

# The effect of the Wellington Roads of National Significance - Traffic and Public Transport Indicators

FINAL

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## **1. Executive Summary**

Analysis completed recently in relation to the RLTP has assumed that all the RoNS are completed as programmed along with other transport projects in the region. Whilst such analysis helps us understand the end point it does not reveal how we get there; understanding how we get to a future state is as important as the future state itself. Such understanding may help inform the development of other policy measures.

We have been asked questions such as:

- What is the impact of the RoNS on the Wellington Rail network in the future?
- To what extent will people change mode from rail to private vehicle?
- Is there anything that can be done to further improve the performance of the rail network which might counter act any effect?

This report is designed to help answer the first two questions, whilst the third is examined in a separate report. For this analysis we have used the Wellington Transport Strategy Model (WTSM) to analyse how traffic and public transport indicators might change from 2011 to 2031 in the case where no RoNS projects are built, and in the case where each anticipated RoNS project is completed and opened to traffic. These highway projects include, in expected order of completion:

- the Mackays to Peka Peka Expressway (M2PP),
- the Transmission Gully Motorway (TG),
- the Peka Peka to Otaki Expressway (PP2O),
- the Petone to Grenada link road (PG), and
- the Ngauranga to Aotea Quay project (NtAQ).

This analysis takes place across twenty years. It shows the changes that may occur as each RoNS project is completed. All other expected highway and public transport projects are assumed to have been completed throughout the analysis (see the list in the appendix).

The analysis is presented for morning peak hour (7-9 AM, M-F) in 2011 and 2031<sup>1</sup> and examines how the following indicators perform:

- trip ends to Wellington City CBD
- vehicle delay
- rail boardings and patronage at key railway stations

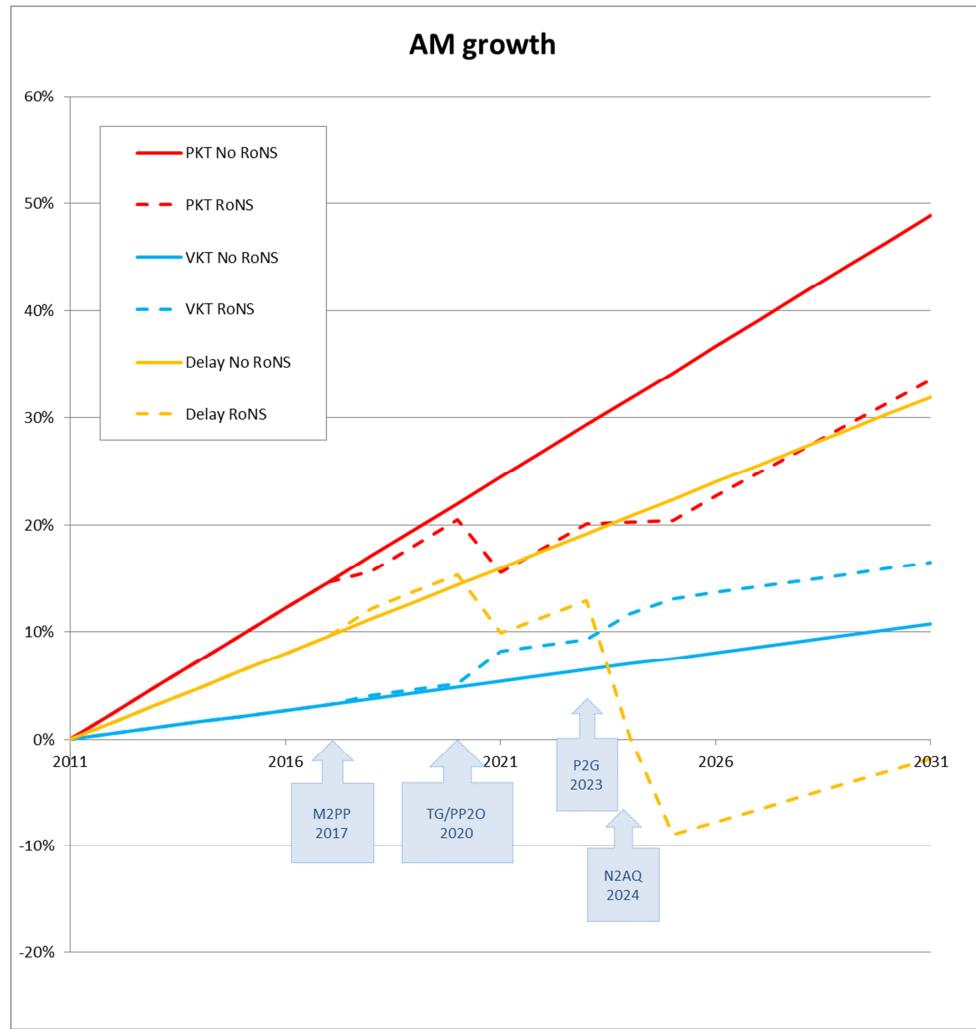
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<sup>1</sup> All analysis has been completed for 2031 and interpolated to arrive at opening year effects

- kilometres travelled by road and rail
- traffic volumes and PT patronage levels at selected ‘screenlines’
- estimated impact on rail fare revenues

Figure 1 below shows a summary of the results for passenger-kilometres travelled (PKT), vehicle-kilometres travelled (VKT) and vehicle delay for ‘RoNS’ and ‘no RoNS’ scenarios. The report discusses each of these and other related indicators in more detail in the following sections.

**Figure 1 Percentage change in key transport indicators by RoNS project**



Solid lines indicate the trend identified by WTSW without any RoNS projects between 2011 and 2031. Dotted lines show how the expected trend would alter as each RoNS is completed. Both PKT and delay are predicted to decline after TG opens. Vehicle delay further declines once P2G and NtAQ projects open to traffic. The graph shows that each project interrupts the expected trend line as the network settles to accommodate new infrastructure.

The decline in PKT associated with the opening of the Transmission Gully motorway has been understood before, and this was in part the reason why the decision to invest in the rail network ahead of TG was made. What has not been so clearly understood is effect of others RoNS projects on the system.

This information may help to explain growth forecasts associated with the investment in rail scenario 1 (RS1) as part of the RRP. To be explicit, the positive impacts of RS1 on rail patronage may have been greater if it had not had to counteract the effects of the highway investment. Investment which might be made on the rail network to complement the Petone to Grenada and the Ngauranga to Aotea Quay projects is considered in a separate report (see “Petone to Grenada Analysis in WSTM and WPTM”).

The rest of this report considers the indicators, outlined above, and others in turn.

## 2. Trip Ends to CBD

This metric measures the percentage change in cars and public transport users arriving at the CBD during the AM peak two hours.

Figure 2 below shows differences between ‘RoNS’ and ‘No RoNS’ trends from 2011 to 2031 as each successive RoNS project is completed and open to traffic.

**Figure 2 Change in trip ends to CBD**

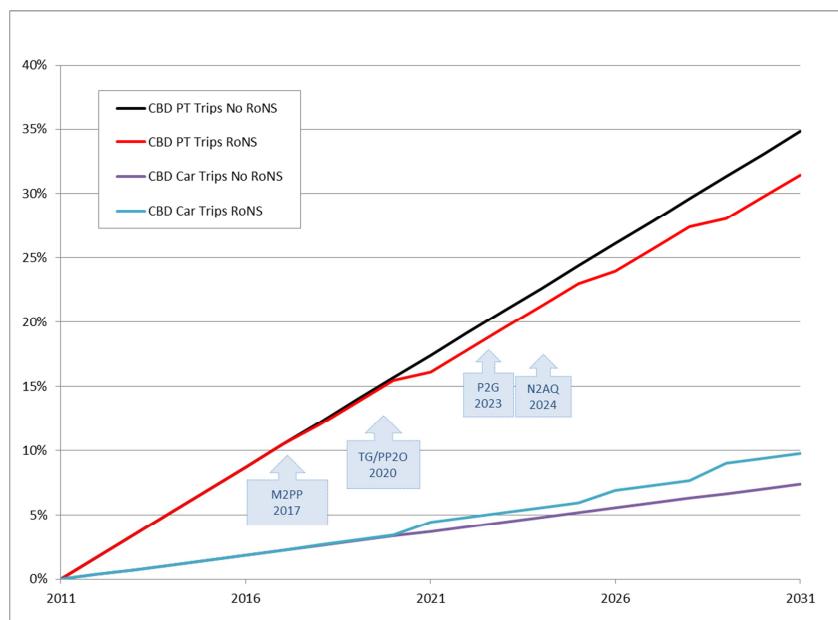


Figure 2 above shows:

- Public transport trips to Wellington City CBD are expected to be about 21,300 trips in 2031 once the RoNS are open to traffic (the 2011 figure is about 16,200). Without the RoNS the figure would be about 21,900 trips by 2031.
- There are expected to be about 2500 more trips entering Wellington City CBD in 2031; about 600 of these can be attributed to the completion of the RoNS projects.

Overall the increase in vehicle trips (between ‘RoNS’ and ‘no RoNS’ cases) is larger than the decrease in public transport trips. This illustrates that there is a mode shift from PT to private vehicles.

### 3. Vehicle Delay

This metric is used to measure the extent to which motorists are delayed by general congestion on the road. For the purposes of this analysis, delay has been defined as total vehicle hours delayed<sup>2</sup>. Figure 3 below shows the change in total delay from 2011 to 2031 in the ‘no RoNS’ case and also after each RoNS project is completed.

**Figure 3 Change in total vehicle hours delayed**

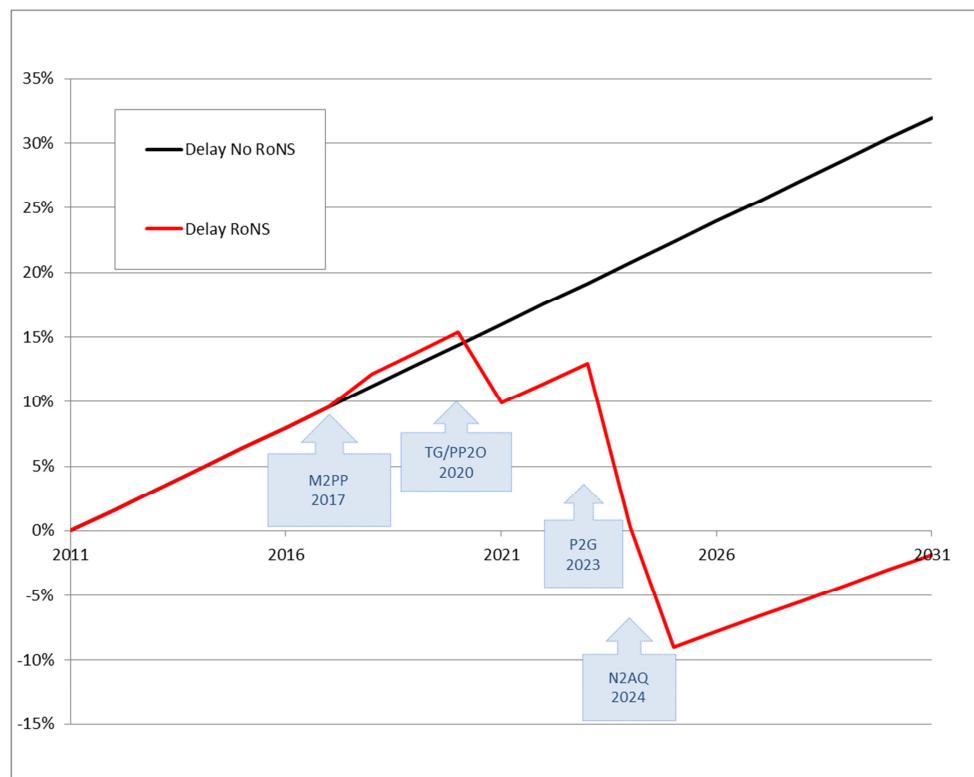


Figure 3 above shows:

<sup>2</sup> Average delay per trip was also calculated but is not included here as the trend was almost identical to total vehicle-hours.

- Total vehicle-hours delayed increases slightly after completion of the first RoNS project, M2PP. There is a tendency for more people to make vehicle trip after M2PP is built but before improvements further south come on stream.
- Vehicle-hours delayed drops slightly after TG and drastically after P2G and NtAQ are completed, with the 2031 state being lower than the 2011 state of 5700 vehicle hours.
- Without the RoNS, delay would be expected to be 2000 vehicle-hours higher in 2031.

These results show that taken together, the RoNS projects significantly reduce vehicle delay in the Wellington region, and that this is likely to enable more private vehicle travel because these trips become quicker.

#### **4. Change in Kilometres Travelled for Car and Public Transport**

This metric examines how far people travel by car and public transport in 2011 and 2031 with and without the RoNS. Figure 4 shows change in PT passenger and car kilometres travelled as each RoN comes on line.

**Figure 4 Percentage change in kilometres travelled**

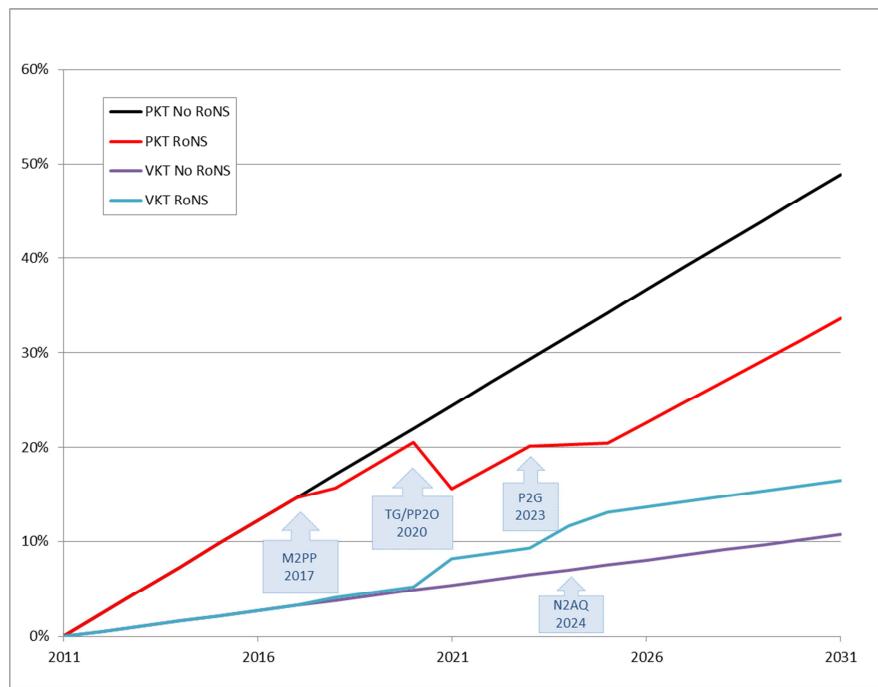


Figure 4 shows that:

- Without the RoNS, both PKT and VKT are expected to increase. Peak PKT increases from 271,900 km in 2011 to 404,700 km in 2031, while peak VKT rises from 1.26 million km in 2011 to 1.39 million km in 2031.
- The completion of Transmission Gully impacts the PKT and VKT trends most noticeably.
- Both P2G and NtAQ also interrupt the trend of increasing PKT travelled. With the RoNS complete by 2031, PKT is expected to be about 363,200 km, while VKT rises to 1.47 million km.
- The decrease in rail PKT roughly echoes the increase in VKT as each RoNS opens.

In summary, this graph shows that the total passenger-kilometres travelled for rail decreases as driving becomes more attractive in light of road capacity upgrades and resulting vehicle travel time savings. TG causes the largest decrease in PKT as it impacts primarily passengers from Kapiti who generally travel a longer distance on the rail network.

## 5. Screenline Analysis

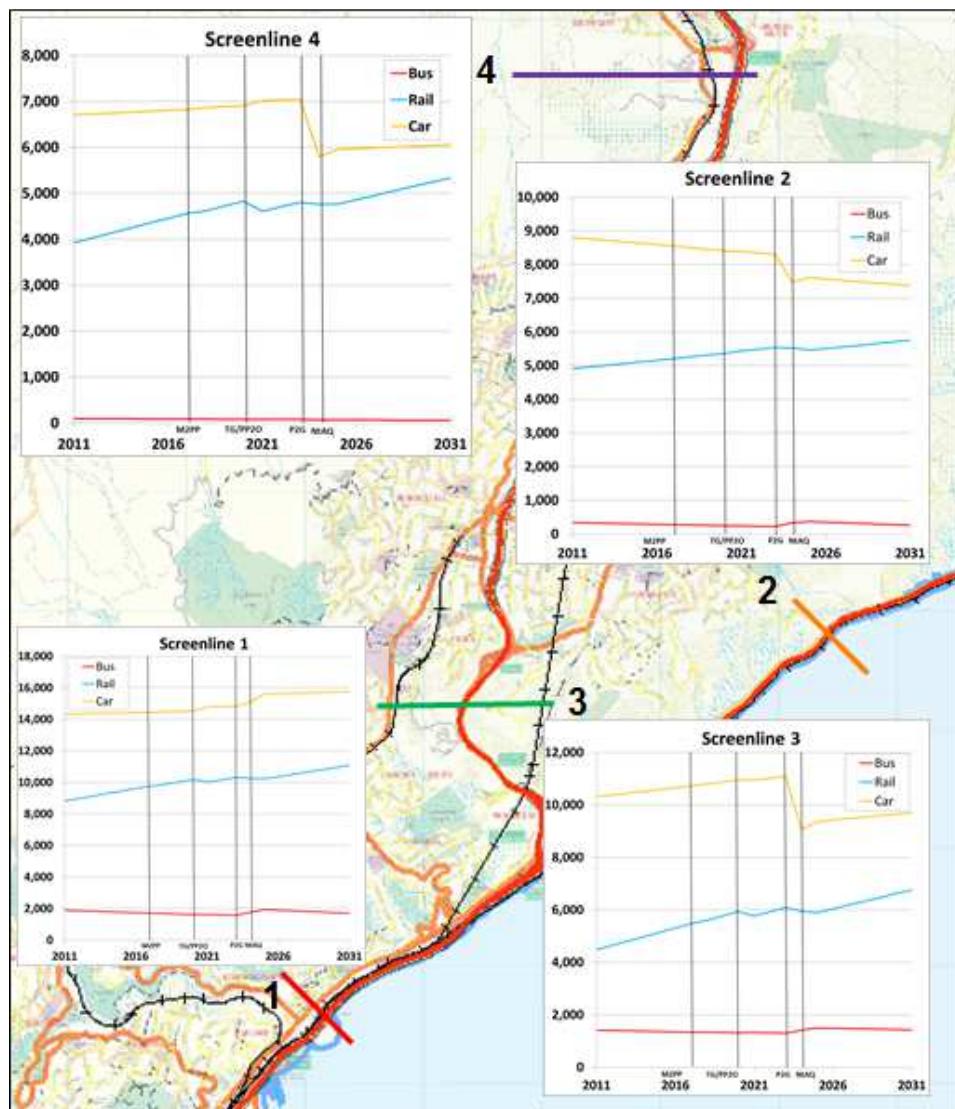
Screenlines have been drawn at various locations across the transport network to determine the number of vehicles and public transport passengers crossing them during the morning peak hours. The screenlines used in the analysis and corresponding modes include:

- SH1, Hutt Road, and all railway lines at Kaiwharawhara (excl. Johnsonville line)

2. SH2 and Hutt Valley/Melling/Wairarapa railway lines north of Ngauranga
3. SH1, Burma Road, the Johnsonville Line and Kapiti line at the Ngauranga Gorge extending west to north of Khandallah
4. SH1, Willowbank/Middleton Road and the Kapiti line south of Takapu Road

A map of the screenlines is displayed as **Figure 5** below. Alongside each screenline is a chart showing how bus patronage, rail patronage and traffic changes in the inbound AM peak direction from 2011 to 2031 as each RoNS project is added.

**Figure 5 Regional Screenline Map**



The following observations are made from Figure 5 above:

#### 5.1 Screenline 1 at Kaiwharawhara shows:

- Bus patronage along Hutt Road are expected to decline over the period from 1,900 AM peak trips in 2011 to 1,700 vehicle in 2031 with slight increases in patronage resulting from P2G and NtAQ.
- Rail patronage from all lines is expected to increase from 8,800 to 11,100 vehicles in 2031, but with declines resulting from TG, P2G and NtAQ.

- Car trips across the screenline on Hutt Road and SH1 are expected to mostly stay flat at 14,300 vehicles in 2011 with increases after TG, P2G and NtAQ. The resulting peak volume in 2031 is expected to be about 15,700 peak trips.

Some traffic from the Hutt Road transfers to the state highway due to an extra lane being added on SH1 as part of NtAQ project. The conversion of a Hutt Road traffic lane to a bus lane explains the decline of traffic on Hutt Rd and the increase in bus patronage.

When P2G is open to traffic the most increase in bus patronage is on SH1 (coming from SH2 and the Northern Wellington suburbs). Traffic shifting to P2G improves travel speeds and bus patronage.

Rail passengers who currently travel from the Hutt Valley to the city may favour the bus due to a faster journey time between The Esplanade in Petone and Ngauranga.

#### 5.2 Screenline 2 north of Ngauranga interchange shows:

- Bus patronage along SH2 is expected to decline across the period from 350 AM peak vehicles in 2011 to 260 trips in 2031 with a slight increase in patronage resulting from P2G.
- Rail patronage from at Screenline 2 is expected to increase from 4,900 to 5,751 vehicles, but with declines resulting from P2G and NtAQ.
- Car trips across the screenline on SH2 are expected to decline from 8,800 vehicles in 2011 with a sharp decline after P2G and small increase after NtAQ. The resulting peak volume in 2031 is expected to be 7,400 peak trips.

The Screenline 2 analysis conveys a similar picture to Screenline 1 for bus and rail, with bus patronage increasing as a result of P2G and NtAQ (although this is from a low base). This is the result of faster journey times on the SH1 and SH2 corridors, south of P2G as vehicle traffic is diverted away from the Ngauranga interchange. Whilst P2G removes traffic from SH2 south of Petone, NtAQ is likely to result in some traffic returning.

#### 5.3 Screenline 3 at Ngauranga Gorge and north of Khandallah shows:

- Bus patronage along SH1 and Burma Road is expected be broadly similar on 2031 compared to 2011.
- Rail patronage from at Screenline 3 is expected to increase from 4,500 to 6,800 trips, but with declines resulting from P2G and NtAQ.
- Car trips are expected to decline from 10,300 trips in 2011 to be about 9,700 peak trips in 2031.

After P2G is open to traffic, those travelling between the northern suburbs of Wellington City / Porirua and the Hutt Valley are able to bypass the Ngauranga

interchange. When NtAQ opens to traffic, traffic counts and bus passengers both increase at this location, due to the Hutt Road gaining a bus priority lane and SH1 gaining a general traffic lane.

Significant change to traffic and public transport patterns in the northern suburbs also occur after P2G is open to traffic. Existing motorists are expected to shift their commuting route from Burma Road to SH1, as SH1 at the Ngauranga Gorge will experience congestion relief.

Existing train passengers from Johnsonville may switch to driving for the same reason, which would mean lower patronage on the Johnsonville line and a lower overall PT share from the northern suburbs. In the end, P2G is expected to shift the current transport equilibrium by moving rail trips to car between Johnsonville and the CBD, as well as shifting those car trips to SH1. A similar shift is expected to occur again with the opening of NtAQ.

#### 5.4 Screenline 4 south of Takapu Road shows:

- Bus patronage along Willowbank Road is expected to fall over the period to 2031.
- Rail patronage at Screenline 4 is expected to increase from 3,900 to 5,300 vehicles, but with declines resulting from TG and P2G.
- Car trips are expected to decline from 6,700 trips in 2011 to be 6,100 peak vehicles in 2031 attributable to P2G opening.

At Screenline 4, the opening of P2G to traffic has a dramatic effect on traffic volumes at this location by redirecting traffic bound for the Hutt Valley away from SH1 and Willowbank to the new P2G link.

## 6. Rail Patronage

Some of the individual RoNS projects are shown to have a greater impact on expected rail patronage than others. Figure 6 below shows the drop in morning peak rail boardings after each RoNS project is added to the no RoNS case, interrupting the otherwise rising patronage trend.

**Figure 6 Change in total morning peak rail boardings**

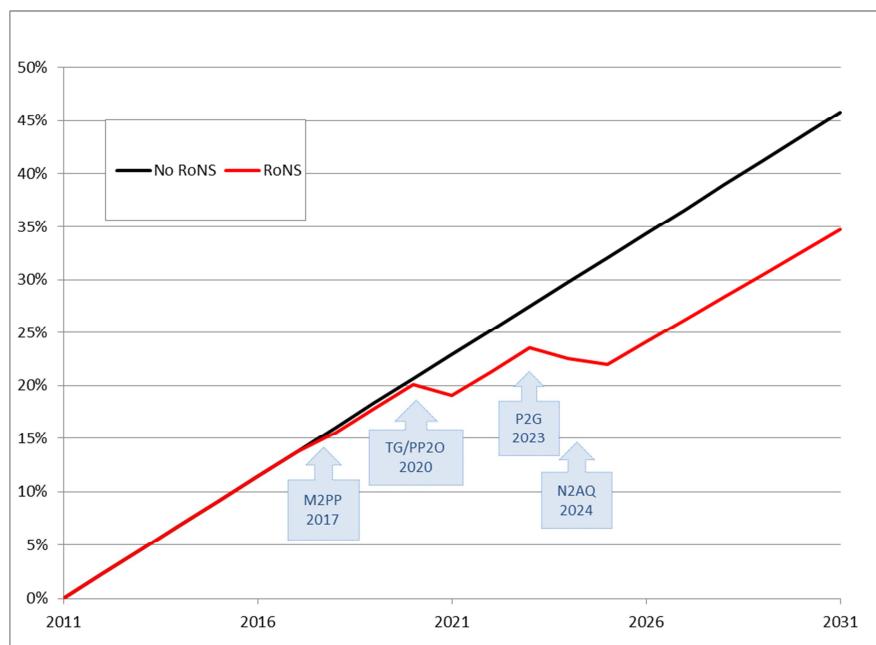


Figure 6 above shows that morning peak rail boardings in the Wellington region are expected to decline after TG is open to traffic and further after P2G and NtAQ are open to traffic, ending at 17,900 boardings in 2031. Without the RoNS, rail boardings would be about 1400 higher.

Figure 7 below shows the patronage changes for the morning peak period for selected stations in the Wellington network. This graph is a snapshot of 2031 patronage comparing futures where none, some, or all RoNS are opened.

**Figure 7 2031 AM Peak boarding's at major Wellington region railway stations**

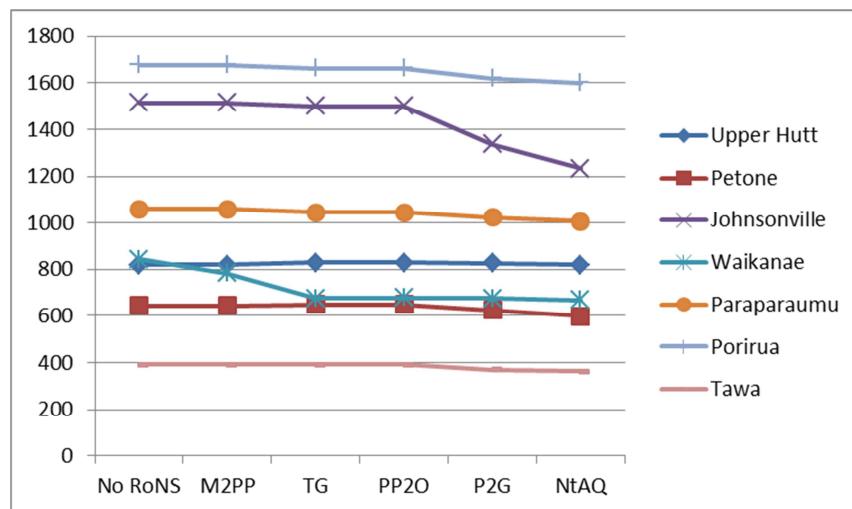


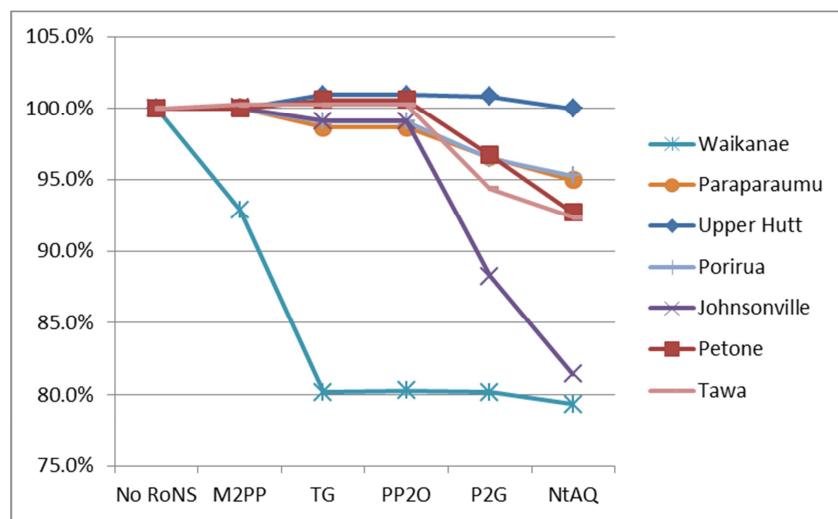
Figure 7 shows:

- Rail passenger boardings at Waikanae, the station furthest north, are expected to be about 170 lower in the AM Peak as a result of M2PP and TG. No other stations are as affected by the opening of those two RoNS projects.
- Porirua, Petone, Paraparaumu and Tawa rail passenger boardings are expected to remain flat until P2G opens then show small declines.
- Johnsonville boardings decline significantly by over 250 trips after the opening of P2G to traffic. This is due to faster journey times between Johnsonville and the CBD through Ngauranga Gorge by car and bus as congestion is relieved at Ngauranga interchange.

To summarise the opening of TG to traffic affects rail patronage on the outer parts of the Kapiti line, while the opening of P2G to traffic will affect the inner suburban rail services south of Porirua, Petone and Johnsonville.

Figure 8 below presents the same data in a different way and shows the percentage change in boardings at the same stations as the five RoNS projects are added (in 2031) to the no RoNS case.

**Figure 8 Percentage change in AM peak patronage in 2031 at major Wellington region railway stations**

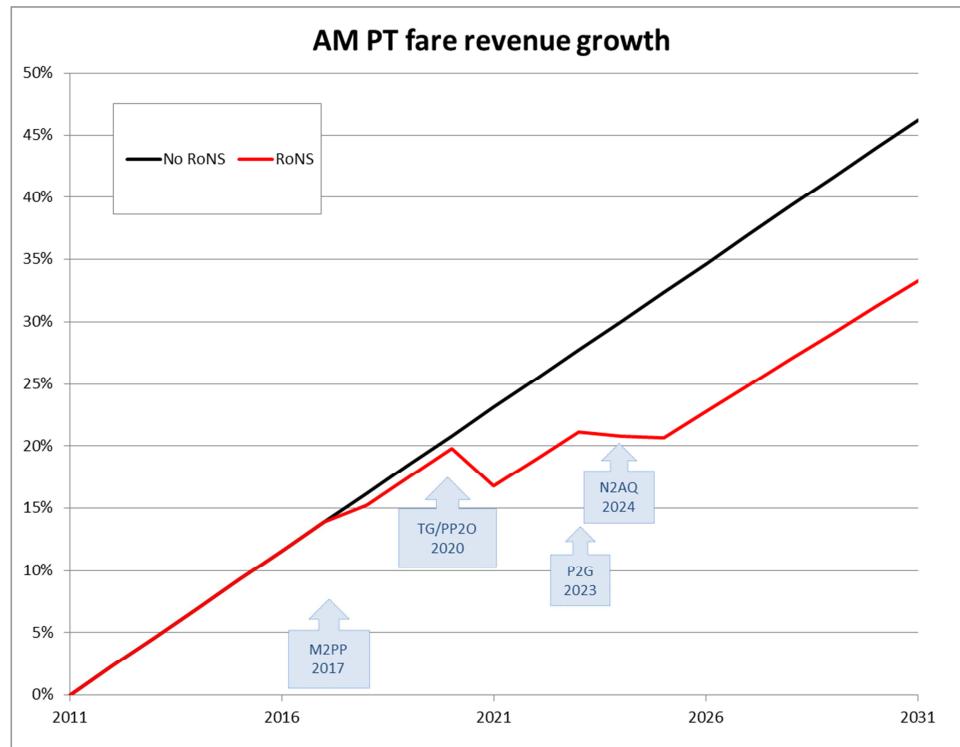


These results shown in Figure 8 are similar to those in Figure 7:

- By percentage, Waikanae shows the largest drop in passenger boardings as a result of M2PP and TG opening to traffic, with over 20% fewer boardings.
- Johnsonville also experiences a 19% drop in passengers boardings off the ‘no RoNS’ case, mainly as a result of P2G opening to traffic
- Petone and Tawa lose over 7% of their initial passengers boardings while Paraparaumu and Porirua lose just 5% of expected passenger boarding in the no RoNS case.

Finally, Figure 9 below shows the impact of the RoNS on rail fare revenue, looking at the change in annual revenue from 2011 to 2031 for ‘RoNS’ and ‘no RoNS’ scenarios.

**Figure 9 Percentage change in annual rail fare revenue**



Without the RoNS fare revenue would be expected to follow the black trend line, increasing from \$60,500 to \$88,500 in the AM peak, or 46%. With the RoNS, the red trajectory shows revenue being \$8,800 lower in the AM peak.

The changes in rail fare revenue with the RoNS is consistent with the changes in rail boardings and passenger-kilometres travelled. The largest drop is caused by TG, as this scheme impacts primarily passengers from Kapiti who travel a longer distance (and pay a higher fare) on the rail network. P2G and NtAQ also have a significant impact with each scheme leading to a lower revenue.

In summary, the Petone to Grenada project has a broader effect on rail boardings across the network as a whole, when compared to TG, where rail patronage effects are confined to the Kapiti Coast.

## 7. Conclusions

Based on the analysis of modelling results discussed in this report, TG and P2G have the most significant impact on the public transport network. Whilst bus patronage is projected to increase as a result of some projects, rail patronage is shown to decline in all cases.

With the opening of TG, patronage on the Kapiti Line will decline most significantly. The opening of P2G, however, will see patronage on the Johnsonville Line and the southern parts of the Kapiti and Hutt Valley/Melling Lines impacted the most.

As part of our input to the P2G project we developed strategies to support the rail network or advance existing plans. This may include:

- increasing the frequency of feeder bus connections to railway stations,
- improving the cycling and walking infrastructure between suburban areas and stations,
- improving park and ride/kiss and ride facilities at stations, and / or
- increasing the frequency of rail services themselves (including new track infrastructure to support such increases, particularly in peak times).

In addition to public transport, consideration will also be given to demand management measures. These include tolling of new infrastructure and management of parking availability in Wellington City CBD.

These issues will be explored in a separate report “Petone to Grenada Analysis in WTSM and WPTM.”

## **8. Appendix: Planned network improvements included in all modelled schemes**

- Basin Reserve Improvements
- Inner City Bypass
- War Memorial Park
- Mt. Vic Tunnel duplication
- SH58 Grade separation
- PTSS BRT
- WCC Bus Review services
- Regional Rail Plan (RS1)
- Integrated Ticketing