



Waikato Expressway: Ngaruawahia section

Benefits Realisation Review

ABOUT BENEFIT REALISATION REVIEWS

Benefit Realisation Reviews assess how well improvement projects* which received National Land Transport Programme (NLTP) funding have achieved their main expected benefits.



ABOUT THIS REVIEW

PROJECT NAME:	Ngaruawahia section of the Waikato Expressway (also known as the Ngaruawahia expressway or bypass)
RESPONSIBLE ENTITY:	NZ Transport Agency
DATA ANALYSIS DATES:	Travel time and crash data up to December 2018 used.
REPORT PUBLICATION DATE:	April 2019

* Includes state highway and local road improvements, public transport, walking & cycling, and regional improvement projects.

SUMMARY

NGARUAWAHIA SECTION OF THE WAIKATO EXPRESSWAY IS DELIVERING ITS EXPECTED BENEFITS

The Ngaruawahia expressway project

The Ngaruawahia section is one of seven projects making up the Waikato Expressway.

It constructed a four lane median divided expressway which bypassed the Ngaruawahia townships.






Successful project

This review has found the Ngaruawahia section is successfully contributing to the expected overall benefits of the Waikato Expressway.

The project was constructed at a cost of \$142m (nearly 20% under budget) and officially opened six months earlier than planned in December 2013. However, remedial work started in early 2019 to fix rutting problems on the road surface will cost several million dollars.

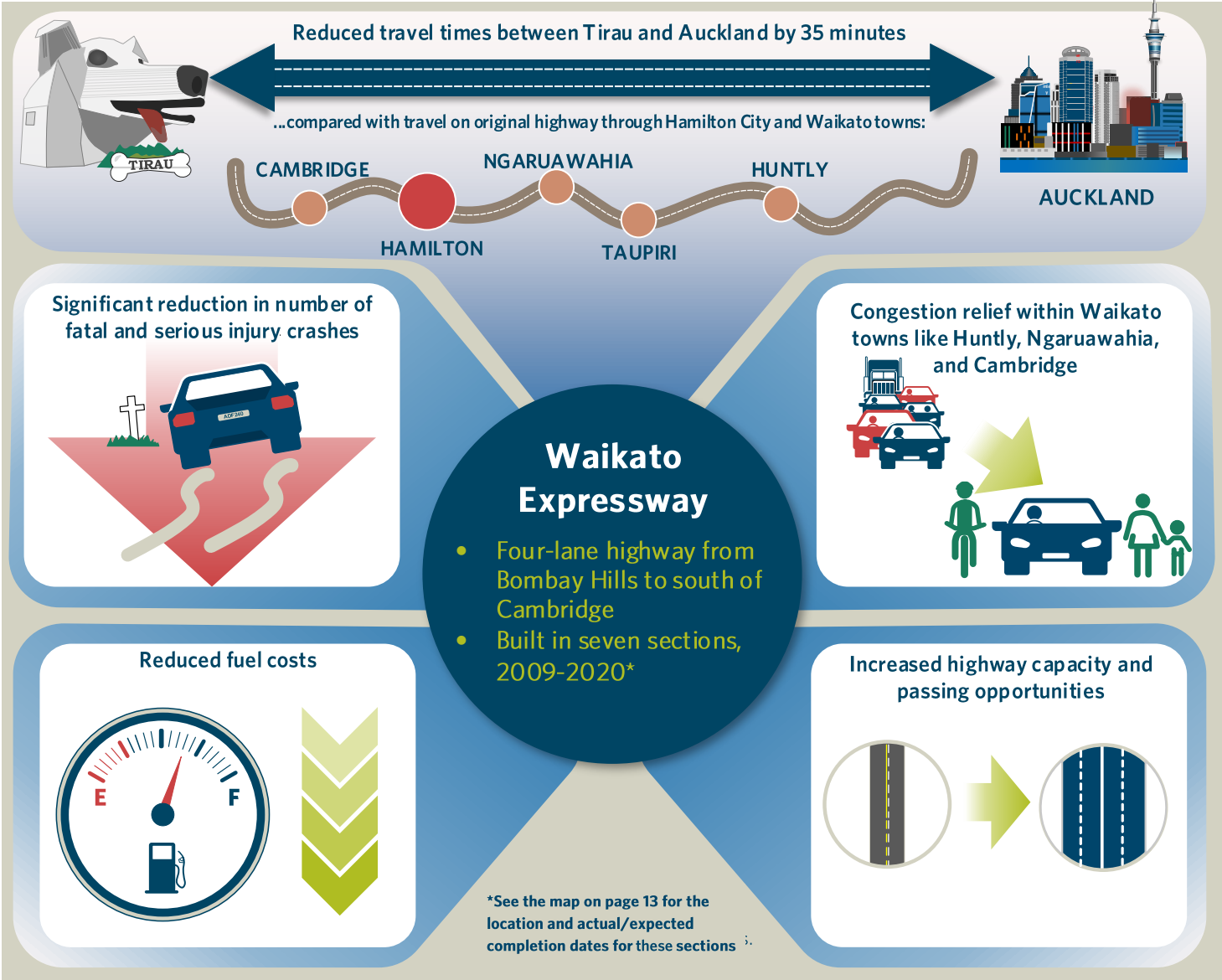


Actual summary results

- 1 Travel time savings**
Predicted travel time savings of more than 3 minutes using the expressway have been exceeded 
- 2 Journey time reliability**
Travel times are significantly more predictable for motorists using the expressway compared with travelling on the previous state highway route. 
- 3 Safety**
Mixed results with crash reduction. Injury crashes have reduced, but non-injury crashes are common on the expressway, especially its northern link. 
- 4 Congestion relief in Ngaruawahia**
Transfer of state highway traffic, including trucks, onto the expressway has reduced congestion in Ngaruawahia 
- 5 Other benefits**
The four lane expressway has increased highway capacity and passing opportunities. Reduced travel times will have helped reduce fuel costs for expressway users. 

WAIKATO EXPRESSWAY MAIN EXPECTED BENEFITS

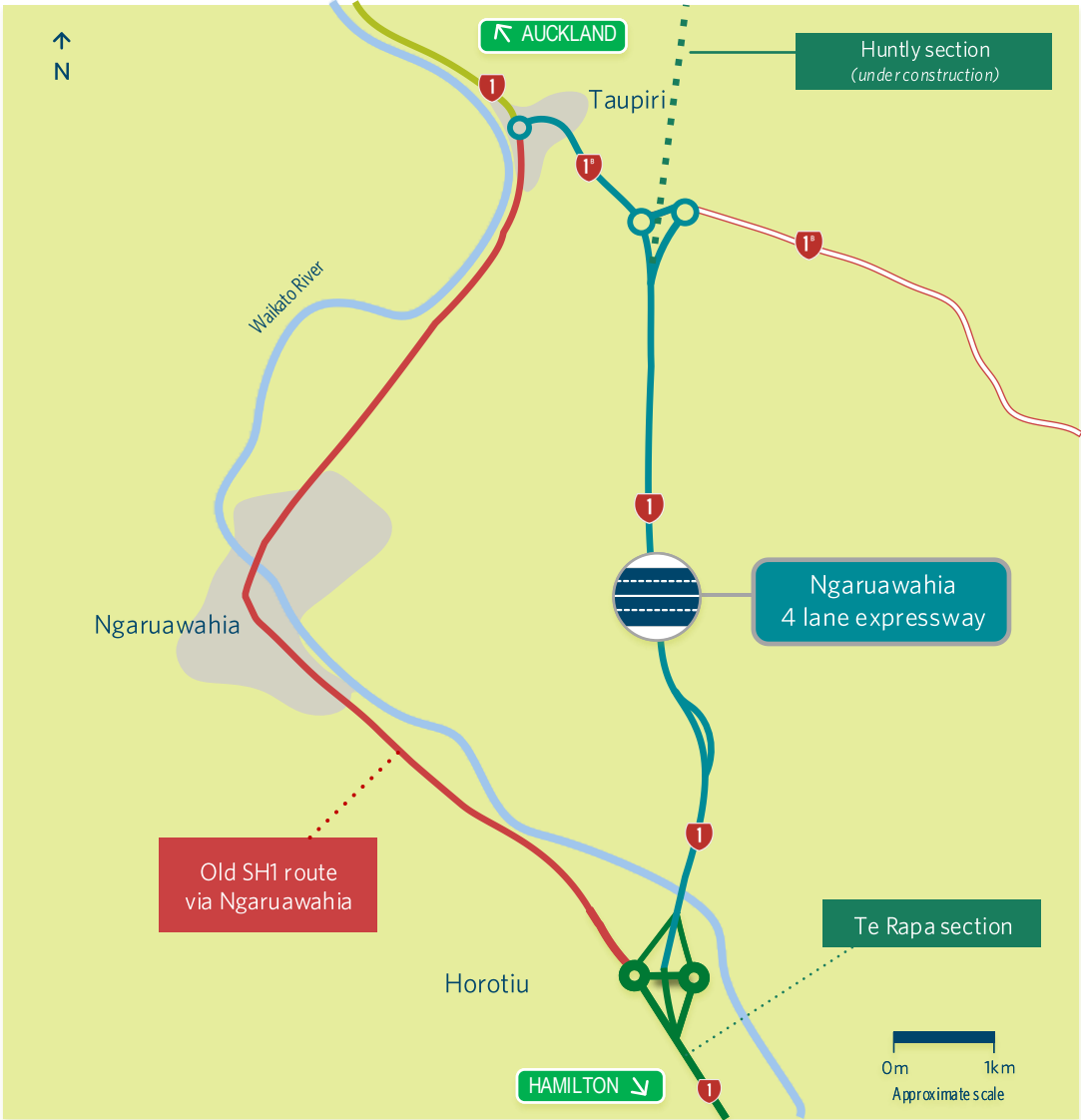
Forming one of the Roads of National Significance (RoNS), the Waikato Expressway is described by the NZ Transport Agency as a key strategic corridor in the Waikato region, connecting Auckland to the agricultural and business centres of Waikato and the Bay of Plenty. The Expressway is predicted to improve growth and productivity through more efficient movement of people and freight.



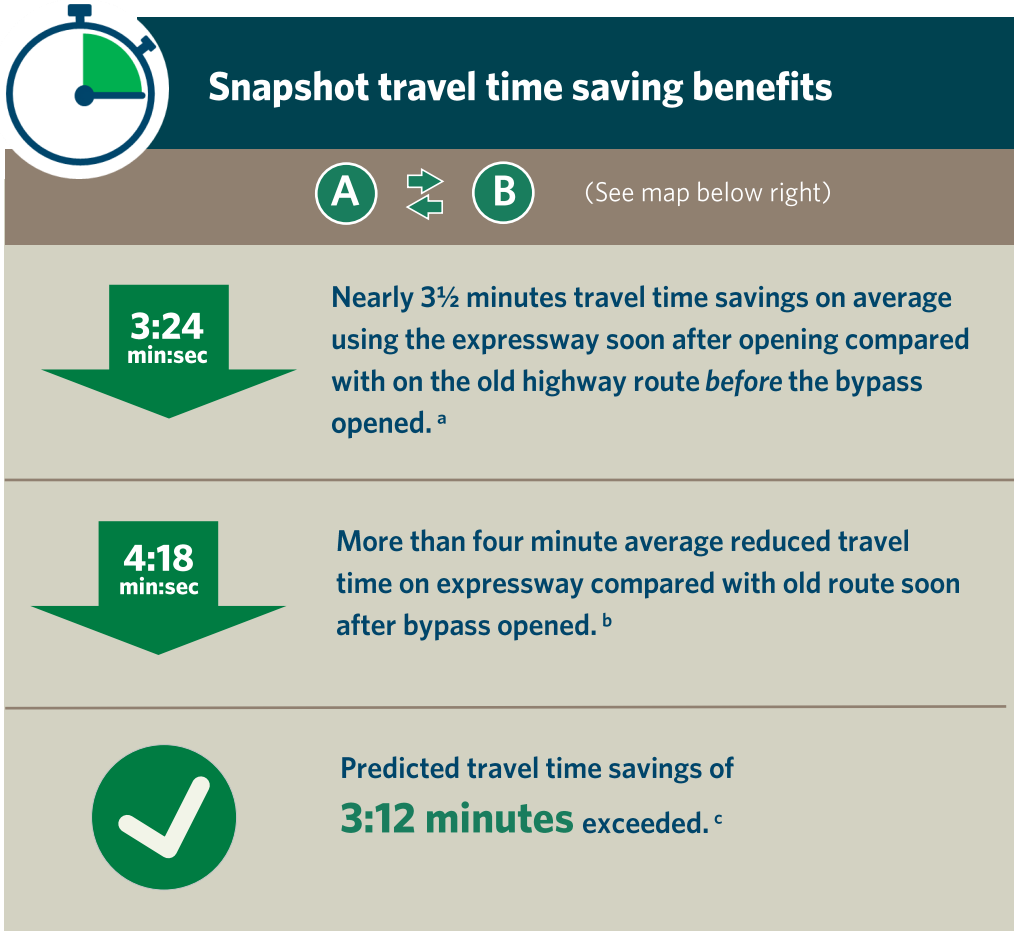
MAP
NGARUAWAHIA SECTION OF WAIKATO EXPRESSWAY

The Ngaruawahia section of the Waikato Expressway is a 4 lane median separated expressway. The second section to be built, it extends almost due north from the northern end of the Te Rapa section before joining with SH1B and linking into Taupiri. This section of the expressway is a bypass of the previous SH1 route through Ngaruawahia.

The northern end of the Ngaruawahia section will join the Huntly section of the expressway when it is completed in 2010. When this happens the Waikato Expressway will bypass both Taupiri and Huntly.



TRAVEL TIMES AND RELIABILITY BENEFITS FROM NGARUAWAHIA EXPRESSWAY SOON AFTER OPENING
PREDICTED TRAVEL TIME BENEFITS EXCEEDED



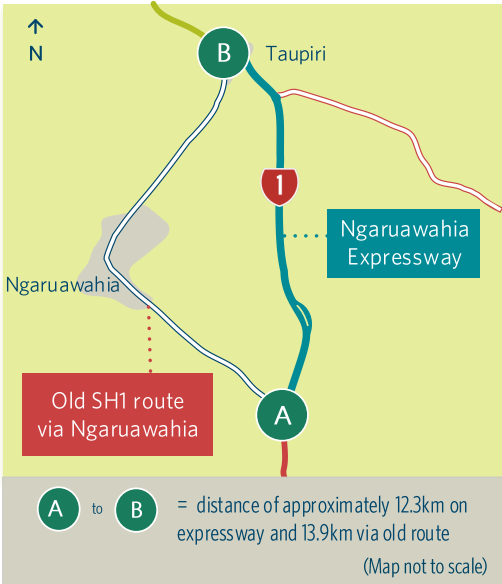
Snapshot travel time saving benefits

(See map below right)

- 3:24 min:sec** Nearly 3½ minutes travel time savings on average using the expressway soon after opening compared with on the old highway route *before* the bypass opened. ^a
- 4:18 min:sec** More than four minute average reduced travel time on expressway compared with old route soon after bypass opened. ^b
- 3:12 minutes** exceeded. ^c

Average travel time 7am-7pm (min:sec)

Old route <i>after</i> bypass opened (March 2014):	12:33
Old route <i>before</i> bypass (March 2011):	11:40
Expressway after opening (March 2014):	08:15



Coverage and terminology notes:
^a Average weekday travel times 7am-7pm were compared between on the expressway in March 2014 (a couple of months after it opened) and in March 2011 on the old highway route before expressway construction started.
^b Average weekday travel times 7am-7pm were compared between on the expressway and old highway route in March 2014 (this is to give an indication of the immediate realisation of benefits from the completed project).
^c Source: MIN-0991—RoNS travel time savings for completed sections.
 Public holidays were excluded from analysis. Average results for northbound and southbound travel times were used as these showed no significant differences. Data source: TomTom Traffic Stats.

**TRAVEL TIMES AND RELIABILITY BENEFITS FROM NGARUAWAHIA EXPRESSWAY SOON AFTER OPENING CONTINUED...
IMPROVED JOURNEY TIME RELIABILITY AND LOWER TRAVEL TIME BENEFITS ACHIEVED**

The expressway immediately improved journey time reliability for people between Te Rapa and Taupiri compared with before construction

Most trips on the expressway soon after opening were consistently taking between 7 and 9½ minutes (fig 1), compared with typical journeys on the previous highway route through Ngaruawahia before the bypass was built ranging between 10½ and 12½ minutes (fig 2).

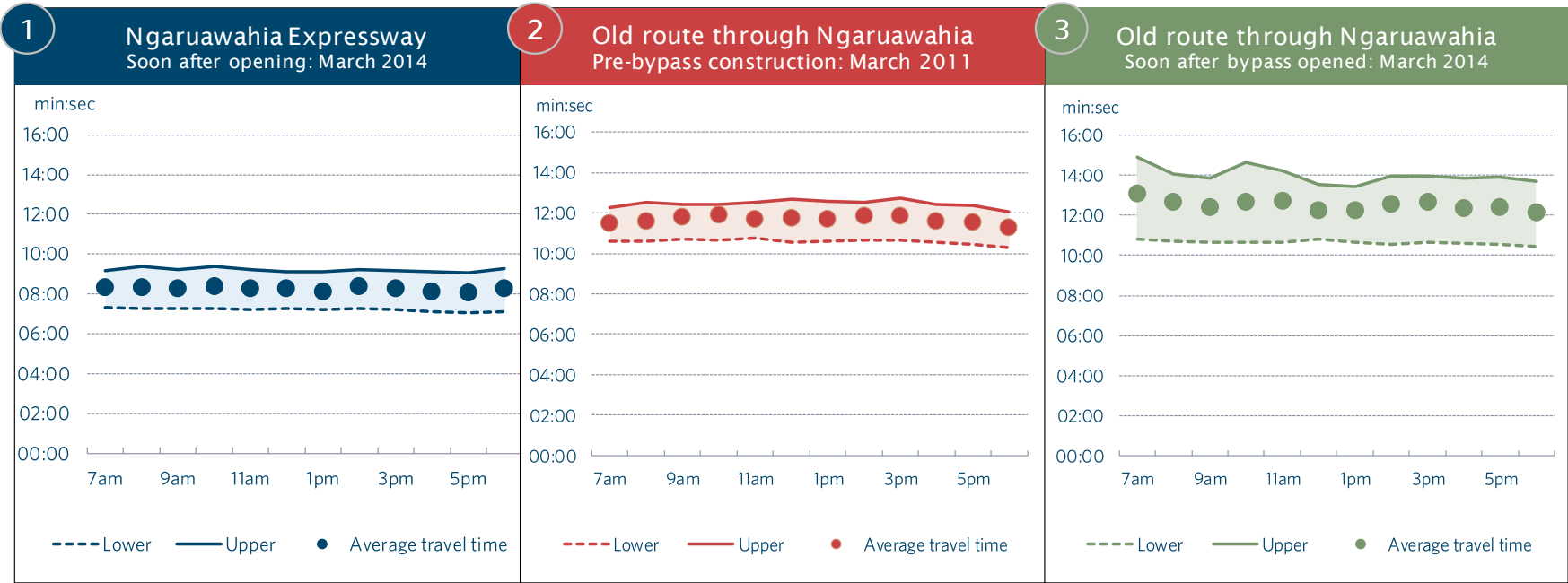
Average travel times for both northbound and southbound state highway traffic between Te Rapa and Taupiri reduced from around 11 to 8 minutes.

Change in traffic environment on previous state highway meant travel time and reliability benefits from using expressway even better soon after opening

There had been significant deterioration in journey time reliability and average travel times on the previous highway through Ngaruawahia by the time the bypass opened in late 2013. Most trips on the full route were by then taking between nearly 11 minutes and up to 15 minutes depending on the time of day (fig3).


The main reasons for this is traffic signals were installed at an intersection towards the southern end of the route at Horotiu in mid-2012, and the speed limit in the area reduced from 80kmh to 70kmh. These changes were part the development of a commercial area at Horotiu. Signalising the intersection improves safety and accommodates higher traffic volumes to move through the intersection.

TIP
See Page 15 of this report for guidance on using these graphs.



Coverage and terminology notes: Travel times compared are average travel times 7am-7pm on weekdays in March for the given years. Public holidays are excluded. The average results for northbound and southbound travel times are presented as these were very similar. Data source: TomTom Traffic Stats.

MORE RECENT (2018) TRAVEL TIME AND RELIABILITY BENEFITS FROM NGARUAWAHIA EXPRESSWAY
TRAVEL TIME RELIABILITY AND SAVINGS BENEFITS ONGOING



Snapshot findings

March 2018

A
↔
B
(See map below)


4:37

min:sec


Travel along the expressway takes about 2/3rds the time as the old highway route.

Average travel times March 2018


Old route	12:58
Expressway	08:20



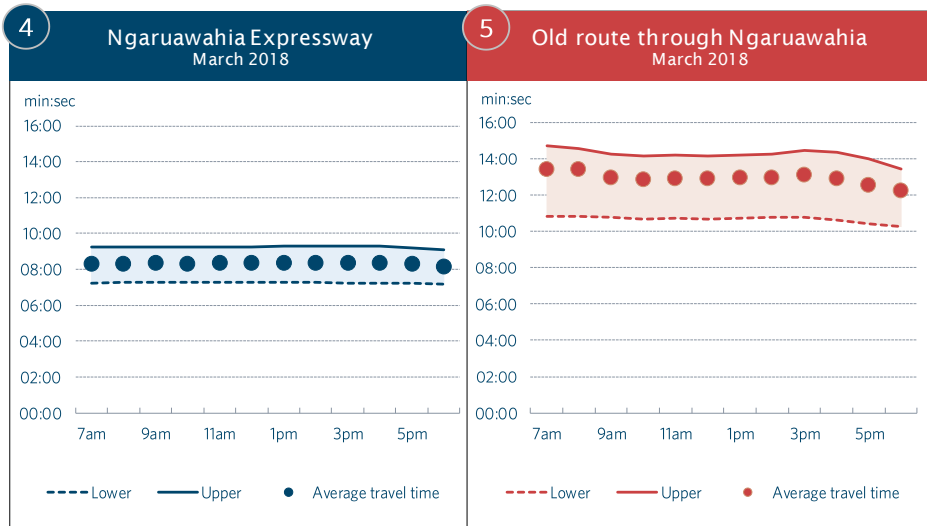
A to B = distance of approximately 12.3km on expressway and 13.9km via old route
 (Map not to scale)

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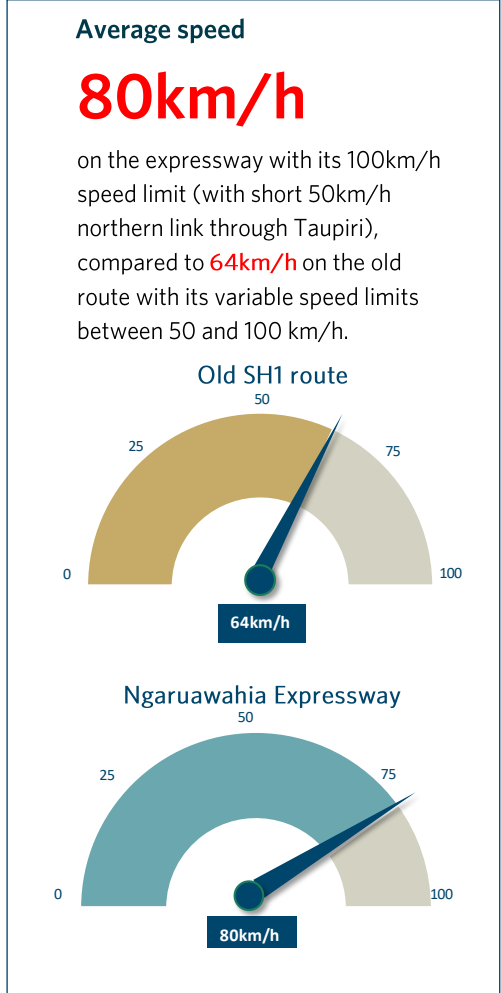
There is still a high level of predictability for travel times along the Ngaruawahia section of the Waikato Expressway.

Journeys mostly take between 7 and 9½ minutes, regardless of the time of day (fig 4). This is the same level of travel time reliability benefits as was evident soon after the section opened in late 2013.
- 

Average travel times on the previous highway route have modestly increased by around half a minute. It is unclear why.



Coverage and terminology notes: Travel times compared are average travel times 7am-7pm on weekdays in March 2018. Public holidays are excluded. The average results for northbound and southbound travel times are presented as these were very similar. Data source: TomTom Traffic Stats.



SAFETY

MIXED OUTCOMES WITH IMPROVING SAFETY

Crashes tend to be random events with many possible causes. This makes it difficult to attribute observed crash trends to safety improvements a project may make. Benefit Realisation Reviews use a crash analysis methodology to help reduce the random effect so that conclusions can be made on a project’s safety outcomes with a sufficient level of confidence.

(See the guidance page on page 16 of this report for more information about crash analysis.)

+ There has been a statistically significant decrease in injury crashes since the Ngaruawahia Expressway opened

There was a significant reduction in injury crashes on both the Ngaruawahia Expressway and the previous state highway route compared with might have been expected based on crash history over nearly 10 years on the previous route before expressway construction began (fig 6 at right). This decrease is statistically significant, meaning it can be concluded with sufficient confidence that the expressway has contributed to this reduction in injury crashes.



+ Several fatal and serious injury crashes since expressway opened

Although overall injury crashes have reduced, there have been two fatal and two serious injury crashes on the expressway between 2014 and 2018. Over the same period there were also three fatal and six serious injury crashes on the previous route through Ngaruawahia.

+ Inconclusive outcomes with all crashes trend

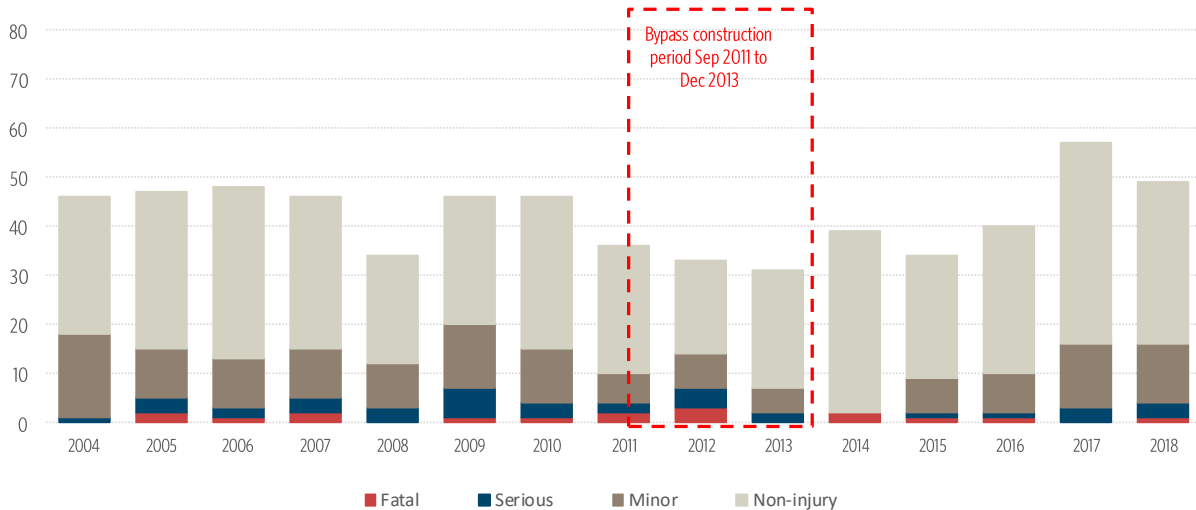
There has been a very marginal increase when looking at all crashes. This has been driven by relatively high levels of non-injury crashes on both the expressway and previous highway route (fig 7 at right).

Figure 6: summary crash analysis results for Ngaruawahia expressway project

Crashes pre-project construction 2002 to August 2010	Expected crashes post-construction 2013-2018*	Actual crashes post-construction 2013-2018	Probability project has improved safety
INJURY CRASHES			
116	75	53	Statistically significant decrease in injury crashes 
ALL CRASHES			
335	218	219	Statistically insignificant increase in all crashes 

* Based on crash history before project construction.

Figure 7: crashes by severity on Ngaruawahia expressway and previous highway route, 2002-2018



Source: NZ Transport Agency: Crash Analysis System (CAS).

SAFETY CONTINUED...

NON-INJURY CRASHES ARE COMMON ON EXPRESSWAY

+ 111 crashes on the expressway in the 5 years since it opened

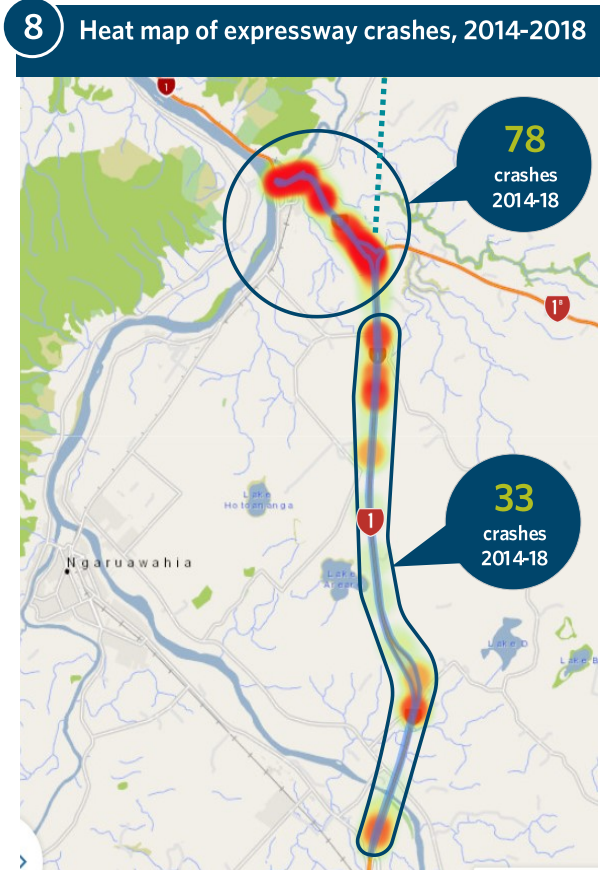
In the six years 2013-18, 108 crashes were recorded on the expressway. The majority of these crashes (78%) were non-injury (see Snapshot figure below).

+ Most crashes are concentrated on the northern link through Taupiri.

Seventy percent of expressway crashes have occurred on the northern section of the Ngaruawahia, which links through Taupiri to the existing SH1 towards Huntly. This is clearly evident in the heat map shown in fig 8 at right, which visually shows the concentration of crashes by location.

This link section was partly upgraded as part of the Ngaruawahia project, but in contrast to the main part of the expressway it is two lanes, with variable speed 70-80km/h speed limits, and several roundabouts. Consequently, it is more congested than the main four lane median divided part of the expressway. This congestion and road design is reflected in the most common crash types on the link. These include 45% of the crashes on it being rear ends, with a further 32% involving loss of control on bends.

The link section will cease being part of SH1 when the Huntly section of the Waikato Expressway is completed in 2020. The southern start of the Huntly section will begin at the northern end of the Ngaruawahia section where it meets SH1B. (The dashed line in fig 8 shows where the Huntly section will join with the Ngaruawahia section.)



SNAPSHOT:

CRASHES ON EXPRESSWAY SINCE OPENING

Jan 2014 to Dec 2018*

111

recorded crashes: 2 fatal, 2 serious injury, 20 minor injury, 87 (78%) non-injury

Most common crash types:



41x rear end/obstruction



27x lost control on bend



20x lost control on straight road

* There can be a lag of up to 3months for all crash records to be entered in the Crash Analysis System (CAS).

Source: NZ Transport Agency: Crash Analysis System (CAS).

CONGESTION RELIEF IN CAMBRIDGE

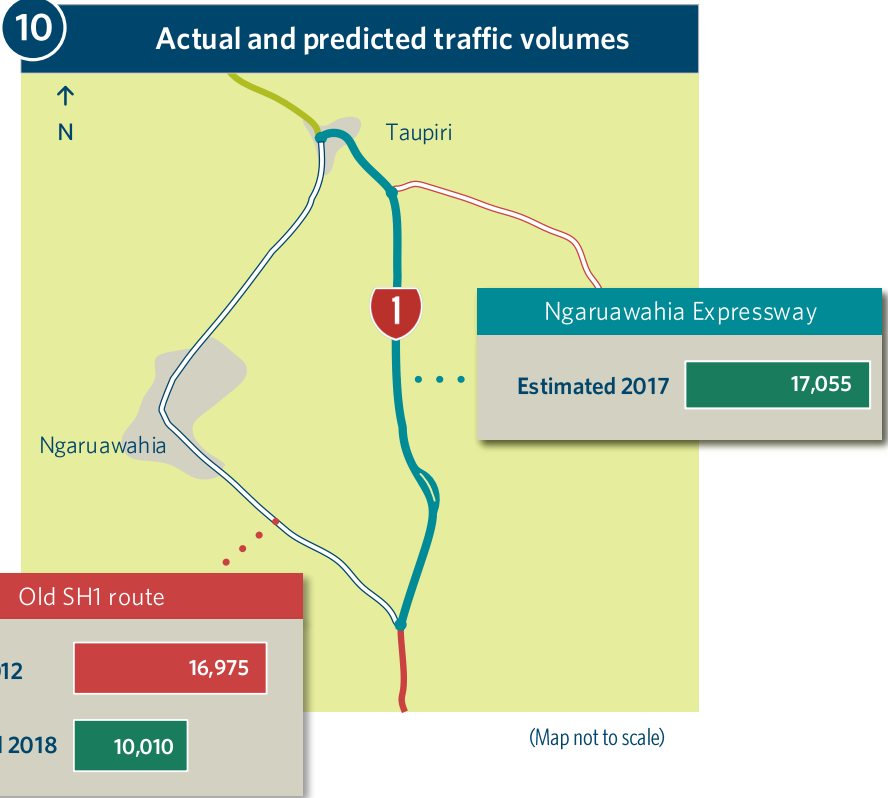
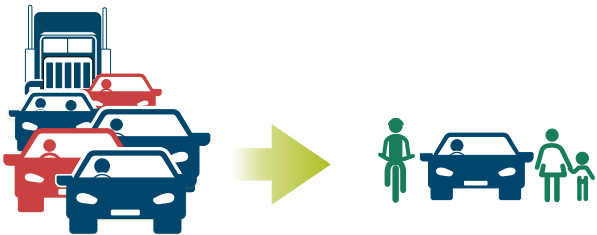
REMOVAL OF STATE HIGHWAY TRAFFIC HAS REDUCED CONGESTION

- ✓ **Removal of state highway traffic onto expressway has relieved congestion through Ngaruawahia**

Nearly 17,000 vehicles travelled through Ngaruawahia each day before the bypass was built. This traffic volume has been reduced to around 10,000 vehicles a day as a result of the expressway (see fig 10 at right).

- ✓ **Trucks and other heavy vehicles moved onto bypass**

Considerably fewer trucks now travel through Ngaruawahia, using the expressway instead. Previously more than 1,800 trucks on average travelled through the township. This has been reduced to around 600 a day since the Ngaruawahia expressway opened.



Sources: RAMM databases; NZ Transport Agency; Mobile Roads.

OTHER BENEFITS

FUEL COSTS LIKELY REDUCED; INCREASED HIGHWAY CAPACITY AND PASSING OPPORTUNITIES

The expected benefits from the Waikato Expressway of reduced fuel costs, and increased highway capacity with more passing opportunities were not specifically evaluated for this Benefits Realisation Review. However, the following observations are made on the basis of the design of the expressway and other benefits' results.

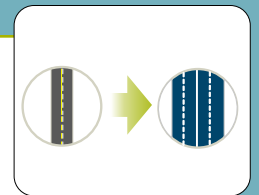
Reduced fuel costs



The significant improvements in travel time savings and journey time reliability from the Ngaruawahia expressway will have reduced average fuel costs for its users compared with if they still had to use the previous highway route.

This is because expressway users generally experience free-flowing travel, compared with stop and start conditions, variable speed zones, and congestion (previously evident) on the old highway route. All of these factors generally cause vehicles to consume more fuel.

Highway capacity and passing opportunities



Improved highway capacity and passing opportunities have been successfully achieved with the four lane median divided road along the main section of the Ngaruawahia expressway.

In contrast, the previous route through Ngaruawahia is a two lane road with only one passing lane immediately north of the town for southbound traffic.

PROJECT CONSTRUCTION AND COST AND TIMEFRAME EXPRESSWAY OPENED ON TIME AND UNDER BUDGET



Construction costs

\$142 million*

construction costs for Ngaruawahia section of Waikato Expressway.

20% under budget

mainly because of lower than expected tender price and reduced contingency value of contract.



Timeframe

Completed on time

The main expressway section of the Ngaruawahia project was constructed as planned between September 2011 and December 2013.

Upgrade of its northern Taupiri Link began earlier, in late 2010.

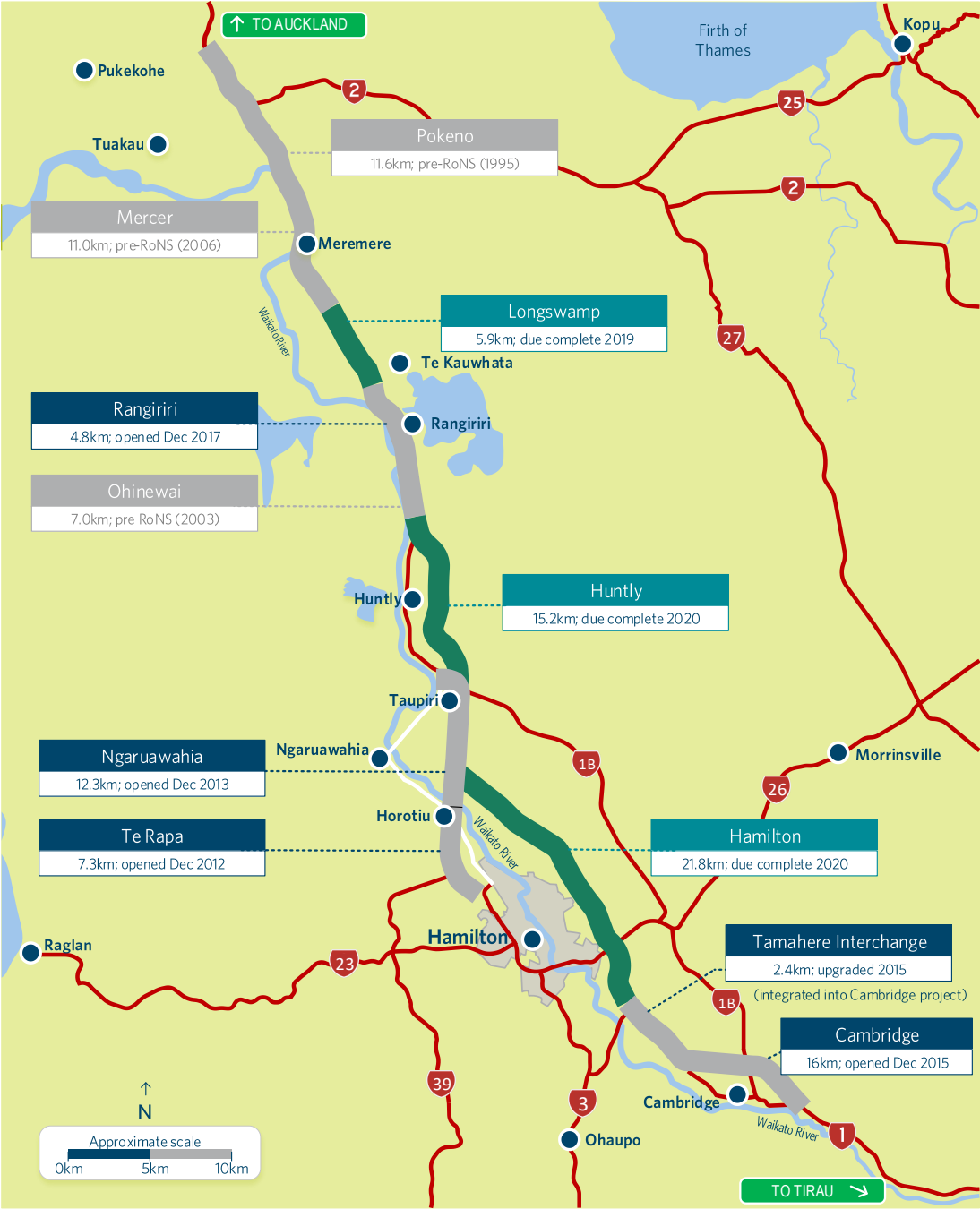


Recent repair costs

Repair work was started in early 2019 to fix rutting problems on the road surfaces of both the Ngaruawahia and adjoining Te Rapa section of the Waikato Expressway. This remedial work will cost several million dollars.

* Other costs associated with the project included: \$19.1m for property and \$4.5m for design.

MAP
WAIKATO EXPRESSWAY SECTIONS
AND COMPLETION DATES



GUIDANCE

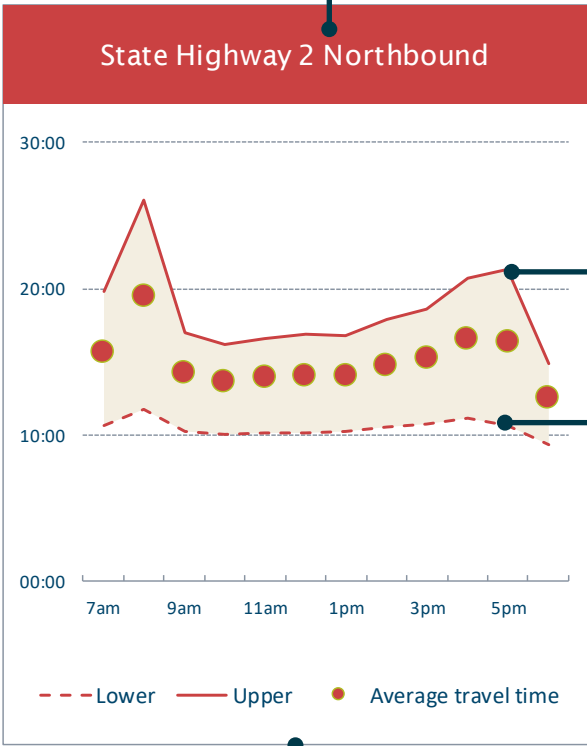
UNDERSTANDING THE TRAVEL TIME & RELIABILITY CHARTS

This page explains the travel time and reliability charts used in this report.

Results presented are averages over a month.
Weekdays are used in this report with holidays excluded.

Travel times vary during different times of the day

- Charts show typical travel times observed each hour between 7am and 7pm.
- Peak periods in the morning and late afternoon are common in urban areas, when commuter traffic volumes and congestion are greatest.
- Inter-peak traffic (travelling between around 9am and 4pm) generally faces faster travel times and less journey time variability.



The wider this range, the less journey time reliability

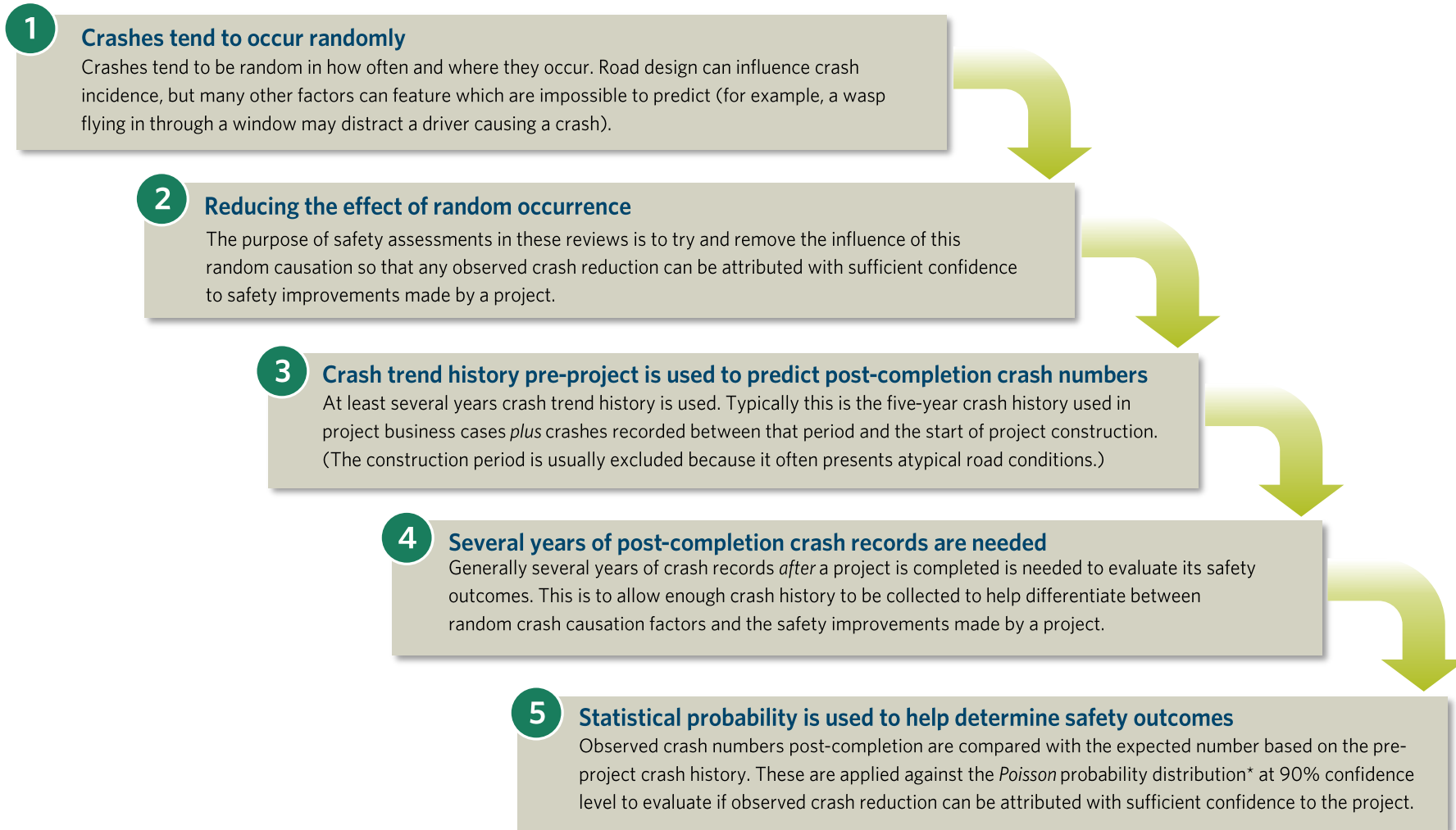
- The majority of vehicles covering the route at this time of day travelled within this time range.
- A project which narrows this range successfully improves journey time reliability.
- Improved reliability means people can better predict their travel times because of less variability.

Source: All travel time data presented in this report was sourced from TomTom Traffic Stats

GUIDANCE

CRASH ANALYSIS USED TO EVALUATE SAFETY OUTCOMES

This page summarises the crash analysis methodology used for this review.



* Due to their chance nature of their occurrence, crashes tend to vary randomly over time in a way best represented by the Poisson probability distribution. This Poisson distribution applies when a relatively small number of uncommon independent events occur over time.