



SH1 Mackays to Peka Peka Expressway

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:	SH1 Mackays to Peka Peka Expressway (commonly called the Kapiti Expressway)
RESPONSIBLE ENTITY:	NZ Transport Agency
DATA ANALYSIS DATES:	Travel time data up to February 2020, and reported crash data up to October 2019 used.
REPORT PUBLICATION DATE:	March 2020

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

SUMMARY

THE MACKAYS TO PEKA PEKA EXPRESSWAY IS DELIVERING ITS EXPECTED BENEFITS

The Mackays to Peka Peka Expressway project

This project constructed a 4 lane expressway through Kapiti District. Opened in early 2017, the expressway was the first section of the Wellington Northern Corridor road of national significance completed.

Successful project

This review has found the expressway is successfully achieving its main predicted benefits, including better journey reliability and safety (see summary at right). However, premature failure of the expressway's pavement has required major remedial work, which means project costs are ongoing and significantly over budget.

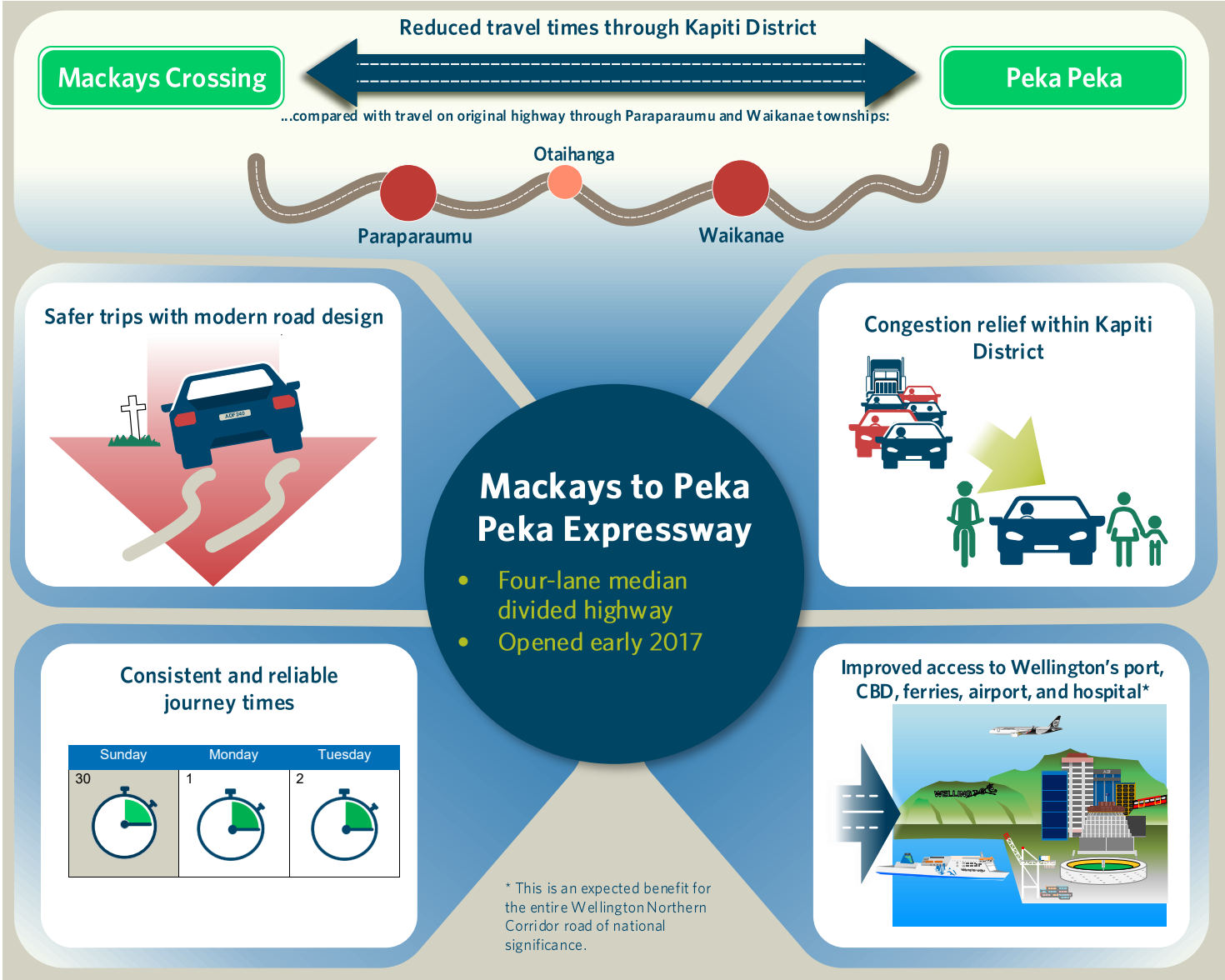


Actual summary results

- 1 Travel time savings and journey reliability**
Predicted travel time savings have been achieved. Journey times on the expressway are highly reliable 
- 2 Morning bottleneck south of expressway**
The merging of southbound commuter traffic to a single lane creates significant congestion in the morning peak 
- 3 Safety**
Indicative safety outcomes are positive, with clear signs of crash reduction emerging, including on the previous highway route through Kapiti 
- 4 Congestion relief through Kapiti District**
Transfer of state highway traffic, including trucks, onto the expressway has reduced congestion through Paraparaumu and Waikanae townships 
- 5 Remedial pavement work required**
Problems with failure of the expressway's pavement have required major resurfacing work and ongoing project cost escalation. 

MACKAYS TO PEKA PEKA EXPRESSWAY MAIN EXPECTED BENEFITS

The Mackays to Peka Peka four lane expressway provided a new route for State Highway 1 through the Kapiti District. It separates local and state highway traffic, with the aim of providing safer, shorter, and more reliable trips to and from the Kapiti Coast. It is one of several highway projects planned or underway between Levin and Wellington which form the Wellington Northern Corridor road of national significance.



MAP MACKAYS TO PEKA PEKA EXPRESSWAY

The Mackays to Peka Peka Expressway (commonly called the Kapiti Expressway) is a 4 lane median divided expressway, completed in early 2017. The expressway replaced the previous two lane State Highway 1 (SH1) route through the Kapiti District townships of Paraparaumu and Waikanae. The 15km long expressway has only four access points: at its southern and northern ends, and at the Kapiti Road and Te Moana interchanges in between.



TRAVEL TIMES AND RELIABILITY BENEFITS FROM CAMBRIDGE EXPRESSWAY SOON AFTER OPENING

TRAVEL TIME SAVINGS BENEFITS IMMEDIATELY ACHIEVED



Snapshot travel time saving benefits

A **B** (See map below right)

5:16
min:sec

More than 5 minutes average travel time savings experienced on expressway soon after opening compared with typical travel times on old highway route *before* expressway section built. ^a

3:56
min:sec

Average travel time savings of nearly 4 minutes on expressway soon after it opened compared with old route over same period. ^b



Predicted travel time savings of around **3 to 4 minutes** in peak periods from using the expressway instead of the old route achieved. ^c

	Average travel time 7am-7pm (min:sec)
Old route <i>before</i> expressway opened (2016):	14:28
Old route <i>after</i> expressway opened (March -May 2016):	11:53
Expressway after opening (March-May 2017):	09:12



Coverage and terminology notes:

^a Average weekday travel times 7am-7pm were compared between on the expressway in March-May 2017 (first three months after it opened) and over 2016 on the old highway route before the expressway was completed.

^b Average weekday travel times 7am-7pm were compared between on the expressway and old highway route in March-May 2013 (this is to give an indication of the immediate realisation of benefits from the completed project).

^c Source: Mackays to Peka Peka Alliance (2011), *Report 1 Assessment of Transport Effects*. This study predicted travel time savings in 2016 of up to 4:10 minutes for northbound expressway traffic, and 3:40 minutes for southbound traffic. Public holidays were excluded from analysis. Northbound and southbound travel times are averaged. Data source: TomTom Traffic Stats.

TRAVEL TIMES AND RELIABILITY BENEFITS FROM EXPRESSWAY SOON AFTER OPENING *CONTINUED...* MORE PREDICTABLE JOURNEY TIMES ACHIEVED WITH EXPRESSWAY

Expressway immediately produced improved journey time reliability through Kapiti District


The four lane median separated expressway with only four interchange immediately provided reliable journey times along its nearly 15km length of mostly between 8½ to 10 minutes (fig1).

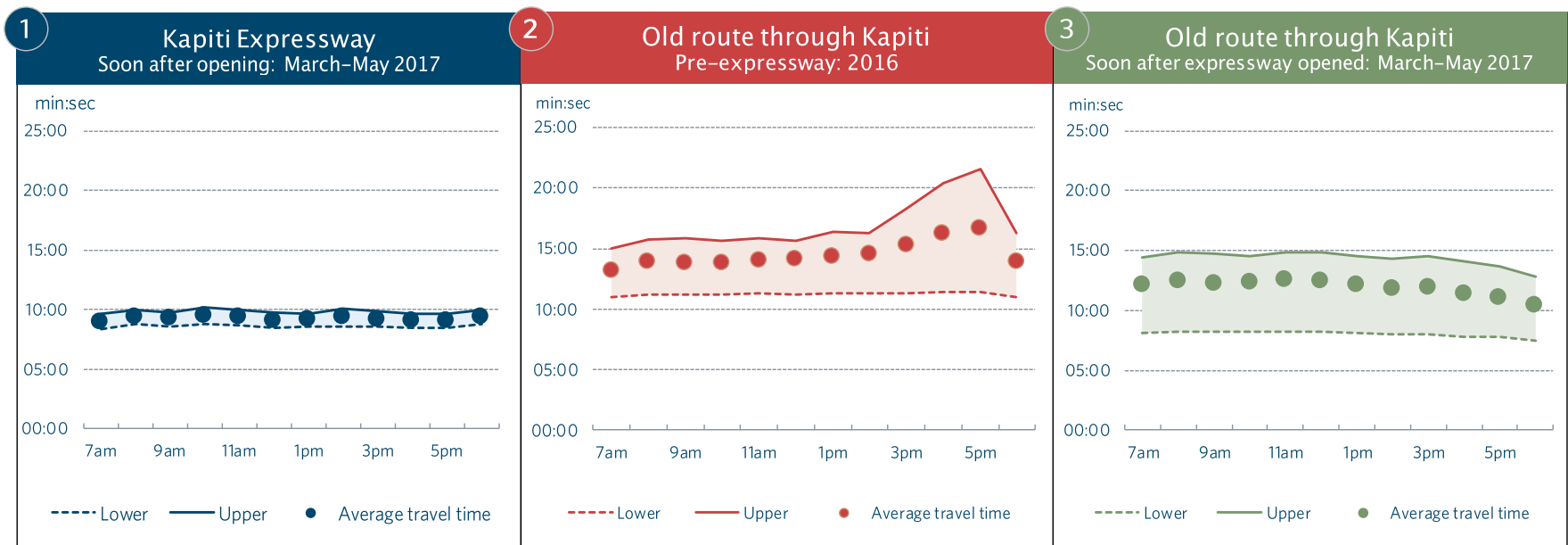
Travel times on the previous SH1 route before the expressway opened could typically vary between 11 and 16 minutes until mid afternoon, before often taking more than 20 minutes in the afternoon peak (fig2). This was primarily caused by congestion at signalised intersections at Paraparamu and Waikanae from northbound commuter traffic.

The expressway has helped considerably improve travel conditions on previous state highway route

The transfer of traffic onto the expressway substantially reduced volumes and congestion on the previous state highway. This immediately had three significant effects (evident in fig3):

- Average travel times on the previous highway fell by around 2½ minutes
- The substantial afternoon peak caused by northbound traffic congestion was removed, and
- There is still quite a wide variability in travel times depending on traffic conditions, but users of the route can predict with high reliability that their journey along the full route will take less than 15 minutes, and may take as little as 8 minutes.

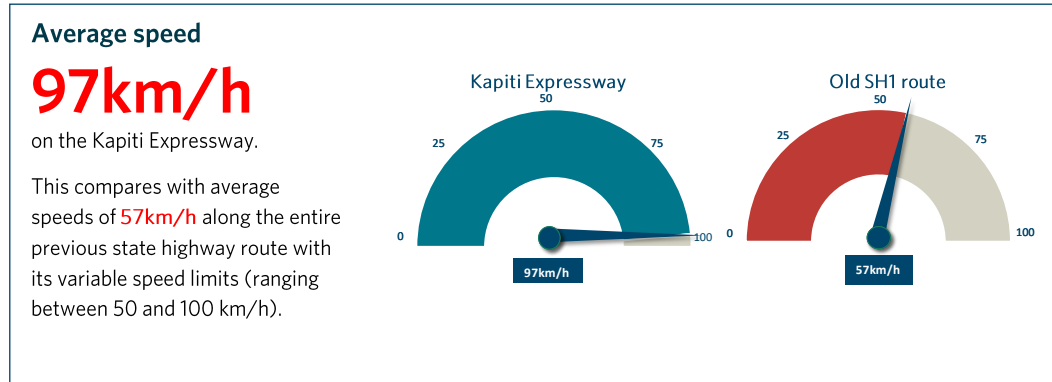
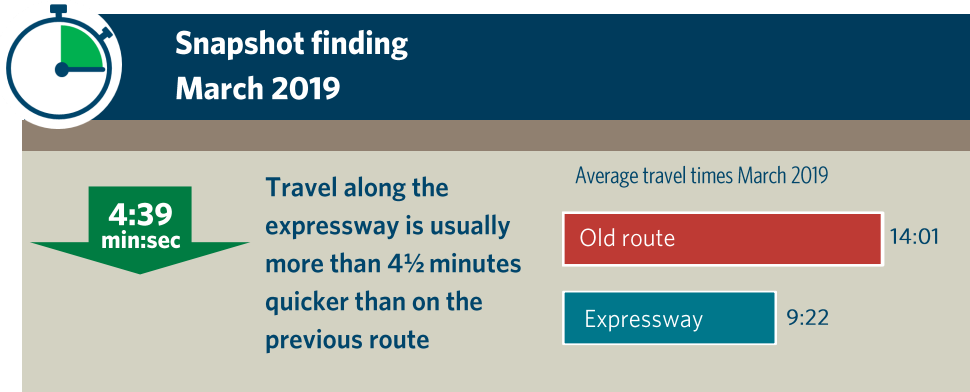
 **TIP**
See Page 14 of this report for guidance on using these graphs.



Coverage and terminology notes: Travel times compared are average travel times 7am-7pm on weekdays for dates covered. Public holidays are excluded. The average results for northbound and southbound travel times are presented as these were similar except for a notable afternoon peak in travel times for northbound traffic on the old highway route before the expressway opened. Data source: TomTom Traffic Stats.

MORE RECENT (2019) EXPRESSWAY TRAVEL TIME AND RELIABILITY BENEFITS

TRAVEL TIME RELIABILITY BENEFITS ONGOING



There is still a high level of efficiency and predictability for journey times along the Kapiti Expressway

Journeys mostly take between 8 and 10½ minutes along the expressway, regardless of time of day or travelling north or south (fig4).

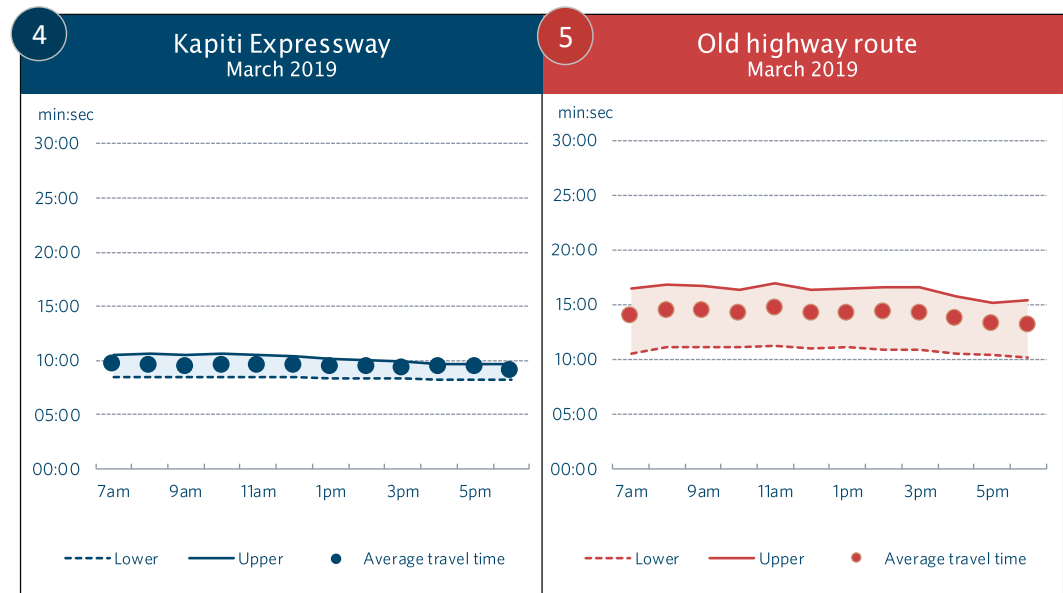
Travel time predictability on the expressway is very high, with most journeys along its entire route taking between 8 and 10 minutes (fig 4).

Weakening of travel times on old route due to temporary speed restrictions

Average travel times in March 2019 along the old highway route were generally around 2 minutes slower than when the expressway first opened (fig5). This was mainly due to temporary speed restrictions in place immediately north of Waikanae during this period. Various maintenance work on different parts of the old state highway since 2017 has resulted in temporary speed restrictions and lower travel times.

Lane merging of expressway traffic at its southern end causes a major bottleneck for commuters in the morning peak.

The effect of this congestion bottleneck is summarised on the next page.

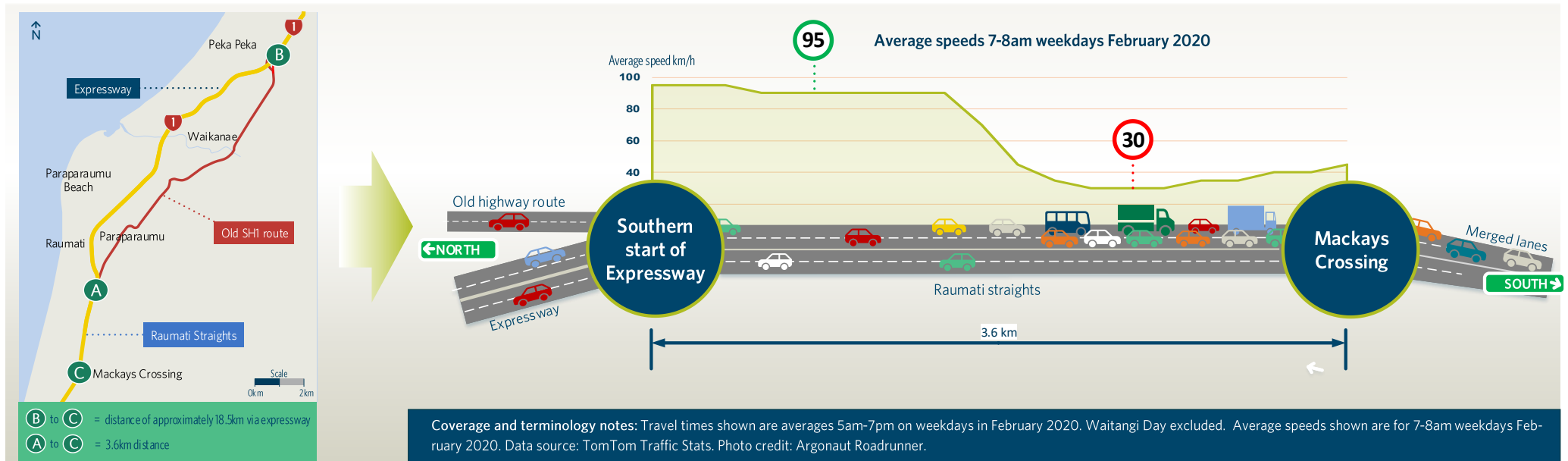
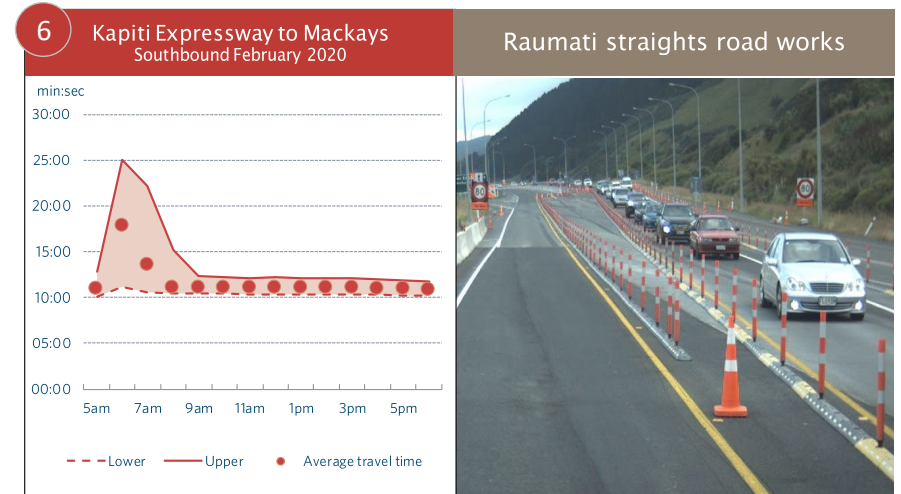


Coverage and terminology notes: Travel times compared are average travel times 7am-7pm on weekdays in March 2019. Public holidays are excluded. The average results for northbound and southbound travel times are presented as these were very similar. Data source: TomTom Traffic Stats.

SOUTH OF EXPRESSWAY MORNING BOTTLENECK: EFFECT ON TRAVEL TIMES AND RELIABILITY SIGNIFICANT DELAYS IN WEEKDAY MORNINGS

Lane merging immediately south of Mackays Crossing creates a significant congestion bottleneck for southbound traffic in the morning peak

- Southbound morning expressway traffic is largely free-flow until it reaches the Raumati Straights. At this point, traffic slows considerably and backs up from the merge point of two to one lanes south of Mackays Crossing. This typically reduces average speeds from near the 100km/h speed limit to 30km/h in the morning peak (see map and infographic below).
- Adding the Raumati straights highway section to the expressway to see its effect on travel times and reliability shows average travel times increase from around 11 minutes to nearly 20 minutes in the morning peak (fig6). Journey time variability also increases, with some journeys taking up to 25 minutes.
- This bottleneck has been exacerbated by road works activity in the past couple of years related to the construction of Transmission Gully expressway (see photo at right). The bottleneck will be removed when the Transmission Gully expressway opens, scheduled for late 2020.

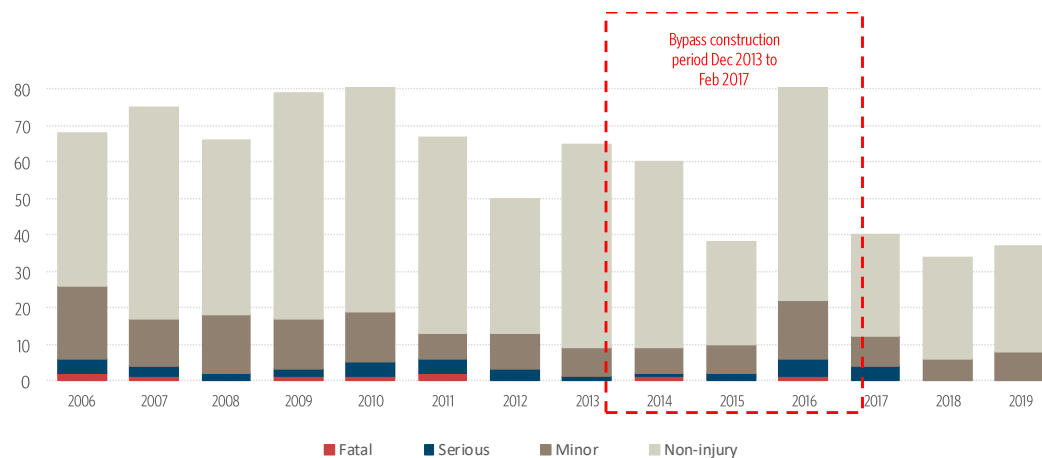


SAFETY

INDICATIVE SAFETY OUTCOMES ARE POSITIVE

- + It is too soon since the expressway was completed (in early 2017) to confirm with sufficient confidence whether expected safety benefits have been achieved. Around five years of post-project completion crash records are generally needed to identify statistically significant changes in crash rates as a result of a project’s interventions. This is because crash incidence has a random element to it — see the guidance on page 15 for more information about crash analysis.
- + Nevertheless, crash trends since the expressway opened are promising. A clear reduction in crash incidence is apparent—see fig 7 below.
- + Eighty six percent of crashes on the expressway itself have been non-injury, with the remaining 14% (four crashes) recorded as minor injury crashes (see Snapshot figures at right). There were no fatal or serious injury crashes since the expressway opened in March 2017 and October 2019.*

Figure 7: crashes by severity on expressway and previous state highway route (2006-2019)



* News reports from August 2019 reported a person was seriously injured on the expressway after being hit by a vehicle. Record of a serious injury crash at this location and date has not subsequently been recorded.

SNAPSHOT:

CRASHES ON EXPRESSWAY SINCE IT OPENED

March 2017 to Oct 2019**

29 recorded crashes: 4 minor injury, and 25 non-injury

Most common crash types on expressway:



18x lost control on straight road or bend (62%)



6x overtaking crashes (21%)



5x rear end/obstruction (17%)

** Crashes after Oct 2019 are not covered as there can be a lag of several months for all crash records to be entered in the Crash Analysis System (CAS). Non-injury crashes after Octo 2019 had not been recorded at time of analysis.

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

SAFETY CONTINUED...

IMPROVED SAFETY THROUGH KAPITI

+ Clear signs of reduced crash incidence on previous SH1 route through Kapiti

An expected benefit of the expressway was to improve safety through the townships of Paraparaumu and Waikanae by shifting substantial volumes of state highway and local traffic off the previous highway route.

This benefit is tracking well to being achieved — the crash rate on the previous state highway route has dropped by more than 60% since the expressway opened (see Snapshot below). The proportion of total crashes in the Kapiti District occurring on the old highway has also substantially reduced: from making up 23% of all district crashes each year over the decade before the expressway opened, to 8% since opening.

+ No fatal crashes have occurred on the old route since the expressway opened*, compared with nine between 2006 and early 2017.

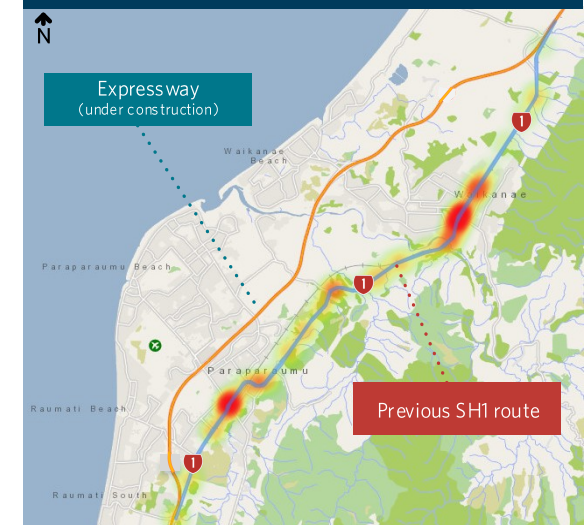
+ The heat maps in figures 8 and 9 at right compare the concentration of crashes on the previous highway route in 2016, the year before the expressway opened, with 2018 (the first full year of annual crash records after opening). These heat maps clearly show a previous concentration of crashes through Waikanae township has nearly been eliminated. A concentration of crashes at a main intersection of the old route in Paraparaumu still occurs, but actual number of crashes (not shown in the heat maps) is much lower. For example, there were 25 crashes reported on the old highway route in 2018, compared with 85 in 2015.

**SNAPSHOT:
CRASH RATES ON PREVIOUS HIGHWAY**

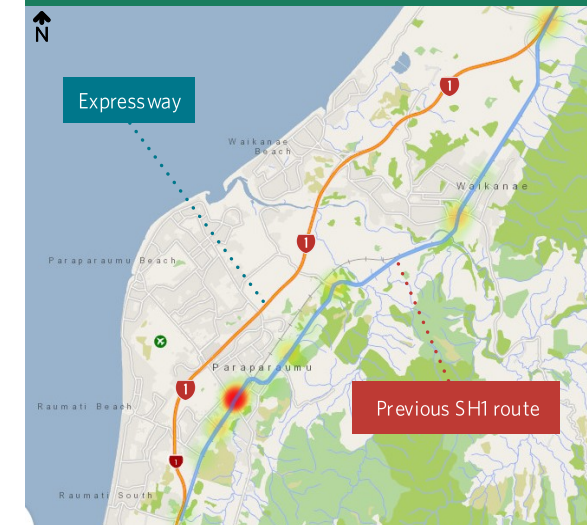
<p>Before expressway:</p> <p>66</p> <p>crashes per year on average 2006– Feb 2015 (11 years, 2 months)</p>	<p>After expressway:</p> <p>26</p> <p>crashes per year on average Mar 2017–Oct 2019 (2 years, 7 months)</p>
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* As of to the end of October 2019.

8 Old SH1 crashes heat map *before* expressway (2016)



9 Old SH1 crashes heat map *after* expressway open (2018)



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

CONGESTION RELIEF THROUGH KAPITI

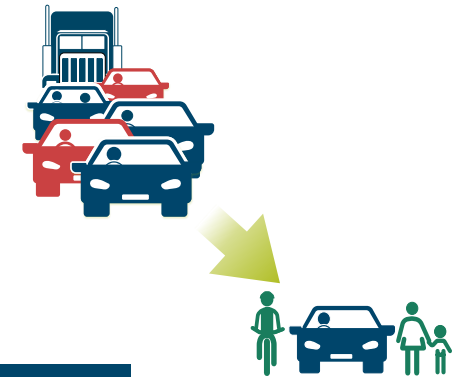
REMOVAL OF STATE HIGHWAY TRAFFIC HAS REDUCED CONGESTION

✓ **Substantial congestion relief through Paraparaumu and Waikanae townships on the old highway route**

More than 25,000 vehicles a day typically used the previous highway route before the expressway. These traffic volumes have dropped by up to 60% since the expressway opened (fig10).

✓ **Trucks and other heavy vehicles moved onto expressway**

Considerably fewer trucks now travel through Kapiti District using the old state highway route. Before the expressway opened, 2,475 heavy vehicles used the old highway at Paraparaumu each day in 2016. This reduced to 1,049 a day by 2018 after the expressway opened (-58%). At Waikanae, the daily volume of heavy vehicles using the old highway fell by 72% from 2,190 in 2016 to 616 in 2018.



* Through traffic only. Excludes traffic using interchange off-ramps and on-ramps.

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

PROJECT CONSTRUCTION TIMEFRAME AND COST

MAJOR PAVEMENT RESURFACING WORK HAS PUSHED PROJECT COSTS OVER BUDGET



Timeframe

Completed early

Main construction work on the expressway began in late 2013, and it opened to traffic in February 2017. This was four months earlier than had originally been planned.



Construction costs

\$680.5 million*

construction costs for expressway are ongoing (as at March 2020) due to substantial cost escalations to fix major pavement failures. This has pushed the construction cost

+17% above

the project's estimated \$579.3m construction costs approved by the Transport Agency Board in 2013.

Remedial pavement work



* Other costs associated with the project included \$90.4m for property and \$48.6m for investigation and design.
Source: NZ Transport Agency, Transport Investment Online (TIO).

GUIDANCE

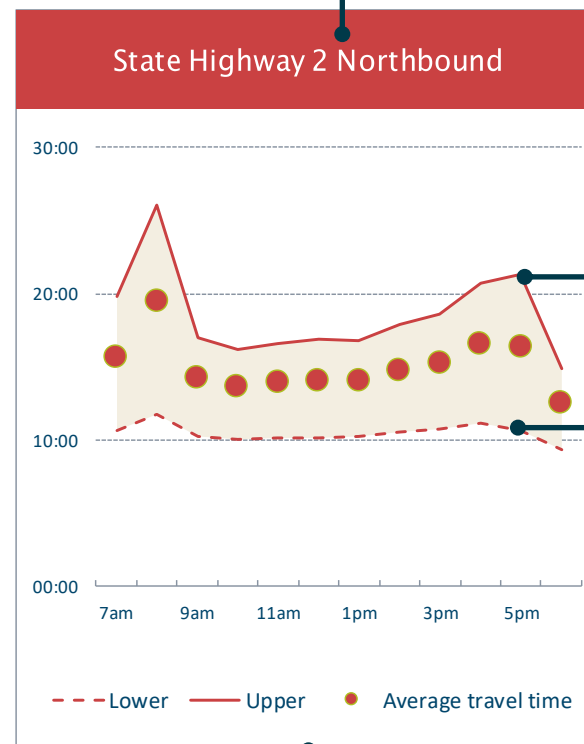
UNDERSTANDING THE TRAVEL TIME & RELIABILITY CHARTS

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

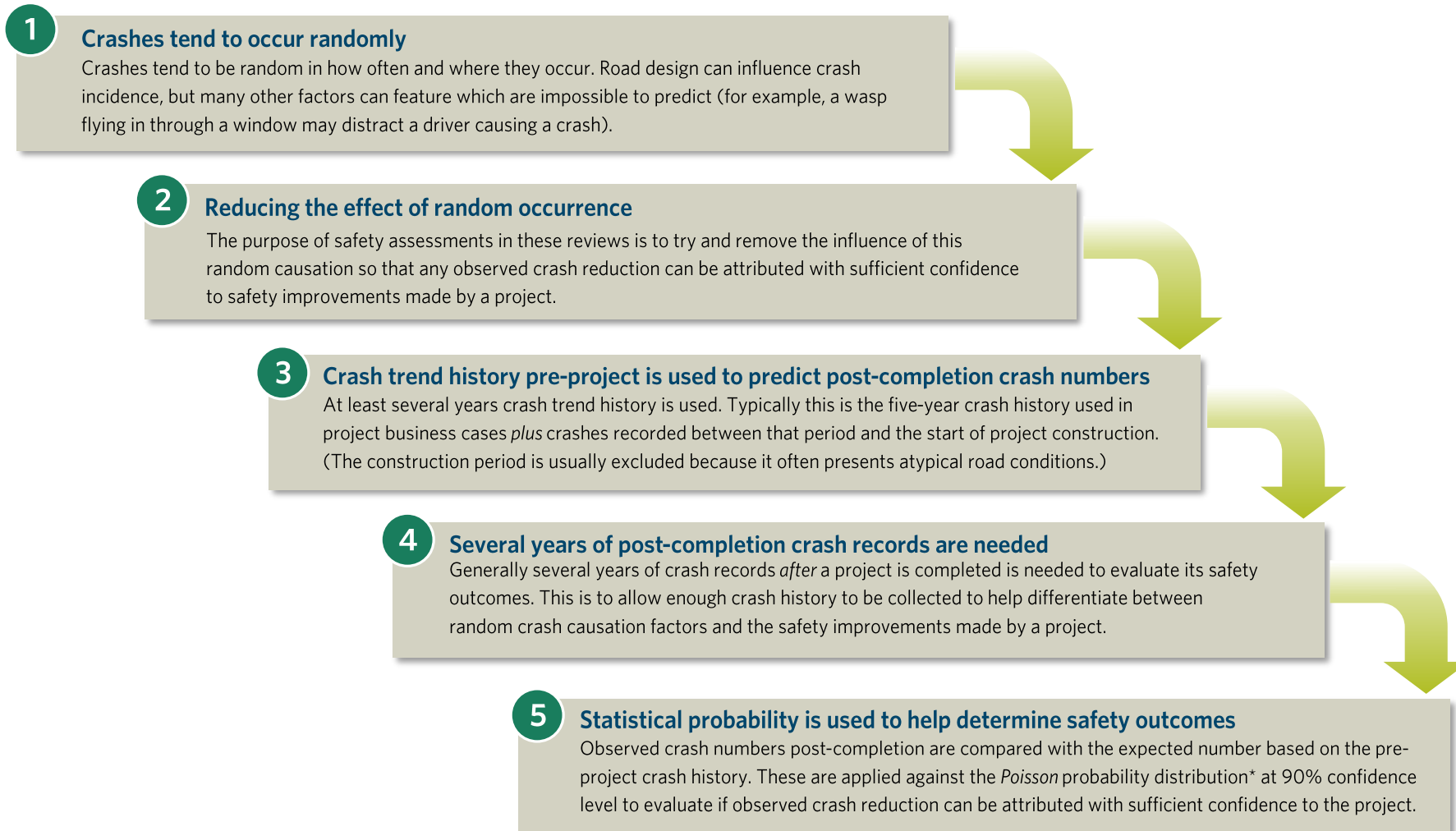
- The majority of vehicles covering the route at this time of day travelled within this time range.
- A project which narrows this range successfully improves journey time reliability.
- Improved reliability means people can better predict their travel times because of less variability.

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.