NZ TRANSPORT AGENCY
WAKA KOTAHI

Roads of national significance

Ara Tūhono - Pūhoi to Wellsford

FURTHER NORTH

Pūhoi to Warkworth

Transportation and Traffic Assessment Report

August 2013

Pūhoi to Warkworth

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Glossary of abbreviations

Abbreviation	Definition
AADT	Average Annual Daily Traffic
AEE	Assessment of Environmental Effects
ARC	Auckland Regional Council (preceded Auckland Council)
ARGS	Auckland Regional Growth Strategy
ARLTS	Auckland Regional Land Transport Strategy
ARGS	Auckland Regional Growth Strategy
ARPS	Auckland Regional Policy Statement
CAS	NZTA's Crash Analysis System
EEM	The NZTA Economic Evaluation Manual
EPA	Environmental Protection Authority
HCV(s)	Heavy Commercial Vehicle(s)
Kph	Kilometres per hour
LOS	Level of Service
MOU	Memorandum of Understanding
NFDS	National Freight Demands Study
NGTR	Northern Gateway Toll Road
NLTP	National Land Transport Programme
NOR	Notice of Requirement
Project	Pūhoi to Warkworth section of the Ara Tūhono Pūhoi to Wellsford Road of National Significance Project
RDC	Rodney District Council (preceded Auckland Council)
RGDP	Real Gross Domestic Product
RoNS	Road of National Significance
SAR	Scheme Assessment Report

SH1	State Highway 1
TMS	NZTA's Traffic Monitoring System
veh/hr	Vehicles per hour
vpd	Vehicles per day

Glossary of defined terms

Term	Definition
Auckland Council	The unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Eastern Beaches	Beach communities located east of Warkworth including Leigh, Omaha, Sandspit, Snells Beach and Mahurangi East.
Furness Process	The Furness process is an iterative factoring of rows (trips from zones) and columns (trips to zones) in a reference matrix (usually the base year matrix) to new trip end totals. This is a method to change the total number of trips going to and from particular zones, for example to account for future year development, whilst retaining the structure of a reference case matrix.
Grade separated interchange	The layout of roads, where one road crosses over/under the other at a different height.
Indicative Alignment	A route and designation footprint selected after short-list and long-list development to enable consultation with the community. This development involved specialist work assessing environmental, social and engineering inputs.
Motorway	Motorway means a motorway declared as such by the Governor-General in Council under section 138 of the PWA or under section 71 of the Government Roading Powers Act 1989.
NZ Transport Agency Planning Advisory Group	A body of professional planners and engineers drawn from the NZTA and their advisors to guide the objectives and direction of the Project in planning terms.
Portal	The entrance way to a tunnel starting where the road is completely uncovered to where it is completely covered.
Project Area	From the Johnstone's Hill tunnel portals in the south to Kaipara Flats Road in the north.
SATURN Traffic Model	SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a suite of flexible network analysis programmes developed at the Institute for Transport Studies, University of Leeds in the United Kingdom.

Term	Definition
Travel time consistency	Travel time consistency, also referred to as travel time reliability, is a measure of the variability of travel times i.e. the variation in travel times from day to day for the same journey undertaken at the same time each day. The less variable travel times are the greater level of travel time consistency.

Contents

1. Introduction

This Report provides an assessment of the operational traffic and transportation effects of the New Zealand Transport Agency's (NZTA's) Ara Tūhono Pūhoi to Wellsford Road of National Significance (RoNS) Pūhoi to Warkworth section (the Project)

1.1 Purpose of report

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's (NZTA's) Ara Tūhono Pūhoi to Wellsford Road of National Significance (RoNS) Pūhoi to Warkworth Section (the Project). Its purpose is to inform the Assessment of Environmental Effects (AEE) and to support the resource consent applications and Notices of Requirement for the Project.

The indicative alignment shown on the Project drawings has been developed through a series of multi-disciplinary specialist studies and refinement. A NZTA scheme assessment phase was completed in 2011, and further design changes have been adopted throughout the AEE assessment process for the Project in response to a range of construction and environmental considerations.

It is anticipated that the final alignment will be refined and confirmed at the detailed design stage through conditions and outline plans of works (OPW). For that reason, this assessment has addressed the actual and potential effects arising from the indicative alignment, and covers the proposed designation boundary area.

1.2 Project description

This Project description provides the context for this assessment. Sections 5 and 6 of the Assessment of Environment Effects (Volume 2) further describe the construction and operational aspects of the Project and should be relied upon as a full description of the Project.

The Project realigns the existing SH1 between the Northern Gateway Toll Road (NGTR) at the Johnstone's Hill tunnels and just north of Warkworth. The alignment will bypass Warkworth on the western side and tie into the existing SH1 north of Warkworth. It will be a total of 18.5 km in length. The upgrade will be a new four-lane dual carriageway road, designed and constructed to motorway standards and the NZTA RoNS standards.

1.2.1 Project features

Subject to further refinements at the detailed design stage, key features of the Project are:

- A four lane dual carriageway (two lanes in each direction with a median and barrier dividing oncoming lanes);
- A connection with the existing NGTR at the Project's southern extent;
- A half diamond interchange providing a northbound off-ramp at Pūhoi Road and a southbound on-ramp from existing SH1 just south of Pūhoi;
- A western bypass of Warkworth;

- A roundabout at the Project's northern extent, just south of Kaipara Flats Road to tie-in to the existing SH1 north of Warkworth and provide connections north to Wellsford and Whangarei;
- Construction of seven large viaducts, five bridges (largely underpasses or overpasses and one flood bridge), and 40 culverts in two drainage catchments: the Pūhoi River catchment and the Mahurangi River catchment; and
- A predicted volume of earthworks being approximately 8M m^3 cut and 6.2M m^3 fill within a proposed designation area of approximately 189 ha earthworks.

The existing single northbound lane from Waiwera Viaduct and through the tunnel at Johnstone's Hill will be remarked to be two lanes. This design fully realises the design potential of the Johnstone's Hill tunnels.

The current southbound tie in from the existing SH1 to the Hibiscus Coast Highway will be remarked to provide two way traffic (northbound and southbound), maintaining an alternative route to the NGTR. The existing northbound tie in will be closed to public traffic as it will no longer be necessary.

1.2.2 Interchanges and tie-in points

The Project includes one main interchange and two tie-in points to the existing SH1, namely:

- The Pūhoi Interchange;
- Southern tie-in where the alignment will connect with the existing NGTR; and
- Northern tie-in where the alignment will terminate at a roundabout providing a connection with the existing SH1, just south of Kaipara Flats Road north of Warkworth.

1.2.3 Design standards

The Project has the following design standards:

- Motorway standards (access at grade-separated interchanges only);
- SH1 to be maintained for local access and to provide an alternate route ;
- Design speed of 100kph[1];
- Minimum horizontal radii of 820m;
- Maximum uphill grade of 6%;
- Sight distance requirements assuming no street lighting;
- Four 3.5m traffic lanes with divided carriageways;
- 2.5m outside shoulders;
- 1.0m inside shoulders;
- 4.0m minimum median; and

[1] The Project has been designed to RoNs standards for at least a 100kph design speed. The RoNs standards provide for the highest level of design criteria (ie minimum sight distances) within Austroads standards. We therefore expect the route will have an operating speed of 110kph.

- 9.0m clear zones.

1.2.4 Local roads

The Project will require work on a number of local roads along the length of the alignment in order to maintain local access. All the local roads traversed by the alignment will be maintained and grade-separated, crossing either over or under the alignment as follows:

- Billing Road – bridge over Okahu Creek crosses over Billing Road;
- Pūhoi Road – bridge over Pūhoi River crosses over Pūhoi Road;
- Moirs Hill Road – crosses over motorway;
- Wyllie Road – alignment crosses over Wyllie Road; and
- Woodcocks Road – alignment crosses over Woodcocks Road.

Additional private access roads will be provided to the west of the alignment near Mahurangi West Road and to the east of the alignment near the southern end of Wyllie Road. These roads will provide access to properties in these areas where current access will be severed by the motorway.

2. Methodology

Our methodology for assessing the operational traffic and transportation effects of the Project involved forecasting and comparing two future transport scenarios:

- the "Base Case" scenario (which assumes that the Project will not be constructed); and
- the "Project" scenario (which assumes that the Project will be constructed).

We compared the performance of the transport network under these two scenarios to determine the transport effects of the Project.

2.1 Assessment of operational effects approach

We have assessed the nature and scale of effects that the operation of the Project will have on the existing and future transport network.

We undertook the assessment of the operational effects by forecasting the performance of the transport network in the future for a "Base Case" scenario (refer to section 2.3 below), which assumed that the Project was not constructed.

We considered the Base Case transport network performance in terms of:

- Traffic volumes;
- Travel times;
- Travel time consistency;
- Crash performance;
- Route security;
- Road freight performance;
- Public transport network performance; and
- Pedestrian and cycle network performance.

We then forecast the performance of the transport network in the future for a "Project" scenario, which assumed that the Project was constructed. The "Project" scenario transport network performance was considered in terms of the same measures bulleted above.

By comparing the performance of the transport network in the two scenarios, it was possible to assess the positive and potentially adverse effects of the Project.

We have also considered relevant provisions of the statutory and non-statutory documents that address traffic and transportation matters, which are outlined in more detail in the AEE.

Construction of the Project is expected to be completed by 2021. Our operational effects assessment has been undertaken using a forecast year of 2026 as it is five years post construction and aligns with available land-use forecast information.

2.2 Traffic modelling

2.2.1 Traffic model

Much of our assessment of operational effects was based on the outputs of the Simulation and Assignment of Traffic to Urban Road Networks (SATURN)[2] traffic model which was initially developed by SKM for the Auckland to Whangarei Strategic Assessment.[3] We subsequently updated that model for the Scheme Assessment phase and for use in this transport assessment. The enhancements we made included a more detailed road network and zoning system around Warkworth and Wellsford.

A full description of the development of the SATURN model, its calibration, validation and peer review is detailed in the following reports:

- Pūhoi to Wellsford Scheme Assessment SATURN Model Validation Report, SKM, dated 1 March 2011;
- Pūhoi to Wellsford RoNS Scheme Assessment Future Forecast Traffic Report, SKM, dated 15 July 2011; and
- SH1 Pūhoi to Warkworth Review of SATURN Traffic Models, Flow Transportation Specialists, dated 24 July 2013.

Both the Validation Report and the Future Forecast Report associated with the SATURN model were peer reviewed by Flow Transportation Specialists.

The geographic scope of the SATURN model is shown in Figure 1. It extends from Auckland (south of the Upper Harbour Highway) to Whangarei (SH1 / Toetoe Road intersection). However, the focus of the SATURN model development was on the accurate representation of travel demands in the SH1 corridor from Pūhoi to Wellsford. We did not revisit calibration of the broader Auckland to Whangarei model beyond the Project Area of interest during the update of the SATURN model. The core model is coded using SATURN simulation network.

[2] SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a suite of flexible network analysis programmes developed at the Institute for Transport Studies, University of Leeds in the United Kingdom.

[3] Auckland to Whangarei Strategic Assessment SATURN Model Validation Report, SKM, issued March 2010.

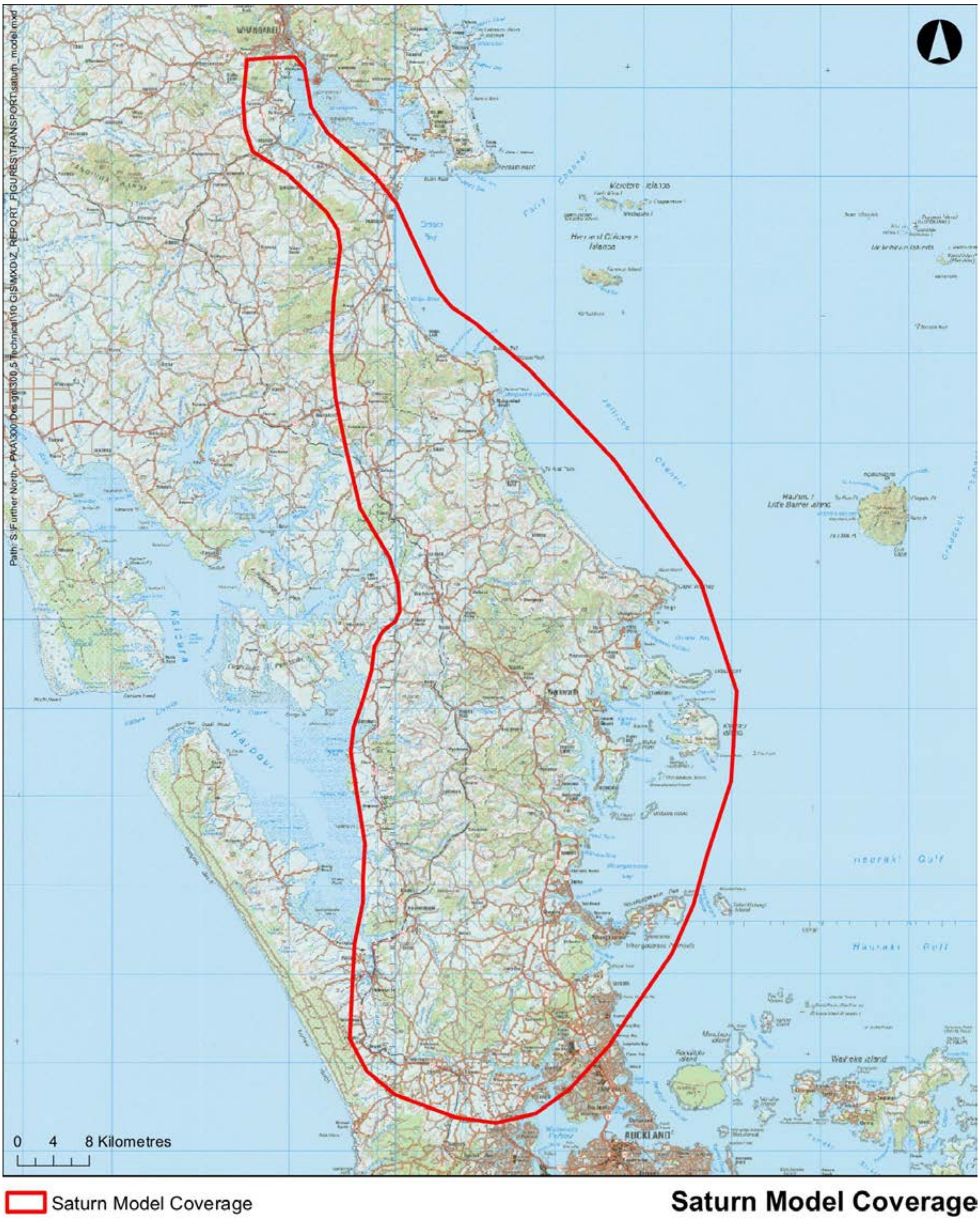

Figure 1: SATURN model coverage

The model has four one-hour time periods:

- A PM peak hour (16.30 – 17.30);
- Inter Peak (an average hour between 09.30 and 16.30);

- Holiday Start (typical start of a holiday period); and
- Holiday End (typical end of a holiday period).

A description of the “Holiday Start” and “Holiday End” periods is provided in Section 3.2.2 below and discusses why models were constructed over these time periods.

The traffic model has a base year of 2009. We developed the base year trip matrices for the SATURN model from traffic counts using a combination of manually Furnessing[4] to trip ends, an iterative loop of matrix estimation and matrix synthesis using the SKM package ExigoMD.[5] This process used available population and employment data to develop trip ends and calibrate distribution parameters. Final adjustments were made using a combination of matrix estimation and manual factoring. To validate the model, we used surveyed data for traffic volumes and travel times from a survey conducted in May 2010.[6] Details of the calibration validation and future forecasting are included in the reports referenced above. These reports contain specific information about key model performance parameters.

The model is based on total vehicles and does not therefore have separate heavy and light vehicle matrices. Separate HCV matrices were not developed because of difficulties with forecasting commercial vehicle trips, including having a lack of available data such as likely future trip distribution patterns specifically for HCVs. We considered that a separate HCV matrix would imply a false level of accuracy in the modelling. For the base forecasts used in the assessment, heavy vehicle trips are forecast to grow at the same rate as general traffic. This is discussed further in Section 3.7 below.

We developed future year trip matrices from forecast changes in population and employment. These changes were multiplied by trip generation rates to produce trip ends. Trips were then distributed through the ExigoMD process using the distribution parameters calibrated in the 2009 base models.

The process for developing the base and future year matrices underwent a peer review by Flow Transportation Specialists who concluded that “the base model was fit for the purpose of the study, and that the forecast models for 2026 were considered to be reasonable”.[7]

We developed the forecast Annual Average Daily Traffic (AADT) volumes used in this report by factoring up the peak model volumes. The factors we used were based on a regression analysis of observed relationships between hourly and daily traffic in the Project Area.[8]

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[4] The Furness process is an iterative factoring of rows (trips from zones) and columns (trips to zones) in a reference matrix (usually the base year matrix) to new trip end totals. The Furness process is a method to change the total number of trips going to and from particular zones, for example to account for future year development, whilst retaining the structure of a reference case matrix.

[5] The SKM product ExigoMD is a Matlab based model that calibrates a Multinomial Logit Model (MNL) describing the trip-making behaviour across the study area. This model seeks to replicate the estimated base year trip matrix using the base year trip-ends (traffic generators and attractors).

[6] This survey was an automatic number plate recognition origin destination survey. Refer to section 5.9 of the Pūhoi to Wellsford Scheme Assessment SATURN Model Validation Report, SKM, issued 1 March 2011.

[7] SH1 Pūhoi to Warkworth Review of SATURN Traffic Models, Flow Transportation Specialists, dated 24 July 2013.

2.3 Base Case scenario definition

The Base Case scenario allows the future transport network performance to be forecast as it would be if the Project was not constructed. It represents the future transport environment baseline. The Base Case scenario includes anticipated land-use and transport network changes in the future assuming that the Project is not constructed.

2.3.1 Base Case land-use assumptions

We used land use forecasts (population and employment) to develop future traffic demands on the road network. These land-use forecasts are inputs to the model and were established from a variety of sources as follows:

- Auckland Regional Growth Strategy (and Auckland Regional Transport model);
- Rodney District Council (RDC) Growth Model as at late 2009; and
- Warkworth Structure Plan 2004.

The Warkworth Structure Plan 2004 envisages significant growth in Warkworth. The Base Case includes land-use changes in Warkworth consistent with those assumed and agreed between the former RDC and the NZTA for the Warkworth Structure Plan (Refer to Section 2.3.2 for further details about the agreement). Whilst acknowledging that the Structure Plan is not contained in the Operative Rodney District Plan, the growth predictions and future land-use in the Warkworth Structure Plan have been used in all recent local strategic planning. We are however aware that as part of the implementation of the Auckland Plan through the Auckland Unitary Plan other options for growth in Warkworth are being considered. At the time of writing this Report, the Unitary Plan had been issued in draft but not publicly notified. If the estimated growth proposed in the Auckland Plan and draft Unitary Plan in the vicinity of Warkworth was to be realised, the benefits of the Project identified in this Report are likely to be understated as the Base Case network performance would be significantly worse. NZTA and Auckland Transport are currently developing the transport network together on this basis.

We developed the forecast model year of 2026 to be consistent with the timeframes for the Auckland Regional Growth Strategy and to be consistent with information available from the former RDC Growth Model.

We created Holiday Start and Holiday End (see Section 3.2.2) period matrices based on the difference between average traffic counts and Holiday Start and End traffic counts taken from NZTA's Traffic Monitoring System (TMS) database at various locations along the existing SH1. This process looked at the allocation of traffic between Auckland and key holiday destinations north of Pūhoi in proportions that satisfied holiday period traffic counts. These "holiday matrices" were added to the traditional PM peak to create Holiday Start matrices, and inter peak to create the

[8] To convert the 2009 inter peak and PM peak flows to AADT flows we used: 5.1xPM + 9.1xIP. To convert the 2026 inter peak and PM peak flows we used: 5.6xPM + 8.6IP. There are a number of ways to reflect peak spreading in a model, and this minor shift of half an off-peak hour to an additional peak hour was considered a suitable proxy for likely increases in congestion in the peak period. It is also within the envelope of peak and interpeak factors generated in a linear regression process of state highway traffic volumes on the corridor.

Holiday End matrices. The holiday traffic distribution is therefore different to the base PM and inter peak matrices.

2.3.2 Base Case transport network assumptions

In response to the proposed Warkworth Structure Plan, a Memorandum of Understanding (MOU)[9] was entered into by RDC and the NZTA (as Transit New Zealand) in October 2006. This MOU detailed agreed road network improvements required in Warkworth to accommodate planned levels of development in the Warkworth area out to 2021. RDC and the NZTA identified improvements on both SH1 and the local road network. We understand that the NZTA and Auckland Transport are currently progressing improvements generally in line with the agreed MOU.

As a result of the MOU, SH1 through Warkworth has been upgraded in recent years to provide an urban type multi-lane route from Woodcocks Road to Whitaker Road, with traffic signal controls at the Woodcocks Road and Whitaker Road intersections.

Improvements at the Hudson Road / SH1 intersection are also being progressed in line with the MOU. The improvements at the Hudson Road / SH1 intersection involve signalisation of the intersection. NZTA has appointed a contractor and expects construction of the Hudson Road / SH1 intersection improvement works to commence shortly (within the next two months from July 2013).

The upgrade plans for the Hill Street / Elizabeth Street intersection are currently subject to further investigation by the NZTA and Auckland Transport. Depending on the outcomes of that investigation, it is possible that construction of the Hill Street / Elizabeth Street intersection improvements could begin in the near future (12 - 24 months). The current planned layout of the Hill Street / Elizabeth Street intersection improvements was designed to cater for the forecast traffic demand without considering the Project. When the Project is constructed, the distribution of traffic using the Hill Street intersection will change. Therefore, it is necessary to review the planned layout of the Hill Street intersection to ensure that, as far as practical, the intersection design is future-proofed for the changes anticipated with the development of the Project.

The Western Collector is a proposed local access road, providing a transportation connection for proposed developments under the Warkworth Structure Plan to the west of the existing SH1. The Western Collector runs roughly parallel to SH1 through the western side of Warkworth between McKinney Road in the south and Hudson Road in the north, shown on Figure 3.

Part of the Western Collector between Woodcocks Road and Falls Road has been constructed from the Woodcocks Road end (Mansel Drive). Auckland Transport is progressing with completing Mansel Drive at present, by extending it to Falls Road. The NZTA has advised us that this section of the Western Collector is likely to be completed in the short to medium term.

The McKinney Road / SH1 intersection and the southern section of the Western Collector (extension of Morrison Drive) is included in the latest National Land Transport Programme[10] (NLTP)

[9] Memorandum of Understanding signed between the NZTA and Rodney District Council on 2 November 2006.

[10] National Land Transport Programme Extract 2012/15, NZTA, updated May 16 2013 3:40AM.

with probable funding and the NZTA expects that this will be completed prior to 2021 with exact timing dependant on uptake of development on the western side of Warkworth serviced by the Western Collector.

The transport networks used in the Base Case scenario are generally the same as the validated 2009 base. A number of transport network changes and improvements have already been made or are anticipated to take place over time. We included these changes to the transport network in our Base Case model networks (and also in our Project model networks).

We based the alterations upon advice provided by the NZTA and discussions with Auckland Transport. The network alterations we incorporated into the SATURN model are consistent for all modelled periods.

The Base Case changes to the transport network in future years are summarised below and are shown spatially in Figure 2 and Figure 3:

- Speed limit reductions and traffic calming measures on Hibiscus Coast Highway in Orewa;
- A link between Grand Drive and the Hibiscus Coast Highway to provide access to the proposed development at Silverdale North;
- Warkworth road network changes consistent with the 2006 MOU comprising:
    - Upgrade of the SH1 / Woodcocks Road intersection:
    - Upgrade of the SH1 / Whittaker Road intersection;
    - Upgrade to the SH1 / Hill Street intersection;
    - Upgrade to the SH1 / Hudson Street intersection;
    - Upgrade to the SH1 / McKinney Road intersection;
    - Addition of the Warkworth Western Collector Road (two lane, sub-arterial road) from McKinney Road to Hudson Road;
- SH16 and SH18:
    - SH16 Brigham Creek Extension;
    - SH18 Hobsonville Deviation;
- SH1:
    - An additional auxiliary lane northbound between Constellation Drive and Greville Road.

completed

to be completed

Figure 2: Base Case Transport Network Changes

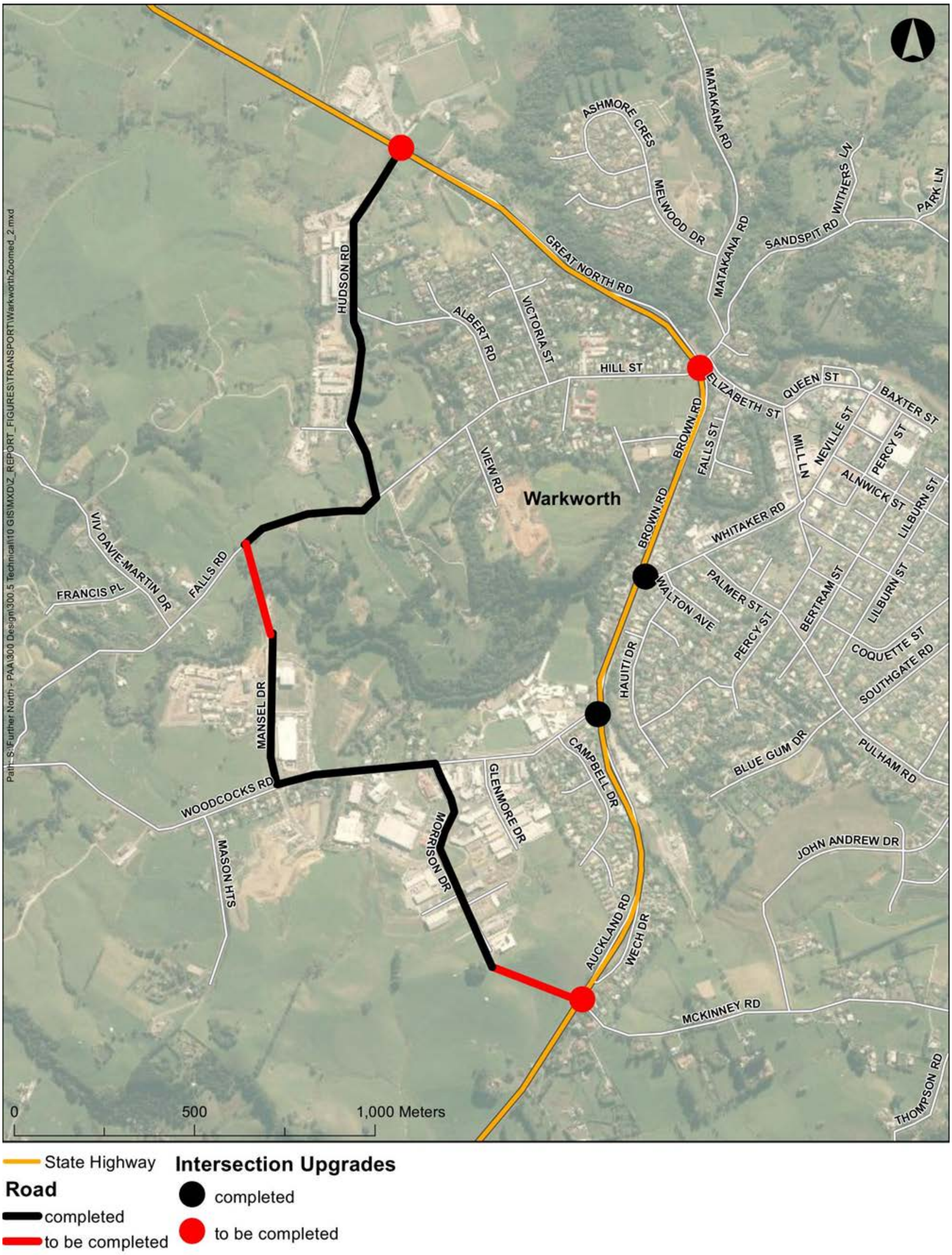


Figure 3: Base Case Transport Network Changes in Warkworth

To be able to model and forecast the effect of the NGTR, a travel time penalty was applied to it during the calibration of the base year model. This penalty reflects the cost of paying the toll to use this section of SH1. It essentially deters some traffic from using the route because it is modelled to take longer (increasing the generalised cost of using the link). The time penalty was first calculated on a generalised cost basis (converting dollar cost to time) then adjusted to achieve a calibrated split of traffic between the NGTR and the alternative free route via Hibiscus Coast Highway through Orewa and Waiwera. The base year time penalty applied between NGTR and Hibiscus Coast Highway was seven and a half minutes.

2.4 Pūhoi to Warkworth scenario definition

The Project scenario is essentially the same as the Base Case, but includes the Project and some land-use changes as described below.

2.4.1 Project land-use assumptions

The Project scenario land-use inputs are essentially the same as for the Base Case described above. However, we assumed that the operation of Project will increase growth rates in the study area. The assumption that growth rates will increase was made on the basis that improved accessibility between Auckland and Warkworth, the Wellsford area and beyond to Northland and the eastern beaches will result in increased growth in population and employment, and hence trips through the transport network. This increased growth in population and employment will result in increases in trips within the SH1 / Project corridor and also at the origins and destinations of these trips.

It is difficult to determine the exact level of traffic that would be induced by the Project. We have therefore assumed for the Project scenario, that the level of growth will be within the annual variation in long-term growth in traffic on SH1 but higher than the average. That is, the Project is assumed to represent a growth stimulus that will shift average trip growth above the observed historical average but will be within the observed yearly variation in growth.

Traffic growth rates on SH1 between Pūhoi and Warkworth have been in the order of 1.5% to 6% per annum over the last five years, with an average growth rate in the order of 4.1%.[11] On this basis, we assumed that an extra 1% of traffic growth in the Project scenario is a reasonable approximation of the induced traffic effects of the Project and is within a range that could be expected.

Instead of changing land-use inputs, the forecast Base Case scenario traffic demand between traffic model zones was simply factored up by 1% to produce a Project scenario demand.

Given the uncertainty around the 1% induced traffic assumption, we have undertaken a sensitivity test to understand how this assessment would be affected if this level of induced traffic was not experienced. This sensitivity test is detailed in Section 4.10 and shows that 1% induced traffic assumption has no material impact on this assessment.

We have also increased holiday traffic demand in the Holiday Start and Holiday End periods from the Base Case scenario for origins or destinations in the key holiday locations of the study area. We

[11] Based on NZTA's TMS counts measured at the count site south of McKinney Road.

did this by simply factoring up the trips to holiday destinations by a total of 10% to produce a base Project scenario demand. The increase is only in the order of 100 veh/hr so does not have a material impact on the assessment.

Drivers generally only use SH16 as an alternative to SH1 during holiday periods when SH1 becomes heavily congested. This congestion will be largely eliminated by the Project. With the Project in place, many of the long distance trips will actually take place in the SH1 / Project corridor rather than SH16. To reflect this, we made some manual adjustments to the model in the Holiday Start and Holiday End periods. 75% of trips that used SH16 but did not have a destination along SH16 (and were travelling further north to Wellsford) were forced to enter the model network on SH1 at the southern extent of the model rather than using SH16.

We made some additional alterations to the land-use assumptions in Warkworth. We anticipate that when the Project is in place, the land closest to the northern interchange will become more attractive. On this basis, we allocated all future land-use growth in the Structure Plan area around Woodcocks Road to model zones adjacent to Hudson Road. The sensitivity of the assessment to this assumption is discussed in Section 4.10.

2.4.2 Project transport network assumptions

The transport networks we assumed are essentially the same as for the Base Case in 2026. However, the Project as described in Section 1.12 above has been included. The Project is assumed to include a motorway standard alignment with south facing ramps at Pūhoi Road and an all movement connection via an at-grade roundabout to the north of Warkworth.

In addition to the Project, we made some changes to the assumed form of the Hill Street intersection. While the basic footprint of the intersection is assumed to generally remain the same as that assumed in the Base Case, the lane arrangements have been modified. The changes to the intersection as compared to the Base Case are summarised below:

- The SH1 southbound approach is widened with an additional left turn lane to Sandspit Road is provided to cope with the increased demand. This movement from the north also becomes signalised rather than a free left turn;
- The lane allocation from the Sandspit Road approach changes to cater for the greater demand for the right turn movement by providing two right turning lanes (lanes 3 and 4) onto SH1 northbound. Lane 2 is remarked to provide for through movement to Hill Street and the left turn to SH1 Southbound. Lane 1 remains unchanged and provides the free left turn into Elizabeth Street; and
- The SH1 northbound, Hill Street and Elizabeth Street approaches remain the same as the Base Case.

We took this approach because of the change in travel patterns at the Hill Street intersection that we expect will occur following construction of the Project. Without these changes, delays at the Hill Street intersection were forecast to increase significantly. We therefore consider it feasible that some low cost changes would be made to this intersection to make it operate more efficiently in the future.

The Peer Reviewer agreed with this approach noting: “The layout at SH1 Hill Street is assumed to change as a result of Project. This seems entirely reasonable, as the traffic patterns will change significantly in this area, so the layout should respond to those changes (providing the future layout assumed remains within the existing designation).”[12]

2.5 Project objectives

The NZTA’s objectives for the Project are:

- Increase long-term corridor capacity, improve route quality and safety (e.g. gradient, alignment, overtaking), improve freight movement and provide resilience in the wider state highway network through the addition of a four-lane route;
- Increase travel time consistency and decrease travel times to and from the north end of the Johnstone’s Hill tunnels and the north end of Warkworth;
- Alleviate congestion at Warkworth by providing a Warkworth bypass for through traffic; and
- Ensure the Warkworth to Wellsford section of the Pūhoi to Wellsford RoNS is not compromised.

Of particular relevance to this transport assessment is the extent to which the Project will increase travel time consistency, decrease travel times and alleviate congestion at Warkworth.

[12] SH1 Pūhoi to Warkworth Review of SATURN Traffic Models, Flow Transportation Specialists, dated 24 July 2013.

3. Existing transport environment

The SH1 corridor from Pūhoi to Warkworth is largely characterised by rolling or steep terrain with some particularly low speed horizontal curves and steep grades. The route is primarily a single carriageway with some passing lanes. The majority of the route has a posted speed limit of 100kph. Warkworth experiences significant congestion during holiday periods and also during weekday evening commuter peak and on weekends.

Under the Base Case scenario (without the Project), we forecast traffic volumes on the existing SH1 to grow at a rate of approximately 4.4% per annum between 2009 and 2026. This means that daily traffic volume on SH1 between Pūhoi and Warkworth is expected to be in the order of 25,000 vpd in 2026.

We forecast a number of key issues for transport in the corridor to worsen over time as traffic volumes increase:

i. Travel times and congestion

Warkworth is currently subject to regular congestion during weekday evening peak periods. More severe congestion is experienced during holiday periods or when incidents occur (such as crashes, slips, etc). This congestion results in increased and unpredictable travel times.

Without the Project in place, we forecast travel times in the corridor as a whole to increase significantly as traffic volumes on SH1 increase. For example, we forecast travel times on SH1 southbound (between the proposed northern connection with the Project and Pūhoi) to increase by 11 minutes (72 %) in the PM peak hour (16.30 – 17:30) by 2026 compared to 2009.

These increasing travel times will have an adverse impact of on the efficiency of general traffic and freight movements in the corridor. Increasing travel times will also decrease accessibility between Auckland, Warkworth and Northland.

ii. Consistency of journey times

As noted above, the corridor is currently subject to regular congestion during weekday evening peak periods, during holiday periods, or when incidents occur. This not only results in increased travel times, but inconsistent travel times. Reduced consistency of journey times makes journey planning difficult for individuals and businesses (such as freight operators).

The inconsistency of travel times in the SH1 corridor is likely to become a significant issue in the future, as traffic volumes and travel times increase.

iii. Crashes

Some road safety improvements have been achieved in recent years along the existing SH1 route. However, the ability to achieve further reductions in the frequency and severity of crashes is constrained by the geometry of the existing route.

We forecast the average number of injury crashes per year on SH1 (between the proposed connection north of Warkworth and Johnstone's Hill tunnel) to increase by 9 (68%) by 2026 compared to the five years up to 2012.

iv. Route security

The existing SH1 route is currently fully or partially closed a number of times a year, for varying durations as a result of events such as crashes, flooding or slips blocking the road. The existing SH1 route is also vulnerable to long-term closure after major natural events such as slips or flooding.

v. Freight movement

All of the issues detailed above for general traffic (travel times route quality and safety, resilience and travel time consistency) are also experienced by commercial freight traffic. Freight vehicles experience even greater challenges in relation to travel time and travel time consistency, due to the difficulties heavy vehicles face with the tight horizontal curves and steep grades on the existing SH1.

vi. Other Modes

Intercity bus services and tourist shuttles currently provide the only public transport services within the corridor. Some bus services are planned to run between Warkworth and Silverdale in the future. While the frequency of these bus and shuttle services may change with demand, it is unlikely that other forms of public transport would be economically viable in the future. These bus and shuttle service utilise the existing SH1 and are therefore subject to the same issues as general and freight traffic described above.

Given the large distances between centres, there is limited opportunity for walking or commuter cycling between centres. However, recreational cyclists do use the existing SH1 and walking and cycling takes place within Warkworth itself. Whilst the SH1 corridor has seen some improvements in pedestrian and cycle facilities in recent years, these road users can feel intimidated by the high volumes of SH1 traffic. These high volumes of traffic affect the perceived safety and enjoyment of walking and cycling within the corridor.

Parts of the Warkworth community suffer severance and problems of accessibility, due to the barrier created by high volumes of through traffic on the existing route. Community facilities and businesses are separated from residential areas to the west of SH1. Crossing the route involves detours, delays and safety concerns.

The purpose of this section is to describe and forecast the performance of the transport network in the future for a Base Case scenario (refer to Section 2.3 above), which assumes that the Project is not constructed. We consider the Base Case to be the existing environment.

3.1 Existing road network

The SH1 corridor in the Project Area is primarily characterised by rolling or steep terrain with some particularly low speed horizontal curves and steep grades. The route is primarily a single carriageway with a limited number of passing lanes. The majority of the route has a posted speed limit of 100kph. Through Warkworth, from just south of Woodcocks Road to just north of Hill Street, the posted speed limit is 60kph. There are short sections of 80kph speed limit on the approaches to Warkworth and between the Johnstone's Hill Tunnels and just south of Pūhoi Road.

A key geographic feature of the route is Schedewys Hill. The route across Schedewys Hill has low speed horizontal curves and steep grades, with a number of short passing opportunities. It has a poor safety record with 2 serious and 15 minor injury crashes in the five years from 2008 to 2012. The challenging geometric alignment also provides an impediment for heavy freight traffic and requires them to climb the grade at low speed as discussed further in Section 3.7. A photo of the Schedewys Hill is shown in Figure 4.

At the southern end of the Project Area, SH1 transitions from a dual carriageway, four-lane, tolled motorway (the NGTR) to a single carriageway, two-lane rural highway. The single carriageway follows the undulating landform with restricted sightlines and steep grades in some locations, presenting limited opportunities for overtaking. Generally, the carriageway has shoulder widths of 1.5 – 2m, allowing for limited stopping for emergency or other reasons. SH1 remains a single carriageway, two-lane highway throughout the Project Area.

Hibiscus Coast Highway is the former SH1 route through Orewa that was bypassed by the NGTR. At the northern end, the Hibiscus Coast Highway currently connects with SH1 immediately north of the northern portals of the Johnstone's Hill tunnels. At the southern end it connects to SH1 at the Silverdale interchange. This route combined with Grand Drive provides the free alternative route to the tolled NGTR.

SH1 serves the dual purposes of providing the national transport function between the Auckland and Northland regions, as well as providing access to local areas including Pūhoi, Warkworth and the eastern beaches of Matakana, Leigh, Omaha, Snells Beach and Sandspit. As a consequence of this dual function, there is a mix of regional and local traffic on SH1, meaning some long distance through traffic can be delayed because SH1 capacity is used by short distance local trips. The current traffic volumes on SH1 include an average of 7% Heavy Commercial Vehicles (HCV) between Pūhoi and Warkworth.

3.1.1 Passing lanes

There are six passing or climbing lanes[13] between Pūhoi and Warkworth, three in each direction as indicated in Figure 5. One northbound passing lane starts at Satellite Station Road and one southbound passing lane starts 200m south of Mahurangi West Road. Two of the northbound passing lanes are on Schedewys Hill and are separated by approximately 500m. Similarly, the two southbound passing lanes at Pohuehue[14] are separated by a short distance of 200m, as a result of SH1 crossing the single-lane Pohuehue Viaduct. The short separation between these passing lanes effectively reduces the number of passing lanes in the Project Area to four; two in each direction between Pūhoi and Warkworth.

The section of SH1 from Pūhoi to Warkworth has specifically been excluded from the NZTA's Passing and Overtaking Long-Term Strategy because the Project four-lane upgrade is proposed. Therefore, additional passing lanes along the existing alignment are not proposed in the National State Highway Strategy.

Figure 4: South of Schedewys Hill looking north

[13] Where passing lanes are located on sections of highway that have severe gradients, which will cause a speed reduction of at least 25kph for a 5kw/tonne design vehicle, they are classified as climbing lanes. However, they also provide a useful passing lane facility. For simplicity, both passing and climbing lanes are referred to as passing lanes in this Report.

[14] The second passing lane finishes at Conwan Bay Road.

3.1.2 Local roads

The existing SH1 intersects with the following local roads in the Project Area. These are shown in Figure 5 and listed below:

- Billing Road;
- Pūhoi Road (connects to Ahuroa Road and Krippner Road in the township);
- Hungry Creek Road;
- Watson Road;[15]
- Mahurangi West Road (connects to Mahurangi West and Jamieson Bay as well as Pohuehue);
- Schollum Access Road;
- Moirs Hill Road;
- Conwan Bay Road;
- Perry Road;
- Twin Stream Road;
- Satellite Station Road;
- Valerie Close;
- Toovey Road;
- McKinney Road (part of a loop around south Warkworth); and
- Wech Drive (connects to the southern part of Warkworth).

[15] This is not a public road. The intersection is formed so that it appears to be a road but it is barriered off to stop general traffic accessing the land it serves.

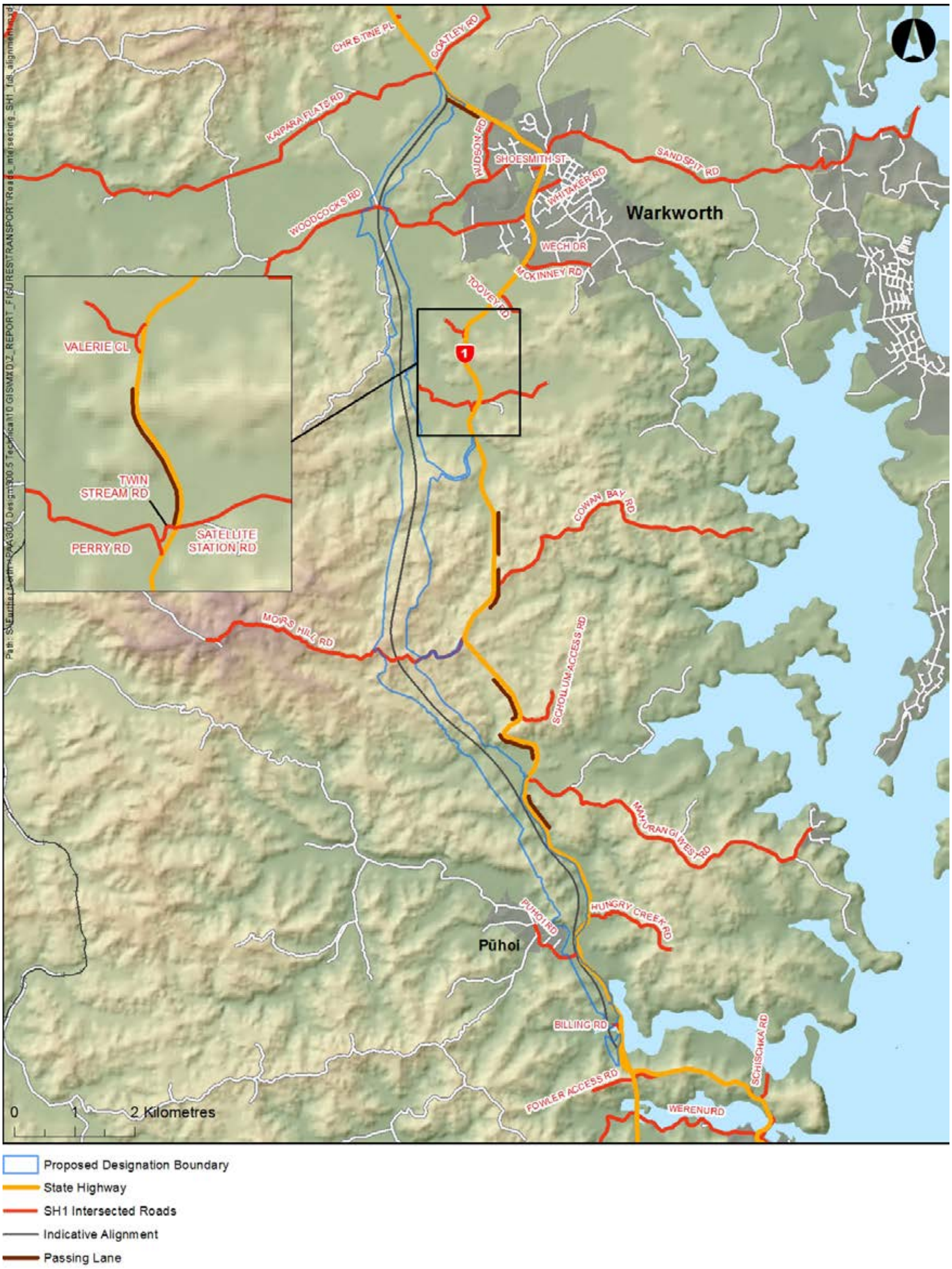


Figure 5: location of local roads

These local roads have generally low traffic volumes providing access to a number of small communities and rural and agricultural land-uses. Many are dead-end roads. Only some of these intersections have adequate acceleration and deceleration treatments on SH1, increasing the potential for conflicts between State highway traffic and local road traffic.

Pūhoi Road provides access to the Pūhoi community. Pūhoi Village is a small, historic settlement situated on the Pūhoi River just west of SH1. Pūhoi has a small population slightly in excess of 200 residents. The wider Pūhoi locality is characterised by a combination of rural lifestyle settlements and a rural working environment with rural industries, farming and forestry contributing to income and businesses in the area. There are few 'large-scale' income-producing farms in the area. Pūhoi provides limited services to the surrounding rural area. Key activities in the town include the hotel, convenience store and tourist-related activities (e.g. Pūhoi River Canoe Hire, Pūhoi Pub and Bistro, Pūhoi Cheese Factory).

Perry Road provides access to the Perry Road lifestyle settlement, with approximately 20 dwellings, an aquafarm, and the Honey Centre (tourist attraction).

Through Warkworth itself a number of roads intersect SH1, as shown in Figure 6:

- Woodcocks Road;
- Whitaker Road;
- Shoesmith Street;
- Hill Street;
- Sandspit Road; and
- Hudson Road.

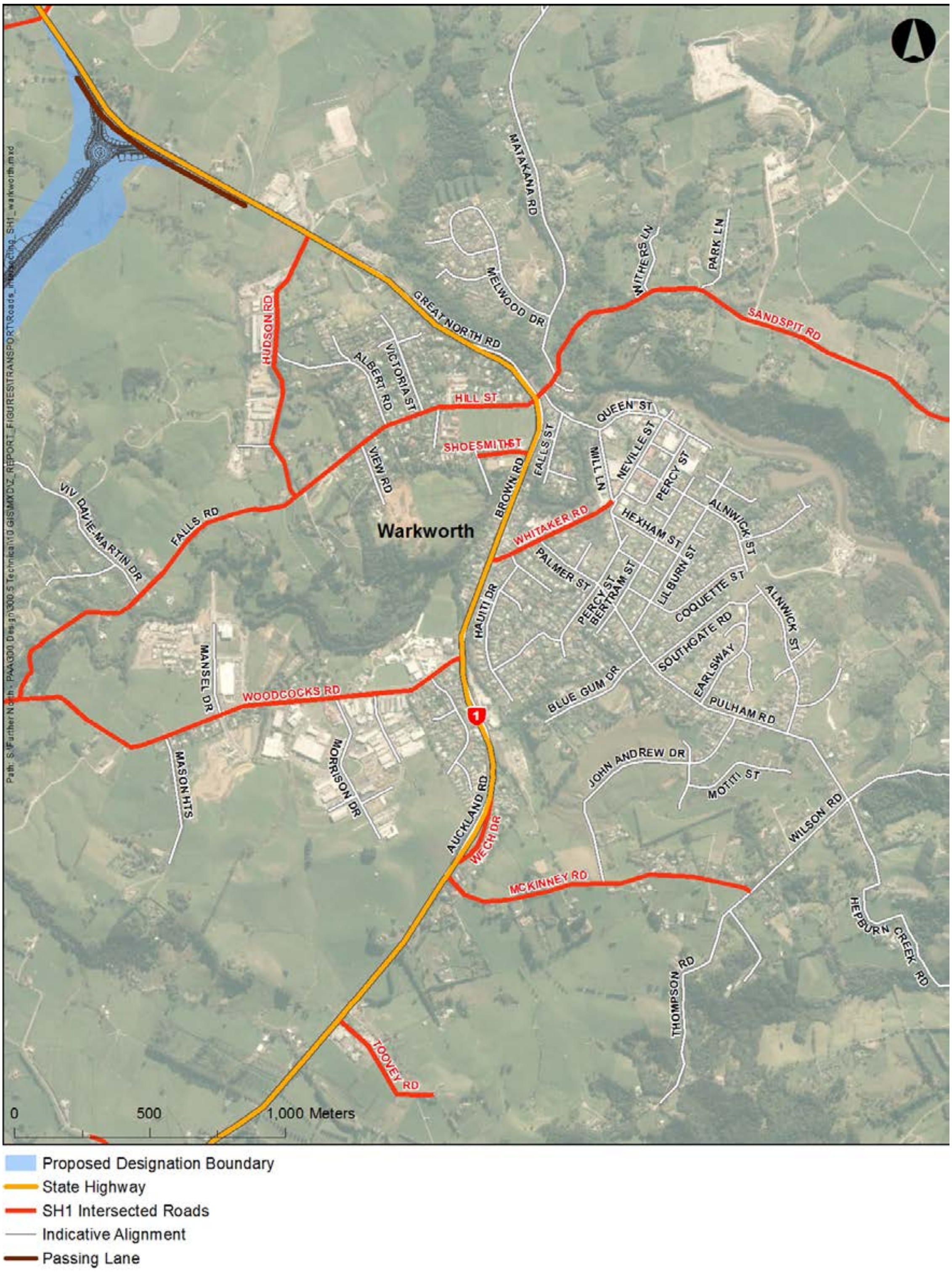


Figure 6: Local roads which intersect SH1 in Warkworth

Warkworth is a busy and established community that has experienced an average annual population growth of 2.75% over the last 10 years.[16] This growth rate is substantially higher than the Auckland urban area, which had an average annual growth of 1.6% for the same period. Warkworth also provides access to nearby east coast beaches. These beaches have high volumes of weekend and holiday accommodation, which attract large numbers of visitors. As a result, during peak holiday periods SH1 through Warkworth is heavily congested. The signalised intersections on SH1 are also congested during weekday PM peak periods and at times during weekends. This congestion feeds back onto the local roads (i.e. the Elizabeth Street Sandspit and Matakana Road intersections). This congestion results from the increased traffic volumes during the commuter peak or as people try to access the recreational uses in the weekend.

One of the key constraints on the road network at present is the Hill Street intersection, which caters for SH1 through traffic and provides access to the coastal communities of Leigh, Omaha, Sandspit, Snells Beach, Mahurangi East and Matakana.

3.2 Traffic volumes

3.2.1 General traffic volumes

The 2012 AADT volume is approximately 17,400 vpd for the Pūhoi to Warkworth section of SH1. SH1 carries high volumes of freight traffic, with up to 7%[17] of traffic being HCVs along the route between Pūhoi and Warkworth.

Average Daily Traffic volumes on SH1 between Pūhoi and Warkworth[18] by month are shown in Figure 7. These volumes are the average for the month and have been averaged over a five year period (2008 - 2012). It can be seen that traffic volumes vary throughout the year with a noticeable decrease over the winter months. Traffic volumes are the highest in January (21,000vpd) and lowest in August (14,500vpd). This trend results from the recreational travel demand through the corridor for destinations along the east coast increasing during the summer months.

[16] Statistics New Zealand estimated resident population for the Auckland and Warkworth Urban Areas (2003 - 2012).

[17] Based on NZTA's TMS counts measured at the count sites at Pohuehue Viaduct and North of Hungry Creek Road.

[18] Based on NZTA's TMS counts measured at the count sites South of McKinney.

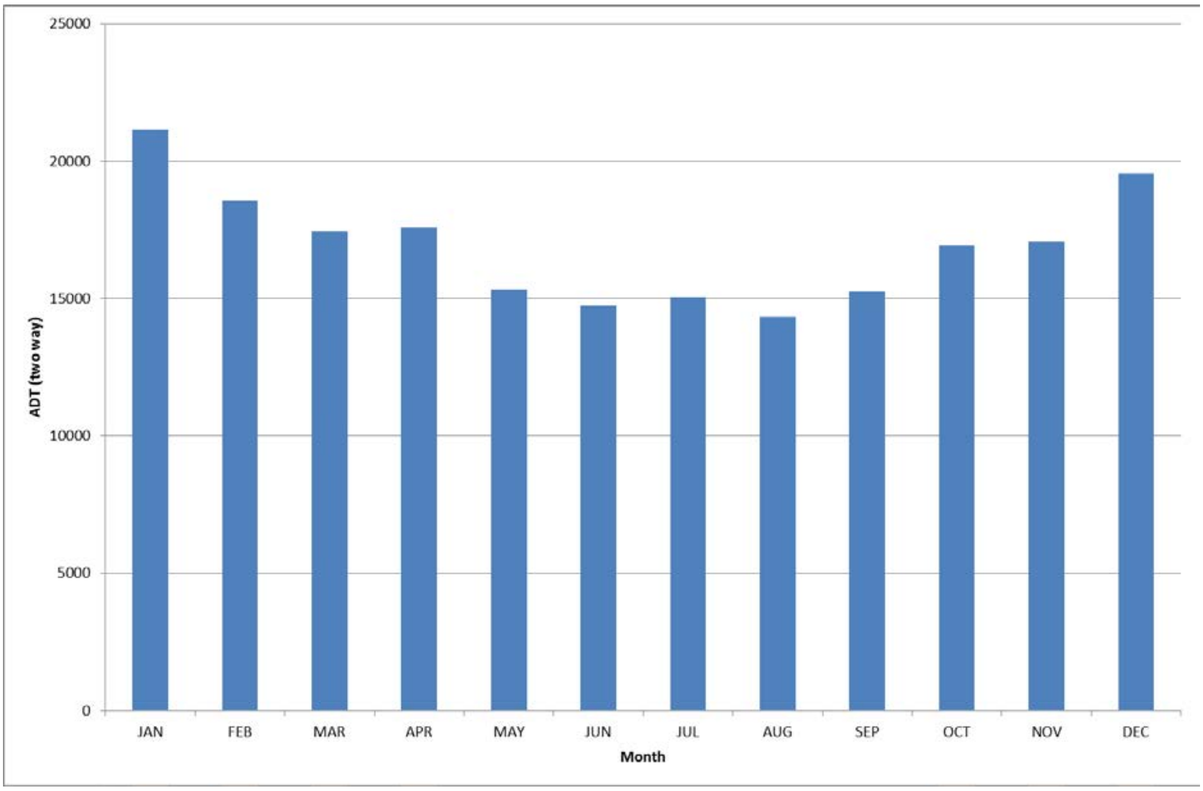


Figure 7: Average daily traffic by month 2008 - 2012

Daily traffic profiles for SH1 between Pūhoi and Warkworth[19] are shown in Figure 8. These profiles have been averaged over a five year period (2008 - 2012). Demand is at its highest between 3pm and 5pm on a Sunday with a two-hour peak volume of 1800 vehicles per hour. The weekday peak two-way volume is 1,300 vehicles per hour between Pūhoi and Warkworth.

Figure 8 also shows that demands on Friday, Saturday and Sunday are higher than flows on other days of the week. This reflects the associated recreational travel demand through the corridor for destinations along the east coast.

[19] Based on NZTA's TMS counts measured at the count site North of Hungry Creek Road.

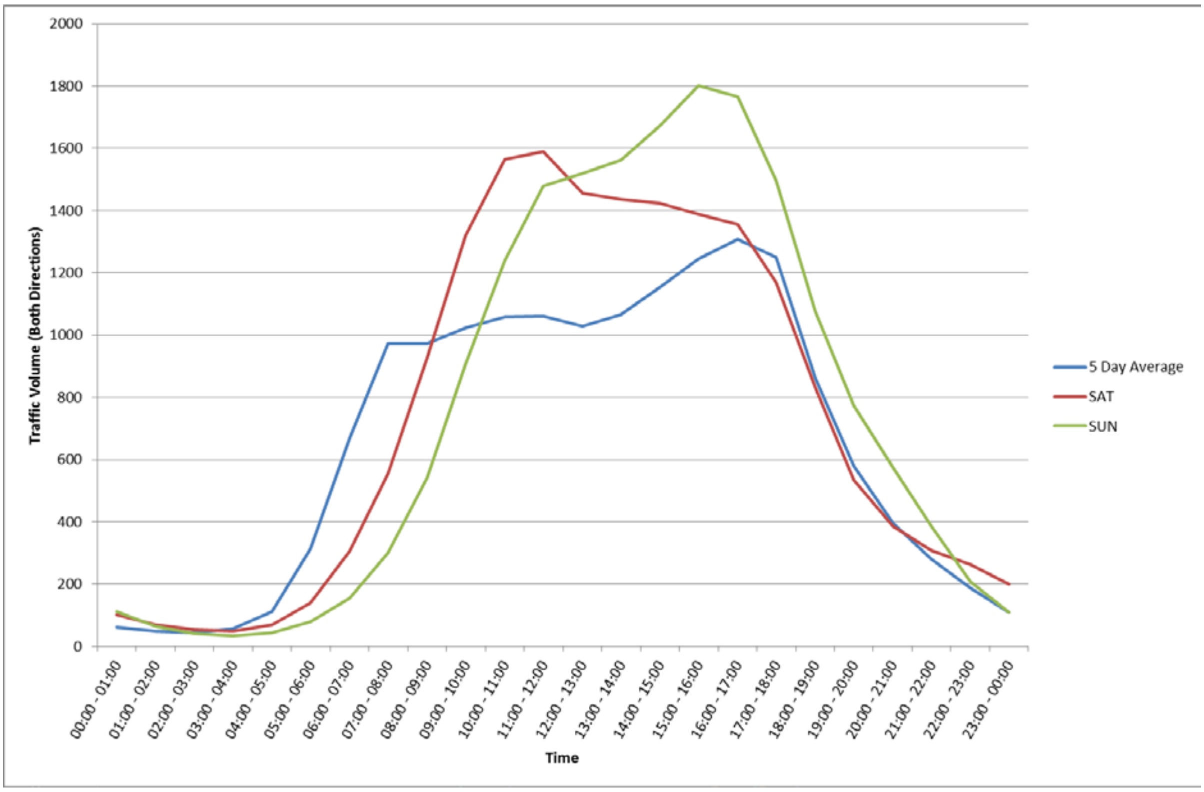


Figure 8: Pūhoi to Warkworth average traffic profile (2008 to 2012)

The typical observed and forecast traffic volumes on SH1 between Pūhoi and Warkworth in 2009 and 2026 for the Base Case scenario (i.e. without the Project) are shown in Figure 9. The red column is the PM peak hour volume while the green is a typical hour between the morning and evening peak periods. The blue column is the AADT which encapsulates all traffic over a typical week day. This highlights that a large proportion of the travel in the corridor takes place outside the morning and evening peaks which is reflected in the factors used to develop the AADT as detailed in Section 2.2.1.

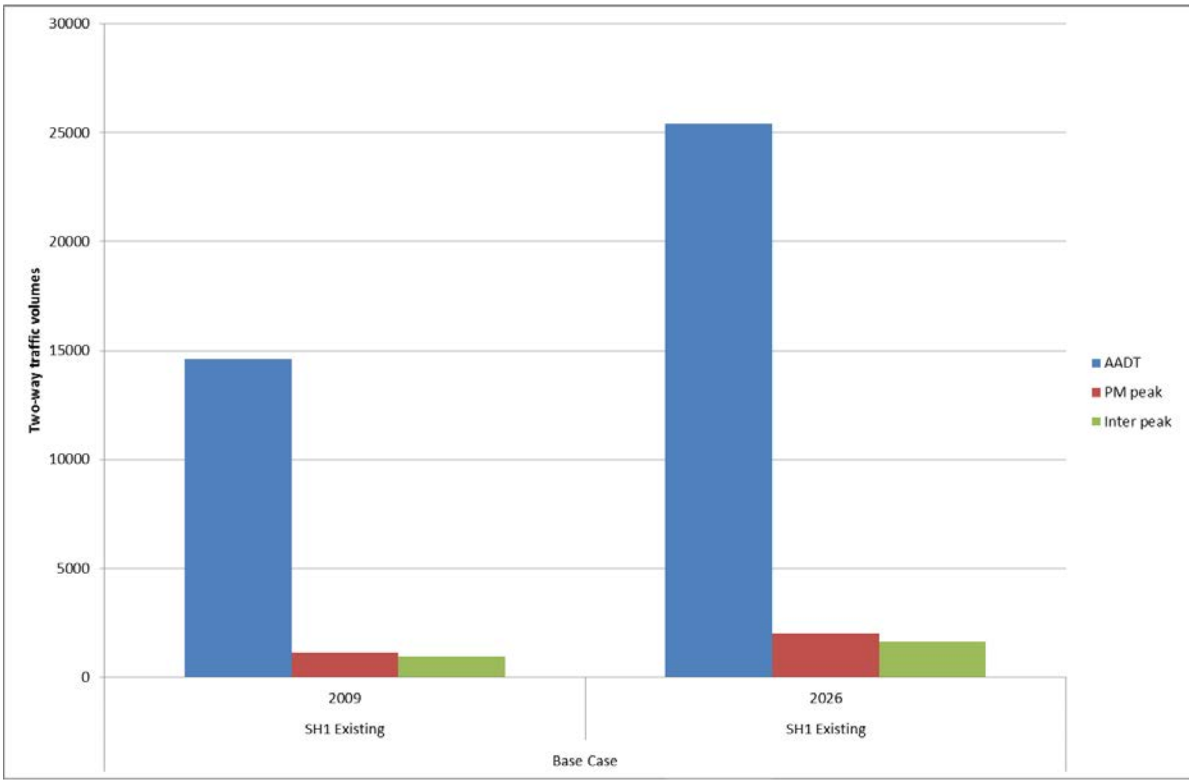


Figure 9: Base Case traffic volumes on SH1 between Pūhoi and Warkworth

As can be seen in the above figure, traffic volumes on the existing SH1 are expected to grow at a rate of approximately 4.4%[20] per annum between 2009 and 2026 without the Project in place. This means that daily traffic volumes on SH1 between Pūhoi and Warkworth are expected to be in the order of 25,000 vpd in 2026. This forecast growth rate is consistent with the growth rate observed over the last five years which has averaged 4.1%.[21]

Forecast traffic volumes on key parts of the network for the Base Case scenario in the different modelled periods are shown in Figure 10 to Figure 13.

[20] Based on the SATURN model forecasts at the location North of Schedewys Hill.

[21] Based on NZTA's TMS counts measured at the count site south of McKinney Road.

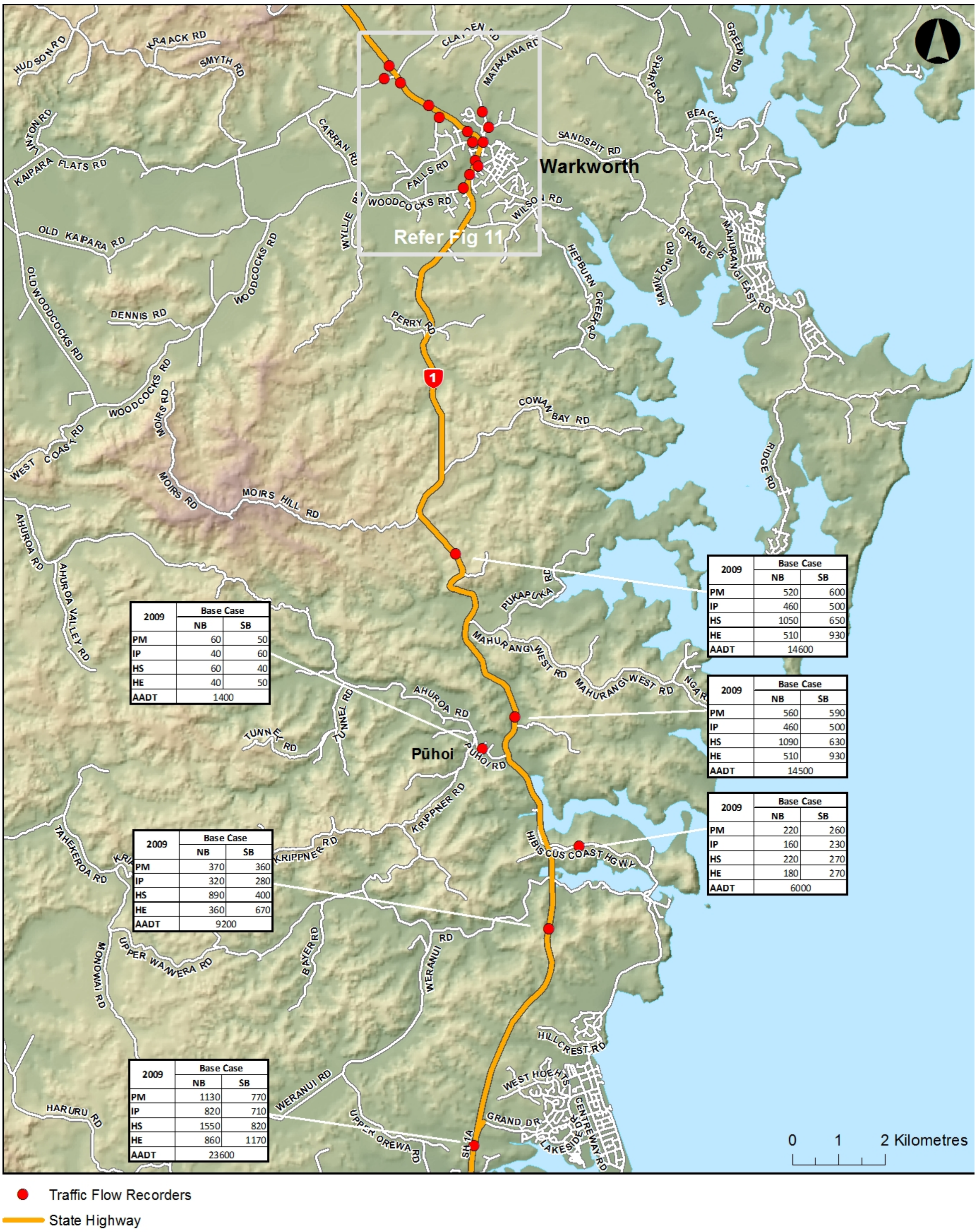
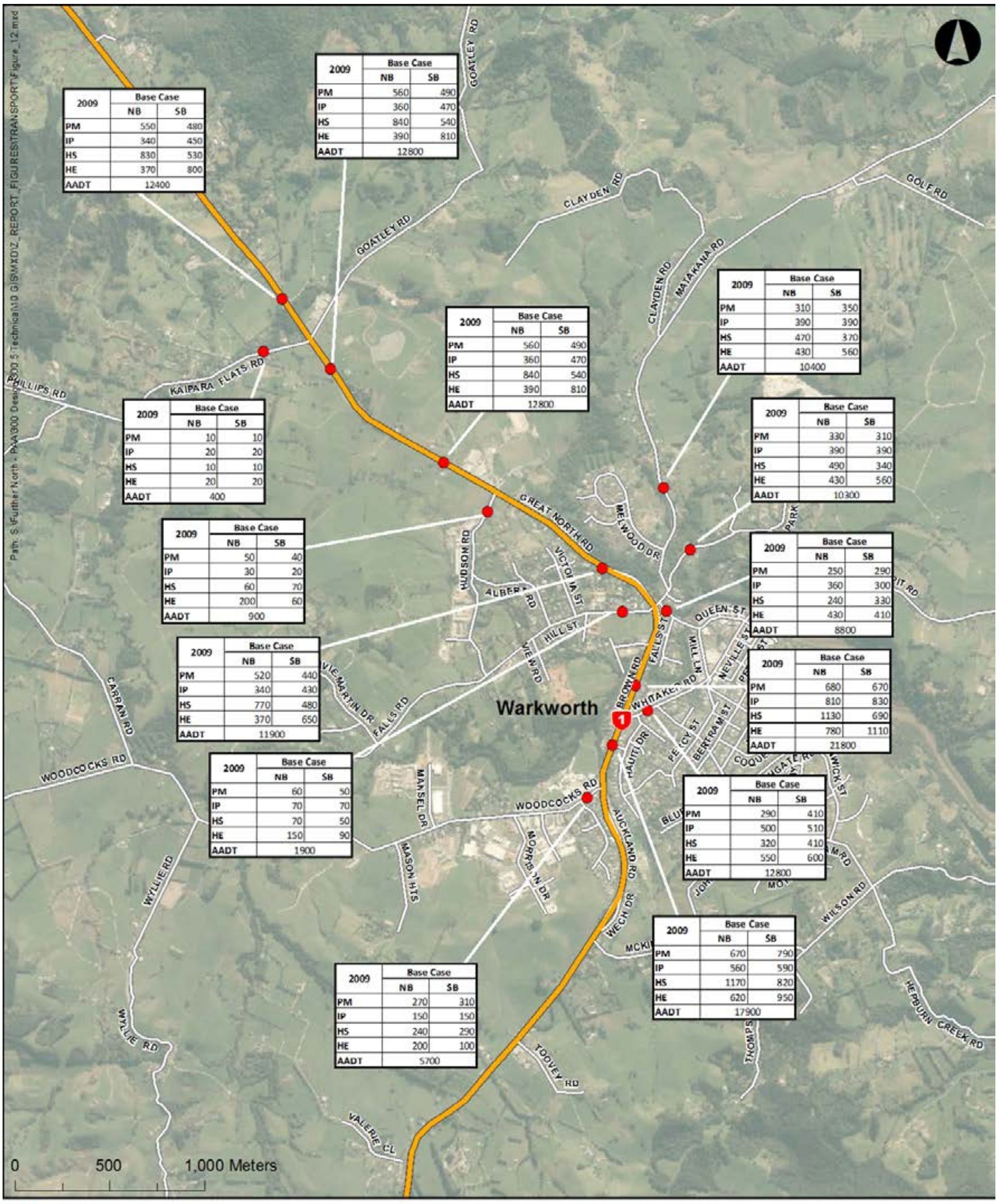
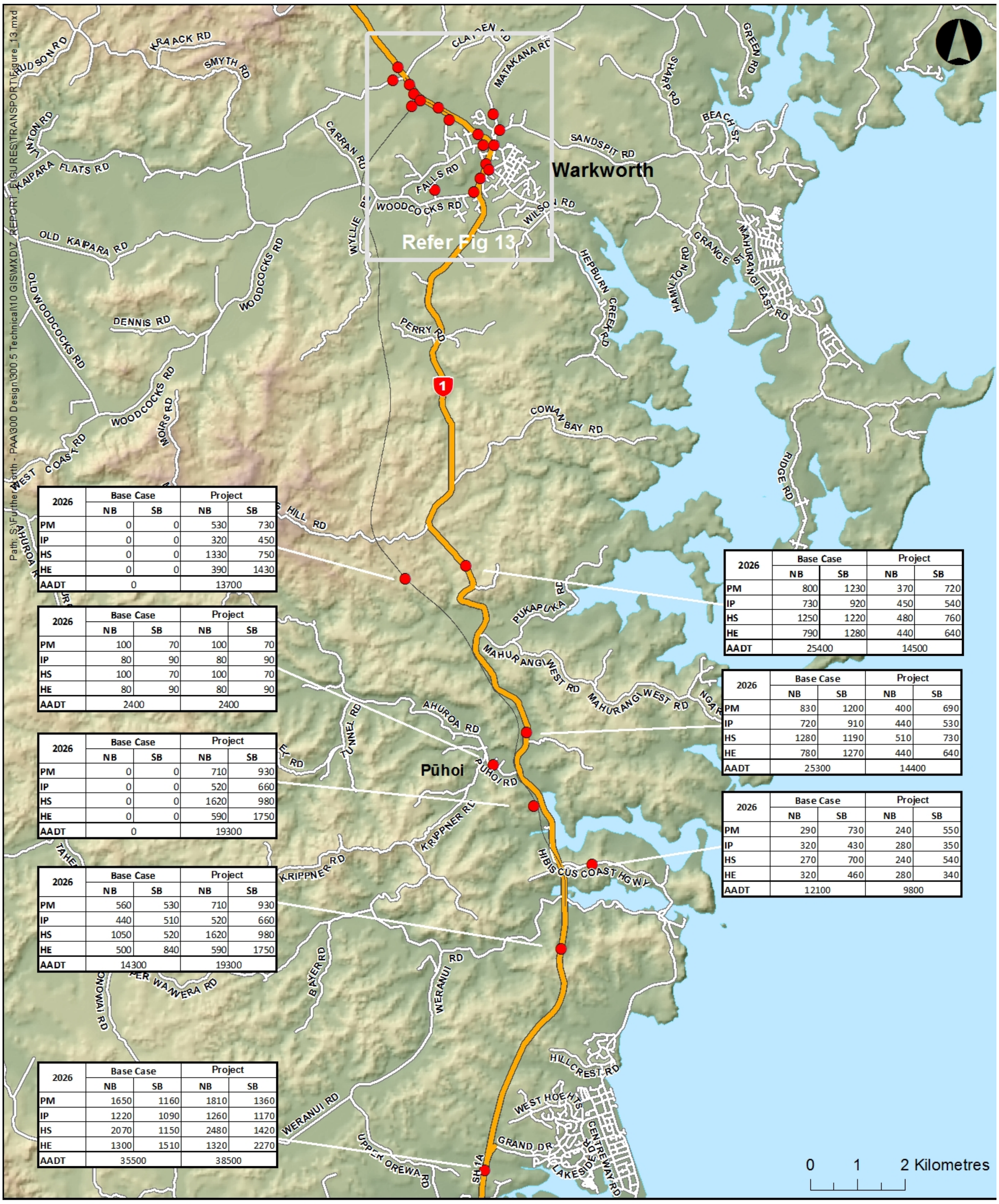


Figure 10: 2009 Traffic Volumes on Key Links (Project Area)



● Traffic Flow Recorders
▬ State Highway

Figure 11: 2009 Traffic Volumes on Key Links (Warkworth)



2026	Base Case		Project	
	NB	SB	NB	SB
PM	0	0	530	730
IP	0	0	320	450
HS	0	0	1330	750
HE	0	0	390	1430
AADT	0		13700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	100	70	100	70
IP	80	90	80	90
HS	100	70	100	70
HE	80	90	80	90
AADT	2400		2400	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	0	0	710	930
IP	0	0	520	660
HS	0	0	1620	980
HE	0	0	590	1750
AADT	0		19300	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	560	530	710	930
IP	440	510	520	660
HS	1050	520	1620	980
HE	500	840	590	1750
AADT	14300		19300	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	1650	1160	1810	1360
IP	1220	1090	1260	1170
HS	2070	1150	2480	1420
HE	1300	1510	1320	2270
AADT	35500		38500	

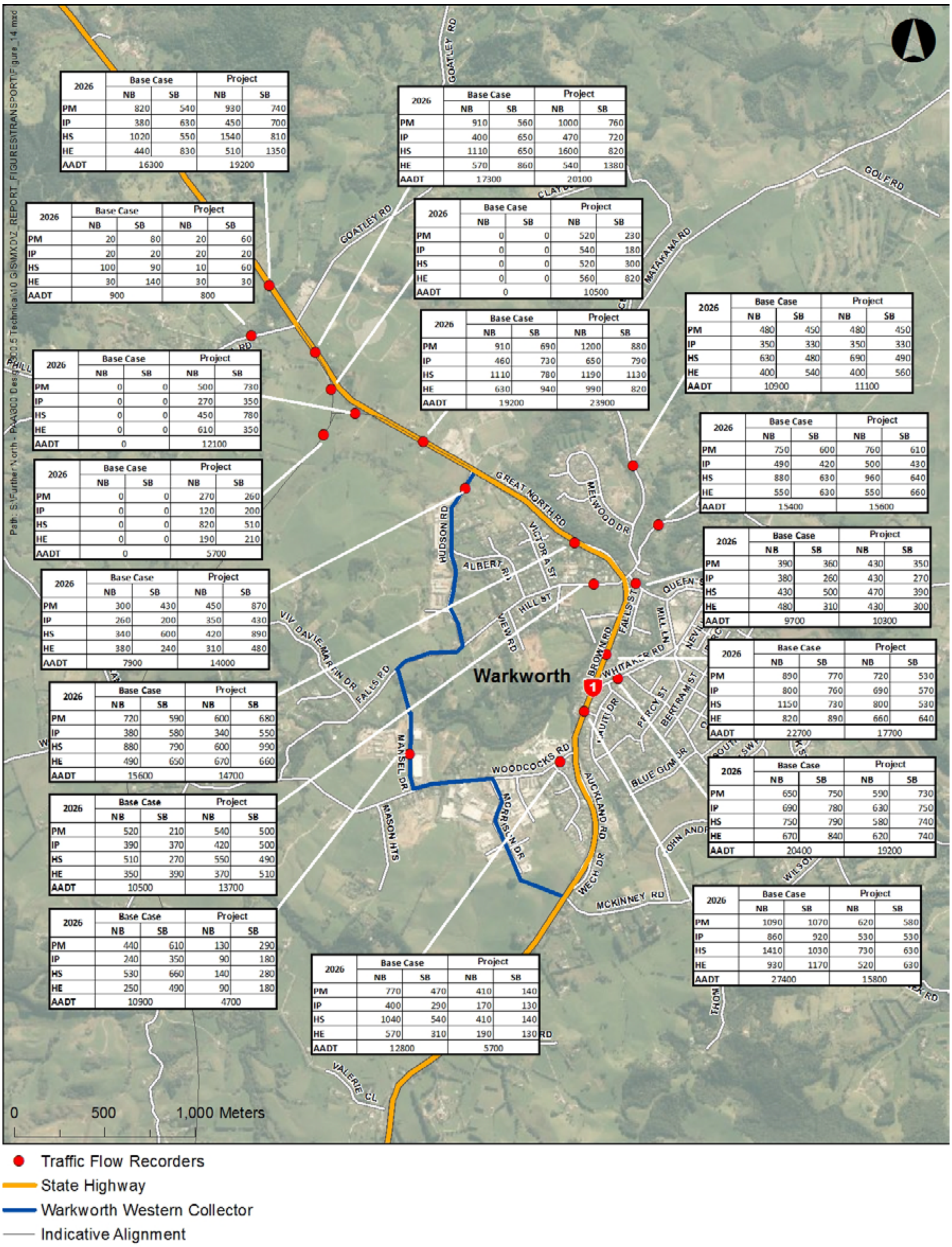
2026	Base Case		Project	
	NB	SB	NB	SB
PM	800	1230	370	720
IP	730	920	450	540
HS	1250	1220	480	760
HE	790	1280	440	640
AADT	25400		14500	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	830	1200	400	690
IP	720	910	440	530
HS	1280	1190	510	730
HE	780	1270	440	640
AADT	25300		14400	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	290	730	240	550
IP	320	430	280	350
HS	270	700	240	540
HE	320	460	280	340
AADT	12100		9800	

Traffic Flow Recorders
State Highway
Indicative Alignment

Figure 12: Forecast 2026 Traffic Volumes on Key Links (Project Area)



2026	Base Case		Project	
	NB	SB	NB	SB
PM	820	540	930	740
IP	380	630	450	700
HS	1020	550	1540	810
HE	440	830	510	1350
AADT	16300		19200	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	910	560	1000	760
IP	400	650	470	720
HS	1110	650	1600	820
HE	570	860	540	1380
AADT	17300		20100	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	20	80	20	60
IP	20	20	20	20
HS	100	90	10	60
HE	30	140	30	30
AADT	900		800	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	0	0	520	230
IP	0	0	540	180
HS	0	0	520	300
HE	0	0	560	820
AADT	0		10500	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	480	450	480	450
IP	350	330	350	330
HS	630	480	690	490
HE	400	540	400	560
AADT	10900		11100	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	910	690	1200	880
IP	460	730	650	790
HS	1110	780	1190	1130
HE	630	940	990	820
AADT	19200		23900	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	0	0	500	730
IP	0	0	270	350
HS	0	0	450	780
HE	0	0	610	350
AADT	0		12100	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	750	600	760	610
IP	490	420	500	430
HS	880	630	960	640
HE	550	630	550	660
AADT	15400		15600	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	0	0	270	260
IP	0	0	120	200
HS	0	0	820	510
HE	0	0	190	210
AADT	0		5700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	390	360	430	350
IP	380	260	430	270
HS	430	500	470	390
HE	480	310	430	300
AADT	9700		10300	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	300	430	450	870
IP	260	200	350	430
HS	340	600	420	890
HE	380	240	310	480
AADT	7900		14000	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	890	770	720	530
IP	800	760	690	570
HS	1150	730	800	530
HE	820	890	660	640
AADT	22700		17700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	720	590	600	680
IP	380	580	340	550
HS	880	790	600	990
HE	490	650	670	660
AADT	15600		14700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	650	750	590	730
IP	690	780	630	750
HS	750	790	580	740
HE	670	840	620	740
AADT	20400		19200	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	520	210	540	500
IP	390	370	420	500
HS	510	270	550	490
HE	350	390	370	510
AADT	10500		13700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	1090	1070	620	580
IP	860	920	530	530
HS	1410	1030	730	630
HE	930	1170	520	630
AADT	27400		15800	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	440	610	130	290
IP	240	350	90	180
HS	530	660	140	280
HE	250	490	90	180
AADT	10900		4700	

2026	Base Case		Project	
	NB	SB	NB	SB
PM	770	470	410	140
IP	400	290	170	130
HS	1040	540	410	140
HE	570	310	190	130
AADT	12800		5700	

Figure 13: Forecast 2026 Traffic Volumes on Key Links (Warkworth)

3.2.2 Holiday traffic volumes

Traffic volumes in the corridor are much higher during key holiday periods than they are during a typical day. These higher volumes result in congestion on the road network resulting in delays to holiday makers, Warkworth residents and other traffic. To determine the scale of differences in travel patterns between a typical day and holiday periods, we collected traffic count data from the NZTA's TMS database for a typical weekday, and for a holiday peak period. We calculated the holiday AADT by averaging the AADT on the days around public holidays where holiday travel is likely. For example, on Queen's Birthday weekend, Monday is a holiday, so we used the AADT from the Friday prior (Holiday Start) and the Monday (Holiday End) since these are the days likely to experience the greatest demand.

Total traffic flow on holiday days is significantly higher than that experienced on a typical weekday. In the section of SH1 between Pūhoi and Warkworth, the typical holiday AADT is on average 43%[22] greater than the weekday AADT.

Holiday traffic volumes are assumed to increase over time in line with population growth in the Auckland region, which is the primary source of such trips. On this basis, we have assumed additional trips to holiday destinations (above the base matrix used to develop the holiday peaks) to increase by 23% (the forecast Auckland regional population growth from 2011 to 2026) from 2009 to 2026[23].

We developed Holiday Start and Holiday End period models to represent travel during the periods discussed above. Forecast Holiday Start and Holiday End traffic volumes on different parts of the network are shown in Figure 10 to Figure 13 as HS and HE respectively.

3.3 Travel times

Warkworth is currently subject to regular congestion during weekday evening peak periods. This congestion is because there is an increase in both long distance through trips and local traffic travelling home within and through Warkworth during the peak resulting in higher traffic volumes. More severe congestion is experienced at some weekends or during holiday periods, or when incidents occur (such as crashes, slips, etc). This congestion results in increased travel times.

Travel times for northbound traffic at the beginning of a holiday period are significantly higher than on a typical day, as most people leave Auckland after work to travel north to popular holiday destinations. This increase in traffic leads to congestion and an increase in travel time for the northbound direction. A similar but less pronounced spike can be seen in the southbound traffic at the end of a holiday period. Increased congestion can also be experienced throughout the holiday period i.e. on a Saturday morning. However, we have not attempted to quantify these congestion spikes in this assessment.

[22] The following holidays were included: New Year's Day, Waitangi Day, Easter Weekend, ANZAC Day, Queen's Birthday and Labour Day from the years of 2008 and 2009. The Christmas holiday period was excluded since the patterns of travel are difficult to predict as most people are on holiday for an extended period of time over the Christmas period. Weekday traffic was obtained by averaging Thursday AADT data over the two year period.

[23] The Auckland Regional Council population forecasts are given in the Future Forecast Report.

Figure 14 indicates that northbound travel times on Friday 29 January 2010 (the Friday before Auckland Anniversary Weekend) were 70% slower than on a typical weekday. Figure 14 also indicates that southbound travel times on Monday, 1 February 2010 (Auckland Anniversary Day) were 18% slower than on a typical weekday.

The larger increase in Friday afternoon travel time is because most people leave Auckland after work to travel north for the holiday weekend. The southbound increase on the Monday is lower in percentage terms, as people can choose to travel back to Auckland at different times during the day, rather than at a single peak time, such as occurs on Friday afternoons.

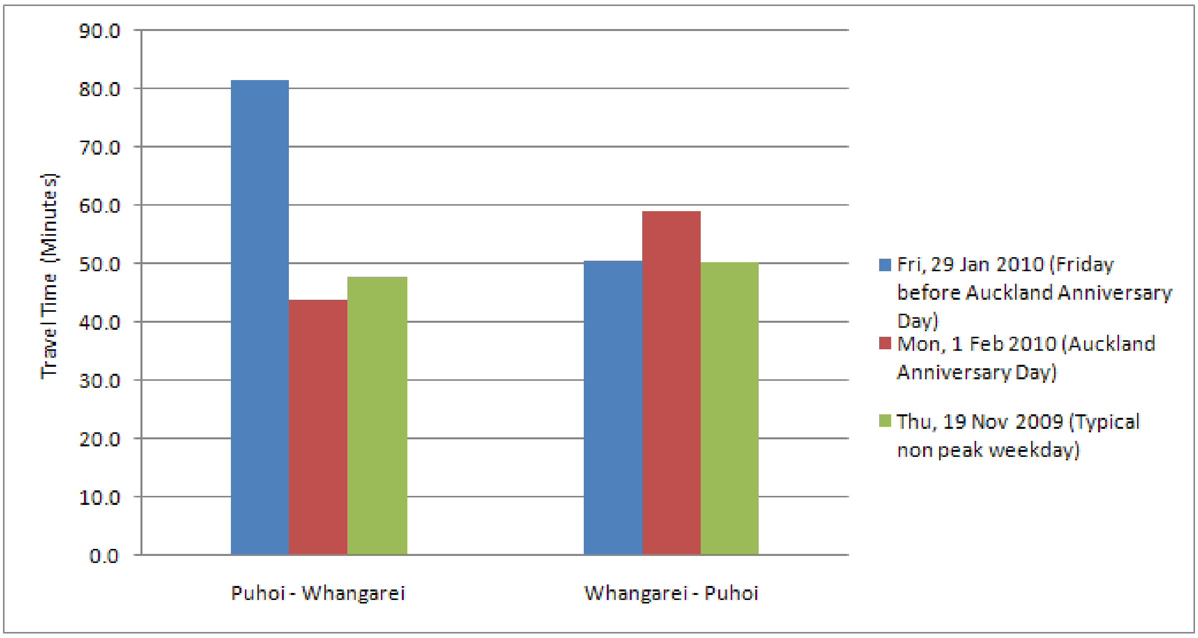


Figure 14: Comparison of Holiday and Typical Day Travel Times[24]

Without the Project in place, travel times in the Pūhoi to Warkworth corridor as a whole are forecast to increase as traffic volumes on SH1 increase in the future. As these travel times increase, the efficiency of general traffic and freight movements in the corridor will reduce. The performance of freight movement is discussed further in Section 3.7 below. As travel times increase, accessibility between Auckland, Warkworth and Northland will reduce.

We have compared the typical travel times in 2009 to those forecasted in the 2026 Base Case along a number of routes within the Project Area in both directions. These routes are shown in Figure 15 and defined below:

- South to Eastern Beaches (from Pūhoi to the Matakana Road / Melwood Drive intersection);
- South to North (from Pūhoi to immediately north of the proposed northern interchange);

[24] These values were calculated by comparing the total non-holiday surveyed travel times between Whangarei and Pūhoi with those collected during the holiday surveys. A total of five runs in each direction were undertaken on each of the surveyed days.

- South to Warkworth Town Centre (from Pūhoi to Queen Street); and
- South to Woodcocks Area (from Pūhoi to the Woodcocks Road / Mansel Drive intersection).

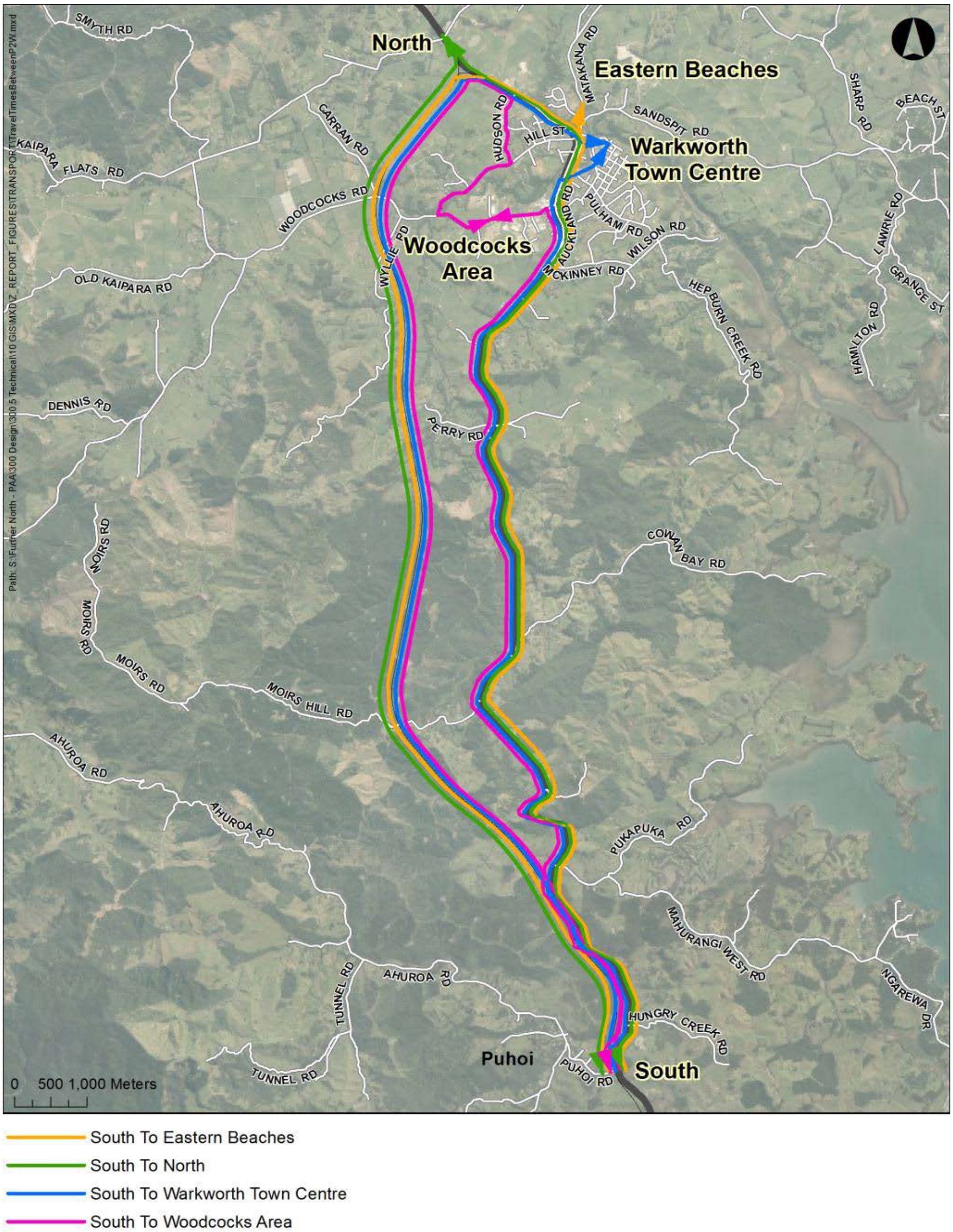


Figure 15: Travel time routes through the Project area

Table 1 shows that without the Project in place, northbound travel times will increase between 14% and 68% across all of the modelled periods. Increases are generally forecast to be over two minutes with some as high as 12 minutes.

Table 2 shows that without the Project in place, southbound travel times will increase between 5% and 78% across all of the modelled periods. Increases are generally forecast to be over three minutes with some as high as 12 minutes.

Table 1: Northbound travel times (minutes) on key routes from south

Northbound from South to:		2009	2026 Base Case		
			2026 Base Case	Absolute change from 2009	% Change from 2009
North	PM	14.3	17.4	3.1	22%
	IP	14.1	16.7	2.6	18%
	HS	19	26.3	7.3	38%
	HE	14.3	17.9	3.6	25%
Warkworth Town Centre	PM	13	15.9	2.9	22%
	IP	13	15.3	2.3	18%
	HS	17.9	30	12.1	68%
	HE	13.2	16.7	3.5	27%
Woodcocks Area	PM	13.1	15.8	2.7	21%
	IP	12.6	14.7	2.1	17%
	HS	17.1	21.4	4.3	25%
	HE	12.7	15.2	2.5	20%
Eastern Beaches	PM	13.9	16.5	2.6	19%
	IP	13.9	15.8	1.9	14%
	HS	18.8	30.6	11.8	63%
	HE	14.1	17	2.9	21%

Table 2: Southbound travel times (minutes) on key routes to south

Southbound to South from:		2009	2026 Base Case		
			2026 Base Case	Absolute change from 2009	% Change from 2009
North	PM	15.4	26.5	11.1	72%
	IP	15.2	21.7	6.5	43%
	HS	15.8	28.1	12.3	78%
	HE	23.2	27.9	4.7	20%
Warkworth Town Centre	PM	13.7	20.5	6.8	50%
	IP	13.5	16.8	3.3	24%
	HS	14.1	20.5	6.4	45%
	HE	18.4	21.3	2.9	16%
Woodcocks Area	PM	13.2	21	7.8	59%
	IP	12.8	16.8	4	31%
	HS	13.6	21.1	7.5	55%
	HE	15.4	21.5	6.1	40%
Eastern Beaches	PM	14.6	21.3	6.7	46%
	IP	14.4	17.7	3.3	23%
	HS	15	21.1	6.1	41%
	HE	22.1	23.3	1.2	5%

Each of the key routes is discussed below. Comparisons are made between the Base Case in 2026 and 2009.

3.3.1 South to North travel times

Without the Project in place, travel times are forecast to increase as traffic volumes on SH1 increase in the future.

3.3.2 South to Warkworth Town Centre travel times

Warkworth Town Centre acts as a key retail and commercial hub supporting the surrounding communities. Without the Project in place, accessibility to and from Warkworth Town Centre is forecast to reduce as travel times to and from Warkworth increase by 2026.

3.3.3 South to Woodcocks Area travel times

Woodcocks Road provides many of the industrial and commercial services within Warkworth and is the location of recent development. Without the Project in place, accessibility to and from the Woodcocks Road area is forecast to reduce as travel times to and from Woodcocks Road increase by 2026.

3.3.4 South to Eastern Beaches travel times

Matakana Road and Sandspit Road provide access to eastern communities of Matakana, Leigh, Omaha, Snells Beach and Sandspit. Without the Project in place, accessibility to and from the eastern beaches is forecast to reduce as travel times to and from Warkworth increase by 2026.

3.3.5 Congestion within Warkworth

We assessed congestion within and through Warkworth using a cordon that enclosed Warkworth; extending from approximately Hudson Road in the north to McKinney Road in the south as indicated in Figure 16. We assessed congestion using the average travel time per vehicle trip within this cordon. Figure 17 shows the average travel times within the cordon, in 2009 and 2026 for the Base Case.

Figure 17 shows that average travel time within the cordon is expected to increase between 2009 and 2026 within Warkworth. For example, compared to 2009, average travel times within the cordon are forecast to increase from 4.5 min to 6 min (an increase of 1.5 minutes or 35%) by 2026 in the PM peak period. Similar increases are forecast across all the modelled periods except the Holiday End peak. This forecast increase in average travel times indicates that congestion within Warkworth will increase without the Project in the future.

During the Holiday End peak, congestion is forecast to reduce as the average travel time within the cordon reduces. This reduction in congestion results from improvements made to the Hill Street intersection in the Base Case (as discussed in Section 2.3.2), which reduces the average travel times for trips coming from Matakana Road.

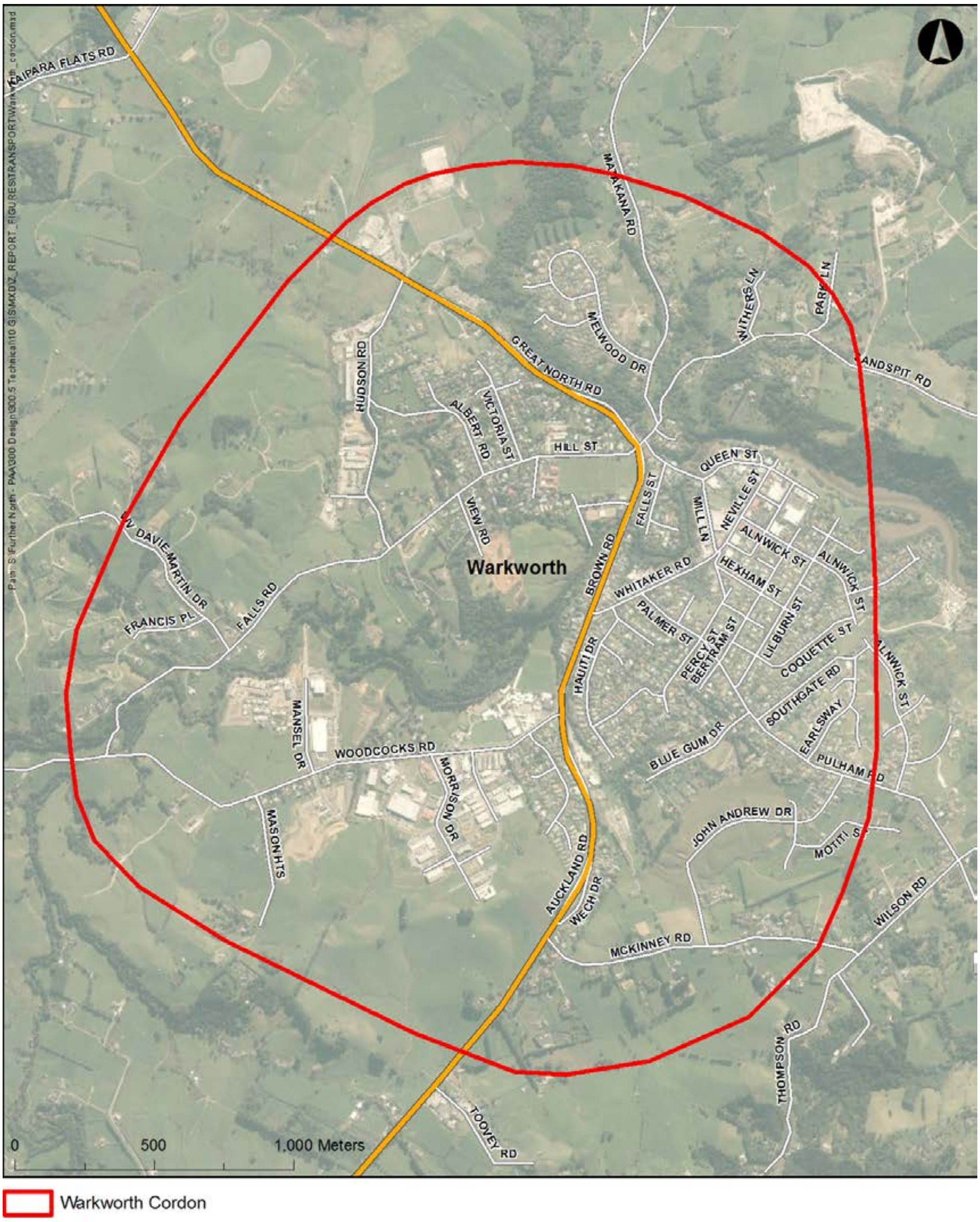


Figure 16: Travel times within Warkworth cordon

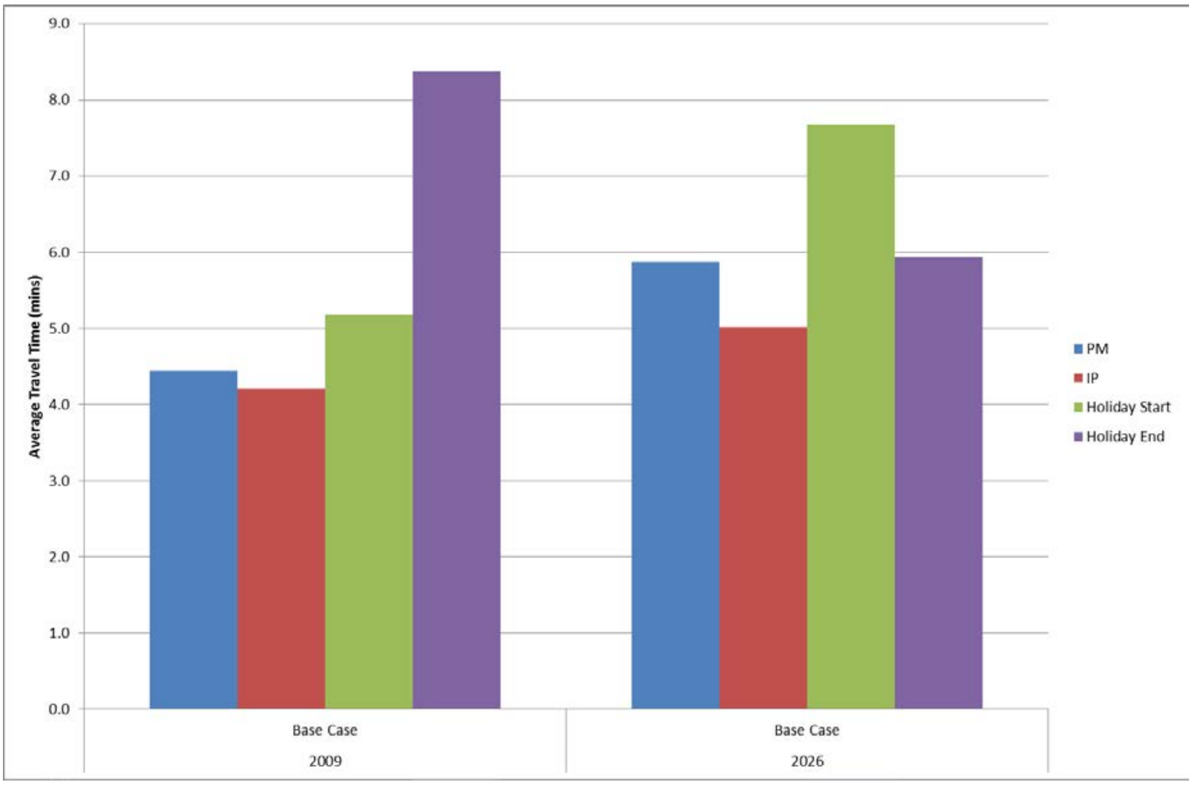


Figure 17: Base Case Warkworth cordon average travel time per vehicle Trip

This analysis shows that as traffic volumes increase, congestion will increase in Warkworth without the Project in place.

3.4 Travel time consistency

Travel time consistency[25] affects both individuals and businesses. At higher levels of traffic demand, travel times and congestion increase significantly. The variability of travel times also increases (reducing consistency). Under such conditions, the consequences of any incidents or disruptions to traffic flow are magnified, with greatly increased travel times. If there is a high degree of inconsistency, people are not able to plan their travel with certainty. They therefore need to allow longer periods of time for their travel to ensure they arrive at their destination by a specific time. Commercial traffic (including freight) must allow longer times in journey planning, therefore reducing the number of movements that can be made by each driver and vehicle, in turn increasing fleet requirements (and therefore freight costs).

The variability or uncertainty of travel times in the Pūhoi to Warkworth SH1 corridor is likely to become more pronounced in the future reducing travel time consistency as traffic volumes, congestion and travel times increase.

[25] Travel time consistency is often referred to as travel time variability or travel time reliability or journey time reliability. As the Project objectives refer to “travel time consistency” this nomenclature has been used throughout this Report.

While anecdotally there are current adverse impacts associated with travel time consistency for general traffic, there is insufficient travel time data on the corridor for light vehicles to analyse travel time consistency in a statistically significant manner. However, over 1,000 commercial vehicle[26] observations are available for the month of November 2012. Figure 18 and Figure 19 show existing data regarding the observed travel times for commercial vehicles between Pūhoi and Warkworth presented by time of day. This data shows that typically commercial vehicle travel times vary between 10 and 25 minutes with an average travel time of 15 minutes from Pūhoi to the north of Warkworth and 16.5 minutes from the north of Warkworth to Pūhoi. The standard deviation[27] of travel time is 1.4 minutes northbound and 2 minutes southbound.

Given the limited passing opportunities within the corridor, much of the general traffic gets caught behind slower moving commercial vehicles. While general traffic can pass slower moving commercial vehicles, there are limited passing opportunities, and travel times along the route are constrained by commercial vehicles. Therefore, we consider that commercial vehicle data also provides a good indication of the scale of variability in travel time for general traffic along the route. We would expect that as traffic volumes on the corridor increase, general traffic will be more influenced by the commercial vehicle speeds due to even more limited overtaking opportunities and the increased likelihood of getting caught behind a slower moving commercial vehicle for a larger proportion of the total journey. The factors described above mean that the variability in general traffic speeds is likely to approach that of commercial vehicles as traffic volumes increase in the future.

[26] Commercial vehicles include HCVs and Light Commercial Vehicles (LCV).

[27] A standard deviation is a statistical measure for normally distributed data sets. One standard deviation either side of the mean travel time equates to 66% of the journeys, where the mean is the measure of central tendency (i.e. the expected travel time).

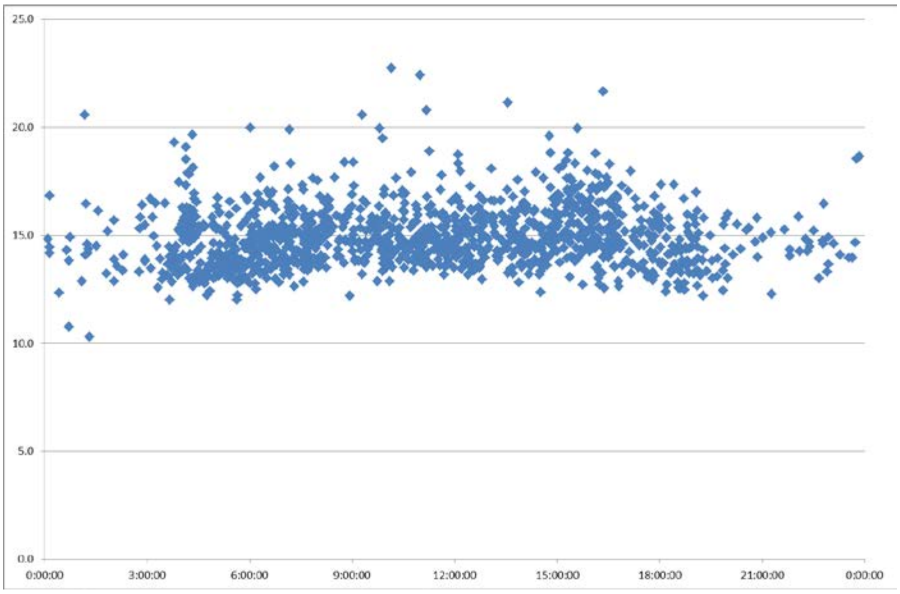


Figure 18: Commercial vehicle travel times by time of day - Northbound Pūhoi to Warkworth

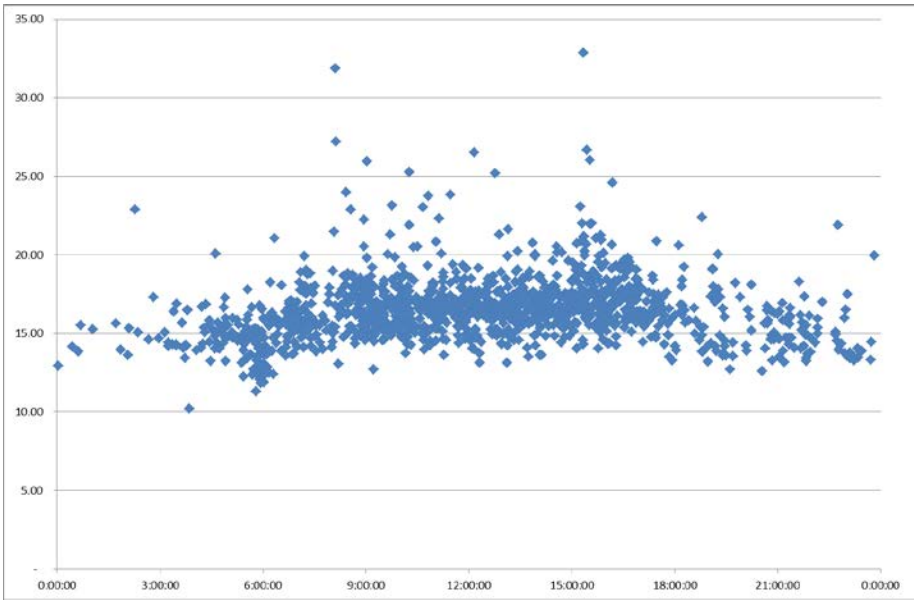


Figure 19: Commercial vehicle travel times by time of day - Southbound Warkworth to Pūhoi

Although not directly forecast by the models (which predict average travel times), it is known that travel time consistency decreases as traffic levels approach the capacity of the network, as expected in this corridor without the Project.

In summary, while it is difficult to determine the exact magnitude of reductions in travel time consistency, our analysis indicates that travel time consistency would reduce considerably in the future without the Project in place as delays increase.

3.5 Crash performance

The section of SH1 between Warkworth and the NGTR has a poor crash history. The section has been assigned a Collective Risk rating of Medium-high in the KiwiRap Risk Maps[28] and is ranked 16th worst in terms of Collective Risk in New Zealand for the 2007 – 2011 period. Although some road safety improvements have been achieved in recent years along the existing SH1 route, the ability to achieve further reductions in the frequency and severity of crashes is constrained by the geometry of the route.

We extracted crash data from the NZTA Crash Analysis System (CAS) database[29] for the existing SH1 between Pūhoi and north of Warkworth. There were 65 injury crashes reported over this section during the 5 year period analysed (2008 - 2012). A further 174 non-injury accidents were reported over the same section and period.

Table 3 summarises the crash severity for the Pūhoi to Warkworth section of SH1 by year.

Table 3: SH1 - Pūhoi to Warkworth 2008 – 2012

Year	Fatal	Serious	Minor	Non-Injury	Total crashes
2012	0	2	9	29	40
2011	0	1	14	37	52
2010	0	3	10	41	54
2009	3	4	6	40	53
2008	1	2	10	27	40
Total	**4**	**12**	**49**	**174**	**239**

[28] KiwiRap Risk Maps and Performance Tracking Report (2012). Risk maps display the safety risk of the State highway network in terms of Collective Risk and Personal Risk. The State highway network is divided into links, which are given a rating and a national rank. Collective Risk and Personal Risk are based on the historical number of fatal and serious injury crashes per length of road and per vehicle-kilometre travelled on that section of road respectively. Historical crash data used for the 2012 Risk Maps was from 2007 to 2011.

[29] NZTA's Crash Analysis System is an integrated computer system that allows users to analyse and map crash data. It contains data from all traffic crashes reported by the Police in New Zealand.

Table 4 below illustrates the total number of injury accidents included in the accident analysis and categorises them by accident type and severity.

Table 4: Injury crashes on SH1 - Pūhoi to Warkworth 2008 – 2012

Type of Accident	Fatal	Serious	Minor	Total injury crashes
Head On	3	3	9	15
Pedestrian	1	0	0	1
Loss of Control	0	4	24	28
Turning / crossing	0	2	5	7
Rear End	0	2	10	12
Overtaking	0	0	0	0
Other	0	1	1	2
Total	**4**	**12**	**49**	**65**

There were 15 head on type injury crashes on this section of SH1 between 2008 and 2012. This crash type is responsible for the largest proportion of fatal and serious injury accidents. Loss of control type accidents resulted in the largest number of injury crashes.

The location of the fatal and serious crashes is shown in Table 5. Only locations that had fatal or serious crashes are shown in the table to help highlight any significant safety issues on the existing SH1. The 1.6km section of road between Valerie Close and McKinney Road has had the most serious and fatal crashes. The one fatal pedestrian crash was within this section approximately 160m north of the SH1 and Toovey Road intersection. Schedewys Hill has a particularly poor horizontal and vertical alignment with two passing lanes on curves that terminate near bends. This geometry has resulted in a large number of minor injury accidents on this relatively short section of SH1.

Table 5: Location of fatal and serious crashes SH1 – Pūhoi to Warkworth 2008 - 2012

Location	Midblock / intersection	Fatal	Serious	Minor	Total
Kaipara Flats Road to Hill Street[30]	M	0	1	2	**3**
Whitaker Road intersection	I	0	1	1	**2**
Woodcocks Road to Wech Drive[31]	M	0	1	0	**1**
McKinney Road to Valerie Close South[32]	M and I[33]	2	2	3	**7**
Valerie Close South to Satellite Station Road[34]	M	0	1	2	**3**
Satellite Station Road to Perry Road[35]	M and I[36]	0	1	2	**3**
Perry Road to Conwan Bay Road[37]	M	0	1	5	**6**
Schedewys Hill[38]	M	0	2	15	**17**
Mahurangi West Road to Hungry Creek Road[39]	M	2	0	3	**5**
Pūhoi Road to Billing Road[40]	M and I[41]	0	1	2	**3**
Pūhoi Road intersection	I	0	1	1	**2**
Total		**4**	**12**	**39**	**55**

[30] Excludes crashes at the intersections of Hill Street and Kaipara Flats Road.

[31] Section of SH1 from: 150 m south of the Woodcocks Road intersection to the Wech Drive North intersection.

[32] Includes crashes at intersections of McKinney Road and Valerie Close North and Valerie Close South.

[33] The majority of the injury crashes are midblock crashes.

[34] Section of SH1 from: 100 m south of Valerie Close South intersection to 100 m north of Satellite Station Road intersection.

[35] Section of SH1 from: 100 m north of Satellite Station Road to 40 m south of Perry Road.

[36] All of the injury crashes were at intersections.

[37] Section of SH1 from: 150m south of Perry Road to 50 m north of Cowan Bay Road.

[38] The Schedewys Hill section is from 300 m north of Mahurangi Road to the intersection with Schollum Access Road.

[39] Section of SH1 from: 50 m south of Mahurangi West Road to 200 m north of Hungry Creek Road.

[40] Section of SH1 from: 100m south of Pūhoi Road to the Billing Road intersection.

[41] No injury crashes were at intersections.

As traffic volumes increase on SH1 in the future, so will the number of crashes. Based on the NZTA Economic Evaluation Manual (EEM) guidance, we forecast the number of crashes by increasing the number of crashes proportionally to the increase in traffic volumes. Increasing the number of crashes proportionally to the increase in traffic volumes is considered to be a conservative approach as it is likely that the number of crashes will rise at a faster rate as SH1 becomes more congested in the future.

The five years up to 2012 had on average 13 injury crashes per year on SH1 between Pūhoi and the proposed northern connection with the Project. We estimate the average number of injury crashes to increase by nine (68%) to 22 by 2026.

3.6 Route security

The existing SH1 route is currently closed a number of times a year as a result of events such as crashes, flooding or slips blocking the road. By way of an example, information provided by the NZTA's network contractor indicates that in the 10 years from 2003 - 2012, SH1 between Pūhoi and Warkworth was closed for a total of approximately 64 hours due to 21 crashes.

The existing SH1 route is vulnerable to long-term closure after a major natural event such as major slips and flooding. While SH16 provides an alternative to SH1, it is some distance from the corridor and its use would significantly increase travel times. For example, in order to use SH16 between Warkworth and Auckland it would be necessary to use Woodcocks Road / West Coast Road to travel more than 20km east to west on low capacity and low standard roads before accessing SH16 to head south.

3.7 Road freight performance

The SH1 corridor has an important freight function, providing freight access between Auckland and Whangarei. Freight movements are likely to grow significantly in the future according to the National Freight Demands Study (NFDS)[42]. That Study estimated the pattern of inter-regional freight movements for 2006/2007 and predicted the pattern for 2031.

The freight volumes by mode between Northland and Auckland for 2006/2007[43] indicate that road freight is the dominant mode with a mode share of 86% compared to rail and coastal, which had mode shares of approximately 3% and 11% respectively.

The volumes of freight originating or terminating in Northland for 2006/2007[44] also had road freight as the dominant mode with a mode share of 67% compared to rail and coastal, which had mode shares of 2% and 31%. The higher mode share for coastal shipping is due to the exports of wood products from Northland to other regions and also the crude oil imports coming from Taranaki.

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[42] National Freight Demand Study, prepared by Richard Paling Consulting for the Ministry of Transport, NZTA and the Ministry of Economic Development, September 2008.

[43] Adapted from Table 4.2, 4.3, 4.5 and 4.6 of the NFDS.

[44] Adapted from Table 4.2, 4.3, 4.5 and 4.6 of the NFDS (excludes movements originating in Northland).

The NFDS expects that by 2031, freight volumes between Northland and Auckland will increase by 84% to 8.98 million tonnes[45]. It also predicts that freight movements originating or terminating in Northland will increase by 51% to 13.2 million tonnes.[46] Not all Northland freight is destined for, nor produced in, Auckland which explains the difference in these numbers.

The Strategic Context Report[47] concluded that for rail freight in the corridor: *"There is little scope to transfer significant volumes of additional freight from road to rail as the main commodities using rail (dairy, forestry and cement products) are already at capacity. Passenger rail in Auckland also limits line capacity and there is limited potential for increased freight capacity with resources currently available."*

Freight and passenger services share the rail infrastructure through central Auckland. There are limited train slots available and as passenger services increase this will become exacerbated. There is limited opportunity for additional rail freight capacity increases. A potential Avondale - Southdown link in the future could reduce some of these constraints for trains travelling from the north to south of Auckland however that project is not currently funded.

The ability of rail to accommodate other commodities is also limited due to clearances on the North Auckland Line particularly through many of the tunnels. Some of these tunnels limit the container size that can be transported on the rail line. The NFDS expects that in the future, if Marsden Point was to become a major container port, significant expenditure would be needed to replace the Makarau tunnel and improve many of the other 12 tunnels on the route. The rail line is also a single track, which would limit capacity in the future. KiwiRail is currently assessing the viability of the North Auckland Line, the running cost of which is currently very high compared to its earnings.[48]

There is also limited ability for coastal shipping between Northland and the rest of the country to grow. The Independent Technical Ports Study[49] assessed the current and future freight demand for ports and port related infrastructure in the Upper North Island over the next 30 years. It predicted that growth of the Whangarei Ports would be slow compared to that experienced at the Port of Auckland and Port of Tauranga. The study explained that: *"This is because the faster growing transhipping element is not expected to be a feature for the Whangarei ports due to the dominance of bulk cargo. Furthermore, growth in Northport's main cargo, unprocessed logs, is expected to be flat after 2020…"*

[45] Figures adapted from Table 4.5 and 9.20 of the NFDS.

[46] Figures adapted from Table 4.5 and 9.20 of the NFDS (excludes movements originating in Northland).

[47] Auckland to Whangarei Strategic Assessment: Strategic Context Report, NZTA, July 2010.

[48] New Zealand Herald article, 2011, http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10706674, accessed 9 July 2013.

[49] How can we meet increasing demand for ports in the Upper North Island? A report for the Upper North Island Strategic Alliance, PWC, November 2012.

In 2012 HCV volumes on SH1 between Pūhoi and Warkworth were in the order of 6 - 7% of the total traffic volumes (approximately 1,200 vpd). [50] Through the Warkworth town centre the HCV volumes were in the order of 9% (approximately 1,600 vpd).[51]

We expect that freight volumes between Auckland and Northland will grow significantly, with road providing the majority of capacity within the corridor. We expect that the daily HCV volumes on SH1 between Pūhoi and Warkworth will increase at least in line with the general traffic growth in the corridor. Based on the forecast general traffic volumes, we expect daily HCV volumes on SH1 between Pūhoi and Warkworth to increase from approximately 1,050 vpd in 2009 to be in the order of 1,830vpd in 2026.[52]

As noted in Section 2.2, we have not forecast HCV volumes directly. It is difficult to forecast commercial vehicle growth and distribution as they are dependent on a number of factors, including land-use and economic growth. Instead, for the base forecasts used in this assessment, we have forecast heavy vehicle trips to grow at the same rate as general traffic.

To confirm the validity of this approach, we have considered the forecast growth in HCVs in a number of ways:

- A linear extrapolation of historic growth at the NZTA count site at Pohuehue Viaduct, gives an average HCV growth rate over the last 10 years of 4.9% per annum which would result in an HCV volume in the order of 1,926 by 2026;
- A 51% increase in freight between 2006 and 2031 (2.1 % per annum) in line with the NFDS, would result in traffic volumes growing to approximately 1,360 by 2026 assuming freight mode share remains constant. As discussed above there are several factors that may limit the growth of rail freight and coastal shipping. If all the growth predicted by the NFDS was to be carried by road[53] (i.e. no rail or coastal shipping growth) then traffic volumes would grow to approximately 1,590 by 2026 (3.2% per annum); and
- The Transport Engineering Research New Zealand report produced in 2006 confirms that a "strong link between New Zealand's Real Gross Domestic Product (RGDP) and truck kilometres travelled has been demonstrated. This means that if New Zealand's economic growth were to be maintained, then a corresponding growth in heavy vehicle traffic of 1.35 times RGDP can be expected."[54] Using this relationship, a 4.4% growth in HCVs, as assumed in the Base Case, would imply a long term RGDP growth of 3.2%. The New Zealand RGDP growth has slowed during the global financial crisis from a peak of approximately 6% in the early 2000s but has risen again to 2.7% in the fourth quarter of 2012.[55] RGDP is difficult to forecast due to the

[50] Based on NZTA's TMS counts measured at the count sites at Pohuehue Viaduct and North of Hungry Creek Road.

[51] Based on NZTA's TMS counts measured at the count site south of Hill Street.

[52] Based on the SATURN model forecasts north of Schedewys and the HCV percentage from NZTA's TMS count site at Pohuehue Viaduct.

[53] The NFDS does not forecast growth by mode – only the total freight task by all modes.

[54] Prediction of New Zealand's freight growth by 2020, Transport Engineering Research New Zealand Ltd (TERNZ), March 2006, page 27.

[55] Statistics taken from the Reserve Bank of New Zealand, http://www.rbnz.govt.nz/statistics/key_graphs/real_gdp/ accessed 9 July 2013.

large number of factors, however a growth of this rate appears to be reasonable, particularly given the NZTA's current objectives for the Pūhoi to Wellsford RoNS, which include enhancing economic growth and improving freight movements between Auckland and Northland.

This analysis gives some comfort that the HCV forecasts are of the right order. In any case, we consider that variation in HCV growth would be unlikely to have a material impact on this assessment.

The geometric alignment of the current SH1 influences HCV performance considerably at present. Schedewys Hill is a good example of this. A series of tight horizontal curves with speed advisory signing between 35kph and 65kph means that HCVs need to slow down to travel through the corners. At the same time, there are steep vertical grades. Vehicles that have slowed for horizontal curves then need to climb up these steep sections further loosing speed.

For example, vehicles travelling northbound from the bottom of Schedewys Hill must slow down for the 65kph corner at the start of the assent within the passing lane provided. They then decelerate from 65kph as they climb the over 8% grade to the 35kph corner at the end of the passing lane. A typical large loaded truck would decelerate to a terminal speed of approximately 30kph over approximately 400m.[56] From that point the truck would continue to travel slowly up the second passing lane to Schollum Access Road unable to accelerate further. The grade then levels out somewhat to approximately 3 – 4% for the continued climb up Windy Ridge to Moirs Hill Road where the truck would be able to accelerate back up to approximately 60kph before the next posted 75kph corner near Moirs Hill Road.

Similarly in a southbound direction a truck travelling up the approximately 6% Pohuehue Viaduct grade will slow to a terminal speed of approximately 40kph after approximately 1km before continuing to climb to the top.

More powerful or more lightly loaded HCVs find it difficult to pass other HCVs because of the low differential in speeds between the vehicles. They therefore get stuck behind slower vehicles impacting on travel times and reducing efficiency as drivers are less able to choose their optimum speed. HCVs also have to travel slowly downhill as well. Typically, downhill speeds are in the same order as uphill speeds. For example a truck travelling in the northbound direction down the approximately 6% Pohuehue Viaduct grade will slow to a terminal speed of approximately 40kph before continuing down the grade.

These factors mean that HCVs are currently slowed considerably by the geometric alignment of SH1. Figure 20 and Figure 21 show the average commercial vehicle travel speeds between Watson Road access and the top of Schedewys Hill in November 2012. These speeds are for both HCVs and LCVs. As can be seen, the average northbound speed is in the order of 62kph while the southbound speed is in the order of 66kph.

[56] Austroads Guide to Road Design, Part 3: Geometric Design, 2009. Figure 9.3 provides determination of truck speeds on grade, for a 19m semi-trailer (42.5t), 12 l diesel carrying a maximum load (7.5kW/t). These figures have been used to estimate truck speeds as described throughout this section.

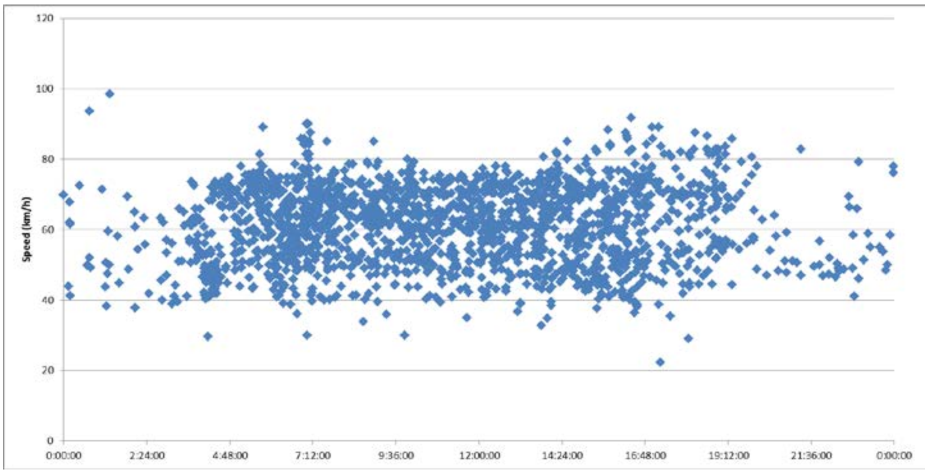

Figure 20: Average commercial vehicle travel speeds northbound from Watson Road access to the top of Schedewys Hill

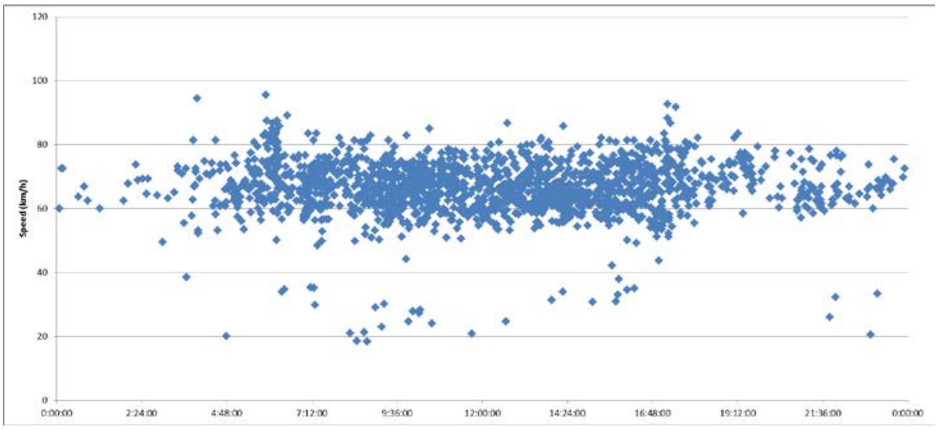

Figure 21: Average commercial vehicle travel speeds southbound from the top of Schedewys Hill to Watson Road access

Given the limited passing opportunities within the corridor, we would expect that as traffic volumes on the corridor increase, the likelihood of all vehicles getting caught behind a slower moving commercial vehicle for a larger proportion of the total journey would also increase.

The consistency of travel times for commercial vehicles over the length of SH1 from Pūhoi to north of Warkworth is discussed in Section 3.4. There is currently a relatively wide distribution of travel times for commercial vehicles in the corridor. This wide distribution is in part due to the different power to weight ratios of the commercial vehicles and whether they are heavily loaded or not. It is also a factor of the limited passing opportunities. In a similar way to general traffic, it is expected that travel time consistency for commercial vehicles will reduce over time as traffic volumes increase. However, given that HCVs are already constrained by the geometry of SH1 and their power to weight ratios, consistency will likely reduce at a slower rate than for general traffic as volumes increase.

A review of the crash data described in Section 3.5 indicates that HCVs were involved in approximately 6% of the injury crashes on SH1 between Pūhoi and Warkworth. HCVs make up about 7% of the traffic volumes so are not considered to be over represented in the crash history.

3.8 Public transport network performance

Intercity and Nakedbus bus services operate at a rate of three buses per day in each direction between Whangarei and Auckland during the week, with additional services on weekends. These buses will stop at Warkworth, Wellsford and Kaiwaka for pre-booked passengers. These services are unlikely to be used by local residents for commuter travel due to their limited frequency.

A large number of tourist shuttle services operate between Auckland and destinations to the north including Warkworth, Matakana, Mangawhai, Whangarei, Bay of Islands, 90 Mile Beach and Cape Reinga.

The Draft Auckland Regional Public Transport Plan[57] details the public transport services that Auckland Transport proposes for the region over the next 10 years. A service from Warkworth to the Silverdale Park and Ride station has been included in that plan. The proposed frequencies (in minutes) for the service are shown in Table 6.

Table 6 Warkworth to Silverdale proposed bus service frequencies

Route	Mon-Fri Peak Frequency	Mon-Fri Off-Peak Frequency	Mon-Fri evening Frequency	Sat Frequency day/evening	Sun Frequency day/evening
Warkworth to Silverdale Park & Ride	60	120	120	120	240

These bus and shuttle service use the existing SH1 and are therefore subject to the same road performance conditions as general and freight traffic as described above. Without the Project the travel times are expected to increase as traffic volumes and congestion increases.

The KowhaiConnection is a bus service between Warkworth and Matakana via Snells Beach that runs a limited daily service and provides a number of options for boarding and alighting.

While there is a railway line between Auckland and Wellsford and Whangarei, it is some way from the SH1 corridor and does not provide access to Warkworth. The railway line can be seen on Figure 2. This rail line was closed to passenger services by the 1970s and has not been used by regular passenger services since. The rail passenger service now only extends as far north as Waitakere Station. Given the investment that would be required for a passenger rail option to provide an attractive route for a significant number of passengers travelling between Auckland and

[57] Draft Auckland Regional Public Transport Plan, Auckland Transport, 2012. In March 2013 the Auckland Transport Board endorsed changes to the plan as a result of the public hearing process. Auckland Transport is currently undertaking local consultation which is expected to be finished in late 2014.

Northland, and the pressures for investment in the rail network elsewhere, the rail line is unlikely to provide any significant capacity for passengers in the foreseeable future.

3.9 Pedestrian and cycle network performance

There is a limited amount of data available in relation to walking and cycling in the Project Area. Given the large distances between centres, there is limited opportunity for walking or commuter cycling between centres. Recreational cyclists do however use the existing SH1.

Walking and cycling are important modes within Warkworth itself. Parts of the Warkworth community suffer from physical severance and problems of accessibility arising from the barrier represented by high volumes of through traffic on SH1. Community facilities and businesses are separated from residential areas by SH1. Crossing SH1 involves detours, delays and safety concerns. There are schools on the western side of SH1 (Mahurangi College and Warkworth Primary School with enrolments of 550 and 1250 students respectively[58]) and many students must cross the existing SH1 to access their homes and the Warkworth town centre to the east.

SH1 through Warkworth is shown on the Regional Cycle Network Plan as an existing cycle route, while potential future routes are shown along:

- Matakana Road to Leigh and Omaha;
- Sandspit Road and Mahurangi East Road;
- Woodcocks Road from SH1 to Falls Road;
- Whitaker Road, Palmer Street, Pulham Road, Wilson Road South and McKinney Road; and
- Hudson Road and Hills Street

The NZTA has been developing and upgrading the walking and cycling facilities in Warkworth as part of recent intersection improvements along SH1. These improvements have included some on street and some shared path facilities through Woodcocks Road and Whitaker Street intersections. The proposed improvements at Hill Street and Hudson Road will extend these treatments further and the NZTA is currently developing plans for facilities between these intersections. These improvements have made (and will continue to make) walking and cycling safer and more convenient in Warkworth.

As Warkworth grows, the demand for walking and cycling will also grow. At the same time, traffic volumes on SH1 are forecast to increase significantly. For example, under the Base Case scenario, traffic volumes on SH1 through Warkworth north of Woodcocks Road are forecast to increase some 53% to 27,400 vehicles per day by 2026.[59] An increase in people walking and cycling and an increase in traffic volumes will increase exposure between the modes and is likely to result in increased conflicts. While there is no history of crashes involving pedestrians and cyclists on the route or through Warkworth, the safety risk is likely to increase.

[58] Enrolments are from http://nzschools.tki.org.nz/. Accessed on 21 May 2013.

[59] Based on the SATURN model forecasts at the location South of Whitaker Road.

4. Assessment of operational effects

Assessment of operational effects

The Project is a new four-lane dual carriageway road, designed and constructed to motorway and the NZTA's RoNS standards. This road will provide a much higher quality alternate route, with improved journey times and safety.

We forecast daily traffic volumes in the corridor as a whole to grow at a rate approximately 1% per annum higher under the Project scenario compared to the Base Case, as a result of induced demand for travel. However, we predict that the Project will significantly reduce daily volumes on the existing SH1, due to traffic electing to use the new route. We expect daily traffic volumes on SH1 between Pūhoi and Warkworth to reduce in the order of 10,500 vpd (40%) to 14,500 in 2026 compared to the Base Case.

We identified a number of transport issues with the existing environment for the Base Case, which are set out above. The Project has been specifically developed to address many of these issues. We discuss the effects of the Project below:

i. Travel times and congestion

The provision of a new motorway standard four-lane alignment will reduce travel times and allow journeys to be planned with a greater level of certainty around travel times. The Project will reduce congestion and travel times between Pūhoi and the north during typical peak periods. This benefit will be received by both general and freight traffic. The Project will also improve travel times during the holiday periods, when large delays are currently experienced.

Travel times on both the existing SH1 and on the Project to and from the north of Warkworth will be significantly faster than the Base Case travel time on SH1. For example, we forecast travel times in the PM peak southbound on the Project in 2026 to be 16 minutes (60%) faster than the Base Case travel time on SH1.

ii. Consistency of journey times

Significant reductions in regular congestion and the effects of random incidents means that the Project will virtually eliminate travel time variability for travel between Pūhoi and north of Warkworth. This is an important benefit of the Project, enabling individuals and businesses to plan their travel with a much greater degree of certainty. Consequently, the Project will provide a much more robust network that can cater for some disruption without significant increases in travel time.

Travel time consistency for freight traffic will improve, as the result of reduced congestion, improved geometric alignment and improved passing opportunities.

By reducing travel times and improving travel time consistency during all time periods, the Project will remove deterrents to travel in the corridor. The Project will consequently improve accessibility between Auckland, Warkworth and Northland.

iii. Crashes

Although volumes in the corridor will increase over time, many of the increased trips will be on the Project. The Project will be constructed to modern motorway standards and will have an improved crash performance compared to the existing SH1. We forecast the average annual number of injury crashes in the corridor to decrease from 22 to 17, a decrease of 5 (23%) in 2026 when compared to the Base Case. As a result, the Project will have a positive effect on road safety.

iv. Route security

The introduction of a high quality parallel alternative route to SH1 will significantly reduce the effects of incidents (crashes and natural events such as slips and flooding) on travel through the Pūhoi to Warkworth corridor.

v. Freight movement

All of the benefits detailed above for general traffic (reduced travel times, improved route quality and safety, resilience and travel time consistency) will also be experienced by commercial freight traffic. Freight vehicles will experience even greater benefits than general traffic in terms of travel time improvements, given the challenges heavy vehicles currently face with the tight horizontal and steep grades on the existing SH1. Heavy vehicles will benefit from additional passing opportunities, higher speed horizontal curves and reduced grades on the Project route.

vi. Other Modes

The Project will have a minimal but positive impact on existing or potential public transport service performance. The same performance improvements forecast above for general traffic will be enjoyed by existing or improved public transport services.

The much lower volumes of traffic along the existing SH1 route will improve safety and amenity for vulnerable road users and create opportunities for measures to encourage walking and cycling. Such changes are consistent with the new local function of the route.

The reduction in traffic volumes will also improve recreational cycling amenity along the rural highway corridor between Pūhoi and Warkworth. The Project will reduce crash risk by reducing the exposure of cyclists along this section.

As the Project will remove a significant amount of traffic from SH1 through Warkworth, it will improve walking and cycling amenity in Warkworth and reduce potential conflicts between modes. Parts of the Warkworth community will also benefit from improved levels of connectivity, accessibility and safety, thereby reducing physical severance.

In this section, we forecast the performance of the transport network in the future for a “Project” scenario, which assumes that the Project was constructed. We then compare that scenario to the Base Case to understand the effects of the Project’s operation.

4.1 Traffic volumes

4.1.1 General traffic volumes

The typical daily forecast traffic volumes on SH1 and the Project route between Pūhoi and Warkworth for both the Base Case and Project scenarios are shown in Figure 22. The total corridor volume is the combination of the volumes on the existing SH1 and the Project.

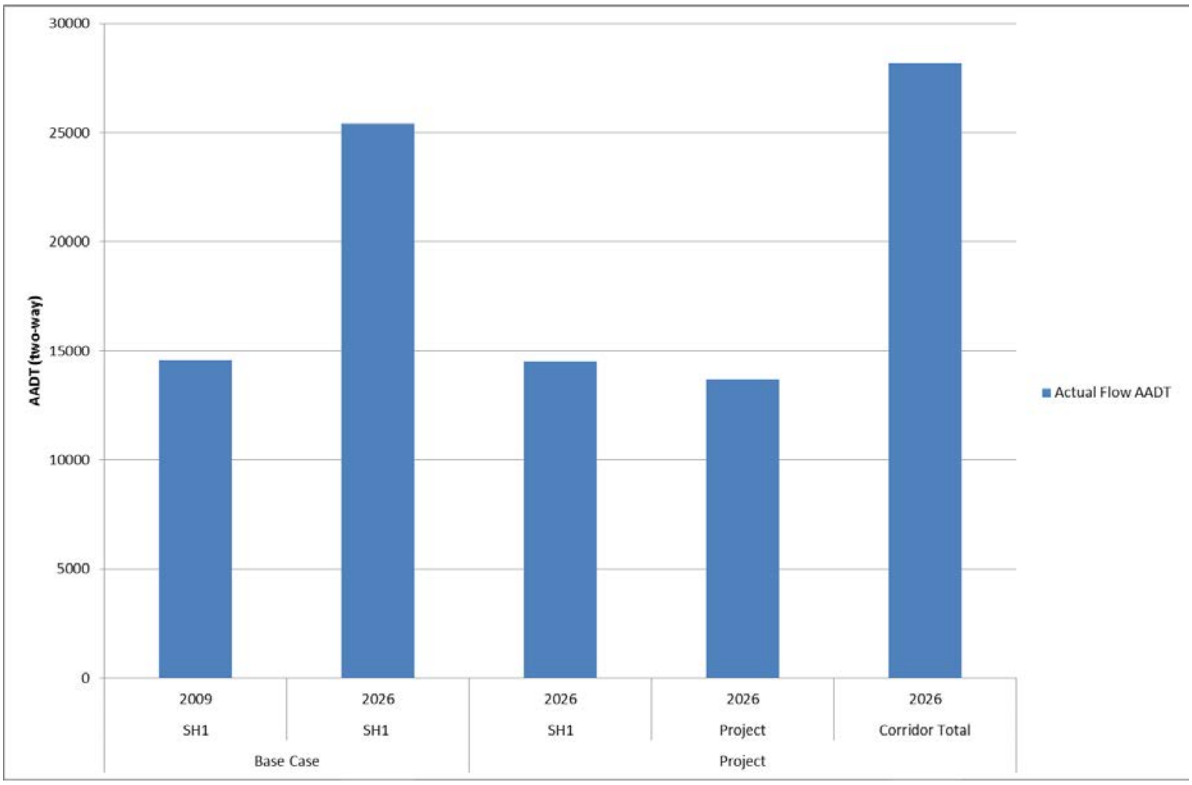

Figure 22: Traffic volumes between Pūhoi and Warkworth

Daily traffic volumes in the Pūhoi to Warkworth corridor as a whole are assumed to grow at a rate 1% per annum higher under the Project scenario compared to the Base Case. This difference is a result of the additional capacity provided by the Project and the induced traffic effects of the Project as described in Section 2.4.

However, the daily volumes on the existing SH1 are expected to reduce significantly. We forecast that about half of all traffic will elect to use the Project alignment rather than SH1. Daily traffic volumes on SH1 between Pūhoi and Warkworth are expected to be in the order of 14,500 vpd in 2026. This is 10,500 vpd (40%) less compared to the Base Case.

Traffic volumes on the Project between Pūhoi and Warkworth are expected to be in the order of 14,000 vpd in 2026.

Forecast traffic volumes on key parts of the network for the Base Case and with the Project in place in the different modelled periods are shown in Figure 10 to Figure 13.

Traffic volumes generally reduce on all parts of the network as a result of the Project. The key exceptions, (where any increases are more than 60 vph / more than 1 vehicle per minute) in the PM or Inter peak periods, are discussed below.

SH1 north of the Project northern interchange:

North of the Project, two-way traffic will increase by 2,800 vpd (16%) to 20,100 vpd in 2026. This is as a result of the additional capacity provided by the Project and the induced traffic (refer to Section 2.4.1) expected under the Project scenario. From a capacity perspective, this increase in volume is forecast to have a minor impact on the performance of SH1 north of Warkworth.

Forecast travel times between Warkworth and Wellsford are shown in Figure 23 and Figure 24. As can be seen, the additional traffic north of Warkworth has very little impact on travel times; the exception being northbound travel times in the Holiday Start and southbound travel times in the Holiday End periods. This is a minor adverse effect for relatively few holiday periods each year. However, the scale of this adverse effect is reduced further when considering that many of the people making this journey will have travelled the whole length of the route from Auckland. For example, if they travel the whole route, they will have had a 15.5 minute reduction in their travel time from Pūhoi to Warkworth as a result of the Project in the Holiday Start period.

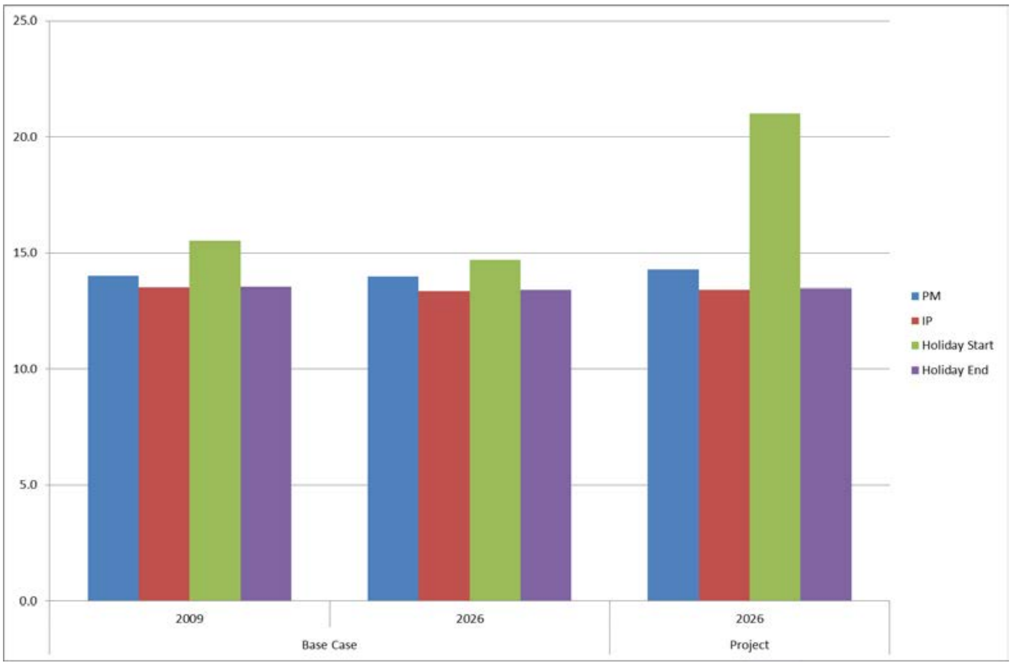

Figure 23: Northbound travel times between Warkworth and Wellsford

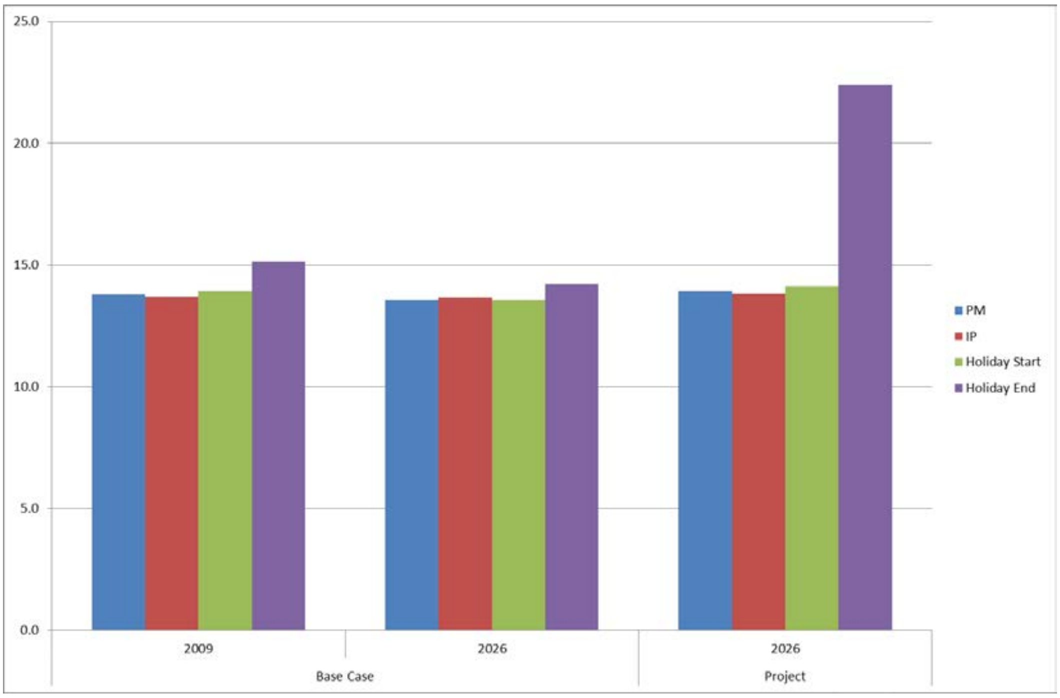

Figure 24: Southbound travel times between Warkworth and Wellsford

As traffic volumes increase in the future, it will be more difficult to make turning movements at intersections north of Warkworth. As part of its management of the State highway network, the NZTA will monitor the performance of intersections along this route and make improvements to intersections as required for capacity and safety reasons. These improvements may involve the installation of right turn bays at the more heavily trafficked intersections. General traffic growth will be the driver for any changes required over this length of SH1 irrespective of whether the Project is in place or not. If the induced traffic does eventuate as a result of the Project, it may simply accelerate the need for the NZTA to consider improvements or move forward with the Warkworth to Wellsford section of the RoNS.

The Project design has allowed for the upgrade of the Kaipara Flats Road intersection immediately north of the proposed Project tie-in with SH1 with the provision of a right turn bay. Delays at this intersection will increase because of the traffic growth assumed to be induced by the Project (refer Section 2.4.1). Average delay at the intersection will remain at five seconds in the PM peak in 2026. However, delays for the through and right turn movements from Kaipara Flats Road will increase even with the installation of a right turning bay. The average delay for these movements is forecast to increase from 20 seconds in 2013 to approximately two minutes in the PM peak in 2026 with the Project. Given the low volume of traffic forecast to be making these movements (22 veh/hr combined in the PM peak) we consider this negative effect on delay at the intersection to be minor.

When the Warkworth to Wellsford section of the RoNS go ahead, any negative effects for through and right turn movements from Kaipara Flats Road would be relieved and would in fact become positive.

This increase in traffic volumes north of Warkworth also means that there will be additional traffic on the route north through the Dome Valley. The Dome Valley has a poor crash history. The impact of this additional traffic on crash performance is discussed further in Section 4.4.

Hudson Road:

As described in section 2.4.1, we anticipate that when the Project is in place, the land closest to the northern interchange will become more attractive. On this basis, we reallocated all the growth around Woodcocks Road to zones adjacent to Hudson Road (refer Section 2.4.1). This has resulted in two way increases in traffic volumes between the Base Case and the Project scenario of 6,100 vpd (77%) to 14,000 vpd on the section of Hudson Road from SH1 to Albert Street in 2026. The SH1 / Hudson Road intersection is about to be signalised (due for completion in 2013). Given the low base volumes and commercial nature of the adjacent land-uses, we do not consider there will be any adverse effects from this increased volume of traffic.

In saying that, any effect from increased traffic would be a result of the land-use assumptions made rather than as a result of the Project itself. Section 4.10 details a number of sensitivity tests we have undertaken. One of these tests was to see what the effects of the Project would be if the relocation of growth north to Hudson Road did not eventuate. As can be seen in Table 9, if the land-use did not relocate to Hudson Road, volumes on Hudson Road would be very similar between the Base Case and the Project scenario. Another sensitivity test assumed that the 1% induced traffic did not eventuate. Under that scenario, there is almost no increase in volumes on Hudson Road compared to the Base Case.

This sensitivity analysis indicates that Auckland Council has the ability to manage land-use growth in the Warkworth area through its planning processes to ensure that the transportation effects of any land-use changes are properly addressed.

SH1 between Hudson Road and the new northern interchange:

We forecast there to be a two-way increase in traffic volumes between the Base Case and the Project scenario of 4,700 vpd (24%) to 23,900 vpd in 2026 on this section of SH1. This increase is partly as a result of the additional growth assumed adjacent to Hudson Road described in the paragraphs above, and partly as a result of changed traffic patterns as a result of the Project. Vehicles accessing the Project from Warkworth or the eastern beaches that used to travel south on SH1 through Warkworth, now travel north to access the Project alignment to travel south via the northern interchange.

This section of road provides access to agricultural land-uses and trade and contractor yards. When the Project is complete and the Hudson Road intersection improvements are complete, the section of SH1 from the northern tie-in to Hill Street will have a different character. The alignment will change so that all traffic is directed through the northern interchange roundabout. There will be a reduction in speed limit to allow the Hudson Road signals to operate efficiently.

We recommend that prior to the completion of the Project, the NZTA develop a management strategy for the section of SH1 from the northern interchange to Hill Street. This strategy might include the closure of the northbound passing lane north of Hudson Road, a revised speed limit for this length and treatments such as painted flush medians to cater for adjacent land-uses and reinforce the lower speed and more urban environment.

Hill Street:

We forecast a two-way increase in traffic volumes between the 2026 Base Case and the Project scenario of 3,200 vpd (30%) to 13,700 vpd on Hill Street. This increase is partly as a result of the induced traffic growth in the corridor and the relocation of growth from Woodcocks Road to the Hudson Road area (refer Section 2.4.1), and partly as a result of changed traffic patterns as a result of the Project.

Additional traffic past the Warkworth Primary School on Hill Street is undesirable because it would increase potential conflicts with school children. There would be an increase in traffic as children are picked up and dropped off at the start and end of the school day. While we have not modelled explicitly a “school” peak period that would model this increase in volumes, the Inter peak is a representation of a typical hour between the morning and evening peak periods. We have therefore focused the analysis on the Inter peak period to draw our conclusions.

There is a large increase in traffic forecast between 2009 and 2026 in the Base Case on Hill Street without the Project in place. Even without the Project, two-way traffic volumes on Hill Street are forecast to increase by 620 veh/hr (885%) to 760 veh/hr by 2026 in the Inter peak. This is a large change and we would expect that as traffic volumes increased the NZTA and Auckland Transport would normally undertake a review of road safety associated with Warkworth Primary School and develop a management strategy to reduce the potential for any additional safety issues to arise. For example this strategy might involve education programmes, additional speed management or improved crossing facilities. The NZTA and AT have confirmed that they will undertake such a review if traffic volumes on Hill Street continue to rise.

With the introduction of the Project, we forecast two way volumes on Hill Street to increase a further 160 veh/hr (21%) past the school in the Inter peak period. This increase is in the order of 2.5 additional vehicles each minute travelling past the school, on average. The increase in traffic as a result of general traffic growth in Warkworth will mean that measures to address the safety implications of additional traffic will be required irrespective of the Project. We consider that this additional level of increased traffic can be managed safely.

The increase in traffic along Hill Street is not a direct result of the Project itself but rather the land-use changes that are assumed in the Project scenario. The limited effect of the project itself and the larger impact of the land-use changes are highlighted by the sensitivity tests detailed in Section 4.10. If the land-use growth was to remain in the Woodcocks Road area, the volumes on Hill Street would be almost identical to the Base Case.

During the school peak period, people will also modify their travel behaviour. Because they know that school traffic will make this route congested, it is likely that people will reroute away from Hill Street. Traffic will be able to use Woodcocks Road or Hudson Road as an alternative to access to SH1 or travel to Warkworth Town Centre.

We also forecast a corresponding decrease in traffic through the majority of the rest of Warkworth with the Project in place, which has benefits for school students. For example, students who currently cross or walk along SH1 north of Woodcocks Road will have an improved situation as two way traffic volumes are forecast to reduce there by 720 veh/hr (40%) in the Inter peak.

While we consider that the increase in volumes on Hill Street as a result of the Project would only have a minor potential for adverse effects on road safety, we expect that prior to opening the Project or significant uptake of additional development adjacent to Hudson Road, the NZTA and Auckland Transport would undertake a review of road safety associated with Warkworth Primary School.

SH1 South of Pūhoi:

We forecast a two-way increase in traffic volumes between the 2026 Base Case and the Project scenario of 5,000 vpd (35%) to 19,300 vpd on the NGTR. This increase is partly as a result of the induced traffic. However, the major reason why volumes are forecast to increase on the NGTR is because only south facing ramps are provided at Pūhoi. This means that the NGTR must be used to access the Project in a northbound direction as no northbound onramp is provided at Pūhoi. Similarly, vehicles travelling southbound on the Project cannot avoid the NGTR by exiting SH1 and using Hibiscus Coast Highway as no southbound off-ramp will be provided at Pūhoi.

The toll on the NGTR is assumed to remain constant in real terms, however people with destinations in Warkworth and further north will enjoy a significantly larger travel time saving using the NGTR and the Project alignment. As a result, more people are forecast to pay the toll and use the NGTR rather than avoiding the NGTR and using Hibiscus Coast Highway as the free alternative through Orewa. The NGTR is a four-lane motorway that has more than enough capacity for the forecast volumes of traffic in 2026. Given the high quality of the NGTR, we consider this increase in traffic volumes on the NGTR south of the Project to be a positive effect of the Project.

Hibiscus Coast Highway:

We forecast a two-way decrease in traffic volumes between the 2026 Base Case and the Project scenario of 2,300 vpd (19%) to 9,800 vpd on the Hibiscus Coast Highway. This decrease is a result of the south facing ramps provided at Pūhoi. As explained above, the ramp configuration encourages traffic to use the Project / NGTR route instead of the alternative SH1 / Hibiscus Coast Highway route. Given the lower standard of the Hibiscus Coast Highway and the fact that traffic volumes through Orewa are further reduced, we consider this reduction in traffic volumes on the Hibiscus Coast Highway to be a positive effect of the Project.

4.1.2 Holiday traffic volumes

Forecast Holiday Start and Holiday End traffic volumes on different parts of the network are shown in Figure 10 to Figure 13 as HS and HE respectively. Holiday peak volumes in the corridor as a whole are forecast to increase between the Base Case and the Project scenarios. This is as a result of the expected additional growth in holiday trip making as a result of the improved accessibility to key holiday destinations provided by the Project.

With the Project in place, the forecast Holiday peak period volumes on SH1 reduce as traffic uses the new route.

4.2 Travel times

The provision of a new motorway standard, four-lane alignment will reduce travel times across the Project Area. The Project reduces congestion and travel times between Pūhoi and the north during typical peak periods but also during the holiday periods when large delays are currently experienced. This benefit will be received by both general and freight traffic. The effects on road freight performance are discussed further in Section 4.6.

We have compared the typical travel times forecasted in the 2026 Base Case with those in the 2026 Project scenario along the routes discussed in section 3.3 and shown in Figure 15.

Table 7: Northbound travel times (minutes) on key routes from south

Northbound from South to:		2009	2026 Base Case	Project 2026		
				2026 Project using fastest route	Absolute change from 2026 Base Case	% Change from 2026 Base Case
North	PM	14.3	17.4	10.2	-7.2	-41%
	IP	14.1	16.7	10.1	-6.6	-40%
	HS	19	26.3	10.7	-15.6	-59%
	HE	14.3	17.9	10.1	-7.8	-44%
Warkworth Town Centre	PM	13	15.9	14.7	-1.2	-8%
	IP	13	15.3	14.1	-1.2	-8%
	HS	17.9	30	15.4	-14.6	-49%
	HE	13.2	16.7	14.5	-2.2	-13%
Woodcocks Area	PM	13.1	15.8	14	-1.8	-11%
	IP	12.6	14.7	13.9	-0.8	-5%
	HS	17.1	21.4	14.3	-7.1	-33%
	HE	12.7	15.2	13.9	-1.3	-9%
Eastern Beaches	PM	13.9	16.5	14.3	-2.2	-13%
	IP	13.9	15.8	14.1	-1.7	-11%
	HS	18.8	30.6	14.8	-15.8	-52%
	HE	14.1	17	14	-3	-18%

Table 8: Southbound travel times (minutes) on key routes to south

Southbound to South from:		2009	2026 Base Case	Project 2026		
				2026 Project using fastest route	Absolute change from 2026 Base Case	% Change from 2026 Base Case
North	PM	15.4	26.5	10.2	-16.3	-62%
	IP	15.2	21.7	10.2	-11.5	-53%
	HS	15.8	28.1	10.2	-17.9	-64%
	HE	23.2	27.9	10.5	-17.4	-62%
Warkworth Town Centre	PM	13.7	20.5	14.3	-6.2	-30%
	IP	13.5	16.8	14	-2.8	-17%
	HS	14.1	20.5	15	-5.5	-27%
	HE	18.4	21.3	14.3	-7	-33%
Woodcocks Area	PM	13.2	21	15.9	-5.1	-24%
	IP	12.8	16.8	14.8	-2	-12%
	HS	13.6	21.1	16.1	-5	-24%
	HE	15.4	21.5	15.2	-6.3	-29%
Eastern Beaches	PM	14.6	21.3	15.1	-6.2	-29%
	IP	14.4	17.7	14.8	-2.9	-16%
	HS	15	21.1	16.6	-4.5	-21%
	HE	22.1	23.3	15.2	-8.1	-35%

Table 7 shows that, with the Project in place, northbound travel times will decrease between 8% and 59% across all of the modelled periods. Decreases are generally forecast to be over 2 minutes with some as high as 16 minutes.

Table 8 shows that, with the Project in place, southbound travel times will decrease between 12% and 64% across all of the modelled periods. Decreases are generally forecast to be over 5 minutes with some as high as 18 minutes.

Each of the key routes is discussed below. Comparisons are made between the future situation when the Project is in place and the Base Case in 2026.

4.2.1 South to North travel times

With the Project in place, travel times are forecast to decrease because of the additional capacity and higher operating speed provided by the Project. The Project provides a faster alternative to using SH1 for trips to the north of Warkworth. By taking traffic off the existing SH1, travel times on the existing SH1 are improved. Even with the large land-use and traffic growth forecast in the future, northbound and southbound travel times in all modelled peaks are forecast to be lower than in 2009.

4.2.2 South to Warkworth Town Centre travel times

Warkworth Town Centre acts as a key retail and commercial hub supporting the surrounding communities. With the Project in place, accessibility to and from Warkworth town centre is forecast to improve as travel times to and from Warkworth decrease compared to the Base Case.

4.2.3 South to Woodcocks Road Area travel times

Woodcocks Road provides many of the industrial and commercial services within Warkworth and is the location of recent development. With the Project in place, accessibility to and from the Woodcocks Road area is forecast to improve as travel times to and from Woodcocks Road decrease compared to the Base Case.

4.2.4 South to Eastern Beaches travel times

Matakana Road and Sandspit Road provide access to eastern communities of Matakana, Leigh, Omaha, Snells Beach and Sandspit. With the Project in place, accessibility to and from the eastern beaches is forecast to improve as travel times to and from Warkworth decrease compared to the Base Case. Even with the large land-use and traffic growth forecast in the future, northbound travel times in the critical Holiday Start period are forecast to be lower than in 2009 as traffic heads north out of Auckland to holiday destinations in the north. Similarly, southbound travel times in the Holiday End period are forecast be lower than in 2009 as holiday traffic returns to Auckland.

4.2.5 Congestion within Warkworth

We assessed congestion within and through Warkworth using a cordon that enclosed Warkworth; extending from approximately Hudson Road in the north to McKinney Road in the south as indicated in Figure 16. We assessed congestion using the average travel time per vehicle trip within this cordon. Figure 25 shows the average travel times within the cordon, in 2009 and in 2026 for the Base Case and the Project scenario.

Figure 25 shows that average travel time within the cordon is expected to decrease when the Project is in place compared to the Base Case in all modelled peaks. Average travel times within the cordon are forecast to decrease from 6 minutes to 4.5 minutes (a decrease of 1.5 minutes or 35%) in the PM peak period. Similar scales of decreases are forecast across all the modelled periods. These decreases indicate that congestion within Warkworth will decrease with the Project in the future. In fact even with the large increase in forecast land-use and traffic volumes, congestion within Warkworth will remain close to 2009 levels in 2026 with the Project in place. This forecast reduction in congestion within Warkworth is a significant benefit of the Project.

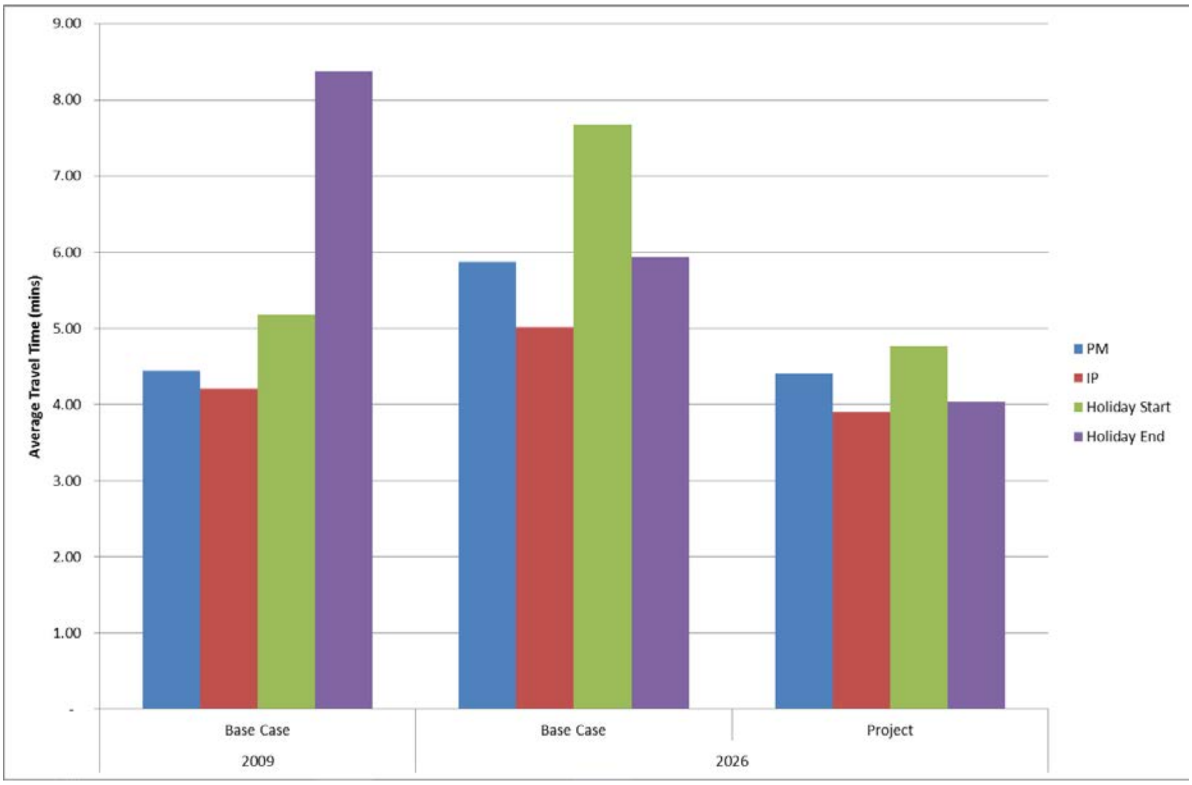

Figure 25: Warkworth cordon average travel time per vehicle trip

4.3 Travel time consistency

Section 3.4 describes the current issues with travel time consistency and discusses why travel time consistency is expected to reduce in the future without the Project. The construction of the Project will have a number of benefits in relation to travel time consistency, namely:

i. Capacity of the corridor is increased substantially by the construction of the Project. Trips to and from locations to the north of Warkworth will be faster on the Project, while the reduction in traffic from the existing SH1 will also reduce travel times for vehicles that remain on SH1. Travel times and congestion are forecast to reduce compared to the Base Case as described in Section 4.2. Given the relationship between congestion / delay and travel time variability discussed in Section 3.4, travel time consistency in the corridor is expected to improve when the Project is constructed.

ii. On the Project alignment there will be two lanes in each direction over the entire length. On the existing SH1 there are limited passing opportunities, but on the Project vehicles will be able to pass one another easily along the whole route. The improved passing opportunities provided by the Project mean that general traffic using the Project will be able to choose their desired speed without being held up by other general traffic or slow moving commercial vehicles, which will improve consistency of journey times.

iii. Reduced traffic volumes on the existing SH1 corridor will allow light vehicles to be less constrained by slow moving HCVs, particularly on the steeper graded sections.

iv. A shift of HCVs onto the Project route will provide greater travel time consistency for those HCVs due to the improved road geometry compared to the existing SH1 (refer Section 4.6), which was causing a speed differential between low and high power to weight ratio vehicles.

In summary, although generally not directly forecast by the models (which predict average travel times), travel time variability increases as traffic levels approach the capacity of the network, as expected in this corridor. Therefore, the significant increase in capacity provided as part of this Project is also expected to significantly improve travel time consistency. There is a proven link between congestion and reliability, i.e. in general, reduced congestion results in improved reliability, largely through reductions in day to day variability.

The Project improves travel times and reduces congestion throughout the corridor due to the extra road capacity. The reductions in congestion levels on the existing SH1, as well as the improved travel times, are therefore likely to improve travel time reliability along the corridor.

This improvement in travel time consistency is a significant benefit of the Project, enabling individuals and businesses to plan their travel with a much greater degree of certainty and providing for a much more robust network that can cater for some disruption without significant increases in travel time.

By enabling reduced and more certain travel times at all time periods, the Project removes deterrents to travel in the corridor and improves accessibility between Auckland, Warkworth and Northland.

4.4 Crash performance

While volumes in the corridor will still increase over time, a large proportion of the trips will be undertaken on the Project alignment, which will have an improved crash performance when compared with the existing SH1. This improved crash performance means that the number and severity of crashes will be reduced when compared to the Base Case, resulting in the Project having a significant improved road safety effect.

The Project will be designed to the latest motorway standards and as such we expect it to perform significantly better than the existing SH1 in relation to road safety. The existing SH1 has a lower standard of road geometry with clear zones[60] that do not meet current standards and horizontal and vertical curves that have low design speeds meaning vehicles are more likely to lose control. In Section 3.5, we identified that the majority of fatal and serious crashes on SH1 between Pūhoi

[60] A clear zone is an area either side of the road in which an errant vehicle may traverse with minimum damage to itself and occupants. It includes the shoulder, verge, batters and footpaths.

and Warkworth were head on crashes. The Project alignment will include a barrier separating north and southbound traffic, which will virtually eliminate this type of crash along the Project route.

We forecast the number of injury crashes on the existing SH1 and the Project alignment (under the Project scenario) in accordance with the procedures set out in the EEM. Crashes on the existing SH1 were forecast to decrease proportionally to the decrease in traffic volumes. Crashes on the Project alignment were forecast by undertaking a crash rate analysis using a typical crash rate for a motorway standard road. The forecasts of average annual injury crashes in the Pūhoi to Warkworth corridor are shown in Figure 26.

The average annual number of crashes on the existing SH1 is forecast to be less in the 2026 Project scenario than in the 2026 Base Case scenario. This reduction in the forecast number of crashes is because there are fewer vehicles predicted to use the existing SH1 route once the Project is in place (see section 4.1). In 2026, the average annual number of crashes on the Project route is forecast to be lower than on the existing SH1 even though the two routes are predicted to have similar traffic volumes. This lower crash rate is because the Project alignment will be constructed to a higher standard than the existing SH1. The improved perception of safety may even encourage some people to use the Project route in preference to the existing SH1, even if it was to result in a longer journey.

When we consider the total expected number of crashes per year for the corridor as a whole, there is a significant improvement from the Base Case to the Project scenario. The average number of injury crashes per year for the corridor is forecast to decrease by five (23%). This reduction is a major benefit of the Project.

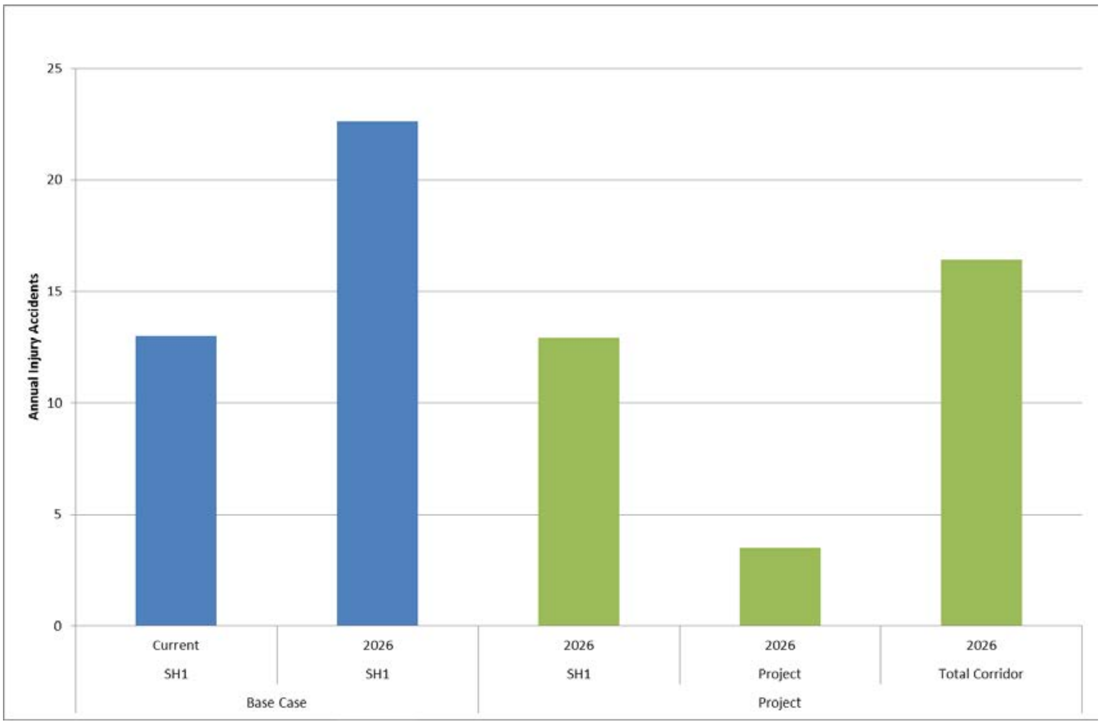

Figure 26: Forecast annual injury crashes - Pūhoi to Warkworth in 2026

If the induced traffic assumed in the core assessment eventuates (refer Section 2.4.1) there may be additional traffic north of the northern interchange. This induced traffic means that there will be additional traffic on the route north through the Dome Valley. The Dome Valley has a poor crash history. By increasing the crash exposure, the road safety risk will increase over this length.

We extracted crash data from the CAS database for the existing SH1 between Kaipara Flats Road and Wayby Valley Road[61] for the 2008 - 2012 period. There were a total of 61 injury crashes reported over this period (an annual average of 12 injury crashes). We used the same method described in section 3.5 to forecast the number of injury crashes in 2026.[62] Figure 27 shows the forecast number of annual injury crashes between Pūhoi and Wellsford for both the Base Case and the Project scenario in 2026. Although the annual injury crashes between Warkworth and Wellsford is forecast to increase from 16 in the Base Case to 19 in the Project scenario, there is an overall decrease in crashes between Pūhoi to Wellsford as a result of the Project.

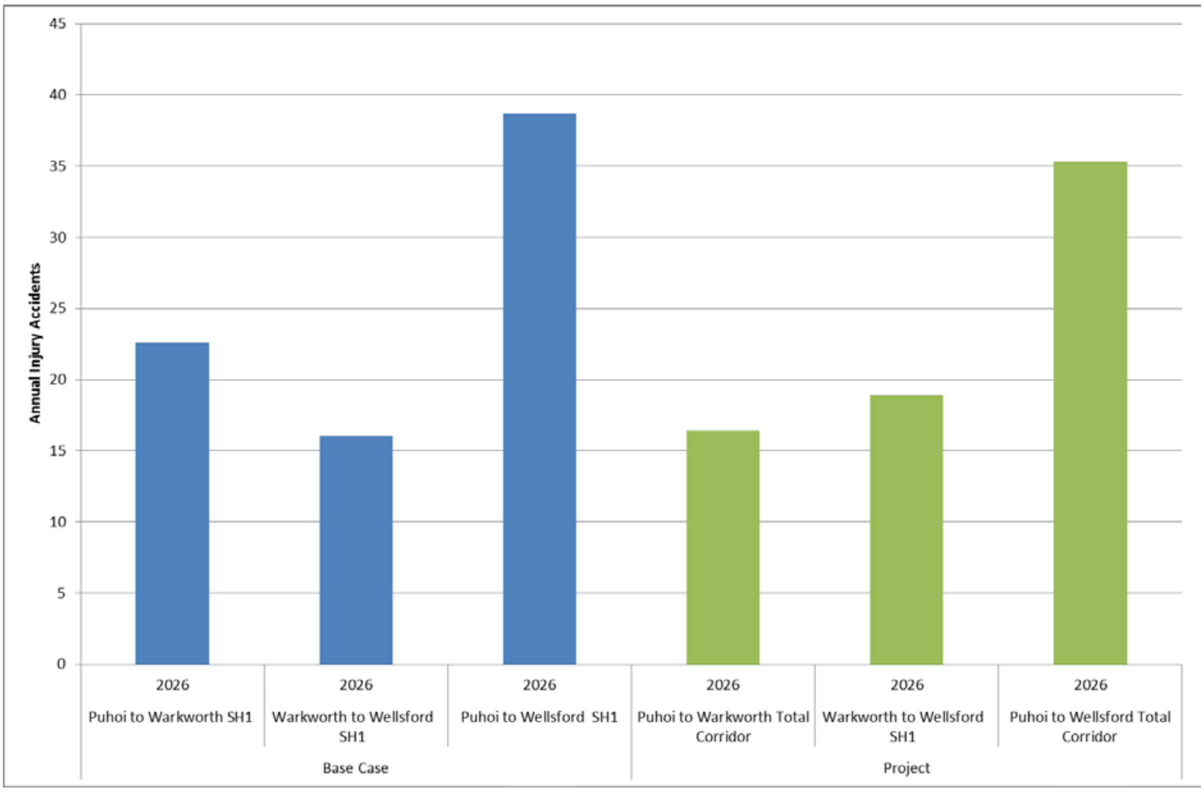

Figure 27: Forecast annual injury crashes - Pūhoi to Wellsford in 2026

When the Warkworth to Wellsford section of the RoNS goes ahead, any negative effects over this length would be relieved.

[61] Including crashes at Kaipara Flats Road intersection and Wayby Valley Road intersection.

[62] Crashes were increased proportionally to the increase in forecast traffic volumes north of Kaipara Flats Road.

4.5 Route security

The introduction of a high quality, parallel alternative route to SH1 will reduce the effects of incidents (crashes and natural events such as slips and flooding) on travel between Northland and Auckland.

The Project will improve route security in a number of ways:

- Having two routes provides a measure of redundancy and a greater level of security and availability of travel between Auckland and Northland.
- There will be improved slope stability on the new route as a result of engineered embankments and cuttings having appropriate factors of safety, and designed to current standards for seismic events.[63]
- Instances of flooding closures will be less frequent on the new route because the Project has been designed to avoid 100 year average recurrence interval storm event flood paths and incorporates improved stormwater management systems.[64]
- The Project route has been selected to, where possible, bypass sections identified as geotechnically unstable.[65]
- As noted in Section 4.4 above, the number of crashes is forecast to reduce, which will consequently reduce the number of times the route is closed.
- The Project route will have four traffic lanes. This will allow the route to be opened sooner following a crash than is currently possible on the existing SH1, which is primarily a single carriageway.

As a result of these factors, the resilience of the State highway network is improved as a result of the Project.

4.6 Road freight performance

As noted in Section 3.7, freight volumes are expected to increase significantly within the Project corridor. HCV volumes in the corridor as a whole are assumed to grow at a rate 1% higher under the Project scenario compared to the Base Case, in line with general traffic. This higher rate of growth is a result of the induced traffic effects of the Project as described in Section 2.4. However, with the Project in place, the volume of HCVs on the existing SH1 will reduce.

Figure 28 shows the HCV volumes on SH1 and the Project route. As shown, the number of HCVs in the corridor will be 200 vpd (10%) greater in the Project scenario than in the Base Case. HCV volumes on SH1 reduce from 1,830 vpd in the Base Case to 1,040 vpd in the Project scenario (a decrease of 790 vpd or 45%). The reduced travel times and improved geometry on the Project will be more attractive to HCVs as their values of time and desire for travel time certainty will be higher. As a result, the reduction in HCVs on SH1 could be even greater.

[63] The design and assessment of geotechnical issues is documented in the Geotechnical Engineering Assessment Report.

[64] The design and assessment of stormwater issues is documented in the Operational Water Assessment Report.

[65] The design and assessment of geotechnical issues is documented in the Geotechnical Engineering Assessment Report.

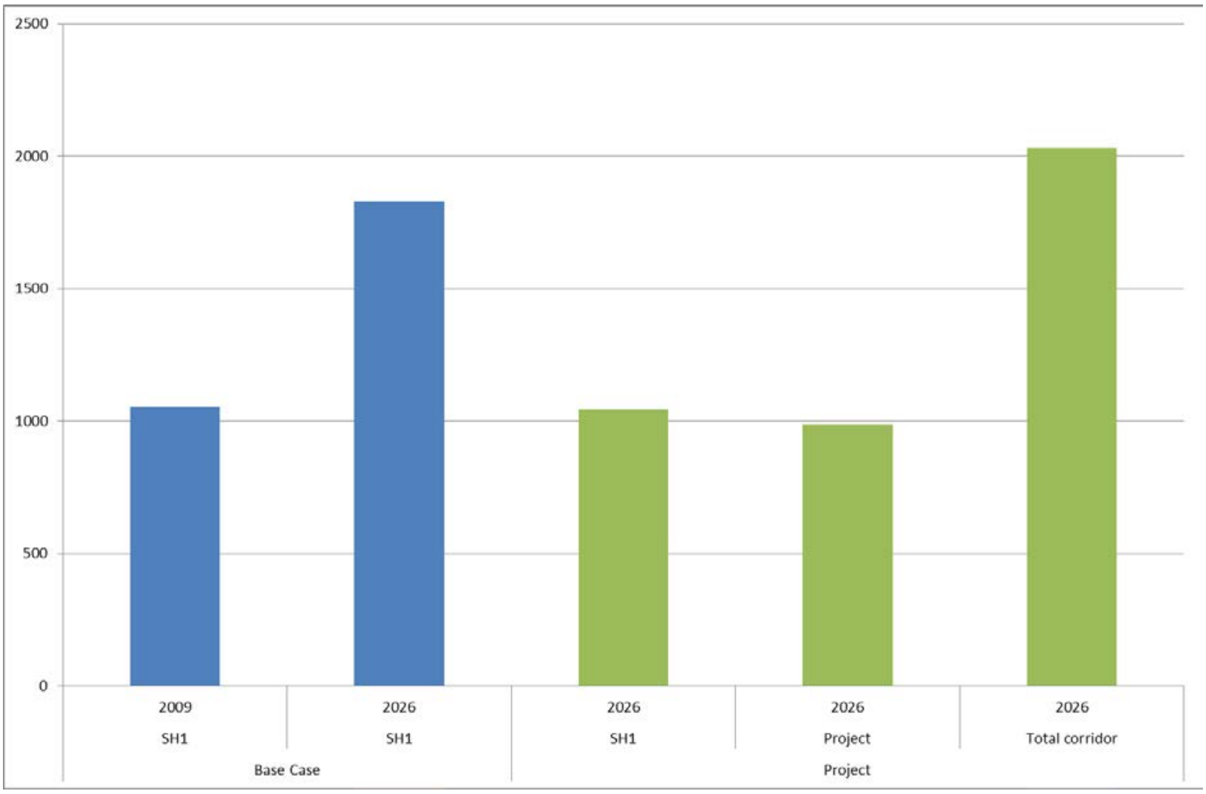

Figure 28: Daily HCV volumes within the Pūhoi to Warkworth corridor

Travel times for commercial vehicles will reduce in the same way as described for general traffic in Section 4.2 when the Project is constructed.

As discussed in Section 3.7, the geometric alignment of the current SH1 influences HCV performance considerably at present. The geometric alignment of the Project will be much better than the existing SH1. The Project has been designed to RoNS standards for at least a 100kph design speed. The RoNs standards provide for the highest level of design criteria (i.e. minimum sight distances) within Austroads standards. It is therefore expected that the Project route will have an operating speed of 110kph. On the Project route, HCVs will not need to slow for horizontal curves, which will mean they will be able to maintain speed more easily.

The more than 8% grade northbound at Schedewys Hill and approximately 4% grade up to the Moirs Hill Road will be replaced by a combination of approximately 625m of 6.5% grade and 1120m of 5% grades. This vertical alignment will still result in a typical laden truck reaching a terminal speed of approximately 35kph[66]. However, as there are two lanes provided, general traffic and more powerful or lightly loaded trucks will be able to pass slow moving HCVs easily. The improved passing opportunities provided by the Project will improve efficiency and reduce travel

[66] Austroads Guide to Road Design, Part 3: Geometric Design, 2009. Figure 9.3 provides determination of truck speeds on grade, for a 19m semi-trailer (42.5t), 12 l diesel carrying a maximum load (7.5kW/t). These figures have been used to estimate truck speeds as described throughout this section.

times as drivers are more able to choose their optimum speed. The Project has been developed so the introduction of crawler lanes up the grades to Moirs Hill Road are not precluded if they are determined to be necessary during more detailed design.

The more than 6% grade for vehicles travelling southbound up to Moirs Hill Road will be replaced by a combination of short 5% grades and plateaus on the Project. Where a typical laden truck would reach a terminal speed of approximately 35kph[67] on the existing SH1, HCVs on the Project will be able to maintain higher speeds in the order of 70kph. Again, as there are two lanes provided, general traffic, a more powerful truck or lightly loaded truck will be able to pass slow moving HCVs easily.

Because of the lower vehicle volumes on SH1, commercial vehicles that continue to use that route will also get stuck behind other vehicles less frequently. This lower likelihood of getting stuck behind other vehicles will improve travel times and journey time consistency.

The current distribution of travel times for commercial vehicles over the length of SH1 from Pūhoi to north of Warkworth is discussed in Section 3.4. There is currently a relatively wide distribution of travel times for commercial vehicles in the corridor. This is in part due to the different power to weight ratios of the commercial vehicles and whether they are heavily loaded. It is also a factor of the limited passing opportunities. In a similar way to general traffic, it is expected that travel time consistency for commercial vehicles will improve when the Project is constructed. This improved travel time consistency will be as a result of decreased delay on the existing SH1, improved journey times and increased passing opportunities provided by the Project alignment.

Safety for commercial vehicles will also improve as described for general traffic in Section 4.4.

4.7 Public transport network performance

The Project will have a minimal but positive impact on existing or potential public transport service performance. With the Project, the same performance improvements forecast above for general traffic will be experienced by regional bus and shuttle services and Auckland Transport's proposed bus service outlined in section 3.8.

4.8 Pedestrian and cycle network performance

The lower volumes of traffic along the existing SH1 route will improve safety and amenity for vulnerable road users (i.e. pedestrians and cyclists) and create opportunities for the implementation of measures if appropriate (such as wider shoulders or cycle lanes) to encourage walking and cycling, more consistent with the local function of the route.

[67] Austroads Guide to Road Design, Part 3: Geometric Design, 2009. Figure 9.3 provides determination of truck speeds on grade, for a 19m semi-trailer (42.5t), 12 l diesel carrying a maximum load (7.5kW/t). These figures have been used to estimate truck speeds as described throughout this section.

The Project will be a motorway and pedestrians and cyclists will be prohibited from using it. However, the Project does include some measures to support walking and cycling:

- The design allows for cycling facilities at the northern tie-in by providing an off-carriageway path through the roundabout including cycle crossing points to enable safe use of the facility by cyclists;
- At the southern end of the Project, cyclists will continue on the existing SH1 from the Hibiscus Coast Highway using the shoulders once it is returned to a two way road;
- A footpath is provided on the Moirs Hill Bridge over the motorway. While there is likely to be limited pedestrian demand, the structure has been future proofed;
- An approximately 3 metre wide berm is provided under the Wyllie Road overbridge to allow a safe distance for walking and cycling modes off the existing Wyllie Road carriageway; and
- While there is likely to be limited pedestrian or cycling demand at Woodcocks Road, space is provided between the piers to allow for pedestrian and cycling provision in the future if required.

Traffic volumes on SH1 between Pūhoi and Warkworth are forecast to be in the order of 40% lower with the Project in place than for the Base Case in 2026. This reduction in traffic volumes will improve recreational cycling amenity along the rural highway corridor between Pūhoi and Warkworth. It will also improve crash risk by reducing the exposure of cyclists along this section.

As Warkworth grows, the demand for walking and cycling within Warkworth will also grow. The Project will remove a significant amount of traffic from SH1 through Warkworth (in the order of 42% in 2026[68]). This reduction in traffic through Warkworth will improve walking and cycling amenity and reduce conflicts between the modes, when compared to the Base Case.

Parts of the Warkworth community will also benefit from reduced physical severance as a result of improved levels of connectivity, accessibility and safety. For example, students from schools on the western side of SH1 (Mahurangi College and Warkworth Primary School) will still need to cross the existing SH1 to access homes and the town centre to the east, however, the volumes of traffic on SH1, will be significantly reduced, making it safer to cross.

The Project will not compromise future improvements to pedestrian and cycle facilities in the SH1 corridor or within Warkworth. In fact the reduction in traffic volumes is likely to make it easier to implement any improvements in the future.

4.9 Mitigation measures

The effects of the Project on the transport network are on the whole significantly positive. However, we have identified a small number of potential adverse effects.

While we consider that the increase in volumes on Hill Street as a result of the Project would only have a minor potential for adverse effects on road safety, we recommend that prior to opening the Project or significant uptake of additional development adjacent to Hudson Road, the NZTA and Auckland Transport undertake a review of road safety associated with Warkworth Primary School.

[68] South of Whitaker Road.

The NZTA and AT have indicated that they will undertake such a review if traffic volumes on Hill Street continue to rise.

The Project design has allowed for the upgrade of Kaipara Flats Road intersection immediately north of the proposed Project tie-in with SH1 with the provision of a right turn bay which will help mitigate effects on this intersection.

The character of the existing SH1 between the Project's northern interchange and Hill Street will change in the future as a result of the Project and other influences such as the signalisation of Hudson Road intersection. We recommend that prior to the completion of the Project, the NZTA develops a management strategy for that section of SH1. Such a strategy may include the closure of the northbound passing lane north of Hudson Road, a revised speed limit for this length and treatments such as painted flush medians to cater for adjacent land-uses and reinforce the lower speed and more urban environment.

4.10 Sensitivity testing

The core analysis of the Project necessarily makes a number of implicit assumptions regarding the future land-use growth and changes to the transport network. We have undertaken tests to assess the sensitivity of the analysis to variance in these key assumptions. The purpose of these tests is to confirm the validity of the core assessment of the Project with changes to these assumptions.

The tests we performed relate to the Project, but with the following changes:

- Test A: No changes to growth: assumes that the growth in the Project scenario will be the same as that in the Base Case; and
- Test B: Warkworth Growth remains at Woodcocks Road: assumes that future land-use growth takes place at Woodcocks Road rather than adjacent to Hudson Road.

Whilst all of the travel time and traffic volume changes have been reviewed in detail as part of this assessment, for reporting purposes we have only identified the more significant changes.

Table 9 shows traffic flows under each of the sensitivity tests for a number of representative routes and compares these to the Core Assessment (the Base Case and Project scenarios).

Table 10 and Table 11 show northbound and southbound travel times through the Project Area on the routes discussed in section 3.3 for each of the sensitivity tests.

Table 9: Traffic volumes – sensitivity tests

	Core Assessment		Test A	Test B
	Base Case	Project	Project	Project
SH1 existing - North of Schedewys				
PM	2030	1090	1350	1380
IP	1650	990	1100	1130
AADT	25400	14500	16900	17300
Hill Street - West of SH1				
PM	730	1040	770	740
IP	760	920	670	670
AADT	10500	13700	10000	9900
SH1 existing - South of Kaipara Flats Road				
PM	1470	1760	1590	1760
IP	1050	1190	1060	1190
AADT	17300	20100	18000	20100
Hudson Road North of Albert Street				
PM	730	1320	700	740
IP	460	780	500	540
AADT	7900	14000	8100	8800
SH1 existing - North of Hill Street				
PM	1310	1280	1200	1310
IP	960	890	810	860
AADT	15600	14700	13600	14800

Table 10: Northbound travel times (minutes) on key routes from south – sensitivity tests

Northbound from South (Pūhoi) to:		Core Assessment		Test A	Test B
		2026 Base Case	2026 Project using fastest route	2026 Project using fastest route	2026 Project using fastest route
North	PM	17.4	10.2	10.2	10.2
	IP	16.7	10.1	10.1	10.1
	HS	26.3	10.7	10.3	10.5
	HE	17.9	10.1	10.1	10.1
Warkworth Town Centre	PM	15.9	14.7	14	14
	IP	15.3	14.1	13.9	14
	HS	30	15.4	14.1	14.4
	HE	16.7	14.5	13.9	13.9
Woodcocks Area	PM	15.8	14	14.8	14.9
	IP	14.7	13.9	14.3	14.4
	HS	21.4	14.3	15	15.1
	HE	15.2	13.9	14.3	14.4
Eastern Beaches	PM	16.5	14.3	14.1	14.1
	IP	15.8	14.1	14	14
	HS	30.6	14.8	14.4	14.6
	HE	17	14	14	13.9

Table 11: Southbound travel times (minutes) on key routes to south – sensitivity tests

Southbound to South (Pūhoi) from:		Base		Test A	Test B
		2026 Base Case	2026 Project using fastest route	2026 Project using fastest route	2026 Project using fastest route
North	PM	26.5	10.2	10.2	10.2
	IP	21.7	10.2	10.2	10.2
	HS	28.1	10.2	10.2	10.2
	HE	27.9	10.5	10.3	10.4
Warkworth Town Centre	PM	20.5	14.3	14.8	14.1
	IP	16.8	14	13.9	13.9
	HS	20.5	15	14	14.1
	HE	21.3	14.3	14.1	14.2
Woodcocks Area	PM	21	15.9	16.5	16.6
	IP	16.8	14.8	15.4	15.4
	HS	21.1	16.1	16.5	16.6
	HE	21.5	15.2	15.5	15.7
Eastern Beaches	PM	21.3	15.1	14.9	15
	IP	17.7	14.8	14.7	14.7
	HS	21.1	16.6	15.6	16.3
	HE	23.3	15.2	15	15.1

4.10.1 No Changes in assumed growth (Test A)

As detailed in Section 2.4.1, under the Project scenario some additional alterations were made to the land-use assumptions in Warkworth. We anticipate that when the Project is in place, the land closest to the northern interchange will become more attractive. On this basis, we relocated all future land-use growth in the Structure Plan area around Woodcocks Road to zones adjacent to Hudson Road. In addition, we assumed that the Project would induce an extra 1% of traffic growth as a result of the increased accessibility provided by the Project.

There is the potential that this relocation of growth may not eventuate and growth may continue as assumed in the Structure Plan. Similarly the induced traffic growth may not eventuate. To understand whether these assumptions would have a material impact on our core assessment, we undertook a sensitivity test using exactly the same traffic demands as used in the Base Case but with the Project included.

Daily traffic volumes on most of the routes are lower under Test A than in the Core Assessment. The exception is SH1 north of Schedewys Hill which has 2,400 vpd (17%) more under Test A, even though the 1% induced growth has been removed. This increase in traffic volumes is due to more people using the existing SH1 to travel from the south to the Woodcocks Road area (which has more trips in Test A as growth has not been relocated from the Woodcocks Road area to the Hudson Road area) because it is faster than using the Project route (which requires backtracking through Warkworth). Although this volume is higher than in the Core Assessment, it is still much lower than the Base Case volume (25,400 vpd).

Travel times on most of the routes are very similar under Test A as in the Core Assessment, with the majority of travel times increasing by 6 to 12 seconds.

Travel times during the Holiday Start period southbound from Warkworth Town Centre and Eastern Beaches to the south are both one minute (7% and 6% respectively) less under Test A than in the Core Assessment. In the same period northbound from the south to Warkworth Town Centre, travel times are 1.3 minutes (8%) less under Test A than in the Core Assessment.

During the PM peak, travel times in both directions between the south and the Woodcocks Road area are greater under Test A than in the Core Assessment (0.8 and 0.6 minutes northbound and southbound respectively).

This analysis highlights that the assessment undertaken is not sensitive to the land-use change assumptions we made. The effects of the Project are still positive.

4.10.2 Warkworth growth remains at Woodcocks Road (Test B)

Under this sensitivity test, the population growth adjacent to Hudson Road has been moved back to the Woodcocks Road area (as per the Base Case and the Warkworth Structure Plan). However, the one per cent induced growth remains in the Project scenario.

Daily traffic volumes on most of the routes are lower under Test B than in the Core Assessment. The exception is SH1 north of Schedewys Hill which has 2,800 vpd (20%) more under Test B. This increase in traffic volumes is due to people using the existing SH1 to travel from the south to the Woodcocks Road area because it is faster than using the Project (which requires backtracking through Warkworth). Although this volume is higher than in the Core Assessment, it is still much lower than the Base Case volume (25,400 vpd).

Daily traffic volumes on Hudson Road and Hill Street are 5,200 vpd (40%) and 3,800 vpd (30%) less respectively with the growth moved to the Woodcocks Road area.

Moving the population growth from Hudson Road to Woodcocks Road has a minimal effect on travel times to and from the south and the north and the Eastern Beaches, with the majority of travel times decreasing by 6 to 12 seconds. Travel times between the south and the Woodcocks Road area increase across all periods with the greatest increase of one minute northbound during the PM peak as more traffic uses SH1 to access Woodcocks Road as described above. Travel times between the south and Warkworth Town Centre decrease across all periods with the greatest decrease of one minute northbound during the HS period.

This analysis highlights that the assessment undertaken is not sensitive to the land-use change assumptions made. The effects of the Project are still positive.

5. Conclusions

Overall, we consider the operation of the Project will have a significant positive effect on the transport network.

The project will increase capacity within the corridor, improve road safety, reduce journey times, and improve consistency of journey times for general traffic and freight. It will improve route security by providing an alternative route built to higher standards and that is more resilient to incidents. We conclude that given these benefits with few negative effects, there are no transportation reasons why the NoR for the Project should not be approved.

Overall, we consider the operation of the Project will have a significant positive effect on the transport network. In particular, we note the following positive effects:

5.1 Increase long-term corridor capacity

Through the provision of a new four-lane motorway standard alignment between Pūhoi and Warkworth, the capacity of the SH1 corridor is increased substantially. It spreads the traffic demand between the new route and the existing SH1 and the performance of the existing SH1 is improved by reducing congestion and delay.

5.2 Improve route quality and safety

The existing State highway has a poor geometric alignment with tight horizontal curves and steep grades. There are many sections that operate below 100kph with advisory speeds as low as 35kph. The Project provides a new four-lane motorway standard alignment built to RoNS standards. We expect the operating speed of the Project route to be much higher than the existing SH1, with an operating speed in the order of 110kph.

While traffic volumes in the corridor will increase over time, many of the trips will be on the Project. As the Project will be constructed to modern motorway standards it will have an improved crash performance when compared with the existing SH1 (refer Section 4.4). This improved crash performance means that the average annual number of injury crashes in the corridor as a whole is forecast to decrease from 22 to 17, a decrease of five (23%) in 2026 when compared to the Base Case. As a result, the Project will have a positive effect on road safety.

5.3 Provide resilience in the wider state highway network

By the introduction of a high quality four-lane alignment, the effects of incidents on travel along the Project alignment (crashes and natural events such as slips and flooding) will be significantly reduced. The Project will also provide redundancy because it provides an alternative route to the existing SH1, improving the resilience of the State highway network (refer Section 4.5).

5.4 Increase travel time consistency

As a result of significant reductions in regular congestion and the effects of random incidents, the Project will virtually eliminate travel time variability for travel between Pūhoi and north of Warkworth (refer Section 4.3). This improved travel time consistency is an important benefit of the Project, enabling individuals and businesses to plan their travel with a much greater degree of certainty and provides for a much more robust network that can cater for some disruption without significant increases in travel time.

Travel time consistency will be improved for freight traffic because of the reduced congestion, improved geometric alignment and improved passing opportunities.

By enabling reduced and more certain travel times during all time periods, the Project removes deterrents to travel in the corridor and improves accessibility between the Auckland, Warkworth and Northland.

We therefore consider the Project will contribute positively towards improvement of travel time consistency.

5.5 Decrease travel times

Section 4.2 details the positive contribution the Project makes towards reducing travel times.

By way of example, travel times on the Project southbound (between the north end of Warkworth and the north end of the Johnstone's Hill tunnels) are forecast to be 16 minutes (60%) faster in 2026 in the PM peak when compared to the Base Case travel time on SH1.

5.6 Alleviate congestion at Warkworth

Section 4.2.5 details the positive contribution the Project makes towards alleviating congestion at Warkworth.

At a network level, we assessed congestion within Warkworth using the average travel time per vehicle trip on links with a cordon which enclosed Warkworth. Average travel times within the cordon will reduce compared to the Base Case. For example, compared to the Base Case, average travel times per vehicle within the cordon are forecast to reduce by 1.5 minutes (25%) by 2026 in the PM peak period. This reduction in average travel times indicates that congestion within Warkworth will be held close to 2009 levels in 2026 with the Project in place. This reduction in congestion is a significant benefit of the Project.

5.7 Improve freight movement

All of the benefits detailed above for general traffic in terms of reduced travel times, improved route quality and safety, resilience and travel time consistency are also experienced by commercial freight traffic. Because of the challenges facing heavy vehicles with the tight horizontal and steep grades on the existing SH1 as described in Section 4.6, freight vehicles will experience even greater benefits in terms of travel time improvements. This increased travel time reduction is because of the additional passing opportunities provided and the higher speed horizontal curves and reduced grades on the Project route.

We expect that prior to opening the Project or uptake of significant additional development adjacent to Hudson Road, the NZTA and AT will undertake a review of road safety associated with Warkworth Primary School.

We recommend that prior to the completion of the Project, the NZTA develops a management strategy for the section of SH1 from the Project interchange to Hill Street intersection.

Overall, we consider the operation of the Project will have a significant positive effect on the transport network. Given that there are few negative effects we consider that that there are no transportation reasons why the NoR for the Project should not be approved.

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