AusRAP
AUSTRALIAN ROAD ASSESSMENT PROGRAM

# How Safe Are Queensland's Roads?

## Rating Queensland Highways For Risk

December 2010

AUSTRALIAN AUTOMOBILE ASSOCIATION

RACQ


RURAL SECTIONS OF THE NATIONAL NETWORK

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### December 2010

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Visit www.ausrap.org for more information about the Australian Road Assessment Program (AusRAP).

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# Executive Summary

**This report provides risk maps for 4,783km of Queensland's national network highways. The risk maps are based on casualty crashes (where at least one person was killed or injured) on highways generally zoned at speed limits of 90km/h or higher.**

The length of roads analysed for the risk maps represented just 2.7% of the total road network in Queensland, yet experienced 296 road deaths (18% of all Queensland road deaths) for the period 2003-07.

During that period 5,370 casualty crashes occurred on the national network.

Results are reported using two types of risk maps: collective risk (average annual casualty crashes per kilometre of road) and individual risk (average annual casualty crashes per 100 million vehicle kilometres travelled). The maps are colour-coded to denote relative levels of risk across the range of low, low-medium, medium, medium-high and high.

Road links are classified as 'best' or 'worst' according to how each road link scored when looking at both risk map types in combination. There was only one best link rated in the low or low-medium bands but 16 could be classified as worst links by falling into the high or medium-high risk category for both collective and individual risk.

The worst links represented less than one percent (0.7%) of Queensland's total road network but experienced over 11% (184) of the state's road deaths.

Of all the roads analysed, the section of Bruce Highway from Brisbane (Bald Hills) to Cairns accounted for 59% of deaths (175) and 51% (2,725) of casualty crashes on the national network. It rated medium–high or high for both collective and individual risk along much of its length. The worst section of Bruce Highway was the 40km section between Cooroy and Gympie. It carried approximately 13,800 vehicles per day and experienced 172 casualty crashes and 25 deaths between 2003 and 2007.

This highlights that drivers should exercise extra care when travelling the Bruce Highway and road authorities should concentrate on delivering a 10 year strategic program of safety improvements to reduce the risk to road users.

Accordingly, other links of major concern which rated high for both collective and individual risk and thus deserve attention included:

- Bruce Highway - Sarina to Mackay
- Bruce Highway - Innisfail to Cairns

During 1999-03 there was a total of 3,756 casualty crashes (on national network highways excluding the Pacific Motorway) while 4,084 occurred in the period 2003-07, a total of 328 more casualty crashes (9%). However, there were 48 fewer road deaths (-15%).

In addition, there has been little change between 2000-04 and 2003-07 in the medium-high and high risk bands for both collective and individual risk. It is important to note that the proportion of Queensland's national network highways rating as medium-high or high individual risk remains at 89%.

Of the 38 road links (excluding the Pacific Motorway) assessed in this study, statistical testing found that three links recorded a reduction in crashes large enough to be considered significant while seven links recorded an increase in crashes large enough to be considered significant.

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# Introduction

**The Australian Road Assessment Program (AusRAP) is a sister program to the Australasian New Car Assessment Program (ANCAP), which crash-tests new cars and awards them stars for safety.**

AusRAP is based on the European equivalent, EuroRAP, which produces maps showing the risk of road crashes that cause death and life-threatening injury and rates roads for safety. It highlights improvements that could be made to roads to reduce the likelihood of crashes – and to make those that do happen survivable.

AusRAP uses two complementary methods – or protocols – for assessing the safety of roads: star ratings and risk mapping.

In October 2006, AAA published Star Ratings: Australia's National Network of Roads – AusRAP's first star ratings report.[1] The star ratings involve an inspection of a number of design elements such as lane and shoulder width, whether the road is divided and the presence of safety barriers, which are known to have an impact on the likelihood of a crash and its severity. Between one and five stars are awarded to road links depending on the level of safety which is 'built in' to the road. The star ratings do not take into account a road's crash history.

This report focuses on risk mapping, which is based on a road's crash history. It measures the safety performance of rural sections of national network highways during the period 2003-07. A performance tracking analysis of traffic and crash data for the periods 1999-03 and 2003-07 has been included for the first time.

We have analysed more than 4,700km of highway, which represents just 2.7% of the total road network in Queensland, yet experienced 296 road crash deaths, or 18% of all the road deaths that occurred in Queensland during 2003-07.

[1] AusRAP reports are available at www.ausrap.org

# Results

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**The results of this report are presented in five parts:**

1. crash history;
2. risk maps;
3. best and worst links;
4. performance tracking; and
5. complete results.

The AusRAP analysis focuses on casualty crashes that occurred between 2003 and 2007 on rural sections of the national network. A casualty crash is defined as being one in which at least one person is killed or injured. Rural highways are generally defined as being those with a speed limit of 90km/h or more, though some lower speed limit sections are included where they form an integral part of a higher speed route.

## Crash history

### The rural sections of six national network highways in Queensland were assessed, totaling 4,783km in length.

The length of each highway and number of casualty crashes and deaths that occurred between 2003 and 2007 are listed below.

**Table 1: Highways in Queensland**

| Highway | From - to | Length | | Casualty crashes | | Deaths | |
|---|---|---|---|---|---|---|---|
| | | km | % | 2003-07 | % | 2003-07 | % |
| **National network highways** | | | | | | | |
| Bruce Hwy | Brisbane to Cairns | 1553 | 32% | 2725 | 51% | 175 | 59% |
| Flinders Hwy | Townsville to Barkly Highway | 756 | 16% | 141 | 3% | 10 | 3% |
| Gore/Leichhardt Hwy | Toowoomba to NSW border | 219 | 5% | 126 | 2% | 9 | 3% |
| New England/Cunningham Hwy | Ipswich to NSW border | 216 | 5% | 263 | 5% | 27 | 9% |
| Pacific Motorway | Gateway Motorway to Gold Coast | 78 | 2% | 1286 | 24% | 26 | 9% |
| Warrego/Landsborough/ Barkly Hwy | Cunningham Highway to NT border | 1961 | 41% | 829 | 15% | 49 | 17% |
| **Total** | | **4783** | **100%** | **5370** | **100%** | **296** | **100%** |

### Between 2003 and 2007, 5,370 casualty crashes and 296 deaths occurred on the national network highways included in this study.

The Bruce Highway experienced the highest level of trauma, accounting for 59% of deaths and 51% of casualty crashes on the lengths analysed in this report. It is not surprising then that the collective risk map (Figure 1) shows that the Bruce Highway is medium-high or high risk along much of its length. The individual risk map (Figure 2), which takes account of traffic volumes, shows that the risk of being involved in a crash is also rated medium-high and high along much of its length. This combination of poor collective and individual crash risk means the Bruce Highway is likely to be a key candidate for remedial upgrades, and is a road on which drivers should exercise extra care.

# Results *(continued)*

## Risk maps

### AusRAP uses two types of colour coded risk maps to illustrate relative levels of risk throughout road networks:

- **Collective risk** maps show the density, or total number, of casualty crashes over a given length of road. Collective risk is calculated by dividing the number of casualty crashes per annum by the length of highway.
- **Individual risk** maps show the casualty crash rates per 100 million vehicle kilometres traveled. This effectively represents the risk of being involved in a crash faced by an individual driver, by taking traffic volumes into account. Individual risk is calculated by dividing the frequency of crashes per annum by the distance traveled on each section of highway per annum.

The colours and thresholds used in the maps to denote relative levels of risk are shown below in Table 2.

**Table 2: Colours and thresholds used in risk maps**

| Risk Rating | Collective risk (average annual casualty crashes per km) | Individual risk (average annual casualty crashes per 100m veh-km) |
|---|---|---|
| Low | < 0.03 | < 6.85 |
| Low-medium | 0.03 – 0.10 | 6.85 – 9.56 |
| Medium | 0.10 – 0.17 | 9.56 – 12.34 |
| Medium-high | 0.17 – 0.29 | 12.34 – 16.44 |
| High | > 0.29 | > 16.44 |

Previous risk mapping reports provide further details on the specific method used to produce the risk maps. These reports are available at www.ausrap.org

# Collective risk ratings, 2003–07

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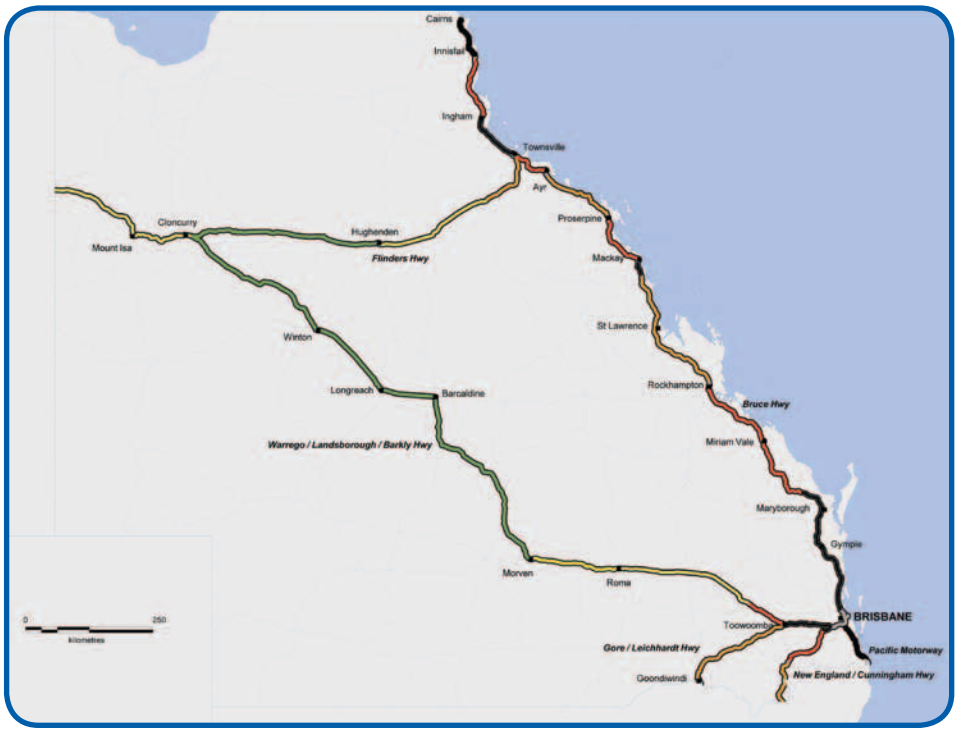
Figure 1: Average annual casualty crashes per km in Queensland




| Risk Rating | Percentage |
|---|---|
| Low | 30% |
| Low-medium | 21% |
| Medium | 18% |
| Medium-high | 17% |
| High | 14% |

# Individual risk ratings, 2003–07

Figure 2: Average annual casualty crashes per 100m veh-km in Queensland


| Risk Rating | Percentage |
|---|---|
| Low | 1% |
| Low-medium | 6% |
| Medium | 4% |
| Medium-high | 49% |
| High | 40% |

# Best and worst links

The measures of collective and individual risk are particularly useful when used together to tell a "combined story". Roads that score poorly on both measures – having relatively high collective and individual risk – might be considered as candidates for investment, and as roads where drivers should exercise extra care. The AusRAP star ratings, published in April 2008 for the AusLink National Network and State highways, and further cost-benefit analysis will assist in determining the appropriate treatment and priority for such roads.

The "best" links are those that are in the low or low-medium band for both collective and individual risk. The "worst" links are those that are in the high or medium-high band for both collective and individual risk.

Table 3 below shows that there is only one link that can be classified in the best category, but as shown in Table 4, 16 links can be classified in the worst category. The worst of these is on the Bruce Highway between Cooroy and Gympie. This link is 40km long, carried around 13,800 vehicles per day and experienced 172 casualty crashes and 25 deaths between 2003 and 2007.

The worst links represented less than one percent (0.7%) of Queensland's total road network but experienced over 11% (184) of the state's road deaths.

Complete results are provided in Table 11 at the end of this document. These results include information on length, carriageway type, traffic volume, casualty crashes, deaths and risk ratings for individual sections of each highway.

### Table 3: Best links

| Highway | From - to | Collective risk rating | Individual risk rating |
|---|---|---|---|
| Warrego/Landsborough/Barkly Hwy | Barcaldine to Winton | Low | Low-medium |

### Table 4: Worst links

| Highway | From - to | Collective risk rating | Individual risk rating |
|---|---|---|---|
| Bruce Highway | Caloundra to Cooroy | High | Medium-high |
| Bruce Highway | Cooroy to Gympie | High | High |
| Bruce Highway | Gympie to Childers | High | Medium-high |
| Bruce Highway | Childers to Miriam Vale | Medium-high | High |
| Bruce Highway | Miriam Vale to Rockhampton | Medium-high | Medium-high |
| Bruce Highway | Sarina to Mackay | High | High |
| Bruce Highway | Mackay to Proserpine | Medium-high | High |
| Bruce Highway | Ayr to Townsville | Medium-high | Medium-high |
| Bruce Highway | Townsville to Ingham | High | Medium-high |
| Bruce Highway | Ingham to Innisfail | Medium-high | High |
| Bruce Highway | Innisfail to Cairns | High | High |
| New England/Cunningham Hwy | Kalbar to Warwick | Medium-high | High |
| Pacific Motorway | Gateway Motorway to Logan Motorway | High | Medium-high |
| Pacific Motorway | Smith Street Fwy to Gold Coast | High | Medium-high |
| Warrego/Landsborough/Barkly Hwy | Cunningham Hwy to Gatton | High | Medium-high |
| Warrego/Landsborough/Barkly Hwy | Helidon to Toowoomba | High | Medium-high |

# Performance tracking

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## The most recent Risk Mapping data has provided the opportunity to performance track the latest results against the data collected for the period 1999-03.

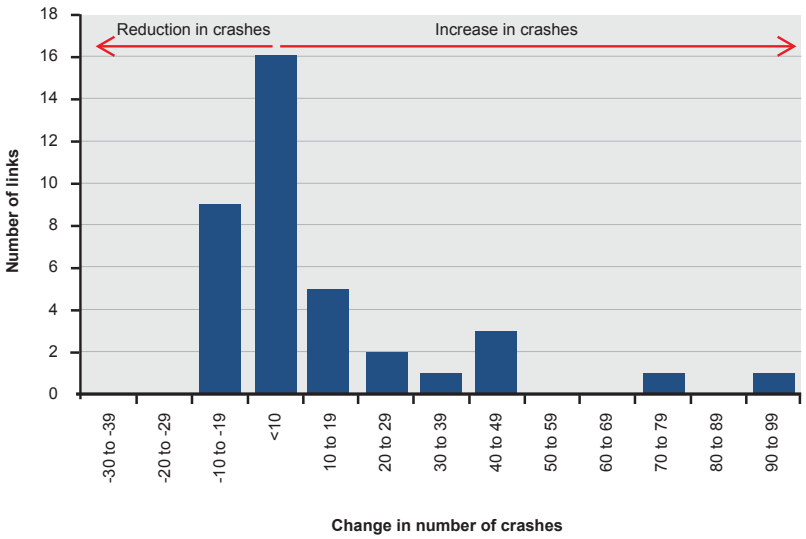
During 1999-03 there was a total of 3,756 casualty crashes on highways listed in Table 5 while 4,084 occurred in the period 2003-07, a total of 328 more casualty crashes (9%). However, there were 48 fewer road deaths (-15%).

### Table 5: Casualty Crashes and deaths 1999-03, 2003-07

| Highway | From - to | Casualty crashes | | | | Deaths | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1999-2003 | 2003-2007 | Ch | % | 1999-2003 | 2003-2007 | Ch | % |
| Bruce Hwy | Brisbane to Cairns | 2442 | 2725 | 283 | 12% | 205 | 175 | -30 | -15% |
| Flinders Hwy | Townsville to Barkly Highway | 173 | 141 | -32 | -18% | 12 | 10 | -2 | -17% |
| Gore/Leichhardt Hwy | Toowoomba to NSW border | 116 | 126 | 10 | 9% | 12 | 9 | -3 | -25% |
| New England/Cunningham Hwy | Ipswich to NSW border | 298 | 263 | -35 | -12% | 29 | 27 | -2 | -7% |
| Warrego/Landsborough/Barkly Hwy | Cunningham Highway to NT border | 727 | 829 | 102 | 14% | 60 | 49 | -11 | -18% |

A total of 38 road links (excluding the Pacific Motorway) were assessed in this study. Of the 38 road links, 17 (45%) had a reduction in crashes between 1999-03 and 2003-07, 20 had an increase (52%) and one (3%) had no change. Figure 3 below shows that where a reduction in crashes was recorded, the reductions were small. The same is not true for links that recorded increases in crashes, with 6 of the 38 links showing an increase of more than 30 crashes.

### Figure 3: Number of links by size of change in crash numbers (1999-03 to 2003-07)



# Performance tracking *(continued)*

## Most improved roads

Of the 17 (45%) road links that recorded a reduction in crashes between 1999-03 and 2003-07, statistical testing found that three of these sections had reductions in crashes that were large enough to be considered significant. These are listed in Table 6.

**Table 6: Sections of highway where there was a significant reduction in casualty crashes**

| Highway | From - to | Casualty crashes | | | | Deaths | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1999-2003 | 2003-2007 | Ch | % | 1999-2003 | 2003-2007 | Ch | % |
| Flinders Highway | Hughenden to Richmond | 20 | 10 | -10 | -50% | 3 | 1 | -2 | -67% |
| Flinders Highway | Richmond to Julia Creek | 27 | 14 | -13 | -48% | 2 | 1 | -1 | -50% |
| New England Highway | Stanthorpe to NSW border | 42 | 26 | -16 | -38% | 5 | 5 | 0 | 0% |

It is often difficult to be definitive about the cause of a reduction in crashes on any given section of road. Frequently, the improvement in safety is the result of a combination of factors which can include reductions in traffic volumes, road upgrades and changes in police enforcement. This study did not seek to provide a comprehensive review of the causal factors, though a review of national highway information found that both Flinders Highway links (Hughenden to Richmond and Richmond to Julia Creek) had a number of projects listed as widening, rehabilitation and shoulder sealing, completed during the 2003-07 financial years. In contrast, the New England Highway (Stanthorpe to NSW border) link did not receive any dedicated funding for upgrade projects during 2003-07 financial years.

# Performance tracking *(continued)*



## Roads where crashes increased significantly

Several sections of highway were identified where the number of crashes increased (although in some cases the number of deaths actually decreased). After statistical testing it was found that seven of these sections had increases in crashes that were large enough to be considered significant (see Table 7).

**Table 7: Sections of highway where there was a significant increase in casualty crashes**

| Highway | From - to | Casualty crashes | | | | Deaths | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1999-2003 | 2003-2007 | Ch | % | 1999-2003 | 2003-2007 | Ch | % |
| Bruce Highway | Caloundra to Cooroy | 183 | 259 | 76 | 42% | 13 | 5 | -8 | -62% |
| Bruce Highway | Gympie to Childers | 212 | 254 | 42 | 20% | 23 | 24 | 1 | 4% |
| Bruce Highway | Miriam Vale to Rockhampton | 148 | 183 | 35 | 24% | 17 | 13 | -4 | -24% |
| Bruce Highway | Mackay to Proserpine | 108 | 156 | 48 | 44% | 13 | 12 | -1 | -8% |
| Bruce Highway | Innisfail to Cairns | 85 | 129 | 44 | 52% | 3 | 5 | 2 | 67% |
| Gore/Leichhardt Highway | Yandilla to NSW border | 62 | 82 | 20 | 32% | 4 | 6 | 2 | 50% |
| Warrego/Landsborough/Barkly Hwy | Cunningham Highway to Gatton | 248 | 343 | 95 | 38% | 17 | 23 | 6 | 35% |

While it can sometimes be difficult to identify the factors that might have caused a reduction in crashes, it is often more difficult to explain an increase. One of the common reasons for a rise in crashes is that there has been an increase in traffic volumes and thus a greater exposure to risk. Traffic volume changes appear to have been a factor in at least some of the cases listed in Table 7 and are shown in Table 8.

**Table 8: Traffic volumes on sections of highway where there was a significant increase in casualty crashes**

| Highway | From - to | Traffic Volumes | | | |
|---|---|---|---|---|---|
| | | 1999-2003 | 2003-2007 | Ch | % |
| Bruce Highway | Caloundra to Cooroy | 22100 | 26500 | 4400 | 20% |
| Bruce Highway | Gympie to Childers | 6100 | 7000 | 900 | 15% |
| Bruce Highway | Miriam Vale to Rockhampton | 3700 | 4100 | 400 | 11% |
| Bruce Highway | Mackay to Proserpine | 3500 | 4000 | 500 | 14% |
| Bruce Highway | Innisfail to Cairns | 4400 | 5100 | 700 | 16% |
| Gore/Leichhardt Highway | Yandilla to NSW border | 1700 | 1400 | -300 | -18% |
| Warrego/Landsborough/Barkly Hwy | Cunningham Highway to Gatton | 19300 | 22300 | 3000 | 16% |

# Performance tracking *(continued)*

## Change in network crash risk

Tables 9 and 10 (and Figures 4 and 5) below show there has been little change between 2000-04 and 2003-07 in the medium-high and high risk bands for both collective and individual risk. It is important to note that the proportion of Queensland's national network highways rating as medium-high or high individual risk remains at 89% (refer to Table 10).

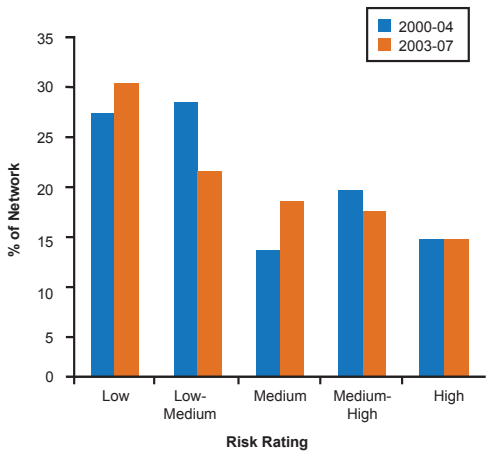
### Table 9: Collective risk - 2000-04, 2003-07

| Collective Risk | 2000-04 | 2003-07 | Difference |
|---|---|---|---|
| Low | 27% | 30% | 3% |
| Low-medium | 28% | 21% | -7% |
| Medium | 13% | 18% | 6% |
| Medium-high | 19% | 17% | -2% |
| High | 14% | 14% | 0% |

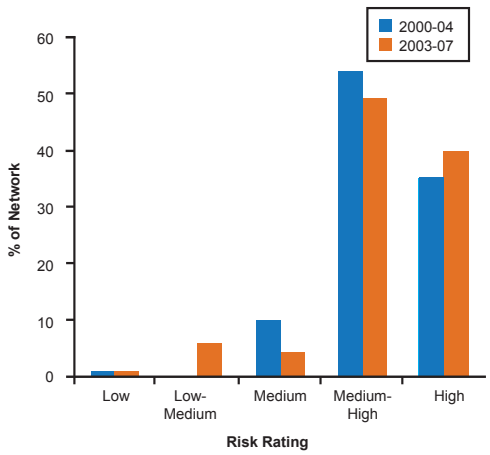
### Table 10: Individual risk - 2000-04, 2003-07

| Collective Risk | 2000-04 | 2003-07 | Difference |
|---|---|---|---|
| Low | 1% | 1% | 0% |
| Low-medium | 0% | 6% | 6% |
| Medium | 10% | 4% | -6% |
| Medium-high | 54% | 49% | -5% |
| High | 35% | 40% | 5% |

### Figure 4: Collective risk




### Figure 5: Individual risk




# Complete results

| From – to | Type | Length | Traffic | Casualty crashes | Deaths | Collective Risk Rating | | Individual Risk Rating | |
|---|---|---|---|---|---|---|---|---|---|
| | | km | Vehicles per day | 2003-07 | 2003-07 | Annual average casualty crashes per km | | Annual average casualty crashes per 100m veh-km | |
| **Bruce Highway** | | | | | | | | | |
| Bald Hills to Caloundra | Dual | 61 | 50600 | 593 | 16 | 1.94 | High | 10.48 | Medium |
| Caloundra to Cooroy | Dual | 41 | 26500 | 259 | 5 | 1.28 | High | 13.17 | Medium-high |
| Cooroy to Gympie | Single | 40 | 13800 | 172 | 25 | 0.86 | High | 17.17 | High |
| Gympie to Childers | Single | 138 | 7000 | 254 | 24 | 0.37 | High | 14.36 | Medium-high |
| Childers to Miriam Vale | Single | 152 | 3100 | 173 | 12 | 0.23 | Medium-high | 20.33 | High |
| Miriam Vale to Rockhampton | Single | 164 | 4100 | 183 | 13 | 0.22 | Medium-high | 14.78 | Medium-high |
| Rockhampton to St Lawrence | Single | 165 | 2300 | 115 | 9 | 0.14 | Medium | 16.65 | High |
| St Lawrence to Sarina | Single | 118 | 2400 | 74 | 5 | 0.13 | Medium | 14.30 | Medium-high |
| Sarina to Mackay | Single | 25 | 8500 | 69 | 3 | 0.54 | High | 17.39 | High |
| Mackay to Proserpine | Single | 118 | 4000 | 156 | 12 | 0.27 | Medium-high | 18.07 | High |
| Proserpine to Ayr | Single | 160 | 2800 | 126 | 13 | 0.16 | Medium | 15.59 | Medium-high |
| Ayr to Townsville | Single | 74 | 5300 | 97 | 11 | 0.26 | Medium-high | 13.59 | Medium-high |
| Townsville to Ingham | Single | 100 | 6400 | 177 | 8 | 0.35 | High | 15.22 | Medium-high |
| Ingham to Innisfail | Single | 137 | 3500 | 148 | 14 | 0.22 | Medium-high | 16.75 | High |
| Innisfail to Cairns | Single | 60 | 5100 | 129 | 5 | 0.43 | High | 23.36 | High |
| **Flinders Highway** | | | | | | | | | |
| Townsville to Charters Towers | Single | 122 | 2000 | 63 | 5 | 0.10 | Medium | 14.40 | Medium-high |
| Charters Towers to Hughenden | Single | 245 | 500 | 37 | 0 | 0.03 | Low-medium | 15.42 | Medium-high |
| Hughenden to Richmond | Single | 117 | 300 | 10 | 1 | 0.02 | Low | 14.32 | Medium-high |
| Richmond to Julia Creek | Single | 148 | 300 | 14 | 1 | 0.02 | Low | 20.65 | High |
| Julia Creek to Barkly Hwy | Single | 123 | 300 | 17 | 3 | 0.03 | Low | 27.00 | High |
| **Gore/Leichhardt Highway** | | | | | | | | | |
| Toowoomba to Yandilla | Single | 64 | 2800 | 44 | 3 | 0.14 | Medium | 13.28 | Medium-high |
| Yandilla to NSW border | Single | 155 | 1400 | 82 | 6 | 0.11 | Medium | 20.48 | High |
| **New England/Cunningham Highway** | | | | | | | | | |
| Ipswich to Willowbank | Dual | 18 | 17900 | 65 | 1 | 0.72 | High | 11.08 | Medium |
| Willowbank to Kalbar | Single | 37 | 4900 | 34 | 6 | 0.18 | Medium-high | 10.11 | Medium |
| Kalbar to Warwick | Single | 68 | 4200 | 95 | 9 | 0.28 | Medium-high | 18.02 | High |
| Warwick to Stanthorpe | Single | 57 | 3300 | 43 | 6 | 0.15 | Medium | 12.68 | Medium-high |
| Stanthorpe to NSW border | Single | 36 | 2700 | 26 | 5 | 0.14 | Medium | 14.35 | Medium-high |
| **Pacific Motorway** | | | | | | | | | |
| Gateway Motorway to Logan Motorway | Dual | 15 | 108800 | 392 | 5 | 5.31 | High | 13.37 | Medium-high |
| Logan Motorway to Smith Street Fwy | Dual | 35 | 106400 | 430 | 10 | 2.45 | High | 6.32 | Low |
| Smith Street Fwy to Gold Coast | Dual | 29 | 70800 | 464 | 11 | 3.27 | High | 12.63 | Medium-high |
| **Warrego/Landsborough/Barkly Hwy** | | | | | | | | | |
| Cunningham Hwy to Gatton | Dual | 55 | 22300 | 343 | 23 | 1.24 | High | 15.22 | Medium-high |
| Gatton to Helidon | Single | 20 | 12100 | 36 | 1 | 0.36 | High | 8.14 | Low-medium |
| Helidon to Toowoomba | Dual | 16 | 17400 | 84 | 4 | 1.02 | High | 16.12 | Medium-high |
| Toowoomba to Dalby | Single | 74 | 5500 | 72 | 6 | 0.20 | Medium-high | 9.74 | Medium |
| Dalby to Roma | Single | 262 | 1400 | 96 | 5 | 0.07 | Low-medium | 13.86 | Medium-high |
| Roma to Morven | Single | 175 | 600 | 35 | 3 | 0.04 | Low-medium | 17.70 | High |
| Morven to Barcaldine | Single | 413 | 300 | 32 | 3 | 0.02 | Low | 13.38 | Medium-high |
| Barcaldine to Winton | Single | 285 | 500 | 22 | 0 | 0.02 | Low | 9.20 | Low-medium |
| Winton to Flinders Hwy | Single | 334 | 200 | 25 | 0 | 0.01 | Low | 16.53 | High |
| Flinders Hwy to Mt Isa | Single | 131 | 1200 | 43 | 3 | 0.07 | Low-medium | 15.10 | Medium-high |
| Mt Isa to NT border | Single | 195 | 300 | 41 | 1 | 0.04 | Low-medium | 41.76 | High |

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