



# Social cost of road crashes and injuries 2017 update

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Ministry of **Transport**

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New Zealand Government

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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 components<sup>1</sup> 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.

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<sup>1</sup> 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

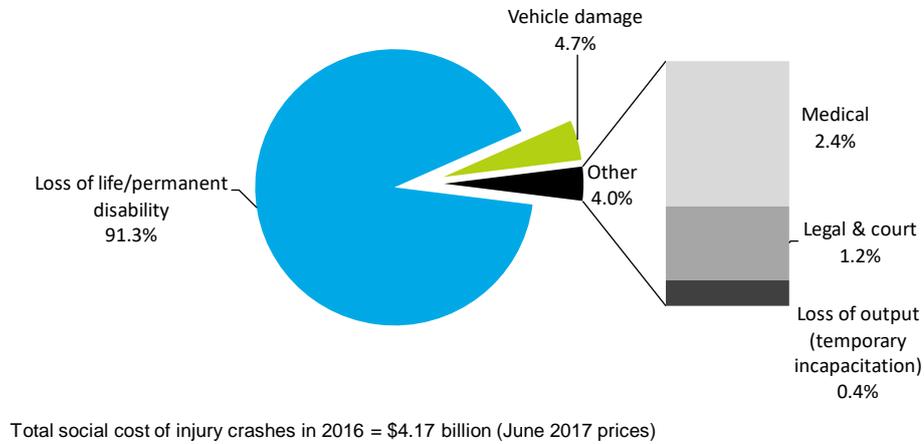
The total social cost of motor vehicle injury crashes in 2016 is estimated at approximately \$4.17 billion, at June 2017 prices. This represents an increase of \$0.3 billion (or 7.8 percent) compared to the previous year (\$3.87 billion in 2015). This increase reflects a 2.5 percent increase in the total 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)<sup>2</sup>.

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.

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<sup>2</sup> 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**

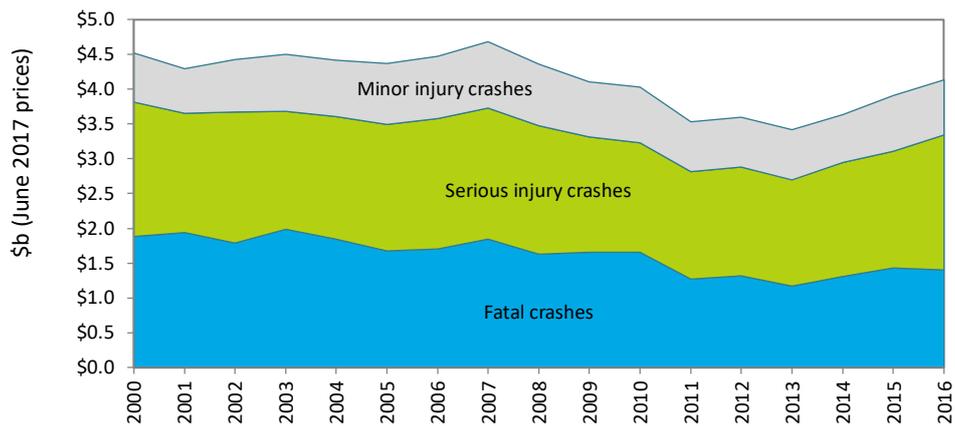


In addition, there are an estimated 228,250 non-injury crashes<sup>3</sup>, valued at a further \$0.70 billion. This gives a total social cost of all motor vehicle crashes in 2016 of \$4.87 billion (increased from \$4.57 billion in 2015). These estimates include the costs associated with both reported 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)**



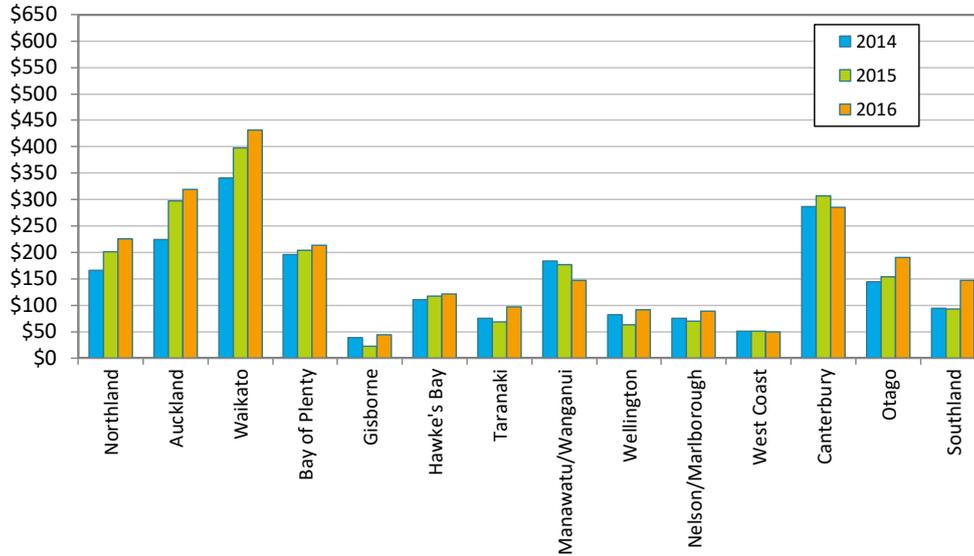
Note: This chart includes allowances for non-reported cases.

<sup>3</sup> 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.]

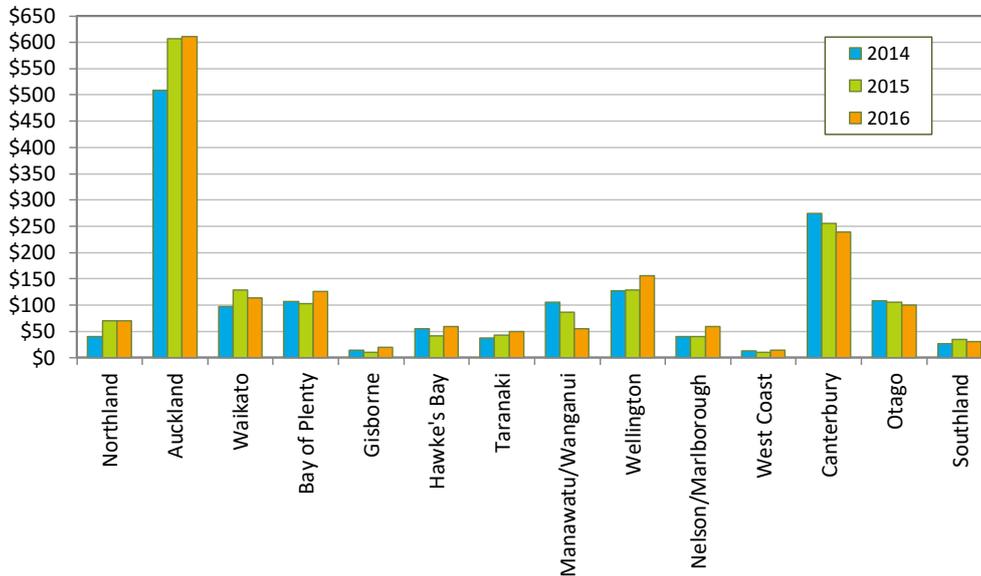
## 1.6 Social cost of injury crashes by area and region from 2014 to 2016

On average, around 58 percent of the total social cost of road injury crashes relates to crashes that occurred on open roads<sup>4</sup>. 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)**



<sup>4</sup> 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         |
| <b>Total</b>                          | <b>4,915,900</b>      | <b>513,000</b> | <b>29,000</b> |

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         |
| <b>Total</b>                          | <b>4,242,100</b>      | <b>446,000</b> | <b>23,800</b> |

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 (\$) |                  |                |                |                   |                   |                          |
| <b>All areas</b>      |                  |                |                |                   |                   |                          |
| 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                  |
| <b>New Zealand</b>    | <b>4,916,000</b> | <b>923,000</b> | <b>104,000</b> | <b>271,000</b>    | <b>1,441,000</b>  | <b>408,000</b>           |

Table 8 continued

| Region             | Average social cost per reported crash<br>June 2017 prices (\$) |                |                |                   |                   |                          |
|--------------------|---|----------------|----------------|-------------------|-------------------|--------------------------|
|                    | Fatal   | Serious        | Crash severity |                   | Fatal and serious | Fatal, serious and minor |
|                    |   |                | Minor          | Serious and minor |                   |                          |
| <b>Open roads</b>  |   |                |                |                   |                   |                          |
| 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                  |
| <b>New Zealand</b> | <b>5,045,000</b>  | <b>984,000</b> | <b>111,000</b> | <b>322,000</b>    | <b>1,738,000</b>  | <b>569,000</b>           |
| <b>Urban roads</b> |   |                |                |                   |                   |                          |
| 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                  |
| <b>New Zealand</b> | <b>4,557,000</b>  | <b>867,000</b> | <b>100,000</b> | <b>236,000</b>    | <b>1,127,000</b>  | <b>293,000</b>           |

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 (\$) |                  |                |               |                   |                   |                          |
| <b>All areas</b>      |                  |                |               |                   |                   |                          |
| 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                  |
| <b>New Zealand</b>    | <b>4,242,000</b> | <b>786,000</b> | <b>82,000</b> | <b>213,000</b>    | <b>1,210,000</b>  | <b>316,000</b>           |
| <b>Open roads</b>     |                  |                |               |                   |                   |                          |
| 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                  |
| <b>New Zealand</b>    | <b>4,242,000</b> | <b>777,000</b> | <b>81,000</b> | <b>235,000</b>    | <b>1,354,000</b>  | <b>404,000</b>           |

Table 9 continued

| Urban roads        |                  | Average social cost per reported injury<br>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                  |
| <b>New Zealand</b> | <b>4,242,000</b> | <b>796,000</b>   | <b>82,000</b>   | <b>196,000</b>    | <b>1,032,000</b>  | <b>243,000</b>           |

## 2.5 Crash statistics and price indices

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

| All areas    |                     |                   |              |               |                      |                    |               |                |
|--------------|---------------------|-------------------|--------------|---------------|----------------------|--------------------|---------------|----------------|
|              | Reported<br>crashes | Reported injuries |              |               | Estimated<br>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         |
| <b>Total</b> | <b>28,622</b>       | <b>939</b>        | <b>6,723</b> | <b>29,290</b> | <b>90,301</b>        | <b>939</b>         | <b>11,853</b> | <b>100,633</b> |
| Open roads   |                     |                   |              |               |                      |                    |               |                |
|              | Reported<br>crashes | Reported injuries |              |               | Estimated<br>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         |
| <b>Total</b> | <b>11,841</b>       | <b>705</b>        | <b>3,529</b> | <b>12,429</b> | <b>36,001</b>        | <b>705</b>         | <b>6,151</b>  | <b>41,609</b>  |
| Urban roads  |                     |                   |              |               |                      |                    |               |                |
|              | Reported<br>crashes | Reported injuries |              |               | Estimated<br>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         |
| <b>Total</b> | <b>16,781</b>       | <b>234</b>        | <b>3,194</b> | <b>16,861</b> | <b>54,300</b>        | <b>234</b>         | <b>5,702</b>  | <b>59,024</b>  |

**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<br>(Base: Dec 2010=1000)   | June 2017<br>June 2016<br>June 2015 | 1081<br>1056<br>1050 | +2.4%                                    |
| Legal and court cost          | Producers price input index – Legal services: Personal and Corporate | PPI027AA<br>(Base: Dec 2010=1000)   | June 2017<br>June 2016<br>June 2015 | 1126<br>1100<br>1083 | +2.4%                                    |
| Vehicle damage cost           | Consumers price index – Vehicle servicing & repairs                  | CPI013AA<br>(Base: June 2006 =1000) | June 2017<br>June 2016<br>June 2015 | 1363<br>1350<br>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.