland	4,242,000	896,000	80,000	257,000	1,228,000	349,000
Auckland	4,242,000	764,000	82,000	186,000	978,000	225,000
Waikato	4,242,000	488,000	82,000	147,000	918,000	231,000
Bay of Plenty	4,242,000	1,242,000	83,000	254,000	1,542,000	319,000
Gisborne	4,242,000	1,086,000	83,000	253,000	1,086,000	253,000
Hawke's Bay	4,242,000	897,000	83,000	206,000	1,094,000	244,000
Taranaki	4,242,000	1,090,000	83,000	241,000	1,495,000	331,000
Manawatu-Wanganui	4,242,000	666,000	82,000	170,000	1,045,000	241,000
Wellington	4,242,000	647,000	82,000	180,000	801,000	211,000
Nelson-Marlborough	4,242,000	1,028,000	84,000	241,000	1,255,000	291,000
West Coast	4,242,000	686,000	81,000	228,000	1,054,000	338,000
Canterbury	4,242,000	881,000	82,000	215,000	1,066,000	254,000
Otago	4,242,000	759,000	82,000	195,000	953,000	235,000
Southland	4,242,000	1,041,000	83,000	200,000	1,099,000	209,000
New Zealand	4,242,000	796,000	82,000	196,000	1,032,000	243,000

2.5 Crash statistics and price indices

Table 10: Reported and estimated number of crashes and injuries from 2014 to 2016

All areas								
	Reported crashes	Reported injuries			Estimated crashes	Estimated injuries		
		Fatal	Serious	Minor		Fatal	Serious	Minor
Fatal	842	939	330	356	842	939	330	356
Serious	5,657		6,393	1,935	10,183		11,523	3,527
Minor	22,123			26,999	79,276			96,750
Total	28,622	939	6,723	29,290	90,301	939	11,853	100,633
Open roads								
	Reported crashes	Reported injuries			Estimated crashes	Estimated injuries		
		Fatal	Serious	Minor		Fatal	Serious	Minor
Fatal	619	705	282	282	619	705	282	282
Serious	2,716		3,247	1,255	4,901		5,869	2,296
Minor	8,506			10,892	30,481			39,031
Total	11,841	705	3,529	12,429	36,001	705	6,151	41,609
Urban roads								
	Reported crashes	Reported injuries			Estimated crashes	Estimated injuries		
		Fatal	Serious	Minor		Fatal	Serious	Minor
Fatal	223	234	48	74	223	234	48	74
Serious	2,941		3,146	680	5,282		5,654	1,231
Minor	13,617			16,107	48,795			57,719
Total	16,781	234	3,194	16,861	54,300	234	5,702	59,024

Table 11: Price indices for updating unit costs

Cost components	Indices/measures	Infoshare table references	Period	Indices/values	% change over the 12 months to June 2017
Loss of life and life quality	Average hourly earnings (ordinary time)	QEX001AA	June 2017	\$30.09	+1.6%
Loss of output			June 2016	\$29.62	
			June 2015	\$29.01	
Medical cost	Producers price input index – Health and community services	PPI021AA (Base: Dec 2010=1000)	June 2017 June 2016 June 2015	1081 1056 1050	+2.4%
Legal and court cost	Producers price input index – Legal services: Personal and Corporate	PPI027AA (Base: Dec 2010=1000)	June 2017 June 2016 June 2015	1126 1100 1083	+2.4%
Vehicle damage cost	Consumers price index – Vehicle servicing & repairs	CPI013AA (Base: June 2006 =1000)	June 2017 June 2016 June 2015	1363 1350 1317	+1.0%

Source: Infoshare, Statistics New Zealand.

2.6 Appendix: Methodology

The following section describes the methods used to update various social cost components.

Loss of life and life quality

The loss of life and life quality component represents an estimated value of pain and suffering to the injured and to their family. For non-fatal injuries, it also includes the loss of output due to permanent disability. These values were established through a Value of Safety survey (conducted in 1991). The survey was conducted to understand how respondents trade off between safety and wealth. Such information is then used to determine the willingness-to-pay value for avoiding one premature death (known as the willingness-to-pay value of statistical life) and one serious or minor injury. This willingness-to-pay approach has been widely used by many countries and is considered the most appropriate approach for use in safety intervention analysis.

The value of statistical life (VOSL) was established at \$2 million in 1991. It is regularly indexed to the average hourly earnings to express the value in current dollars. The updated value in 2017 prices is \$4.21 million per fatality. The loss of life and life quality component represents over 90 percent of the total social cost of injury crashes.

Loss of output due to temporary disability

Many injuries result in workers taking time off work. While the lost earnings are either met by employers or by Accident Compensation Corporation, such disruption affects gross output. Estimates of loss of output per injury are determined using average length of hospital stay (as a proxy for the average time lost per injury) and average daily earnings (as a proxy of loss of output) obtained from the latest Household Income Survey published by Statistics New Zealand.

For a serious injury, the average time lost per injury was 11.2 days and the average daily earnings per person (considering the age and gender profiles of 2014-2016 crash data) was \$141.00. These give an average loss of output of \$1,580 per serious injury. A similar estimate was also derived for minor injuries. In aggregate terms, loss of output due to temporary disability accounts for less than 1 percent of the total social cost of injury crashes.

Medical costs

The methodology for estimating medical costs was developed in the mid-1990s. It uses injury and cost data obtained from Dunedin and Waikato hospitals to determine the average cost associated with emergency treatment, hospital in-patient treatment and follow-on treatment by injury severity. Estimates for these average costs are updated annually to current dollars using the producers' input price index for health and community services. In aggregate terms, medical costs account for just over 2 percent of the total social cost of injury crashes.

Legal and court costs

Legal and court costs include three components: the justice system costs, the cost to New Zealand Police of crash attendance and investigation and the cost of imprisonment. These are based on actual administrative data obtained from New Zealand Police's Road Policing Programme and from the Ministry of Justice. In aggregate terms, legal and court costs account for around 1 percent of the total social cost of injury crashes.

Vehicle damage cost

Estimates of vehicle damage costs were established in the mid-1990s based on insurance claims data. They are updated annually for price changes using the consumer price index under the vehicle servicing and repairs category. In aggregate terms, property damage costs account for nearly 5 percent of the total social cost of injury crashes.