IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	applications for resource consents and notices of requirement in relation to the Ōtaki to North of Levin Project
BY	**WAKA KOTAHI NZ TRANSPORT AGENCY**
	Applicant

ŌTAKI TO NORTH OF LEVIN HIGHWAY PROJECT

TECHNICAL ASSESSMENT A: TRANSPORT

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EXECUTIVE SUMMARY

1. This assessment considers the transport effects of the Ōtaki to North of Levin Project ("**Ō2NL Project**"). To assess those effects, I have considered and compared three scenarios:

    (a) the "Current Transport Network", including the existing State Highway 1 ("**SH1**") and State Highway 57 ("**SH57**") ("**the State Highways**") between just north of Ōtaki and just north of Levin, and the interaction of those highways with local roads and the North Island Main Trunk ("**NIMT**") railway;

    (b) the "Do Minimum", which is the assumed transport network in 2039 (including various already committed improvements), without the Ō2NL Project; and

    (c) the "With Project" scenario, which includes the Do Minimum with the Ō2NL Project in place as of 2039.

2. In considering these scenarios I have applied a bespoke Ō2NL Project Traffic Model, and applied best practice safety and resilience assessments.

The current transport network and its problems

3. The sections of SH1 and SH57 between north of Ōtaki and north of Levin are crucial, nationally significant transport links for people and freight.

4. The rural sections of these highways are heavily trafficked, two-lane roads without median barriers. Drivers encounter high traffic volumes and numerous out-of-context horizontal curves, almost 40 intersections and over 400 accessways. The current transport network is therefore not fit-for-purpose, falling well below the standard expected of national state highways. This is demonstrated by the highways' very high safety risk, with published KiwiRAP star ratings of 2 (out of 5), and ultimately by a history of high numbers of serious and fatal crashes, culminating in 72 deaths and serious injuries ("**DSIs**") in the last five years.

5. In addition to being unsafe, the existing State highway network lacks resilience to natural hazards, weather and traffic events. SH1 is at high risk of closure from earthquakes, flooding, and crashes.

6. This is particularly problematic, for both local and inter-regional travelers, because SH1 is the only direct route between Manakau and Ohau (and

therefore points further south or north). The highway is closed at least four times a year, and when an event occurs between Manakau and Ohau, the only alternative route is via the Wairarapa, which increases trip time by at least two hours, significantly more in peak hours.

7. There are also five bridges vulnerable to earthquakes, two which will affect the railway below if they fail (cutting off all transport modes between Ōtaki and Levin).

8. Travel times between Ōtaki and SH1 north of Levin vary depending on travel periods but are on average 26 minutes in the evening peak. Access from side roads onto SH1 and SH57 typically takes less than 30 seconds, but there are a number of intersections which have delays up to 70 seconds. These delays can extend to several minutes on holiday weekends and other high traffic situations.

9. The regional active mode network is very limited with no safe ways to walk or cycle between Ōtaki and Levin; the rural sections of SH1 are not safe for either cyclists or pedestrians.

Future problems: the 'Do Minimum'

10. The future transport network (that is, the future transport environment without a new highway) will include the projects committed to by Waka Kotahi and local government. This includes the Peka Peka to Ōtaki Expressway ("**PP2Ō**"), speed limit changes, and other intersection and safety improvements on the State highway and local road networks. These are referred to as the Do-Minimum interventions.

11. The Do-Minimum interventions are expected to save approximately 27 DSIs per 5-year period. This represents approximately a 30% reduction in DSIs on the State Highways and a 4% reduction on local roads (when compared to the 2039 'Do Nothing' scenario explained below). However, whilst the improvements will have a marked decrease in the number of fatal and serious injuries on the corridor and a reduction in overall risk in the short term, escalating traffic volumes means that by 2039, the risk will increase again. The number of deaths and serious injuries on the State Highways is expected to be the same in 2039 as today, even with the safety improvements in place.

12. The communities from Ōtaki to Levin are projected to grow considerably in the next 20 years, with an additional 15,000 people living in the Horowhenua

District and over 22,000 in the Kāpiti Coast District by 2040.[1] As a result, significantly higher traffic volumes are predicted into the future, including by 2039. The benefits of the Do-Minimum interventions, which are in any event not intended to be a complete solution to the current problems with the state highway network, will reduce over time as a consequence of the increased traffic on the network.

13. Overall, the Do-Minimum improvements will not of themselves create a fit for purpose network. Increased population and traffic will put further pressure on the state highway network (between Ōtaki and north of Levin), resulting in more traffic incidents and delays.

14. In terms of safety, the general trend under the Do Minimum will be for a worsening safety risk over time. Safety issues associated with the level crossings of the NIMT will be heightened under the Do Minimum: traffic volumes will under the Do-Minimum scenario increase the risks at all level crossings, including the Tararua Road level crossing.

15. Travel times and delays will increase significantly under the Do-Minimum. On SH1, trips between Ōtaki and Central Levin and Ōtaki and SH1 North of Levin are expected to increase by 25% to 40% or around 6-7 minutes per journey. Trips between Ōtaki and SH57 north of Levin are forecast to increase by over 40% or 9 minutes per journey. Delays on side roads accessing SH1 are predicted to increase at 25 locations by over a minute on a typical evening trip.

16. The existing vulnerabilities of the network in terms of resilience will remain under the Do Minimum. Those vulnerabilities will be exacerbated by climate change, which will impact the reliability of the network as flood events are predicted to become more frequent.

17. Finally, the Do Minimum will not address the lack of a safe north to south cycling or walking route.

The Ō2NL Project and its transport benefits

18. The Ō2NL Project has been conceived and designed to address the current and future problems with the network (and with the Do Minimum). That is reflected in the Project objectives, which focus on safety, resilience, connections to the local network and urban areas, provision of a north to

[1] Horowhenua District Council and Kāpiti Coast District Council population forecasts are based on (separate) 75th percentile Sense Partners Population Projections.

south cycling and walking facility and supporting growth through improved movement of people and freight.

19. The Ō2NL Project involves the construction, operation, use, maintenance, and improvement of approximately 24km of new four-lane state highway between Taylors Road (to the north of Ōtaki) and SH1 and SH57 north of Levin, along with a dedicated north to south Shared User Path ("**SUP**"). The new Ō2NL route, which will become SH1, will be a modern, high-quality highway, and will address the fundamental safety and resilience problems impacting the current transport network and result in quicker trips for users.

20. On completion, approximately 35 DSIs are expected to be saved per 5-year period following its opening. When coupled with the online safety improvements a total of approximately 60 DSIs will be saved per 5-year period. This is achieved by attracting through traffic off the substandard sections off state highway (between Ōtaki and north of Levin) and shifting them to a high quality, median divided road (which will have a KiwiRAP 4 star or higher rating).

21. In addition, there will be significantly less traffic across almost all the existing NIMT level crossings, which in turn will improve the safety at those crossings. Traffic volumes will increase at the Tararua Road and Liverpool Street level crossings. Improvements are proposed by the Project at the Tararua Road level crossing, which will provide a significant safety benefit at this crossing point and that also supports planned urban growth to the east of Levin and planned commercial development on Tararua Road. KiwiRail are also planning improvements to the Liverpool Street crossing to improve the safety risk. Overall safety at level crossings will ensure they remain at least as safe as under the Do Minimum scenario.

22. The number of crash related closures on the future state highway network will be at least 50% less than the current network. The Ō2NL Project, in conjunction with the old (current) state highway, will ensure that detour routes for any incidents are significantly shorter,[2] as a parallel alternative second route will exist. The Ō2NL Project will ensure the resilience of this critical national transport route, for example, flooding, crashes, and bridge problems,

[2] Journeys impacted between Wellington and Levin would reduce in length by at least 60% (95 km Do Min, 256 km detour (via Saddle Road), 97km Ō2NL). However, a journey impacted between Manakau and Ohau would reduce by 90% (6.6km Do Min, 306km detour, 30km Ō2NL). If there is a major crash/breakdown event on Ō2NL, the old SH1 will likely be available. However, for larger natural events, if Ō2NL is unavailable, the availability of the old SH1 cannot be guaranteed.

including from earthquakes, on the old SH1 route will no longer affect highway traffic, and local traffic will be able to reroute.

23. The forecast travel time savings are significant compared to the Do-Minimum, with 11-15 minute reductions for trips from Ōtaki to destinations north of Levin and 6 minute savings for trips to Levin. In addition, journey time reliability for these routes is improved as the additional capacity provided eases congestion and mitigates the impact of unplanned events, such as breakdowns. A more reliable system enables network users, including freight and logistics companies, to better plan beyond their travel and become more efficient.

24. Side road delays will reduce to negligible levels, except for a couple of intersections in urban Levin.

25. Community connectivity will be improved through reduced journey times. While the location of the Ō2NL Project will result in some increased journey distances for a minor number of local trips, these do not result in increased travel times due to the Ō2NL Project reducing congestion, improving road connections, and allowing higher speeds on the new highway.

26. The SUP will provide a high-quality commuter facility between Ōtaki and Levin, and will also be appropriate for recreational use and is easily and conveniently accessible to adjacent communities. The SUP can be directly accessed from Levin, Manakau, Ohau, and all roads that cross the alignment. This facility will become the north-south active mode spine through Horowhenua (where none currently exists) and, therefore, a key part of the regional active mode network that connects through to Kāpiti.

27. Public transport will benefit from the Ō2NL Project creating a quieter 'old highway', with fewer vehicles that may enable investment in more frequent and attractive public transport options for surrounding communities. Ō2NL also provides a new route that could be used for longer distance public transport trips.

The Project's Minor Adverse Transport Effects

28. The effects of the Ō2NL Project are overwhelmingly positive in transport terms. That said, there are some minor adverse effects relating to travel times and property access for certain locations.

29. In a small number of locations, access and travel times would be adversely affected by the Ō2NL Project. These include:

    (a) the residual parcels of land on the eastern side of the alignment south of Kuku East Road (although none of these have a dwelling on them);

    (b) Kimberley Road East residents wanting to travel directly west (trips north to Levin or south to Ohau are not affected);

    (c) Waihou Road residents who will be diverted up to MacDonald Road; and

    (d) Avenue North Road, whose access north is being severed to improve safety at the northern connection back into the old SH1.

30. The Ō2NL Project will result in increased traffic on the network compared to the Do-Minimum. A proportion of this is due to the release of some of the 'suppressed' trips which are not predicted to be made on the Do-Minimum network due to delays and congestion, but others are due to the increased attractiveness of the Ō2NL Project. These suppressed network trips have been considered in the overall evaluation of travel time, safety and resilience impacts in this report.

Construction effects

31. As with all major transport projects, construction of the Ō2NL Project will have impacts on the existing transport network. In this case, the potential effects are minimised by the fact that the Ō2NL Project is an 'offline' highway, largely being constructed away from the old SH1 and SH57.

32. There will still, however, be effects, relating to heavy vehicle movements and site accesses, that will need to be managed appropriately over the duration of construction. This will be achieved through designation conditions, with detailed methodology to be provided through a Construction Traffic Management Plan ("**CTMP**"). This will ensure site access routes and access arrangements are managed in a safe and efficient manner. It will also outline details of how pedestrian and cycle routes, and property accesses, are maintained throughout the construction period.

INTRODUCTION

33. My name is Philip Jeremy Peet.

34. I am currently the Sector Leader for Transport Advisory for Stantec, leading this service line across New Zealand.

35. I have been involved in the investigation of the Ō2NL Project since January 2011 as Consultant Team Leader. In this role, I have led the consultant transport planners, designers, and assessors through many stages of project development. I have attended the site many times, reviewed information and reports prepared by my team, and met stakeholders, landowners, and community representatives regularly.

36. I led the development of the Indicative Business Case ("**IBC**") and Detailed Business Case ("**DBC**") for the Project, including reviewing their supporting technical addendum reports.

Qualifications and experience

37. I have the following qualifications and experience relevant to this assessment:

    (a) BE (Civil)(Hons), University of Canterbury, 1999.

    (b) CPEng (Chartered Professional Engineer), IntPE (International Professional Engineer), and MIPENZ (Member of the Institute of Professional Engineers New Zealand).

    (c) 20 years of traffic engineering and transport planning for clients and consultants in New Zealand and England, including managing investigations into large scale transportation projects.

Code of conduct

38. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of assessment

39. This assessment is an assessment of the actual or potential effects of the construction and operation of the Ō2NL Project on the transport network. This includes:

    (a) The transport benefits of the Ō2NL Project including:

        (i) safety;

        (ii) resilience; and

        (iii) travel times.

    (b) The potential adverse transport effects of the Ō2NL Project including:

        (i) induced traffic;

        (ii) community connectivity; and

        (iii) property connectivity.

    (c) The transport effects associated with the construction of the Ō2NL Project.

40. This assessment refers to traffic modelling that has been undertaken by Tim Wright of Quality Transport Planning under my supervision. The traffic modelling methodology was developed in discussion with Horowhenua District Council ("**HDC**"). The model was subject to an independent peer review and all comments made as part of this peer review process have been resolved. The modelling approach has also been circulated and agreed by both HDC and Kāpiti Coast District Council ("**KCDC**") representatives.

41. The project team has had regular and ongoing communication, including site visits, in relation to the model and transportation effect outcomes with HDC, KCDC, and the Project Iwi Partners. This engagement has informed the project development process enabling improvement, development, and refinement of many different parts of the Ō2NL Project.

42. Future project performance has been based on forecasts from the Ō2NL Traffic Model. Whilst in some other models, population growth is forecast based on Statistics NZ predictions, in Horowhenua, these predictions significantly underestimate the growth that has occurred already, let alone the growth that is currently visible and planned. Accordingly, overall

population growth within the Horowhenua District has been based on the projections within the Horowhenua Socio-Economic Projections Report by Sense Partners (May 2020), utilising the 25%ile, 75th%ile and 95%ile projections.[3] These projections would result in the population of the Horowhenua increasing from approximately 36,500 in 2021 (StatsNZ) to 44,100, 50,900 or 59,100 respectively. in 2039.

43. Population growth around Ōtaki has been factored into the KTM4 model, a part of which has been brought into the Ō2NL Traffic Model so traffic volumes south of the Otaki River reflect the growth inherent in that model. The Ō2NL Traffic Model also includes significant growth at the external zones, which is reflective of the overall growth scenario adopted for that run (i.e. 25%ile, 75%ile or 95%ile). I consider this adequately covers any planned development in Ōtaki including the recent Kainga Ora Infrastructure Acceleration Funding announcement.

44. For the purposes of this assessment, the 75th%ile has been adopted as the base scenario. This takes into account the fact that there are likely to be fluctuations in growth over the time period. HDC has adopted the 95%ile projection for its 2021-2041 Long Term Plan, which is appropriate for longer term planning, and therefore we have used that as a sensitivity test.

45. Plan Change 4 to the HDC District Plan, which enables higher intensity development within the Tara-Ika Growth Area, is included in the modelled growth forecasts. Tara-Ika is a 420ha block of land located to the east of Levin that will include over 3,500 houses, a small commercial area, new parks and reserves, and educational facilities.

46. The current assumption for the Do-Minimum is that neither the Liverpool Street link or East West Arterial (**"EWA"**) from Tara-Ika to Arapaepae Road will be constructed. For the scenario with the Ō2NL Project in place, the EWA to Arapaepae Road is in place by 2029, but the Liverpool Street link is not.

47. It has been assumed that, once the Ō2NL Project is open, work will be undertaken on the old sections of State Highway 1 ("**SH1**") and State Highway 57 ("**SH57**"). Investigations to determine the scope of this revocation work are continuing and are being undertaken in discussion with HDC and KCDC. It is assumed that the work will make the old sections of

SH1 and SH57 fit for purpose[4] for their new use within the local road network. These investigations are being undertaken cognisant of the ongoing programme of the safety improvements being undertaken on SH1 and SH57 noted above.

[4] Fit for purpose means the revoked state highway section will provide a similar level of service to other roads with the same function in the local network and that the road is safe despite its change in function. (State Highway Revocation: Policy and Guidance, September 2021).

METHODOLOGY FOR ASSESSMENT OF EFFECTS

48. The broad approach to the assessment of transport effects is to consider the current transport environment, and then to assess the difference between the Ō2NL Project and the 'Do-Minimum'[5] in the future year of 2039. Three scenarios / situations have been considered for the purpose of the assessment:

    (a) The "Current Transport Network" – this is the current transport network that represents the present-day conditions (using 2018 traffic figures as the 'base').

    (b) The "Do-Minimum" or "Without Ō2NL Project" scenario – this is the assumed transport network predicted for 2039, including planned growth and population increase, PP2Ō,[6] online state highway safety improvements and HDC local road improvements (excluding the Ō2NL Project).

    (c) The "With Project" scenario– this includes the Do-Minimum, and the Ō2NL Project.

49. This approach is best practice for transportation assessments and reflects the true impact that is created by the Project. 2039 has been chosen as the future year of reporting effects as it is 10 years after the Project is programmed to open (which is normal practice when assessing and considering the actual and potential effects of new infrastructure projects) and is after a significant period of growth forecast by HDC. Project effects have also been considered in 2029 and 2049 but are not reported in detail here.

50. The methodology adopted to assess the impacts of the Ō2NL Project is presented below in relation to the following assessment areas:

    (a) Safety;

    (b) Resilience;

    (c) Travel Times and Delays;

[5] The Do-Minimum includes planned growth and committed improvement projects for a future year to enable comparison with the Project. The Do-Minimum for this analysis includes PP2Ō, online State highway safety improvements and HDC local road improvements.
[6] PP2Ō is not included in the "Current Transport Network", because it remains under construction at the time of this assessment.

(d) Induced traffic;

(e) Community Connectivity;

(f) Property Connectivity; and

(g) Construction Effects.

The Ō2NL Project Traffic Model

51. To understand the likely future state of the network due to growth and planned infrastructure upgrades, as well as to understand the benefits and impacts of any investment planned in the Project area, a traffic model was built.[7]

52. This model replicates the volumes and delays of the existing situation and forecasts how these will alter with changes in land use, population, and the transport network.

53. Changes to the transport network that have been planned, or are likely irrespective of the Ō2NL Project, have been included in the Ō2NL Project Traffic Model for future years. This is standard transport modelling practice and is appropriate for a project of this nature. The Ō2NL Project Traffic Model considers and compares the three scenarios described above.

54. The majority of the Ō2NL Project Traffic Model was built from scratch although it does incorporate a sub-section of the Kāpiti Coast "KTM4" SATURN model for the Ōtaki area, using both the network and demands.

55. As a wider strategic model is not present in this area, trip generation has been based on 'similar' zones of the Wellington Transport Strategic Model beyond Wellington City to relate demands to demographics (population, jobs, school roll) separately for light and heavy vehicles, for each model period.

56. Estimation of external or through-trips was based initially in 2011 on automatic number plate recognition surveys and this was updated in 2020 with GPS-based routing data from TomTom.

57. Trip distribution for light vehicles uses an innovative approach to apply trip distribution (via a gravity model) separately for some 25 trip types or 'quasi-purposes'. This ensures 'sensible' distribution of trips between where people

[7] The Ōtaki to north of Levin SATURN model was developed by MWH (now Stantec) in 2011 with the Model Validation Report being finalised in 2013. It was later subject to several updates by Tim Wright of QTP between 2015 and 2021.

live, work, shop, school, and receive health services. Matrix estimation[8] is applied in a constrained manner to improve initial validation of the assigned zonal demands to traffic counts. Effects of matrix estimation are carried forward to future years. Validation of travel times was undertaken using TomTom GPS data.

58. The v20a transport model update and reporting were completed in October 2020 and the model was subsequently subject to an additional peer review, which was commissioned by Waka Kotahi and HDC. The peer review process resulted in minor improvements to the model.

59. The model was subsequently updated to include variable trip matrices to enable consideration of suppressed demand (trips that are not made due to increased cost of travel, e.g. congestion) and induced traffic (new trips that are made due to increased attractiveness). The updated model was peer reviewed. Following the peer review and subsequent updates, the model has been approved for use by Waka Kotahi and I am satisfied with it as the basis of my assessment.

60. The Ō2NL Project Traffic Model has scenarios for the AM peak, interpeak, and PM peak periods for the 2018 base and for future years of 2029 (road opening year), 2039 (road opening plus 10 years) and 2049 (road opening plus 20 years).

Modelling future growth and development at Tara-Ika

61. Statistics NZ predictions have significantly underestimated recent growth in Horowhenua. The district has been experiencing exceptionally high growth due in part to more affordable house prices compared to the larger centres coupled with continued investment in the Wellington Northern corridor to the south. As a result, overall population growth within the Horowhenua District has instead been based on the Horowhenua Socio-Economic Projects Report by Sense Partners (May 2020), utilising the 25%ile, 75th%ile and 95%ile projections.[9]

62. The geographical spread of future population is based on analysis provided by HDC of potential household yields at a Meshblock level throughout the district. The three growth scenarios modelled help capture a range of

[8] Adjustment of initial demand estimates of both heavy and light vehicles to better reflect observed traffic volumes.
[9] The impacts presented in this assessment are primarily based on teh 75%ile scenario.

potential futures accounting for growth across both the Kāpiti and Horowhenua Districts.

63. HDC has identified a number of future growth areas, with the Tara-Ika Growth Area being the most notable for the purposes of the Ō2NL Project.

64. The total potential housing yield from the identified potential growth areas is greater than what is required to house the expected population growth. As there is currently no priority assigned to the different growth areas, the take-up-rate (% complete) of housing is expected to be the same across each area, except Tara-Ika. Growth in Tara-Ika is predicted to be greater due to the advanced nature of HDC proposed Plan Change 4 ("**PC4**"),[10] where utilities infrastructure improvements are occurring, and are planned to occur, and its proximity to Levin.

65. Job growth has been applied to the key growth areas north and south of Tararua Road, as advised by HDC, as well as the commercial development area in Tara-Ika. The balance of job growth required to match overall population growth has been applied uniformly to existing employment zones. The new school within the Tara-Ika area with an advised ultimate roll of 600 pupils has been modelled as having a 50% roll in 2029 and 100% in 2039.

66. Growth of external trips is assumed to mirror the wider model population growth assumptions for the different growth scenarios.

Safety

67. Safety is identified as a Strategic Priority of the Government Policy Statement ("**GPS**") and is also reflected in the Investment Prioritisation Method ("**IPM**") where projects are assessed for 'Very High' alignment if:

    (a) They target medium high or high collective risk corridors or intersections to achieve a death and serious injuries reduction of ≥40% over a 5-year period; and

    (b) Speed limit changes reduce operating speed in corridor by >10 km/h.

68. A range of safety measures have been considered in this assessment, to provide an overall picture of the safety of the current transport network, the

[10] At the time of this assessment, PC4 has been confirmed by a decision of HDC, to enable development of over 3,500 houses, a small commercial area, new parks and reserves, and educational facilities.

Do-Minimum, and the network with the Ō2NL Project. Best practice criteria have been applied as discussed in the next section of this assessment.

69. Estimated DSIs were calculated for the Do-Minimum (that is, retaining the existing network with committed Speed and Infrastructure Programme ("**SIP**") improvements) and Ō2NL Project scenarios. The approach taken was in accordance with the latest Waka Kotahi Monetised Benefits and Costs Manual ("**MBCM"**) full procedures.

70. A safety model was developed so that the wider network benefits could be captured – ie, a diversion of traffic from local roads to the Ō2NL Project offline highway consequently reduces the crash risk on those local roads. The Safety Model applied Ō2NL Project Traffic Model traffic volumes and actual crash data to the MBCM crash prediction formulas and reduction factors.

71. KiwiRAP provides three measures of risk: Collective Risk (crash density), Personal Risk (the risk to each individual), and Star Rating (an infrastructure rating). The KiwiRAP Assessment Tool was used to determine the star rating of the existing state highways. An understanding of the factors that affect star rating was used when considering the Do-Minimum, and the typical design features / layout of higher standard star rated state highways (4+) were considered to determine whether the Ō2NL Project would fit in this category.[11] A high-risk rural road is classified as being Medium-High or High in Collective or Personal Risk, or below 3-star rating value.

72. The Infrastructure Risk Rating ("**IRR**")[12] is a similar metric to Star Rating. Infrastructure safety risk was determined using the Waka Kotahi MegaMaps tool. The tool was used to compare the IRR of sections of SH1 and SH57 (the Do-Minimum), using forecasted volumes from the Ō2NL Project Traffic Model. This assessment considered the effects of predicted volume increases, as well as the Do-Minimum SIP treatments comprising of edge and median barriers, and wider centre lines. Roads with an IRR score above 1.6 (in rural areas) and 2.4 (in urban areas) have Medium-High (or higher) risks.

[11] As the KiwiRAP Assessment Tool (KAT) is currently only able to be used to test improvements on existing highways.
[12] Infrastructure Risk Rating (IRR) is a proactive measure of risk that is based on infrastructure and is less sensitive to crash history

73. Collective safety risk[13] was also calculated along sections of SH1, SH57, and local roads for the Do-Minimum and Ō2NL Project scenarios, using estimated DSI equivalents from the Safety Model.

74. The difference between the posted speed limit ("**PSL**") and the safe and appropriate speed ("**SAAS**") was assessed using Waka Kotahi's MegaMaps tool. This is a metric used by safety engineers to assess whether the speed limit exceeds the safety risk of the road. The output of the analysis is a percentage of the state highways in the study area that have a PSL matching the SAAS, to indicate the travel speed gap. Future information such as traffic volume and design features were input into the MegaMaps tool to determine the changes to the SAAS on each section, and I also accounted for sections where speed limit changes were to be undertaken as part of the Do-Minimum.

75. Safety at the rail level crossings within the study area was initially assessed based on the modelled change in traffic volumes across each crossing, as a proxy for the change in exposure risk. The assessment using the Ō2NL Project Traffic Model considers 13[14] of the 15 public level crossings within the study area; the remaining two level crossings are low volume and do not form part of the model.[15]

76. The Tararua Road and Liverpool Street crossings have also been assessed using KiwiRail's Level Crossing Safety Impact Assessment ("**LCSIA**") principles and forecasted traffic volumes from the Ō2NL Project Traffic Model, because they are the two locations likely to have increased traffic movements compared to the Do Minimum.

77. Based on LCSIA guidance,[16] each crossing was assessed against the following criteria:

    (a) Criterion 1: Requires the proposed design and future score of a level crossing to achieve and 'Low' or 'Medium-Low' level of risk as determined by the Level Crossing Safety Score ("**LCSS**").[17]

[13] Collective Risk or crash density is measured as the number of fatal and serious casualties over a distance
[14] South Mankau, Mokena Kohere, North Manakau, Bishops, McLeavey, Kimberley, Tararua, Liverpool, Bath, Queen, Tyne, Roslyn and Heatherlea.
[15] Side roads with level crossings not modelled are Bishops Road (230vpd) and McLeavey Road (215vpd).
[16] Level Crossing Risk Assessment Guide (v4, 2021), KiwiRail.
[17] The Level Crossing Safety Score (LCSS) considers a range of aspects including; ALCAM Risk information, site specific crash and incident data, site specific safety considerations and engineer risk scores.

(b) Criterion 2: Requires the proposed design and future score of a level crossing to achieve a LCSS number lower than, or equal to, the updated existing LCSS number.

Resilience

78. The GPS and the IPM identifies that resilience and security are co-benefits to the Strategic Priority of improving freight connections. This is reflected in the IPM where a 'Very High' alignment can be achieved by reducing unplanned road/rail service disruptions of ≥2hrs by >31%.

79. The One Network Road Classification Customer Level of Service ("**CLoS**") identifies the following as being the appropriate CLoS for state highways for the two relevant classifications of the Ō2NL Project extent:

High Volume	Route or viable alternative is always available. Very rapid restoration of route affecting normal operating conditions. Road users are advised well in advance of issues affecting network performance and availability
National	Route is always available during major weather or emergency events and viable alternatives exist. Rapid clearance of incidents affecting road users. Road users are generally advised in advance of issues and incidents

80. The resilience effects of the Project were estimated based on an analysis of how the journeys impacted by 'events' (in broad terms, crashes and natural hazard events) would change between the Do-Minimum and Ō2NL Project. Best practice criteria have been applied as discussed in the next section of this assessment.

81. The assessment considered information on historic events along the network, volumes of traffic impacted by an event, risk data, detour length, and travel time. Data was obtained from a variety of sources including:

(a) Waka Kotahi Traffic Road Event Information System ("**TREIS**") data from the previous 5 years.

(b) Ō2NL Project Traffic Model volume information for the Do-Minimum and Ō2NL Project.

(c) Waka Kotahi's detour tool.

(d) Google Maps data for approximate travel length (in time and distance).

(e) Ō2NL Project Traffic Model information on the expected travel times on the Ō2NL route.

(f) Waka Kotahi Resilience Data (Hazard exposure maps).

(g) Design information for the Ō2NL Project.

82. From considering the above sources, the lengths and approximate travel times were calculated for the existing SH1 route, the existing alternate route (via SH2 Remutaka Hill), and alternate routes under the Ō2NL Project scenario. The volume of traffic exposed to hazards was also assessed using the traffic model for both the Do-Minimum and Ō2NL Project scenarios.

83. Resilience effects were estimated by considering both the impact of the Project on event frequency and the number of journeys impacted.

84. For 'low impact high probability' events like crashes, resilience benefits were estimated by applying crash reduction calculations (as derived through the safety analysis) to the TREIS data from the previous 5 years. This accounted for most of the closure events as crashes were the most frequent closure event.

85. In terms of bridge and flooding risk, the design standards for the new bridges were used to understand the likelihood of closures for the new highway.

Travel Time and Delays

86. Travel times for three key routes between Ōtaki to north of Levin (Ōtaki to Levin, Ōtaki to SH1 north of Levin and Ōtaki to SH57 north of Levin) were output from the Ō2NL Project Traffic Model. Travel times for the PM peak hour in 2039 along these sections of State highway have been reported and compared for both the Do-Minimum and Ō2NL Project.

87. Similarly, the future state highway and side road delays have also been extracted from the Ō2NL Project Traffic Model. The model has been used as a screening tool to understand network performance, with particular focus on delays. For this assessment LOS D (Level of Service D – side road delays between 31 and 50 seconds) has been considered the minimum tolerable performance threshold. Further investigation of links with a LOS E or worse (51 to 70 seconds; as shown in the Ō2NL Project Traffic Model), for the with

Ō2NL Project scenarios only, was carried out using SIDRA intersection modelling (a software tool used for intersection performance analysis).

Induced Traffic

88. The updated Ō2NL traffic model includes consideration of elastic (or variable) assignments, rather than fixed. This means that rather than assuming the same number of trips happen regardless of the level of service provided by the transport network, the number of trips on the network can increase in response to new infrastructure (ie induced traffic) and decrease in response to congestion (ie suppressed trips).

89. The impacts of elastic assignments have been assessed by considering traffic volumes on the highways, changes in total trips on the entire network and total vehicle kilometres travelled ("**VKT**"). This has been undertaken to compare the Do-Minimum and Ō2NL Project scenarios to understand the relative impacts.

Community Connectivity

90. Community connectivity refers to the ease of access to, from and between communities in the vicinity of the Ō2NL Project.

91. The impact to community connectivity has been assessed following a review of changes in distance and travel times between various areas that would be influenced by the Ō2NL Project.

92. This was undertaken using the Ō2NL Project Traffic Model to look at each zone and determine the average travel distances and times for all trips with an origin or destination of that zone. This compared the Do-Minimum and Ō2NL Project scenarios to understand the relative impacts.

Property Connectivity

93. The impacts of the Ō2NL Project on access to individual properties was assessed using the Ō2NL Project design, property layer data and the latest KMZ[18] showing proposed access connections for impacted properties.

94. Travel times from each of the affected properties (or likely access point where a new parcel is created) were estimated using the additional distance vehicles would travel to a destination in the north (heading towards

[18] This assessment was undertaken using a Google Earth KMZ file entitled "Accesses 21Dec20 updated 5May21"

Palmerston North) or south (heading towards Ōtaki) and the posted speed of the roads. Speeds for any proposed private accessways were assumed to be 30km/h.

Construction Effects

95. A preliminary assessment of the predicted future year safety performance of the potential construction routes and state highway intersections has been undertaken using estimated construction traffic volumes, existing intersection layouts and historic crash data.

96. The details of the construction methodology have not yet been confirmed. A conservative approach has been adopted for the volume of construction traffic and a safety assessment has been undertaken of the likely construction traffic routes and intersections to determine their suitability to handle additional heavy vehicle movements safely.

Statutory Considerations, including National Standards, Regional and District Plans, and Other Relevant Policies

97. The following national statutory and non-statutory documents apply to this assessment (see also AEE Volume II for an assessment of these documents):

    (a) Resource Management Act 1991 ("**RMA**").

    (b) Land Transport Management Act 2003 ("**LTMA**"). Government Policy Statement on Land Transport 2021 ("**GPS**").

    (c) National Land Transport Programme 2021-2024 ("**NLTP**").

    (d) Arataki 2 – Waka Kotahi's 10-year plan.

    (e) Waka Kotahi's Road to Zero 2020-2030.

98. I note that although the Project is not required to be consistent with the GPS as it is funded outside of the NLTF, the Ō2NL Project is strongly aligned with delivering the 'Safety' and 'Improving Freight Connections' strategic priorities of the GPS. It will deliver 'Better Travel Choice' to a moderate level and 'Climate Change' to a low level (for climate change adaptation eg flooding and lifelines).

99. The NLTP was released in September 2021. Although the Project is funded outside of the NLTF, the NLTP highlights the benefits of the Ō2NL Project in

terms of climate change adaptation, improved freight connections, safety and walking and cycling.

100. In relation to Waka Kotahi's Arataki Version 2, the Ō2NL Project is highly aligned with Step Changes No.1 (liveability of Levin), No.3 (safety), No.4. (resilience/freight reliability), and No.5 (regional growth), as they directly relate to the identified problems of the business case. Although the alignment with the other Step Changes (No. 2 Transform Urban Mobility, and No. 4 Tackle Climate Change) are less, I still consider the overall alignment to be strong.

101. I also consider that the Ō2NL Project is strongly aligned with the vision of Road to Zero, as reducing DSIs and improving safety is a primary outcome of the Project.

102. Other regional and district level statutory and non-statutory documents include:

    (a) Regional Land Transport Plans of Horizons Regional Council (2021-2031) and Greater Wellington Regional Council (2021-2031) ("**RLTP**").

    (b) Regional Public Transport Plans of Horizons Regional Council (2021-2031) and Greater Wellington Regional Council (2021-2031) ("**RPTP**").

    (c) Horizons One Plan, Wellington Regional Policy Statement, and the Wellington Proposed Natural Resources Plan.

    (d) District Plans of HDC and KCDC.

    (e) Wellington Regional Growth Framework.

103. The Ō2NL Project was the number one priority activity in the previous Horizons RLTP 2015-2025. The Project is now funded outside of the NLTFP; however, the Project is still identified in the RLTP as a primary investment area, and as a project identified by the Regional Economic Recovery Taskforce in response to COVID-19.

104. Other District Council strategies are also relevant, including but not limited to:

    (a) Levin Town Centre Strategy;

    (b) Horowhenua Shared Pathways Strategy;

    (c) Horowhenua Integrated Transport Strategy;

(d) KCDC Cycleways, Walkways and Bridleways Strategy; and

(e) KCDC Sustainable Transport Strategy.

105. The Ō2NL Project is consistent, from a transport perspective, with all these documents. Therefore, for reasons I outline below, I consider the Project has strong alignment with transport policy at a regional and national level.

THE CURRENT TRANSPORT NETWORK AND ITS PROBLEMS

106. For the purposes of this assessment, the current transport network comprises the area traversed by SH1 and SH57 from just north of Ōtaki (at the northern end of PP2Ō) and to the north of Levin (at the proposed Project 'tie-in' points). In this area, SH1 and SH57 interact with a large number of local roads, and the NIMT.

Figure A.1: Existing Transport Network

107. SH1 and SH57 are heavily trafficked, two-lane state highways without median or significant lengths of side barriers, with problematic geometry, and large numbers of direct accesses and roadside hazards. As a consequence, the current transport network has significant safety and resilience issues.

The existing State Highways

108. SH1 between Ōtaki and Levin is classified as a National (high volume) Road in the One Network Road Classification ("**ONRC**"). It is the only route

between the two centres and has one lane in each direction, although there are a few locations with passing lanes.[19]

109. SH1 through and north of Levin is classified as a National Road, providing north-south connections between Levin and the rest of the North Island (north and west). The 3.3-kilometre stretch of SH1 within Levin has a single lane in each direction, with a flush median for most of the length. This portion of the road has a 50km/h posted speed limit. North of Levin the highway is more rural in nature.

110. SH57 (Arapaepae Road) is an important strategic route which connects SH1 with Shannon, Tokomaru, and Palmerston North. SH57 through and north of Levin is classified as a National Road.

111. My review of the study area[20] showed that SH1 and SH57 fall well below the standard expected of national state highways. These highways have a range of specific deficiencies:

    (a) SH1 has nine out-of-context horizontal curves[21] and 14 geometrically deficient vertical curves. SH57 has the Kimberley Road / Arapaepae Road right-angle bend, which is out-of-context with the remaining straight horizontal alignment.

    (b) Approximately 82% of the length of SH1, and 89% of the length SH57, is rated as having either a moderate or a severe roadside hazard.

    (c) There are almost 40 intersections and over 400 accessways on the rural sections of SH1 and SH57. This is over five times the number of recommended accessways/intersections in the Waka Kotahi Planning Policy Manual[22] for this type of highway, based on the spacing between them. The Waka Kotahi Planning Policy Manual makes recommendations that promote safety outcomes on state highways (and non-compliance indicates higher risk environments).

[19] Passing lanes have been progressively removed / closed in response to increasing safety concerns.
[20] SH1 and SH57 between Taylors Road north of Ōtaki and Heatherlea East Road north of Levin.
[21] Out of content curves are typically less than 400m radius turns where a large approach speed reduction (>20 km/h) is recommended to navigate it safely.
[22] Waka Kotahi, Planning Policy Manual (PPM), https://www.nzta.govt.nz/resources/planning-policy-manual/.

Traffic volumes

112. Current[23] (2019) traffic volumes on the State highway network are as follows (refer Figure A.7 below):

    (a) South of Taylors Road, there are approximately 16,700 vehicles per day ("**vpd**") travelling along SH1.

    (b) Approximately 18,300 vpd, including over 1,750 heavy vehicles, travel along SH1 near Ohau.

    (c) In the section north of the SH1/SH57 intersection, the existing traffic volume on SH1 through Levin is approximately 14,100 vpd.

    (d) On SH1 north of Levin, the existing traffic volume is approximately 11,500 vpd.

    (e) The SH57 traffic volume north of Queen Street is currently over 9,400 vpd.

113. In terms of travel patterns, trips heading north along SH1 north of Ōtaki typically have the following distribution in the morning peak, based on TomTom GPS data:

    (a) 5% have a local destination between Ōtaki and south of Levin.

    (b) 26% are heading north of Levin, via SH1.

    (c) 33% are heading north of Levin, via SH57.

    (d) The remaining 36% of trips are to local destinations around Levin.

[23] Note that due to the on-going impacts of COVID-19 on travel patterns, 'current' flows refer to 2019 observed. While 2020 traffic flows were significantly disrupted, flows in 2021 for several traffic monitoring sites within the study area have recovered to within less than 5% of 2019 volumes (with count sites on SH57 showing a slight increase in flows of 1-4%).

Figure A.2: Ō2NL Project area traffic volumes (2018 modelled and 2019 Actual)[24]

Walking and cycling

114. There are no dedicated walking or cycling facilities to travel from Ōtaki to Levin. The safety and utility of the current transport network for these active

[24] Network differences between modelled and observed volumes are minimal and generally within 500-1,000 vpd (or less) and within model validation guidelines. I believe that the differences will not have a significant bearing of the need for, or effects of the project.

modes is impacted by the volume and speed of general traffic and the poor width and geometry of the roading layout.

115. SH1 through Levin mostly has footpaths on either side of the road. There are pedestrian crossings at two signalised intersections, two median pedestrian refuges, and one zebra crossing. There are few formal provisions for cyclists, with cyclists having to pass angled parking, which creates a dangerous environment.

116. SH1 through Ohau and Manakau operates at 80km/h. Apart from the pedestrian underpass at Ohau, the lack of signalised intersections and active mode facilities in these high-speed zones creates an unsafe environment for pedestrians and cyclists.

117. The rural sections of SH1, between Ōtaki and Levin, and SH57, have sealed shoulders of varying widths (no sealed shoulders on the rail overbridges), which are not suitable for pedestrians or cyclists.

Public transport

118. There is very little public transport provided or used within the Horowhenua District (including to / from Ōtaki).

119. Accordingly, public transport by bus makes up about 0.1% of the mode share for work trips and 14.7% of trips to education in the Horowhenua District. This is due to the low population density, low demand and limited public bus services available around Levin and surroundings.

120. Current bus services (all one return service on the days they operate) are as follows:

    (a) 'A day out in town bus service' which connects Levin, Waitarere Beach, Foxton, Foxton Beach, and Shannon every Friday.

    (b) Levin to Waikanae via Ōtaki service which runs Tuesdays and Thursdays.

    (c) Levin to Palmerston North commuter bus service which runs Monday to Friday.

121. There are also longer intercity services that connect Levin with most other major destinations in the North Island.

122. Rail makes up about 1% of the mode share of trips to work and education in the Horowhenua District, with the Capital Connection providing a daily commuter rail connection between Levin and Wellington. The Levin Rail Station is accessed from SH1. There are no rail stations between Ōtaki and Levin.[25]

123. In total, there are only 17 return bus/train services every week, which could potentially be used by commuters (noting that some of these are focused on shoppers / accessibility rather than commuters). Generally, between eight and 12 inter-regional intercity bus services travel through Levin per day.

Safety

124. As described above, a range of factors make the existing state highway network a challenging roading environment. Overall, these sections of SH1 and SH57 are not fit for purpose, in light of the important functions they serve. The problems with the existing highways are unfortunately reflected in poor safety outcomes, including 72 DSIs from crashes in the last five years.

Crashes

125. Crashes, including those that results in DSIs, were identified through a Crash Analysis System ("**CAS**") search from the last five full years (2017-2021). There were 14 fatal crashes and 39 serious injury crashes on SH1 and SH57 within the study area (outlined below in Figure A.3) during that time. Of the 53 high severity crashes, eight affected vulnerable users of which six involved pedestrians and two involved cyclists. Fatal crashes, including those involving vulnerable users, are outlined below.

126. Of the 14 fatal crashes:

    (a) Eight crashes were head-on collisions in high speed-zones (80km/h and above). Seven of these crashes occurred on SH1, and one on SH57.

    (b) Two crashes involved vulnerable users struck in high-speed zones on SH1 in dry conditions; one pedestrian, one cyclist.

    (c) The four remaining fatal crashes, each on or adjacent to SH1, were:

        (i) loss of control at high speed;

[25] Ōtaki station is located south of the Ō2NL Project area.

(ii) train collision (Bishops Road);

(iii) rear end at high speed while fleeing police; and

(iv) vehicle waiting to turn right in a 50 km/h zone rear ended. This crash was the only fatal crash in an urban area (Levin township).

127. Additionally, there were 107 minor injury crashes, and 303 non-injury crashes during the 2017 – 2021 period.

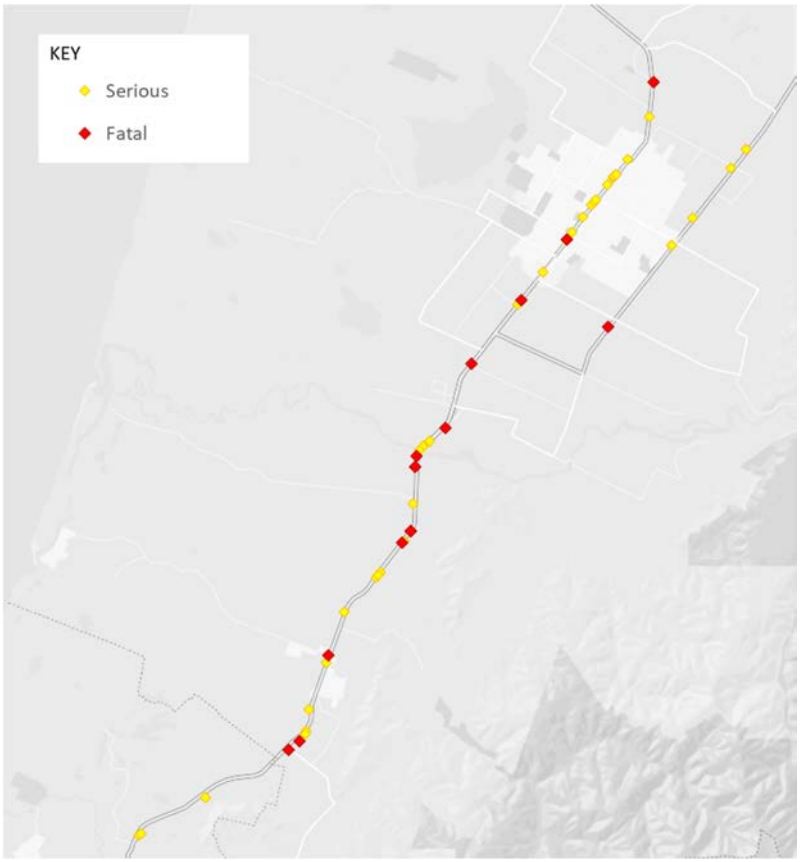

Figure A.3: Fatal and serious crashes within the Ō2NL Project area, 2017-2021

Safety Risk

128. Each state highway around the country is given a KiwiRAP Star Rating, which is a published rating of how safe infrastructure is, taking into account of the volume of traffic it carries. A very good road rates 5 Stars (e.g. MacKays to Peka Peka) and a very poor road rates 1 Star.

129. The SH1 (National High Volume) and SH57 (National) corridors both have a KiwiRAP Star Rating of 2, which is the worst published rating of any state highway in New Zealand.

130. The risk associated with the poor geometry and road alignment of SH1 and SH57 will be amplified once the PP2Ō expressway opens (PP2Ō will be a KiwiRAP 4–5-star median divided highway). In my opinion, this change in roading environment when travelling north, will increase the likelihood of crashes within the Ō2NL Project area unless significant improvements are made. Drivers will be coming off a safe, well aligned and high speed route, and onto a highway with a significantly higher risk profile requiring significantly more caution. The two rail overbridges at Manakau and Ohau are prime examples of poor geometry and are locations where drivers are not able to manage their own risk as there is limited visibility to oncoming traffic and no ability to pull off the road.

131. Another relevant risk metric is the IRR[26] which was determined along the approximately 31.8km (21.9km of SH1 and 9.9km of SH57) of state highways within the Ō2NL Project area (the full extent). This rating tool is often used as an input into safety investigations, as it assesses road sections based on existing infrastructure and is less sensitive to crash history than the KiwiRAP rating.

132. A summary of the analysis is shown in **Table A.1**, and indicates the percentage of the road corridor by IRR band. From this, 88% of SH1 and SH57 within the Project area are classified as a 'Medium' or higher IRR. This means that based on the existing safety infrastructure, a high proportion of SH1 and SH57 are at a medium or higher risk of a crash occurring.

Table A.1: MegaMaps IRR of Analysis of the Existing SH Network

IRR Band	Existing SH Network
Low	0%
Low Medium	12%
Medium	73%
Medium High	15%
High	0%

133. As a result of the large number of high severity crashes on the SH1 and SH57 rural road sections, these roads are classified as High-Risk rural roads. The Waka Kotahi MegaMaps tool indicates that the majority of these road

[26] Infrastructure Risk Rating (IRR) is a proactive measure of risk that is based on infrastructure and is less sensitive to crash history.

sections have medium-high to high collective risk (which is a measure of crash history), as shown in Table A.2, and also reinforces what is indicated by the IRR assessment. This suggests that the recorded crash history (discussed above) generally reflects the high safety risk associated with the current infrastructure. This table also shows the collective risk[27] of the wider network[28] surrounding the Project area.

Table A.2: Collective Risk Assessment of the current State Highways and wider network

Collective Risk Band	Existing SHs	Wider Network
Low	0%	8%
Low Medium	9%	20%
Medium	29%	26%
Medium-High	19%	14%
High	43%	32%

134. For most of the state highway network, the PSL exceeds the calculated SAAS, resulting in a travel speed gap. Overall, only 15% of the state highway network in the study area has a safe and appropriate PSL.

Interactions with the NIMT and safety implications

135. The NIMT line runs adjacent to SH1, but crosses underneath SH1 three times. These locations are the Pukehou Rail Overbridge, the Manakau Rail Overbridge and the Ohau Rail Overbridge.

136. However, as a result of the existing land use and transport network connectivity, there are 19 level crossings[29] within the area, as shown in Figure A.4. This includes a level crossing at SH57 Kimberley Road, adjacent to the intersection between SH1 and SH57, and several level crossings within urban Levin.

[27] Collective Risk or crash density is measured as the number of fatal and serious casualties over a distance.
[28] The wider network considers around 42.5km of road sections within the Ō2NL Project area based on the network crash model (21.9km of SH1, 9.8km of SH57 and 10.8km of key local roads).
[29] 15 are classified as public crossings and 4 as private.

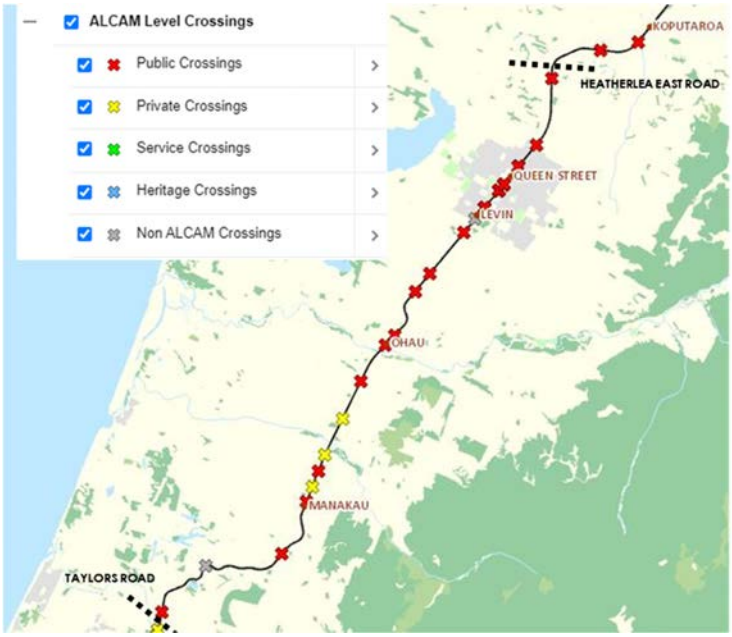

Figure A.4: ALCAM Level Crossing Locations[30]

137. According to the Australian Level Crossing Assessment Model ("**ALCAM**") level crossing risk database,[31] the NIMT line within the study area has an average 15 trains per day. The ALCAM database also highlights that 14 of the 15 public level crossings are rated as being in a "Medium-High" or "High" ALCAM risk band, based on several risk measures, including the number of trains, train speed and side road traffic volumes.

138. Traffic volumes from the Ō2NL Traffic Model[32] base scenario (2018) for flows across each level crossing within the study area (the 'railway screenline') are illustrated in Figure A.5 below. This highlights that the busiest level crossings are those within central Levin (Queen St West, Bath St, Liverpool St, Tyne St and Tararua Rd) followed by SH57 Kimberley Road.

139. As SH1 and the NIMT both effectively bisect Levin, level crossing risks will increase with the expected growth in population and associated increases in both road and rail travel demand.

[30] https://gis.kiwirail.co.nz/maps.
[31] ALCAM 2018 Data for Public Level Crossings.
[32] Model scenario 00a_18.

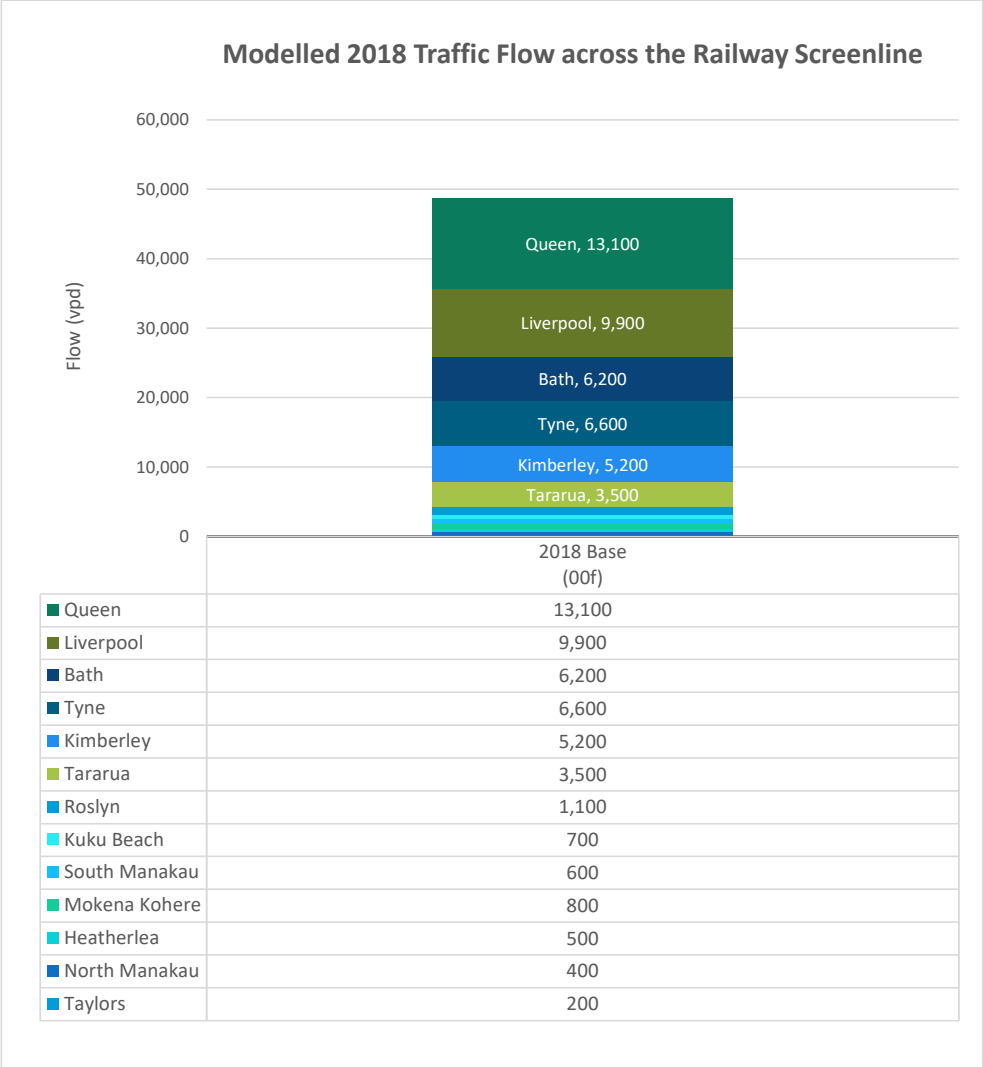

Figure A.5: Railway Screenline Modelled '2018 Base'

Resilience

140. The existing State Highways are critically important for passenger and freight movement through the lower North Island. However, SH1 is highly vulnerable to closures resulting from crashes and natural hazard events. There is no viable alternative route between Ohau and Manakau; closures of SH1 create significant delays. Within the study area, SH1 is at a high risk of closure from:

    (a) Earthquakes, as five bridges have a high or significant earthquake disruption risk, four of which are located on SH1 between Manakau and Ohau and have no viable alternate route.

    (b) Flooding, as the existing highway passes through a floodplain and is also subject to surface flooding. Two recent large-scale events closed

the highway between Ohau and Manakau; one for 90 minutes and the other for over 24 hours, the later was when the approach to the Waikawa Bridge was washed away.

(c) Crashes, as discussed above, high severity crashes often occur between Manakau and Ohau resulting in highway closures for several hours. As there is no alternate route, queues of several kilometres often form.[33]

141. For the period 2017/18 to 2021/22, SH1 had an average of over five unplanned closures per year (28 overall); most were due to crashes. The average closure duration was around four hours. Closures on the SH57 section of the Ō2NL Project area have been less frequent than SH1 (5 since 2017/18, around 1 per year), with a similar average duration of four hours.

142. When an event occurs on SH1 between Manakau and Ohau that closes the highway, the trip from Wellington to Levin needs to be undertaken via the Wairarapa, which increases trip time by at least two hours; much more during peak hours and high traffic conditions.

143. SH1 is critical in the overall accessibility of Wellington, as the only alternative route is SH2 via the Remutaka Hill, which is also at a high risk of disruption.[34] Significantly, two of the SH1 bridges with the highest risks are over the railway line, so if they fail it affects all modes.

144. Without investment, the social and economic consequences of events will continue to increase with travel demand growth, climate change and ageing structures.

Travel times and delays

145. Delays experienced on the Current Transport Network are primarily associated with crashes and natural hazard events. Some congestion is experienced through central Levin and this can become significant during weekends and holiday periods.

146. Existing travel times for three key routes between Ōtaki to north of Levin (Ōtaki to Levin, Ōtaki to SH1 north of Levin and Ōtaki to SH57 north of Levin)

[33] In January 2021, a crash between a motorcycle and truck fully closed SH 1 south of Ohau for several hours with no alternative route, causing significant queuing. https://www.rnz.co.nz/news/national/434396/state-highway-1-closed-near-levin-due-to-crash

[34] Source: https://nzta.maps.arcgis.com/apps/MapSeries/index.html?appid=5a6163ead34e4fdab638e4a0d6282bd2.

were assessed based on TomTom data collected in 2018. This is presented in Table A.3 below for the PM peak.

Table A.3: 2018 TomTom PM Peak Travel Times

Route	2018 TomTom Travel Time
Ōtaki to SH 1 North of Levin	26.0 min
Ōtaki to Central Levin	16.9 min
Ōtaki to SH 57 North of Levin	22.8 min

147. The data shows that PM peak travel times for journeys between Ōtaki and SH1 North of Levin currently take on average 26 minutes, journeys between Ōtaki and SH57 North of Levin take on average 23 minutes while journeys from Ōtaki to Central Levin (Queen Street/ Oxford Street) take on average 17 minutes.

148. To understand the delays currently experienced for journeys across these key routes, the PM peak travel times were compared to an off-peak weekend period. This assessment showed that travel times were typically 5-10% longer during the PM peak. Delays for shorter journeys, for example SH1 through the Levin Town Centre, were found to be over 20% longer during the PM peak when compared to the weekend off-peak.

149. Side road delays[35] have been quantified using the Ō2NL Project Traffic model (discussed under the Traffic Modelling section), which has been built, calibrated, and validated using traffic volume data from 2018, so the delays accurately represent existing delays.

150. To categorise the delays, a simple Level Of Service ("**LOS**") definition has been adopted, based on the Highway Capacity Manual (HCM) 2010 signalised and un-signalised intersection thresholds:

Table A.4: LOS Thresholds for the Ō2NL Project Traffic Model

Level of Service	Description	Delay (s)
A – C	Free flowing / Acceptable delays	<30
D	Unsettled / Tolerable delays	31-50
E	Significant delays	51-70
F	Congested / Queues	>70

[35] The delays experienced by traffic turning out of side roads onto SH1.

151. The traffic model shows most side roads along the SH1 corridor between Ōtaki and Levin operate with delays of less than 30 seconds (LOS C or better).

152. I note that from discussions with local residents, these delays can extend out to several minutes during holiday weekends and during other high traffic situations. For the section of SH1 between north of Ōtaki and south of Levin, eleven of the fourteen side roads have no other way of accessing the road network except via their own intersection with the current SH1.

153. There are also some points on the network that regularly have larger delays. Side road with delays over 30 seconds (LOS D or worse) are shown in Figure A.6.

154. Forest Lakes Road operates at LOS E with a delay of 62 seconds during the PM peak hour to turn right onto SH1. The higher the traffic volume on SH1, the fewer opportunities there are for side road traffic to access the State highway, and consequently, the higher the side road delays.

Figure A.6: Modelled side road delays 2018 PM Peak[36]

[36] Model run 00a_M1

THE FUTURE 'DO-MINIMUM' / WITHOUT Ō2NL PROJECT SCENARIO

155. This section describes the key elements of the 'Do Minimum' scenario.

Growth

156. The communities within the vicinity of the Ō2NL Project are projected to grow considerably over the next 20 years.

157. Growth in Horowhenua District has been occurring at a much faster rate in the last 5 years, than the previous 10 years at least. HDC projections[37] to 2040 equate to an additional 16,000-26,000 people living in the district. The Wellington Regional Growth Framework ("**WRGF**") also includes Levin as a high growth location.

158. HDC has identified several growth areas across the district, including at Ohau, Manakau and the Tara-Ika area east of Levin.[38]

159. The Tara-Ika Growth Area[39] is a 420ha block of land located to the east of Levin. HDC are anticipating that approximately 3,500 houses, a small commercial area, new parks and reserves, and educational facilities will be built within the Tara-Ika Growth Area.

160. The Horowhenua Growth Strategy 2040 (HGS 2040) also identifies 43 hectares of land located to the south of Tararua Road between SH1 and Arapaepae Road for future industrial development. In addition, there is a current but largely vacant lot comprising approximately 60 hectares located to the north of Tararua Road, which is zoned for industrial development.

161. Overall, yield analysis undertaken on data provided by HDC identified 2,400ha of land across the wider district for greenfield growth, which will be implemented over the medium to long term.

162. In addition to growth across the Horowhenua District, the Kāpiti Coast is also expected to grow, with over 22,000 additional people forecast to be living in the district by 2041.[40] This is a population increase of approximately 40% compared to 2021.

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[37] The Horowhenua Socio-Economic Projections Update Report (May 2020) predicts that this growth will continue, especially considering the investment in the transport corridor between Wellington and Ōtaki and the rising cost of living in the main urban centres. Population projection based on a range between the 75th and 95th percentile. For the purposes of infrastructure development planning, HDC have adopted the 95th percentile growth projection for its Long Term Plan ("**LTP**").
[38] See: Horowhenua Growth Strategy 2040.
[39] See: Tara-Ika Master Plan - Horowhenua District Council.
[40] See: https://www.kapiticoast.govt.nz/our-district/the-kapiti-coast/population-and-demographics.

163. Of particular relevance to the Ō2NL Project is the higher rate of growth forecast between the Ōtaki River and Taylors Road, with an additional 5,000 people living in Ōtaki, Ōtaki Beach, Forest Lakes and Waitohu by 2041. This is a higher rate of growth compared to elsewhere in the district, increasing the proportion of Kāpiti residents living north of the Ōtaki River from 13% in 2021 to over 22% by 2041.

Do-Minimum Infrastructure Upgrades

164. There are a number of different infrastructure improvements that have been committed prior to the Ō2NL Project opening. In line with best practice, these elements have been added to the Current Transport Network scenario to create a 'Do-Minimum' scenario. This is the baseline for my assessment. The Do-Minimum includes the following infrastructure upgrades, the majority of which target reducing the existing safety risks:

    (a) Completion of PP2Ō in 2022; being a four-lane expressway and SUP that extends north from the MacKays to Peka Peka expressway and ties into the existing SH1 at Taylors Road (the southern extent of Ō2NL).

    (b) SAAS adjustments from South of Manakau to South of Levin, from SH1/57 to SH57/Tavistock Rd and from SH1 north of Levin to the Manawatu River.

    (c) Construction of roundabouts at SH57/Queen St and SH57/Tararua Rd intersections.

    (d) Removal of short substandard passing lanes on SH1.

    (e) Corridor improvements to centrelines, flush medians, signs, markings, and median barriers on sections of SH1 and SH57.

    (f) With the above works the Taylors Road intersection will be left in left out only with other movements via a turnaround provided at the current layby north of Taylors Road or the new connection under the Waitohu Stream Bridge and into the existing SH1.

    (g) HDC local road improvements:

        (i) Those associated with Tara-Ika (including the internal network).

(ii) Upgrading roundabouts at Queen St East/Cambridge St and Queen St West/Weraroa Rd.

(iii) Construction of a cycle lane on Queen St from Oxford St to Salisbury Rd.

Traffic Volumes

165. Significantly higher traffic volumes are predicted into the future in line with the projected population increases in Kāpiti and Horowhenua.

166. Vehicle volumes are projected to increase in the wider region as follows (see also Figure A.7 below):

(a) South of Taylors Road, the current[41] 16,700 vpd along SH1 is expected to increase to 24,800 (along the PP2Ō expressway) and reduce to just over 200 vpd on the section of former SH1 by 2039.

(b) The current 18,300 vpd, travelling along SH1 near Ohau is expected to increase to over 27,700 vpd by 2039.

(c) In the section north of the SH1/SH57 intersection, the existing traffic volume on SH1 is expected to increase from 14,100 vpd to over 22,000 vpd by 2039.

(d) On SH1 north of Levin, the traffic volumes are expected in increase from 10,500 to 17,400 vpd by 2039.

(e) The SH57 traffic volume north of Queen Street is expected to increase from 9,400 vpd (2019) to over 16,300 vpd by 2039.

167. Overall, the forecast growth rates per annum for the locations outlined above are similar, but slightly lower than observed five-year growth rate, pre COVID-19.[42]

168. The existing and future traffic volumes are shown in Figure A.7. The increase in traffic demand will progressively result in larger 'platoons' (long

[41] Note that due to the on-going impacts of COVID-19 on travel patterns, 'current' flows refer to 2019 observed. While 2020 traffic flows were significantly disrupted, flows in 2021 for several traffic monitoring sites within the study area have recovered to within less than 5% of 2019 volumes (with count sites on SH57 showing a slight increase in flows of 1-4%). In terms of future traffic forecasts, there is uncertainty, particularly due to COVID-19. However, the HDC population projections, which are an input into the model, were developed to include the impacts of COVID-19. Further, the recent trends show that for the study area, volumes have already returned to pre-COVID-19 levels.

[42] Traffic volumes are forecast to increase at a rate of approximately 2.5%-3.5% per annum (2019-2039) based on the 75th percentile population growth scenario, with upper end of this range expected along SH57 as a result of planned development. It is noted that this growth rate is slightly lower than the observed 5-year traffic growth pre COVID-19 (2015-2019), which ranged from 3-4% per annum.

close lines) of vehicles. This then leads to a significant reduction in passing opportunities along the whole corridor, a reduction in mean speed and a greater sensitivity to unplanned or unexpected events.

169. The increase will also reduce the ability for people to access the highways (SH1 in particular) as there will be fewer gaps available for drivers to safely enter the traffic flow from side roads, creating delays. In very high delay situations this can lead to traffic from side roads forcing a gap on the highway and leading to delays for through traffic. In addition, as intersections become busy, there will be fewer opportunities for pedestrians and cyclists to cross the corridor and the complexity of decision-making for all users increases, leading to greater safety risk.

Figure A.7: Do-Minimum modelled Ō2NL Project area traffic volumes (2018 vs 2029, 2039 & 2049)[43]

[43] 2049 volumes on Kimberley Road decrease due to increased congestion at SH1/SH57 resulting in trip re-routing.

PROBLEMS ASSOCIATED WITH THE DO-MINIMUM

170. As discussed above, the Do-Minimum includes a number of interventions which aim to address (in part) the safety problems with the Current Transport Network. Those interventions will have positive impacts. However, the benefits of the interventions will reduce over time because of the significant increase in vehicles on the road.

171. In respect of resilience, existing vulnerabilities to the network will be heightened by climate change.

172. Overall, the Do-Minimum interventions alone do not create a fit-for-purpose road for users in 2039. The projections indicate that, due to increasing traffic volumes associated with growth, the Do-Minimum scenario will result in similar numbers of deaths and serious injuries in 2039 compared to the Current Transport Network today.

Safety

173. The Do-Minimum interventions (primarily through the SIP) are expected to save approximately 27 DSIs per 5-year period. This represents approximately a 30% reduction in DSIs on the State highway and a 4% reduction on local roads when compared to a hypothetical 2039 'Do Nothing' scenario.

174. The provision of sections of targeted edge and median barriers, wide centre lines / flush median, and roundabouts proposed as part of the SIP will improve the KiwiRAP Star Rating for the existing state highways. However, this will be offset, in part, by traffic volume growth over time and the removal of three passing lanes on SH1. Overall, it is expected that the average KiwiRAP Star Rating for both SH1 and SH57 will increase to 3 Stars under the Do-Minimum scenario.

175. In the Do-Minimum scenario, there will be a speed limit reduction from 100km/h to 80km/h on SH1 between Ohau and Manakau and on SH57. These reductions will improve the travel speed gap so that 73% of the State Highways in the Project area will operate under a PSL that equals the SAAS, up from 15% under the existing situation.

176. The IRR[44] was determined along approximately 31.8km (21.9km of SH1 and 9.9km of SH57) of state highways within the Ō2NL Project area. Forecasted 2039 'Do-Minimum' modelled volumes[45] were used to determine the safety risk along these corridors. A summary of the analysis is shown in Table A.5, and indicates the percentage of the road corridor by IRR band.

177. From this, some improvement can be seen:

(a) around 5% of the analysed road sections along SH1 and SH57 are classified as a 'Medium High' or higher IRR, down from 15% under the existing situation as a result of the SIP improvements; and

(b) overall, around 86% of the road sections would be classified as 'Medium' or higher IRR, down from 88% currently.

Table A.5: MegaMaps IRR of Analysis of the Do-Minimum

IRR Band	Existing	Do-Minimum 2039 (without Ō2NL)
Low	0%	0%
Low Medium	12%	16%
Medium	73%	79%
Medium High	15%	5%
High	0%	0%

178. Collective safety risk[46] was assessed for the 'Do-Minimum' scenario by considering around 42.5km (21.9km of SH1, 9.8km of SH57 and 10.8km local roads) of road sections within the Ō2NL Project area based on the network crash model. A summary of this analysis is shown in Table A.6, and indicates the proportions of analysed road section in each collective risk band.

179. From this:

(a) around 42% of the analysed road sections are classified as 'Medium High' risk or higher, down from 46% under the existing situation;[47]

(b) however, Table Table A.6 also illustrates there is an increase in the percentage of road sections classified as 'Medium' risk or higher (85%

[44] Infrastructure Risk Rating is a proactive measure of risk that is based on infrastructure and is less sensitive to crash history.
[45] Scenario 00e_M1 without Ō2NL.
[46] Collective Risk or crash density is measured as the number of fatal and serious casualties over a distance.
[47] Note that due to the impacts of SIP interventions in the Do-Minimum 2039, there are some sections with a low collective risk compared to the existing situation.

up from 72%), indicating that the general trend is a worsening collective safety risk performance for this network overall under the Do-Minimum.

Table A.6: Collective Risk Assessment of the Do-Minimum

Collective Risk Band	Existing	Do-Minimum 2039 (without Ō2NL)
Low	8%	10%
Low Medium	20%	5%
Medium	26%	43%
Medium High	14%	10%
High	32%	32%

Interaction with the railway – level crossings

180. The projected traffic volumes will, under the Do-Minimum scenario, heighten the risks at all level crossings, including the Tararua Road level crossing.

181. The forecast traffic volumes on roads that cross each of the 13 level crossings modelled within the study area for 2018 and 2039 are illustrated in Figure A.8. The figure highlights the impact of expected population growth and resulting east – west travel demand from new developments.

182. Overall, volumes across the railway line increase by over 62% between 2018 and 2039. It is expected that these traffic volume increases, when coupled with the likely increase in future train volumes, will further exacerbate issues at level crossings which are already operating at a Medium-High or High ALCAM risk.[48]

183. As outlined above, the Tararua Road and Liverpool Street crossings have been assessed using KiwiRail's LCSIA principles and forecasted traffic volumes from the Ō2NL Project Traffic Model,[49] because they are the two locations likely to have increased traffic movements (with the Project in place).

184. Key findings from the LCSIA undertaken for Tararua Road included:

    (a) The existing 2021 LCSS was 42, resulting in the crossing being classified as Medium-High Risk.

[48] ALCAM 2018 data shows that 14 of the 15 public level crossings having a Medium-High or High ALCAM Risk.
[49] It is noted that the LCSIA assessments were undertaken on a previous model rus so use slightly different traffic volumes.

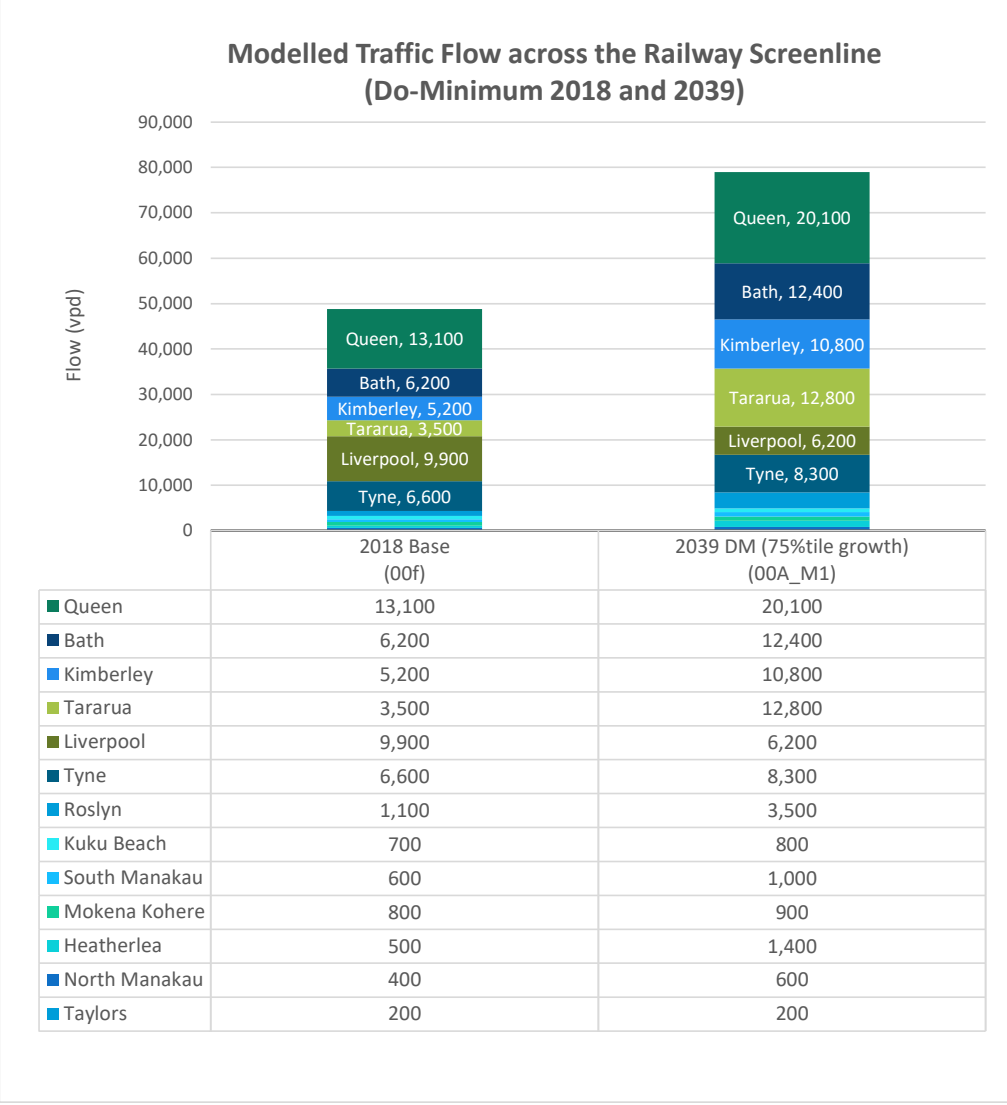
(b) By 2039, due to growth, the LCSS increases to 48, with the crossing remaining in the Medium-High Risk band (but approaching the High-Risk threshold of 50).

185. Key findings from the LCSIA undertaken for Liverpool Street included:

(a) The existing 2021 LCSS was 45, resulting in the crossing being classified as Medium-High Risk.

(b) By 2039, due to growth, the LCSS score increases to 46, with the crossing remaining in the Medium-High Risk band (but approaching the High-Risk threshold of 50).

(c) In addition to the road level crossing risk, the pedestrian risk increases from Medium in 2021 to Medium-High by 2039.



	2018 Base (00f)	2039 DM (75%tile growth) (00A_M1)
Queen	13,100	20,100
Bath	6,200	12,400
Kimberley	5,200	10,800
Tararua	3,500	12,800
Liverpool	9,900	6,200
Tyne	6,600	8,300
Roslyn	1,100	3,500
Kuku Beach	700	800
South Manakau	600	1,000
Mokena Kohere	800	900
Heatherlea	500	1,400
North Manakau	400	600
Taylors	200	200

Figure A.8: Railway Screenline Modelled 'Do-Minimum' Traffic Volumes

Resilience

186. I estimate the following future closures under the Do-Minimum scenario:

    (a) Given there is no treatment proposed to mitigate flooding risks, I expect closure frequency and duration due to flooding will increase with climate change (see Andrew Craig's Hydrology and Flooding assessment (Technical Assessment F provided in Volume IV)).

    (b) Closures at the four structures at-risk of disruption from storm and earthquake events[50] will continue to occur until they are replaced.

    (c) A 30% reduction in network closures related to crashes, based on the outputs of the network safety model. This is due to the safety works proposed as part of the SIP, which is forecast to reduce the incidence of crashes, and with it, crash related closures.

187. I note that even though there will be some crash related resilience benefits from the Do-Minimum scenario, I also expect traffic volumes will continue to grow, and therefore the number of journeys impacted (for the events that do occur) will increase with the growth in travel demand.

Travel Times and Delays

188. In the Do-Minimum scenario, there will be a significant increase in travel times during weekday peak hours and weekends[51] as a result of increased traffic volumes.

189. Predicted travel times for key journeys from the Ō2NL Project Traffic Model for the PM peak in the Do Minimum are summarised in

190.

191.

192.

193. Table A.7. These suggest that it will take around 23 minutes to travel from Ōtaki to Central Levin, approximately 32 minutes from Ōtaki to SH57 north of Levin, and about 33 minutes from Ōtaki to SH1 north of Levin. Compared to

[50] Ohau River Bridge, Waikawa Stream Bridge, Manakau North Rail Overbridge, Pukehou Rail Overbridge.
[51] Although the transport model does not consider weekends, historic 2019 weekend hourly volumes are similar if not higher than the weekday PM peak volumes. Therefore, similar increases in future weekend travel times can be expected.

2018, these are travel time increases of between 25-40% or around 6-9 minutes per journey.

Table A.7: 2039 Modelled Do-Minimum Travel Times (75%ile growth, without Ō2NL)[52]

Route	2018 TomTom Travel Time	Do Min 2039 75%ile growth
Ōtaki to SH 1 North of Levin	26.0 min	32.7 min
Ōtaki to Central Levin	16.9 min	23.4 min
Ōtaki to SH 57 North of Levin	22.8 min	32.2 min

194. By 2039, the increase in traffic due to population growth will result in a worsening of the currently underperforming road network.

195. The Ō2NL Project Traffic Model illustrates this, showing that delays corresponding to LOS E (>50s delay) and LOS F (>70s delay) will occur at many side roads along SH1 during the PM peak period. Large delays are predicted for traffic trying to access SH1, as shown in red and black in Figure A.9, at a number of locations, including the main intersections in Ohau and Manakau. In many locations there are no other routes for people to take – as SH1 is the only north south route, traffic from side roads must use it to get to their destination.

[52] Scenario 00A_M1.

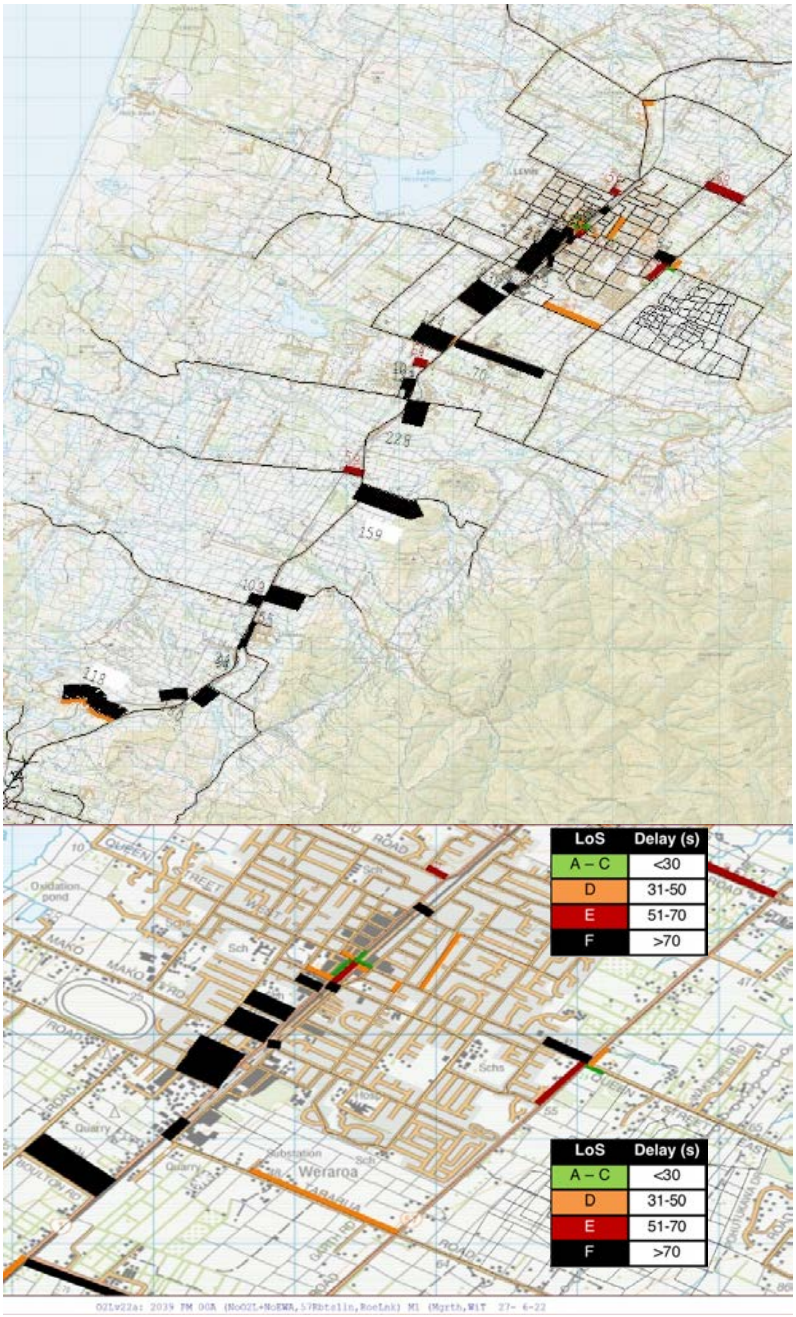


Figure A.9: Do-Minimum[53] side road delay during the 2039 PM peak

196. Delays will occur at key parts of the road network, including at the SH1/SH57, SH57/Queen Street and SH57/Tararua Road intersections. These intersections will be primary connections between Tara-Ika and the Levin Centre, and side road delay could restrict the amount of development that can occur in the area.

[53] Scenario 00A_M1_E.

Induced / Suppressed Traffic

197. As outlined earlier, the Ō2NL traffic model includes consideration of elastic or variable assignments, rather than fixed. This enables estimation of possible responses to new infrastructure (induced traffic) and congestion (suppressed trips).

198. Figure A.10 below shows the comparison of elastic assignment to fixed assignment in the 2039 Do Minimum. This shows moderate trip suppression on the Levin urban network as a result of increased congestion. These impacts are the highest on Queen Street and Tararua Road, east of SH57 (-4,000 vpd and -1,800 vpd respectively) near the Tara-Ika development.

199. Trip suppression in other areas of the network, including SH1 and SH57, is generally less than 1,000 vpd.

200. At a network level, a comparison of the elastic and fixed assignments shows that approximately 12,500 (6%) trips are suppressed in by 2039 due to increased congestion, resulting in a 5% reduction in network VKT.

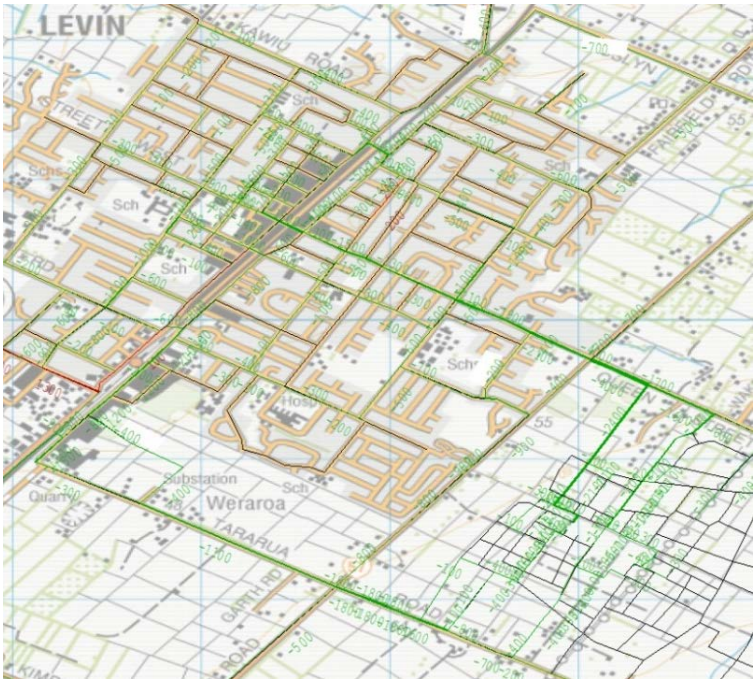


Figure A.10: 2039 Do-Minimum Suppressed Trips in Levin (where green indicates less traffic in elastic model with respect to fixed model)

201. Trip suppression represents people not being able to travel when and where they want without being constrained by congestion. It is particularly a problem on transport networks like Levin without local public transport or a

high standard of cycle facilities, and is likely to have flow on social or economic disbenefits.

Community Connectivity

202. Without investment over and above that proposed for the Do-Minimum, community connectivity will worsen as traffic volumes increase.

203. Figure A.11 below shows how the travel times (in minutes) for modelled zones change between 2018 and 2039, highlighting that the network wide accessibility decreases over time, particularly to the west.

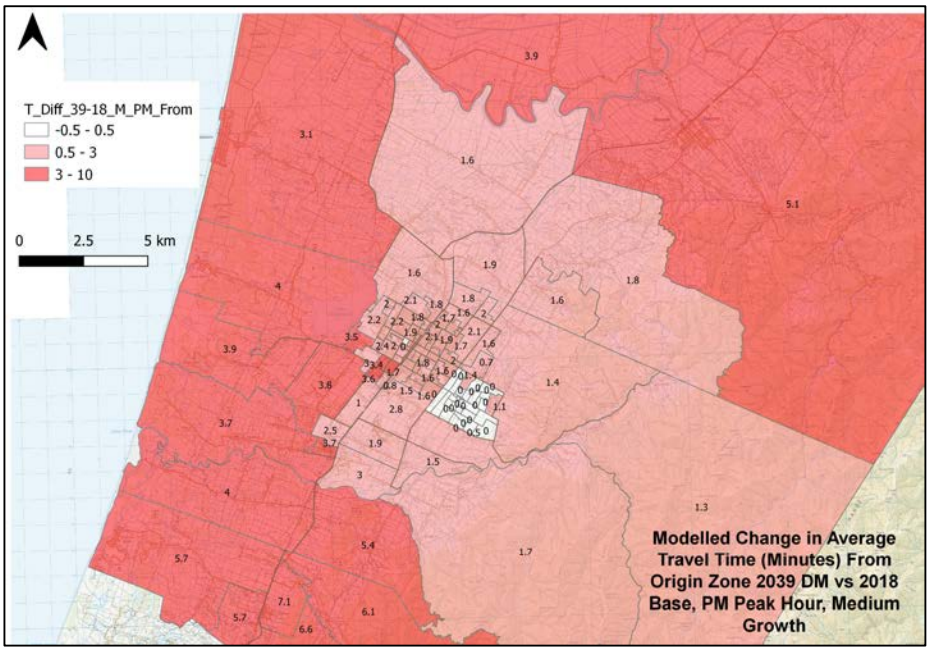


Figure A.11: Modelled change in average travel time in minutes – 2018 vs 2039 Do-Minimum

204. Severance will also increasingly become an issue under the Do-Minimum. Severance can be created when a road acts as, or feels like, a barrier to movement. This tends to be because people feel unsafe crossing the road (which could be on foot, on bike or car) which means people do not make a trip they would otherwise want to, or due to congestion impacting the desire or ability to travel (as shown by suppressed trips). If people do not make journeys they would like to, this has negative consequences at both social and economic levels.

205. Generally, severance, and by extension community connectivity, is more notable when traffic volumes are high, flow is continuous and there is a high proportion of heavy vehicles.

THE Ō2NL PROJECT

206. The Ō2NL Project responds to the existing traffic network and its problems discussed above. That is reflected in the Project objectives, which are:

    (a) To enhance safety of travel on the state highway network.

    (b) To enhance the resilience of the state highway network.

    (c) To provide appropriate connections that integrate the state highway and local road network to serve urban areas.

    (d) To enable mode choice for journeys between local communities by providing a north-south cycling and walking facility.

    (e) To support inter-regional and intra-regional growth and productivity through improved movement of people and freight on the state highway network.

207. As transport outcomes are the key drivers of the Ō2NL Project, the Project has been shaped from the outset to maximise these benefits.

208. In particular:

    (a) Progressing an 'offline' highway, rather than 'online' upgrades to the existing state highways, has maximised safety and resilience benefits. Having the highway offline means that the infrastructure can be built in a way (e.g., geometric alignment, provision of barriers, prohibition of access) to reduce the likelihood of a crash and minimise harm in the event that one does occur. It also means there will be two north-south routes across the Ohau River and Waikawa Stream, immediately making the wider network more resilient in the event of a closure in these high-risk locations.

    (b) The selected highway corridor to the east of Levin maximises the amount of traffic that will be removed off the current road network, thereby significantly reducing the number of crashes that would occur on the old, poor performing state highways and local roads. The selected corridor also provides travel time benefits for the three key journeys of Ōtaki to Levin, Ōtaki to SH1 North of Levin and Ōtaki to SH57 North of Levin.

209. Careful attention has been paid to addressing the potential adverse travel impacts of the Ō2NL Project. In particular:

210. Community connectivity was considered when investigating desired local road connections. All roads that are intersected by the Ō2NL Project alignment were analysed and consulted upon. Of the 14 roads intersected, eight will be directly re-instated with either an overbridge or underpass. The remainder are being managed with schemes that still provide excellent connectivity to key destinations and were the preferred options through community consultation. Overall, this has resulted in excellent connectivity at a community level.

211. The impact of the Ō2NL Project on the performance of intersections on the existing road network was considered during the Project's development. The only intersections that could experience adverse impacts due to re-assignment of traffic (compared to the 2039 Do-Minimum) are the SH57/Tararua Road intersection and the SH1/Tararua Road intersection.[54] The former is being upgraded by the SIP works to accommodate future flows and the latter is being upgraded as part of the Ō2NL Project to address capacity and safety concerns with the intersection and the adjacent rail crossing.

Project Description

212. The form of the Ō2NL Project now being progressed is the result of pursuing the Project objectives and seeking to maximise transport benefits (while managing potential adverse environmental effects, as addressed in the other technical assessments). The Project is shown in Figure A.12 below.

[54] Note that the impacts of the East West Arterial (EWA) intersection with old SH57 are discussed in the East West Arterial Applications which will be lodged separately by others.

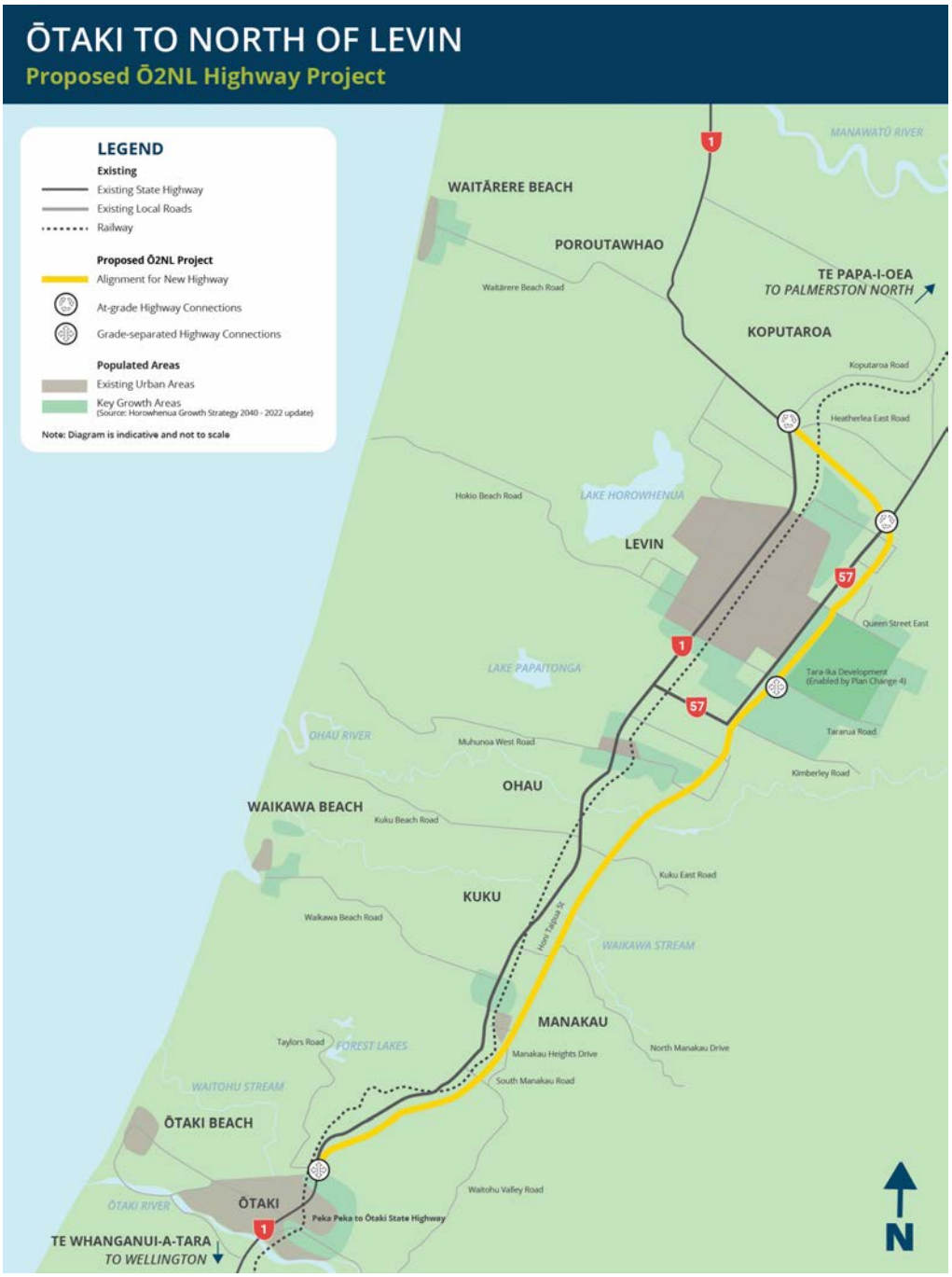


Figure A.12. Proposed Ō2NL Highway Project

213. The Project involves the construction, operation, use, maintenance, and improvement of approximately 24 kilometres of new four-lane median divided State highway (two lanes in each direction) and a shared use path ("**SUP**") between Taylors Road, Ōtaki (and PP2Ō and SH1 north of Levin. The Ō2NL Project includes the following key features:

(a) a grade separated diamond interchange at Tararua Road which will be the signposted route from the south into Levin;

(b) two dual lane roundabouts, one located where Ō2NL crosses SH57 and the other where it connects with the current SH1 at Heatherlea East Road, north of Levin;

(c) four lane bridges over the Waiauti, Waikawa, and Kuku Streams, the Ohau River, and the North Island Main Trunk ("**NIMT**") rail line north of Levin;

(d) a half interchange with south facing ramps near Taylors Road and the new Peka Peka to Ōtaki expressway to provide access from the current SH1 for traffic heading south from Manakau or heading north from Wellington, as well as providing an alternate access to Ōtaki;

(e) local road underpasses at South Manakau Road and Sorensons Road to retain local connections;

(f) local road overpasses to provide continued local road connectivity at Honi Taipua Road, North Manakau Road, Kuku East Road, Muhunoa East Road, Tararua Road (as part of the interchange), and a direct connection at Queen Street East;

(g) new local roads at Kuku East Road and Manakau Heights Road to provide access to properties located to the east of the Ō2NL Project;

(h) local road reconnections connecting:

(i) McLeavey Road to Arapaepae South Road on the west side of the Ō2NL Project;

(ii) Arapaepae South Road, Kimberley Road, and Tararua Road on the east side of the Ō2NL Project;

(iii) Waihou Road north to McDonald Road to Arapaepae Road/SH57; and

(iv) Koputaroa Road to Heatherlea East Road, and providing access to the new northern roundabout;

(i) the relocation of, and improvement of, the Tararua Road and current SH1 intersection, including the introduction of traffic signals and a crossing of the NIMT;

(j) road lighting at conflict points, that is, where traffic can enter or exit the highway;

(k) median and edge barriers that are typically wire rope safety barriers with alternative barrier types used in some locations, such as bridges that require rigid barriers or for the reduction of road traffic noise;

(l) stormwater treatment wetlands and ponds, stormwater swales, drains, and sediment traps;

(m) culverts to reconnect streams crossed by the Ō2NL Project, and stream diversions to recreate and reconnect streams;

(n) a separated (typically) three metre wide SUP, for walking and cycling along the entire length of the new highway (but deviating away from being alongside the Ō2NL Project around Pukehou (near Ōtaki)). The SUP will link into PP2Ō expressway shared use path facilities (and further afield to the Mackays to Peka Peka expressway SUP);

(o) spoil sites at various locations along the length of the Project; and

(p) five sites for the supply of bulk fill /earth material located near Waikawa Stream, the Ohau River, and south of Heatherlea East Road.

214. The Ō2NL Project will become the new SH1. It will replace the existing SH1 and the existing SH57 along Kimberley Road and Arapaepae Road adjacent to the new highway.

Shared use path and other walking and cycling facilities

215. The main Ō2NL Project SUP will have a minimum 3.0m formed width with an additional minimum 0.5m clearance or verge on each side. The path will typically be located on the western side of the highway to best serve the most populous adjacent communities.

216. The SUP will traverse the entire length of the new highway but will not follow the exact horizontal and vertical alignment of the highway. The SUP proposed alignment is intended to provide access for local communities as well as for recreation.

217. At the southern end of the project, the SUP will connect directly to the PP2Ō SUP and traverse adjacent to the current SH1 through the Forest Lakes section, between Taylors Road and just south of the existing NIMT Pukehou rail crossing.

218. Between Muhunoa East Road and the new roundabout connection with SH 57 (located to the northeast of Levin), the SUP will be located on the eastern side of the new highway to provide better connectivity to the Tara-Ika growth area.

219. Where the highway crosses local roads, the SUP will generally connect to the local road to provide connectivity. Walking and cycling facilities at underpasses, overpasses, roundabouts, and the interchange are further described below.

    (a) For the longer bridges, the SUP will use the same deck structures, with an appropriate barrier installed between the SUP and traffic lanes. For the shorter length watercourse crossings, the SUP will generally be integrated with the highway earthworks crossing an extended culvert.

    (b) Walking and cycling facilities at underpasses, overpasses, roundabouts, and the interchange will be provided, as follows:

        (i) At underpasses and overpasses, a road shoulder will be provided as a minimum, and where walking and cycling facilities already exist on the current road these will be reinstated.

        (ii) At roundabouts, walking and cycling facilities will be provided.

        (iii) At the proposed SH57 roundabout connection with the Ō2NL Project, a subway will be provided under the new four-lane highway.

        (iv) At the Heatherlea East Road roundabout pedestrians and cyclists will have the option of using an additional shared path along the northern side of the highway and crossing the NIMT railway to connect to the Sorensons Road subway. This way they will be able to access the main SUP via grade separation (and vice versa for path users heading north).

        (v) At Queen St East, a walking and cycling overbridge (over the Ō2NL Project) is proposed which provides east-west connectivity between Levin, the proposed SUP, the Tara-Ika growth area and existing tracks (eg Trig Walkway). At the Tararua Road interchange, walking and cycling facilities will be provided to access the proposed SUP located on the eastern side of the new highway and destinations further east (to Tara-Ika).

(vi) At Taylors Road, the Ō2NL SUP links directly to the PP2Ō SUP, ensuring that there is a continuous facility to Ōtaki and beyond. The details of this connection are presented in Figure A.13.

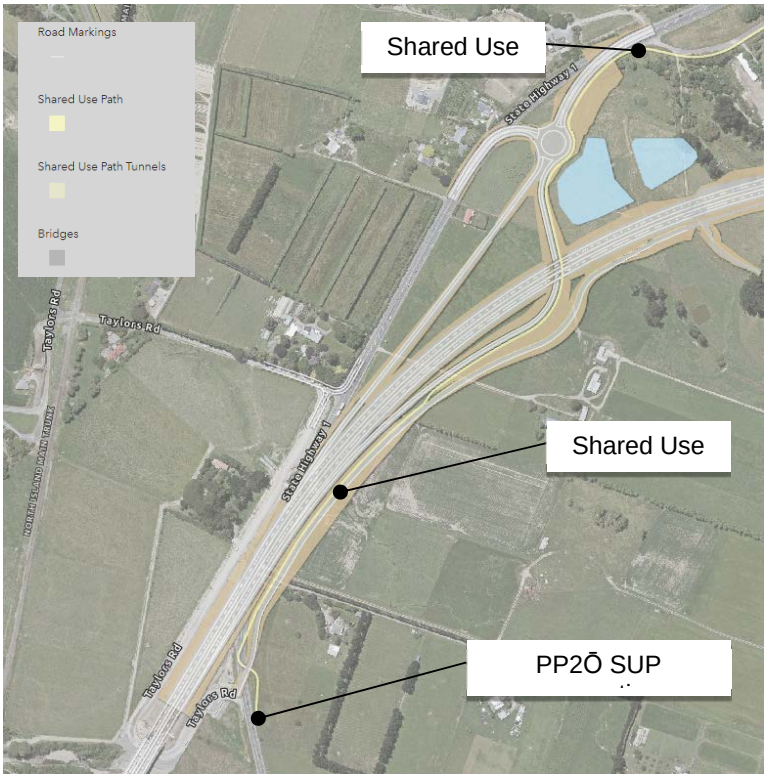


Figure A.13: Shared Use Path – PP2Ō connectivity

Wider Programme

220. The Ō2NL Project is part of a wider programme of activities including:

(a) 'online' speed and safety upgrades to the old SH1 and SH57 (being implemented in 2021-2023);

(b) public transport and passenger rail improvements (eg from the Regional Rail Plan);

(c) shifting freight to rail (for instance through the National Rail Plan); and

(d) local road improvements (set out in the Horowhenua Integrated Transport Strategy).

Traffic Volumes

221. The forecast 2039 daily traffic volumes for the network with and without Ō2NL are presented in Figure A.14 below. The figure demonstrates that significant volumes of traffic are attracted from the existing network to the

ŌNL highway when compared to the Do-Minimum. The effects of these traffic volume changes are discussed further in the sections below.

222. Heavy vehicle volumes on the current SH1 and SH57 are also expected to drop significantly. Comparing 2039 scenarios, volumes on SH1 south of Levin will drop from 3,700 to 700 vpd, volumes on SH1 through Levin will drop from 2,000 to 800 vpd and volumes on SH57 north of Queen Street will drop from 1,600 to 650 vpd.

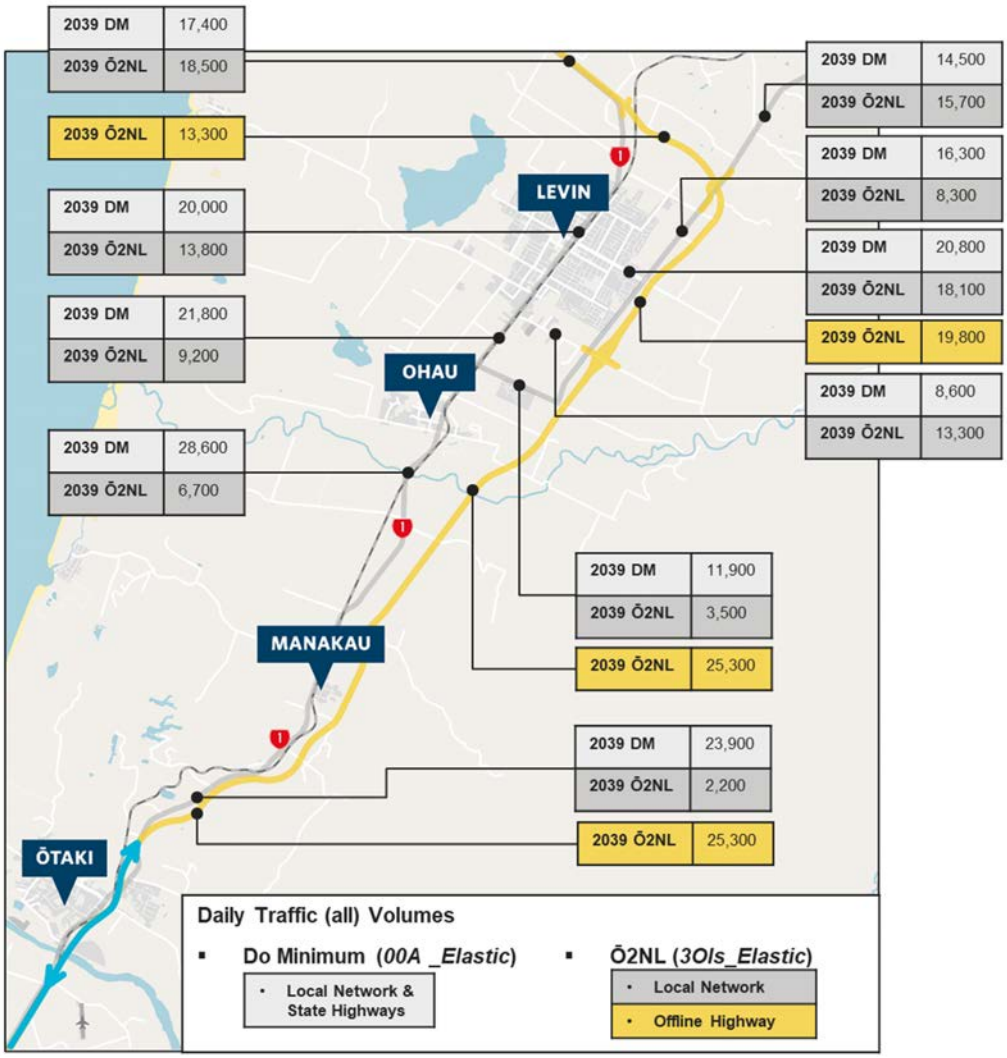


Figure A.14: Do-Minimum and ŌNL Project area (vehicles per day)

THE POSITIVE TRANSPORT EFFECTS OF THE Ō2NL PROJECT

Safety

223. The Ō2NL Project will significantly improve the safety of travel on the state highway network. The new Ō2NL route, which will become SH1, will be a modern, high quality highway. As presented in Figure A.14 above, a large amount of traffic will be removed from the old state highway network (which will instead perform local road functions), which in turn will substantially improve safety on those roads.

DSI savings

224. The Ō2NL Project is expected to save in the order of 35 DSI's per 5-year period following its opening.

225. This represents an approximately 55% reduction in DSIs on the state highway network (including the new Ō2NL State Highway and the current SH1 and SH57) and a 10% reduction on local roads when compared to the Do-Minimum scenario. This means approximately 60 DSIs saved per 5-year period over and above the 'Do Nothing' scenario when considering the combined impacts of SIP and the Ō2NL Project.

226. This is primarily achieved by attracting through traffic off substandard sections of highway and shifting them to a high quality, median divided road. The continuous median barrier on the Ō2NL Project highway provides much stronger protection against head-on collisions, where fatal and serious outcomes are common.

Safety Risk

227. The Ō2NL Project is designed to target a KiwiRAP 4 Star or higher rating and as such will provide a significant improvement compared to the Do-Minimum KiwiRAP 3 Star SH1 and SH57.

228. This will align with PP2Ō and provide road users with a seamless road environment (ie a four-lane divided highway) from the Wellington central city to north of Levin. The Project will also satisfy the provisional ONRC customer level of service metric for High Volume and National status state highways.

229. The IRR score along the approximately 31.9km existing sections of SH1 and SH57 was calculated for the 'Do-Minimum' and the Ō2NL Project scenarios,

based on the difference in modelled traffic volumes.[55] A summary is shown in Table A.8 and indicates the percentage of the routes in each IRR band. The table shows that with the inclusion of the Ō2NL Project, there is a significant reduction in the percentage of the current highways classified as 'Medium' or 'Medium High' IRR, reducing from around 84% to 39%. Those sections remaining at the higher risk levels are the on the old SH1 where traffic volumes will be significantly lower.

Table A.8: MegaMaps IRR Comparison of the existing State Highways in the Do-Minimum and Ō2NL Project scenarios

IRR Band	Existing SH1 and SH57	
	Do-Minimum 2039 (without Ō2NL)	Project 2039 (with Ō2NL)
Low	0%	5%
Low Medium	16%	56%
Medium	79%	35%
Medium High	5%	4%
High	0%	0%

230. A comparison of the Collective Risk[56] was undertaken of the State Highways and key local roads within both the 'Do-Minimum' and 'Ō2NL Project scenarios', based on the network crash model. A summary of this analysis is shown in Table A.9, and indicates the proportions of analysed road sections in each collective risk band. From this, with the inclusion of the Ō2NL Project,[57] there is a significant reduction in the proportion of road sections on the network which are classified as 'Medium High' or higher risk, reducing from around 42% to 14%.

Table A.9: Collective Risk Comparison for with and without Ō2NL Project

Collective Risk Band	Existing SH1 and SH57 and key local roads	
	Do-Minimum 2039 (without Ō2NL)	Project 2039 (with Ō2NL)
Low	10%	24%
Low Medium	5%	41%
Medium	43%	21%
Medium High	10%	10%
High	32%	4%

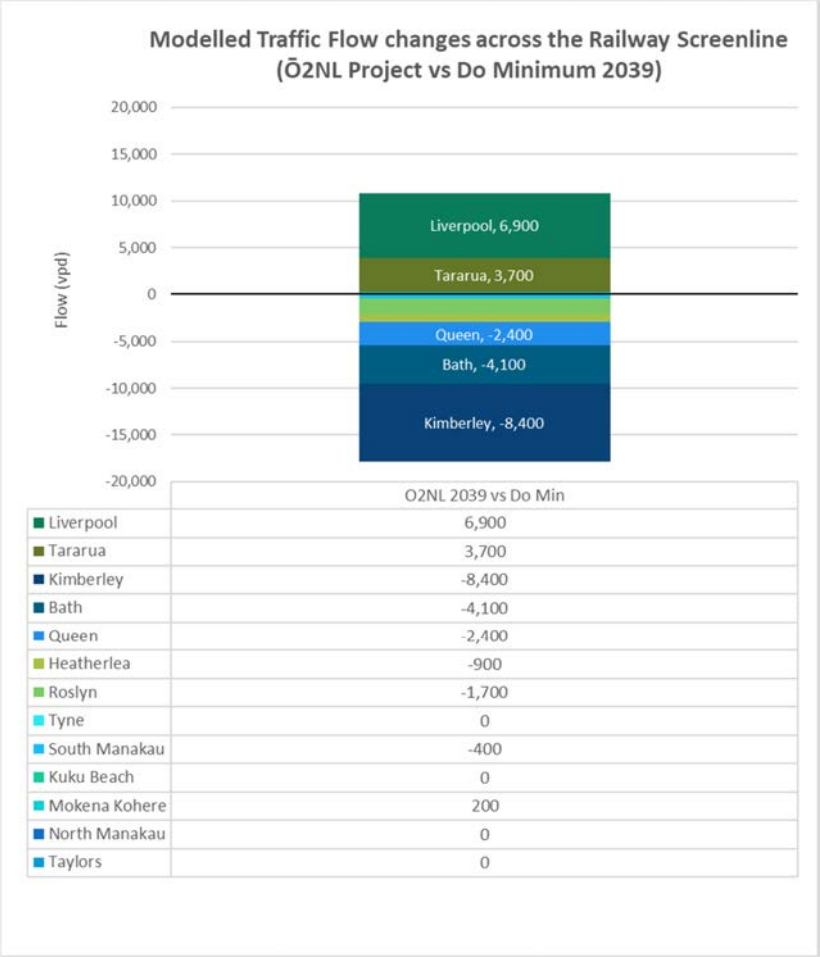
[55] 'Do-Minimum' (scenario 00A_M1 without Ō2NL) and the Project (scenario 3OIs_M1 with Ō2NL).
[56] Collective Risk or crash density is measured as the number of fatal and serious casualties over a distance.
[57] Note that the collective risk of the 24km Ō2NL expressway itself has been assessed as low to low-medium.

231. In relation to safe and appropriate speeds, the Ō2NL Project has been designed with a design speed greater than or equal to the proposed speed limit so it will not have a travel speed gap. It will also cause reassignment of traffic away from the old state highway network to the Ō2NL Project. A reduction in traffic alone will result in a higher SAAS and a corresponding reduction in the travel speed gap on SH1 and SH57 (as they are currently known). Overall, the Ō2NL Project will result in 88% of the old state highway network having a posted speed limit that matches the SAAS (a 15% improvement over the Do-Minimum).

Level Crossings

232. As illustrated in Figure A.15 below, the Ō2NL Project is forecast to result in an overall volume reduction of approximately 7,100 vpd across the level crossings, a 14% reduction compared to the Do-Minimum. The reduction in traffic at these level crossings will result in a safer environment for all users.

233. There will be reduced traffic volumes at all level crossings except the Tararua Road and Liverpool Street level crossings. These two crossings are predicted to have an increase in traffic flow of around 3,700 (+28%) and 6,900 (+34%) vehicles per day respectively with the Ō2NL Project. Increases on Tararua Road are due the Ō2NL/Tararua Road interchange, which means that Tararua Road is the main access into Levin from the new highway. Increases at Liverpool Street are the result of Ō2NL removing congestion within Levin and drivers going back to using their preferred routes. Accordingly, Level Crossing Safety Impact Assessments were undertaken at these two locations.



	O2NL 2039 vs Do Min
Liverpool	6,900
Tararua	3,700
Kimberley	-8,400
Bath	-4,100
Queen	-2,400
Heatherlea	-900
Roslyn	-1,700
Tyne	0
South Manakau	-400
Kuku Beach	0
Mokena Kohere	200
North Manakau	0
Taylors	0

Figure A.15: Effect of Ō2NL Project on Railway Screenline Traffic Volumes[58]

234. The Tararua LCSIA was undertaken for the level crossing currently used by Tararua Road traffic and the Tararua Road at-grade signalised level crossing that is proposed as part of this Ō2NL Project.

235. The LCSIA[59] showed that the proposed Tararua Road level crossing design will be safer at the forecast future 2039 traffic volumes than the current layout is now. This is highlighted in Figure A.16 below. This figure also demonstrates that the risk band reduces from Medium-High to Medium with the design proposed as part of the Ō2NL Project.

[58] 'Do-Minimum' (scenario 00A_M1 without Ō2NL) and the Project (scenario 3OIs_M1 with Ō2NL).
[59] The Do-Minimum for the LSCIA assumed that the East West Arterial was constructed in 2029.

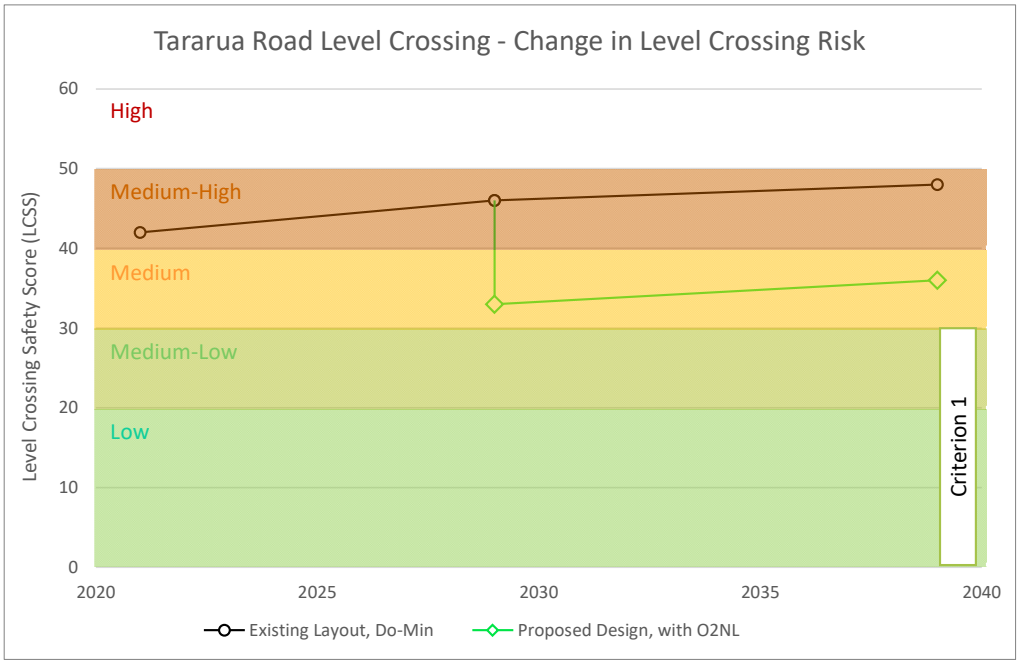


Figure A.16: Tararua Road Level Crossing – Change in Risk

236. Similarly, the Liverpool Street LCSIA considered the existing level crossing layout and the proposed improvements planned by KiwiRail, consisting of at-grade safety improvements.

237. The LCSIA showed the proposed Liverpool Street improvements achieves a safer level crossing at the forecast future 2039 traffic volumes when compared to the current layout, as highlighted in Figure A.17 below.[60] Overall, the proposed design results in short term improvements in risk and no increase over existing levels even by 2039.

[60] Note that Figure A.17 also shows that under the Do-Minimum, without Ō2NL, the overall level crossing risk is lower in 2039 than in 2029. This counter-intuitive result is due to the increased congestion in the network by 2039, making trips in and out of the Liverpool St level crossing and on to SH1/Oxford St more difficult, this results in re-routing of traffic to elsewhere within the network, reducing volumes at the level crossing. With Ō2NL in place, the volumes and delays in accessing the Oxford St/old SH1 reduce, and travel patterns return to more direct trips, resulting in increased volumes across the level crossing.

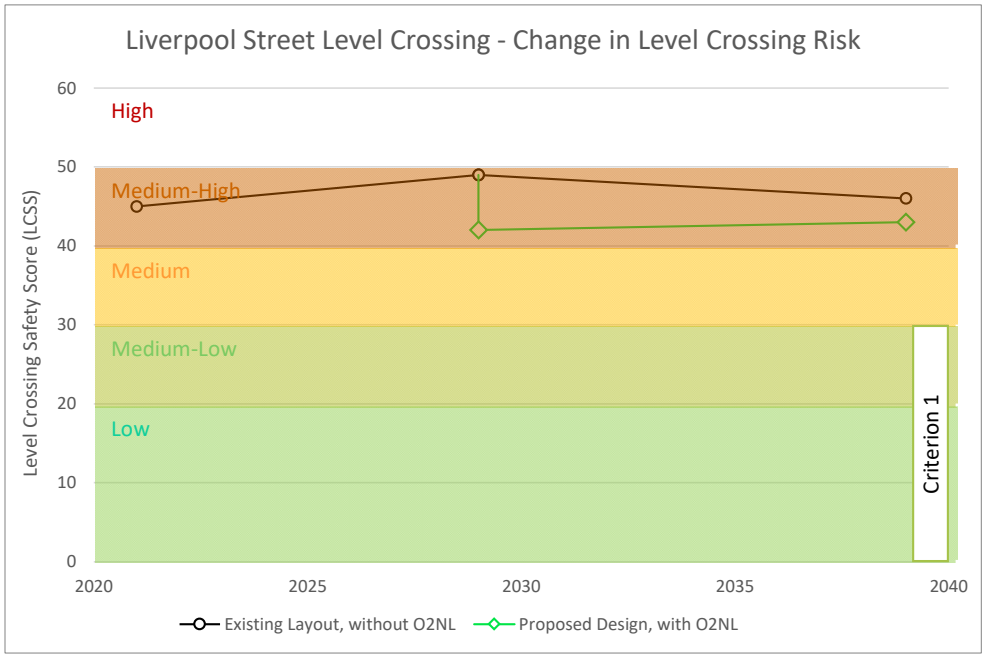


Figure A.17: Liverpool Street Level Crossing – Change in Risk

238. The LCSIAs[61] for both crossings indicated that although the proposed designs were safer than the equivalent Do-minimum scenario and therefore met KiwiRail's Criterion 2, they would not meet Criterion 1 (a low or medium-low risk band).

239. Grade separation or full closure are the only options available to meet Criterion 1. However, assessments undertaken to date indicate that grade separation would be costly and difficult to achieve given the physical constraints of the locations and full closure would be disruptive to the local road network, and due to re-routing, will increase risk at adjacent crossings.

240. As outlined above, overall, the Ō2NL Project is forecast to result in an overall volume reduction of approximately 7,100 vpd across the level crossings within the study area, improving safety for all users. Whilst Ō2NL increases traffic at Tararua Road and Liverpool Street, options proposed mitigate not only the potential increased safety risk of the Ō2NL Project but also the wider impacts of growth including Tara-Ika.

Resilience

241. As outlined above, the existing SH1 within the Project area is a critical route in and out of Wellington. This connection is particularly vulnerable to closures and does not have an appropriate alternative route.

[61] Each LCISA assumed train volumes would rise from 15 in 2021, to 23 in 2029, and to 28 in 2039 based on information provided by KiwiRail.

242. The Ō2NL Project will provide a much more resilient route than the current highway. It has been designed to withstand significantly greater flood events, including from future climate change, than the existing highway, and SH1 highway will be retained as an alternative route,[62] adding redundancy to the network. Flooding, crashes, and bridge problems on the old SH1 route will no longer affect highway traffic, and local traffic will be able to reroute.

243. This is of particular advantage to freight travelling on this national strategic highway, which is currently subject to closures and delays.

244. The number of crash related closures on the state highway network is expected to drop by well over 50% with the opening of the new highway.

245. In the event of an unplanned closure on the revoked section of SH1 (eg flooding), the length and duration of detour journeys from Wellington to Levin will reduce by at least 60%,[63] while the number of journeys impacted would also be significantly reduced compared to the Do-Minimum.

Travel Times and Delays

Travel Times

246. The improvement in travel times expected in 2039 for the key three routes have been extracted from the Ō2NL Project Traffic Model and are shown in Table A.10 below. The forecast travel time savings are significant, with 11-15 minute reductions for trips from Ōtaki to destinations north of Levin.

Table A.10: 2039 Modelled Travel Times for with and without Ō2NL Project (Scenario 00A and 3OIs_M1)

2039 75%ile growth			
Route	Do Min	Ō2NL Project	Difference
Ōtaki to SH 1 North of Levin	32.7 min	21.5 min	-11.2 min
Ōtaki to Central Levin	23.4 min	17.5 min	-5.8 min
Ōtaki to SH 57 North of Levin	32.2 min	16.7 min	-15.5 min

[62] If there is a major crash/breakdown event on Ō2NL the (old) SH1 will likely be available. However, for larger natural events, if Ō2NL is unavailable, the availability of the old SH1 cannot be guaranteed.
[63] Journeys impacted between Wellington and Levin would reduce in length by at least 60% (95 km Do-Minimum, 256 km detour (via Saddle Road), 97km Ō2NL). However, a journey impacted between SH1 Manakau and Ohau would reduce by 90% (6.6km Do Min, 306km detour, 30km Ō2NL).

247. In addition, journey time reliability for these three routes is improved with the Ō2NL Project as the additional capacity provided eases congestion and mitigates the impact of unplanned events, such as breakdowns, compared to the Do-Minimum. A more reliable system enables network users to better plan beyond their travel and become more efficient.

248. Reduced congestion between the Horowhenua and Wellington districts will shorten travel times for these trips. Freight can be transferred between the regions more efficiently, as heavy vehicles will no longer need to pass through the various townships and villages. The Project ensures faster and more consistent travel times to key freight locations in Wellington and Palmerston North as well as the growing industrial areas off Tararua Road.

249. Currently there are no suitable detours, so closures on the existing route result in unreasonable travel times, as previously outlined. The Ō2NL Project will result in two north-south routes, providing an alternative should either route become compromised. It will also support the future growth and productivity of Horowhenua District through the reduction of travel times and notable improvements in reliability.

Delays

250. The daily flow difference plot, (see Figure A.18), shows the forecast shift in traffic volumes on the network in 2039, once the Ō2NL Project becomes operational.

251. SH1 between Ōtaki and Levin, south of SH57 will have the largest volume shift of approximately 25,300 vpd onto the Ō2NL Project. The Ō2NL Project is designed to a level easily able to accommodate the anticipated future traffic volumes generated by the surrounding land use and demand growth.

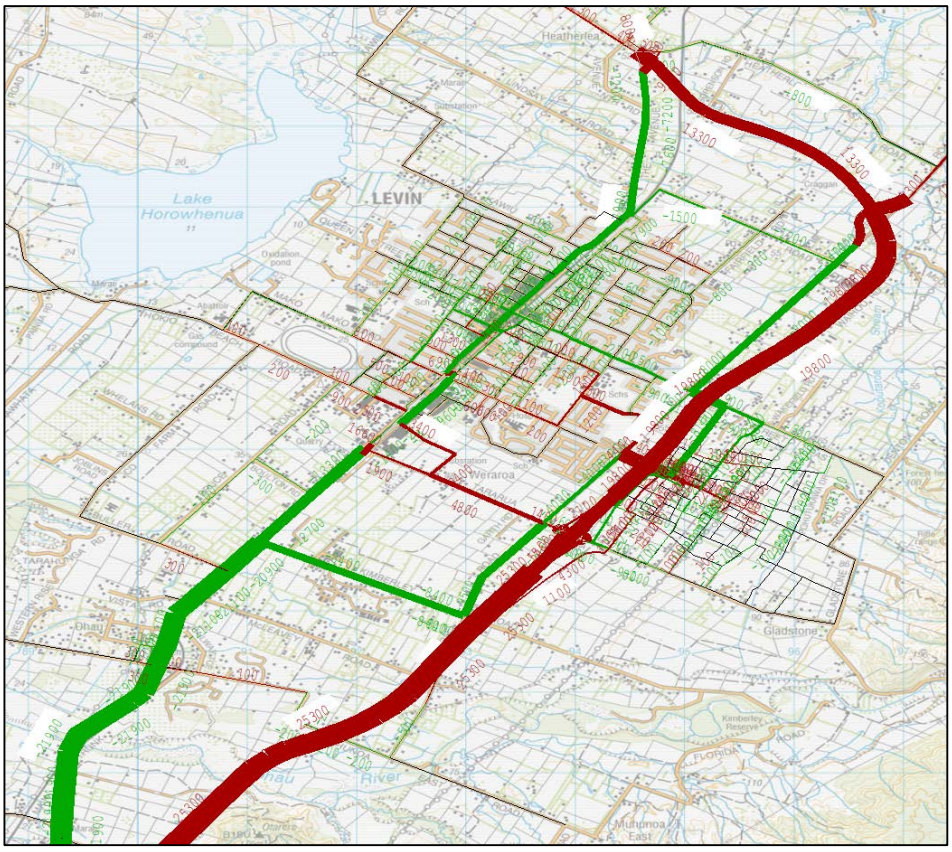


Figure A.18: Flow difference on the network with and without Ō2NL Project in 2039 (green is a traffic reduction and red is an increase)

252. The Ō2NL Project will reduce delays and congestion on the old SH1, making it easier for side road traffic to access that road.

253. The traffic model shows that the Ō2NL Project will result in 26 of the 30 modelled side roads along SH1 or SH57 operating at a LOS D or better, as illustrated in Figure A.19 and Figure A.20. In my view, the reduction in traffic and improvement in level of service helps to support regional growth and contributes to a thriving and vibrant town centre.

254. In addition, the Ō2NL Project will improve the connectivity between the Horowhenua and Wellington districts by providing safer, more efficient connections, including east-west links around Levin.

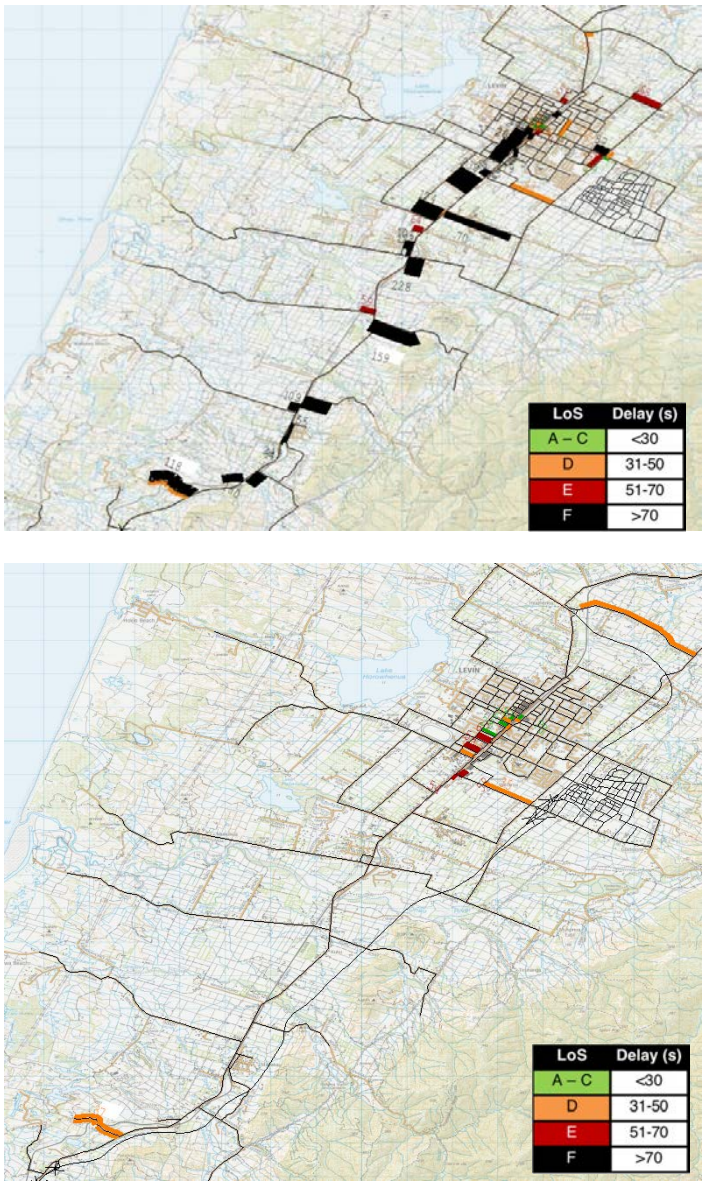


Figure A.19: Õ2NL Project Traffic Model outputs (00A and 3OIs_M1) for side road delay within the study area in 2039 PM Peak for the Do-Minimum (top) and Õ2NL Project (bottom)

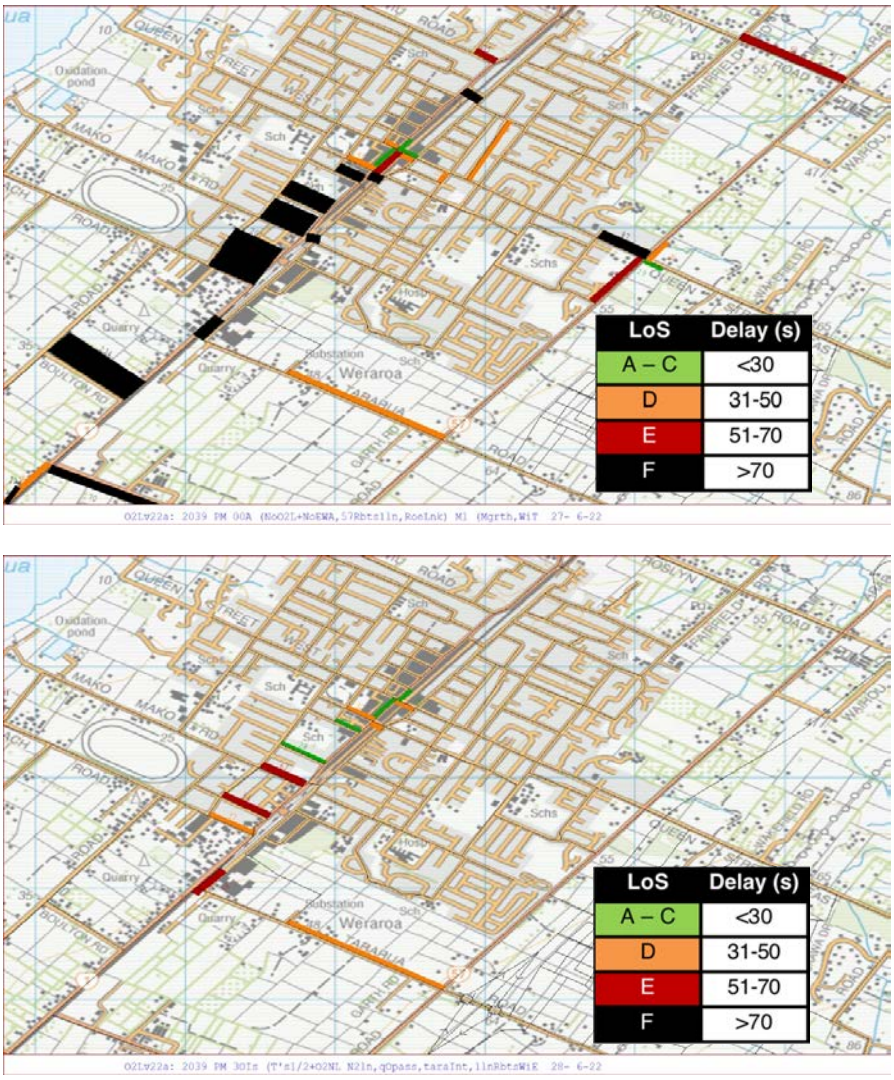


Figure A.20: Ō2NL Project Traffic Model outputs (00A and 3OIs_M1) for side road delay within Levin in 2039 PM Peak for the Do-Minimum (top) and Ō2NL Project (bottom)

255. Even with the Ō2NL Project, some intersections will continue to operate poorly. The worst of these include the Keepa Street and Mako Mako Road intersections, which are predicted to operate at LOS E, with a delay of just over 50 and 60 seconds respectively. However, this is down from LoS F with delays of over 200 seconds at both intersections without the Ō2NL Project. No intersections will have worse delays as a result of the Ō2NL project.

256. Delays at the old SH1/Tararua Road intersection are shown to be at LOS E, however, this intersection has been further assessed through detailed intersection modelling using SIDRA. The SIDRA model indicates that this intersection will perform at a LOS B in the 2039 PM peak, noting that the Tararua Road approach will require around a 50% split of the cycle time.

Community Connectivity

257. As presented in the Ō2NL Project description, the Ō2NL Project involves the reinstatement of most of the local roads that are intersected by the proposed designations to retain local connectivity.

258. The Ō2NL Project will reduce travel delays and congestion on the old SH1, which will make it easier for side road traffic to access the State Highway, refer Figure A.19 above. The Ō2NL Project will also provide access to the local road network east of Levin, at SH57 and north of Levin.

259. The Project will also improve the ease of accessibility to the centres of Levin and Ōtaki, which would otherwise be subject to worsening congestion in peak, weekend and holiday periods.

260. As the new highway will fill the role of a National High-Volume highway or Transit Corridor, it is expected that access points are highly engineered and are of strategic value. The planned corridor and interchange layout maintains easy connectivity from the new highway to the north (SH1) and north-east (SH57) by means of roundabouts as well as providing access to the largest urban area of Levin and its surrounds via a grade separated interchange at Tararua Road.

261. The roundabouts are located where there is less conflict between highway and local traffic and a need to transition drivers down to lower speed highway environments. The grade separation of the Tararua interchange is provided where more movements are expected and ensures that there is no conflict between purely local and purely highway trips whilst also enabling access between the local road system and the highway.

262. In terms of the Project's impact on current trips, Figure A.21 shows the forecast changes in travel distances for all movements to/from various model zones in and around Levin comparing the 'Do-Minimum' to the 'Project'. Figure A.22 shows the forecast changes in travel time. The figures show that whilst the Ō2NL Project will result in some increased journey distances, these do not result in increased travel times and in most cases travel times will be reduced due to the Ō2NL Project reducing congestion, improving road connections, and allowing higher speeds on the new highway.

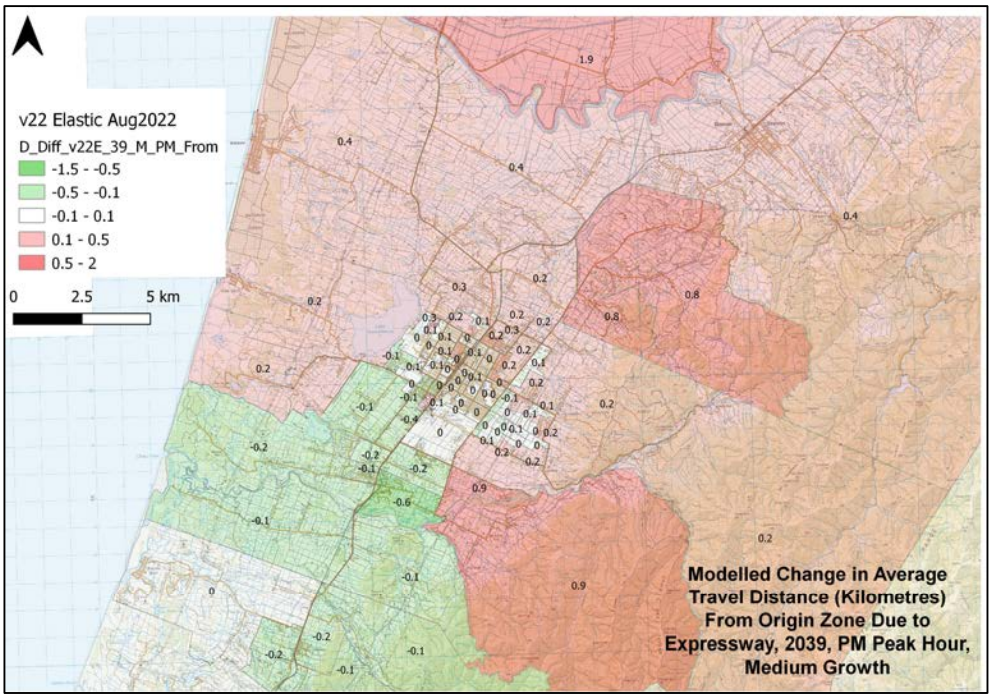


Figure A.21: Modelled change in average travel distance – with Ō2NL Project

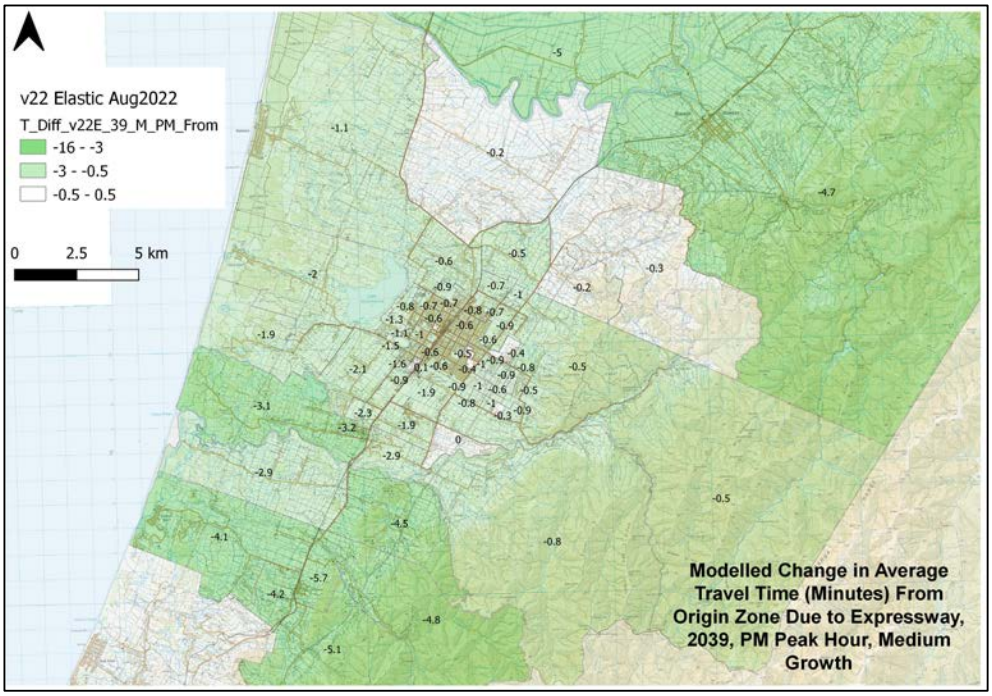


Figure A.22: Modelled change in average travel time – with Ō2NL Project

Other positive impacts

Walking and Cycling

263. The SUP proposed as part of the Ō2NL Project will be routed and aligned to provide not only a high-speed commuter facility, but also a facility that is

appropriate for recreational use and is easily and conveniently accessible by adjacent communities. The SUP has been specifically designed to be directly accessed from Levin, via Queen Street or Tararua Road, Manakau, including via new connection to Mokena Kohere Street for access to the school and other community facilities, Ohau via Muhunoa East Road and all other roads that cross the proposed designations. This gives it much greater connectivity than the road network.

264. This path will link into the SUP facilities built as part of the PP2Ō highway (and further afield to Mackays to Peka Peka). This will significantly help extend an inter-regional cycleway network and enable pedestrians and cyclists to safely move between townships.

265. The SUP enables new links between urban areas and from existing urban areas, improving transport options and improving recreational opportunities. It also adds another resilient route to the transport network.

266. In addition to the SUP, the Ō2NL Project will result in a shift of traffic away from the Levin town centre (refer Figure A.18 above), creating opportunities to enhance the walking and cycling connections and to improve safety for active mode users within the town centre.

Public Transport

267. In my opinion, the old SH1 will likely continue to be the primary route for public transport, as this is the best route to connect the townships of Ōtaki, Manakau, Ohau, and Levin. Regional transport is served by the capital connection rail service contracted by Horizons Regional Council and Greater Wellington Regional Council.

268. With the reduction in traffic using the old SH1, public transport services will benefit, both in terms of improved travel times and reliability. The Ō2NL Project will open opportunities to increase public transport frequency and attractiveness along the old SH1, as well as on the new highway if desired.

269. In terms of public transport provision on the wider network, the Ō2NL Project is part of a programme of work that is investigating improving public transport options, including bus and rail. The Project will reduce restrictions to upgrading rail and enable safer and more efficient access to rail and bus stations, by reducing congestion on the existing road network.

POTENTIAL ADVERSE EFFECTS OF THE Ō2NL PROJECT

270. As discussed above, the effects of the Ō2NL Project are overwhelmingly positive in transport terms and the Project will be transformative for its users and surrounding communities. However, there are potential minor adverse effects relating to induced traffic, property access and the Project's construction.

Property Access

271. I have completed an assessment of the properties whose access will be directly and indirectly affected by the Ō2NL Project. For the purposes of my assessment, I have relied on the latest information from Waka Kotahi in terms of affected properties.

Directly affected properties

272. There are 215 properties directly affected by the Project (ie that will need to be acquired in part or in full to enable construction of the Project). Waka Kotahi has provided confirmation that at this stage

    (a) 123 properties are intended to be acquired in full. Effects on these properties have therefore been disregarded as there will be no private landowners to affect.

    (b) The other 92 properties are provisionally identified as partial acquisitions and therefore access to the road network has been considered and access will be retained.

273. Access onto the road network for these partially acquired properties has been worked through and are shown on the General Arrangement drawing set. The travel times for 78 of the 92 properties will not be impacted by the Ō2NL Project as existing connections remain unchanged or the proposed access provides a like for like travel time solution.

274. The only area where a significant increase in travel time is expected on 14 directly impacted land parcels, is those residual pieces of land on the eastern side of the alignment south of Kuku East Road. None of these residual parcels have a dwelling on them, but access would be via Kuku East Road, resulting in additional travel time for southbound travel compared to the direct access they currently have onto the existing high risk SH1. This is shown in the Figure A.23 below.

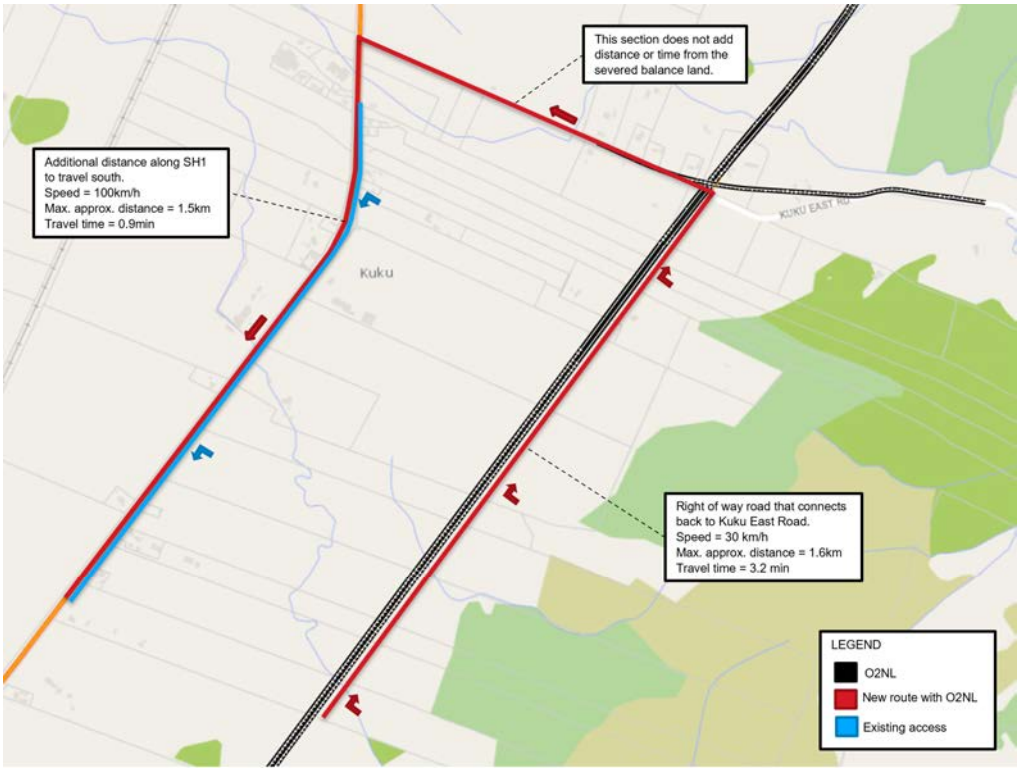


Figure A.23: Additional travel for properties south of Kuku East Road travelling south

Other properties

275. In addition to those properties which are directly affected in terms of land purchase, there are other properties for which trips would be altered.

    (a) As Kimberley Road (which includes the east-west section of SH57 between SH1 and Arapaepae Road) is being severed, trips from one end of Kimberley Road to the other are disrupted. This does not affect journeys to/from Levin, Ohau or further afield, but any very short journeys to Kimberley Road East would take approximately 4-minutes longer. This option was presented to the community alongside another option with a direct connection for Kimberley Road during public consultation (See Consideration of Alternatives in Part E of the AEE). The clear community preference was for the option of Kimberley Road being severed, due to its better connections north and south,[64] and this is therefore included in the Project (see the General Arrangement Drawings).

[64] The alternate option did not provide direct access down to Muhunoa East Road.

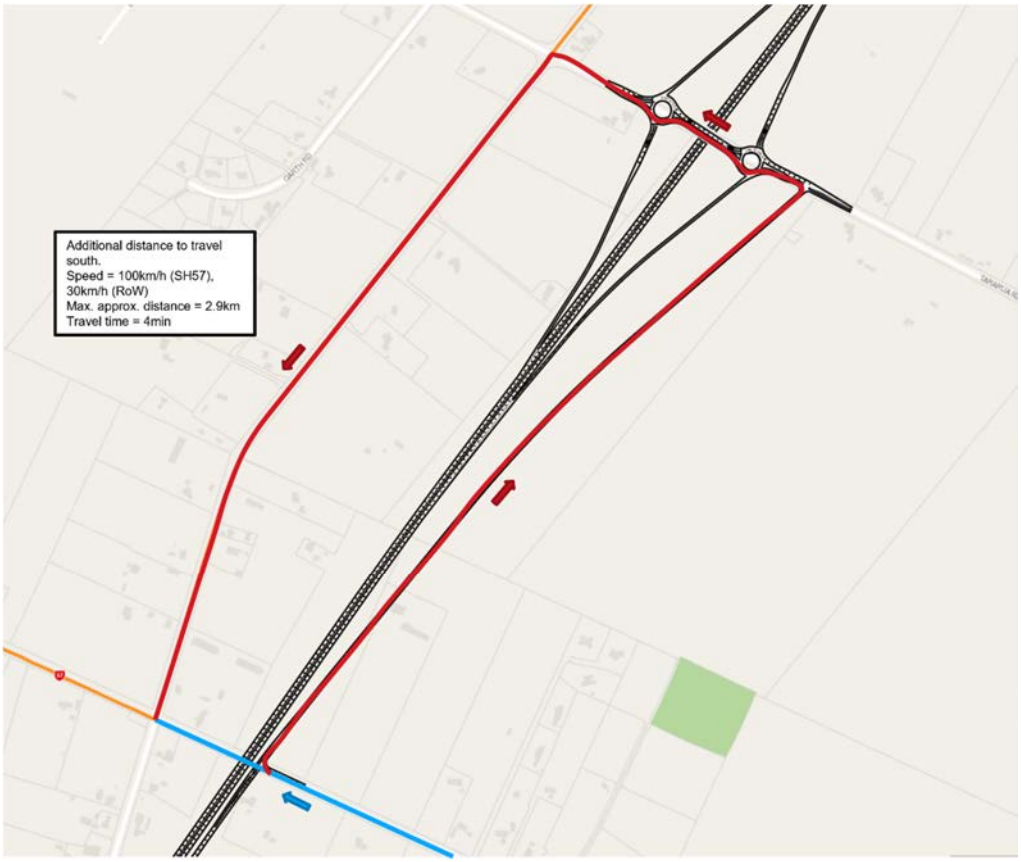


Figure A.24: Additional travel for properties on Kimberley Road travelling west'

(b) As Waihou Road is being severed, those properties on the eastern side will need to travel north to McDonald Road and SH57 before coming south. Traffic on Waihou Road heading south will have an increased travel time of roughly 2.5 minutes, as illustrated in Figure A.25 below. Again, this option was presented to the community alongside another option with a southern connection to Queen Street (See Consideration of Alternatives in Part E of the AEE). The community preference was for the northern connection as it provided better connectivity to the highway network, and this is therefore included in the Project (see the General Arrangement drawings).

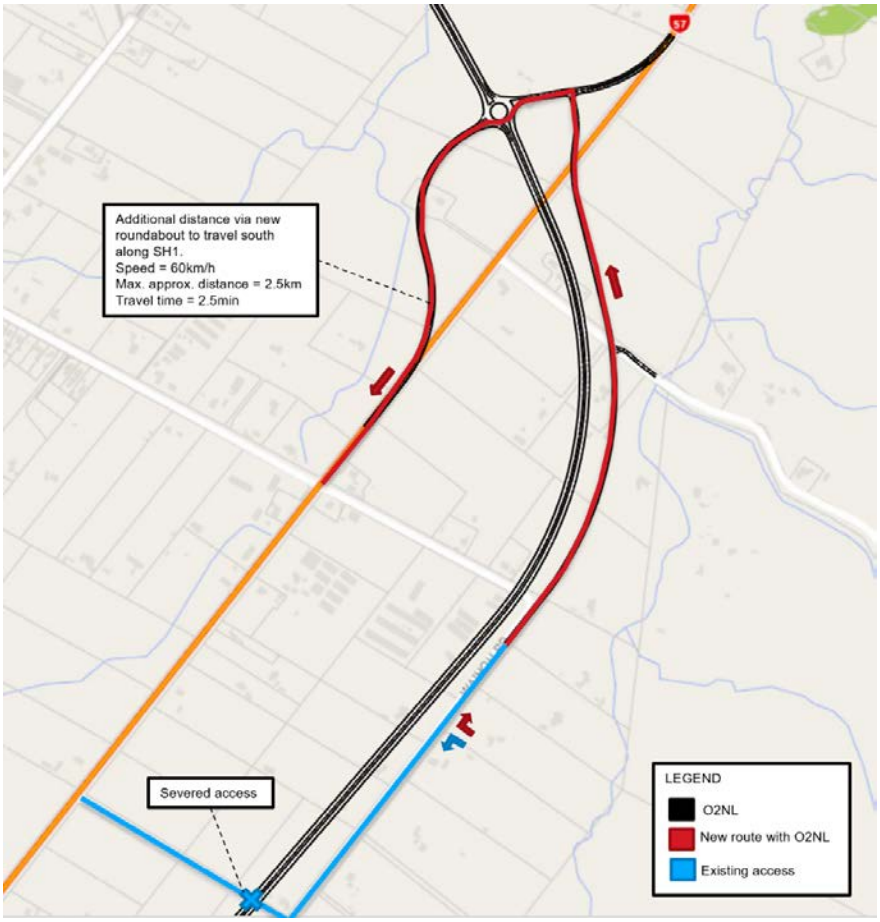


Figure A.25: Additional travel for properties on Waihou Road travelling south

(c) As the northern end of Avenue North Road is to be closed to the current SH1 (See GA Drawings), people leaving properties on this road will need to travel via the southern intersection of Avenue North Road and SH1 (approx. 800m away) if they want to travel north. This closure will result in a maximum total additional distance of approximately 1.3km and an increased travel time of 1.3 minutes, for those properties on Avenue North Road, as illustrated in Figure A.26.[65]

[65] It is noted that this alteration may be implemented by the Safety Improvement Programme before the Ō2NL Project is constructed and hence it would not be a Project effect.

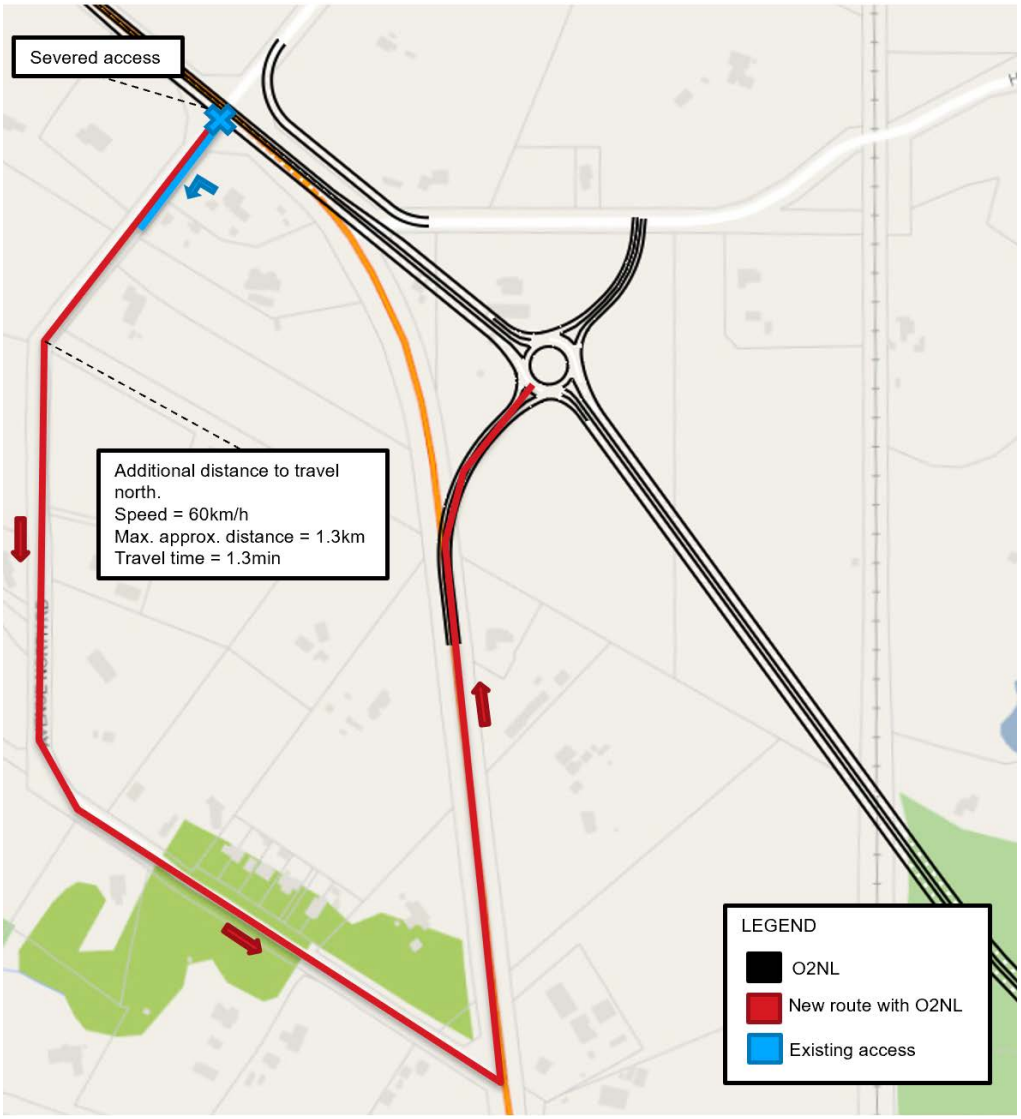


Figure A.26: Additional travel for properties on Avenue North Road travelling north

Induced Traffic

276. The Ō2NL Project is likely to result in some induced traffic due to enhanced route choice opportunities, reduced congestion and improved travel times relative to the Do Minimum.

277. Figure A.27 below shows the comparison of elastic assignment to fixed assignment in the 2039 With Project scenario. This shows moderate levels of induced traffic as a result of the new highway. The biggest change is on the new highway itself where induced traffic ranges from +400 vpd north of Levin (3% of total traffic) to +2,400 vpd south of Levin (9% of total traffic). The levels of induced traffic as a proportion of total traffic are similar to what

was predicted for the MacKays to Peka Peka highway project. All other changes are around or less than 1,000 vpd, including around the Otaki area.

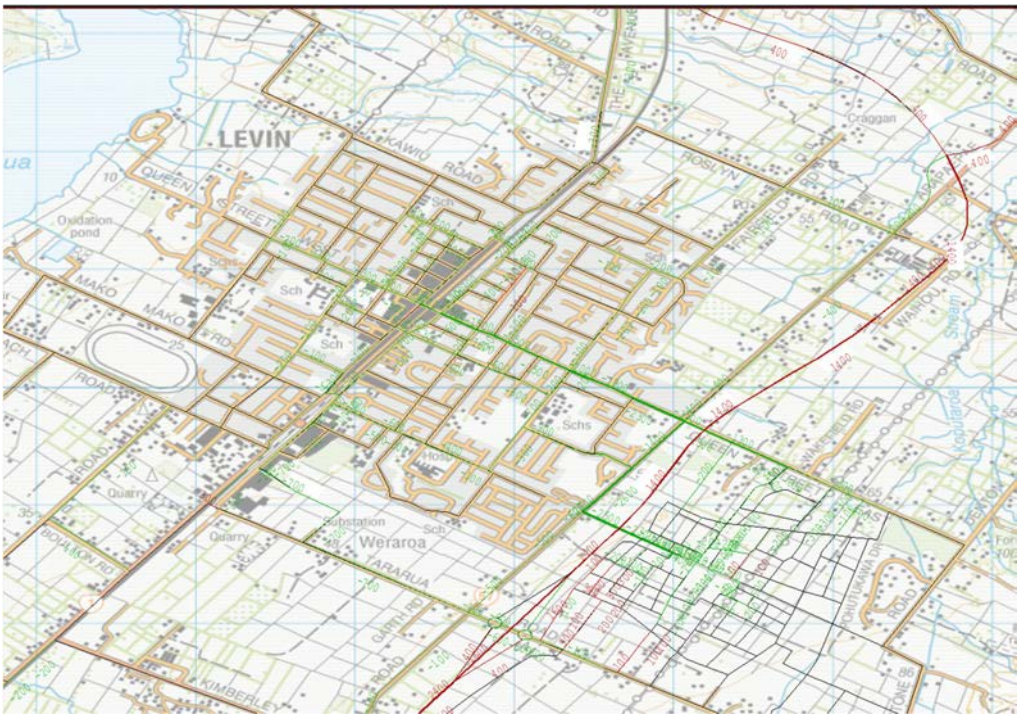


Figure A.27: 2039 Induced and Suppressed Trips in Levin

278. Whilst there are increased trips expected on the new highway, there are estimated to be fewer trips on the overall network with elastic assignment compared to fixed assignment, which shows that there is still a reasonable amount of suppressed traffic on the network. This is also shown in Figure A.27 above. As presented earlier, the Ō2NL Traffic model shows that suppressed trips on the Do Minimum network are likely to be approximately 12,500 vpd, but with the project in place, the suppressed trips are estimated to be around 9,000 vpd.[66]

279. However, as the new highway is longer, as trips get attracted to this route, there will be an overall increase in VKT. This is estimated to be 3% when compared to the fixed assignment model with Ō2NL in place but increases to 10% when compared to the elastic assignment Do Minimum model. Whilst this is an increase, it is noted that the traffic volumes on the network are very much dependant on the growth achieved.

[66] This includes approx 5,000 trips shown by the network statistics plus around 4,000 vpd of induced trips and released suppression onto the new highway.

280. It is further noted that as there are limited options in terms of other modes in this area, induced trips are not trips that would not be taken away from public transport, walking or cycling.

281. The total traffic volumes, including suppressed and induced traffic, have been used in all assessments within this evidence, so no additional adverse effects are expected.

MANAGING CONSTRUCTION AND ITS IMPACTS ON THE TRANSPORT NETWORK

282. As with all major transport projects, construction of the Ō2NL Project will have impacts on the existing transport network. In this case, the potential effects are minimised by the fact that the Ō2NL Project is an 'offline' highway, largely being constructed away from the existing SH1 and SH57. There will still however be effects that will need to be managed appropriately over the duration of construction through conditions and a CTMP. With the CTMP in place the construction traffic effects will be minor.

283. Large proportions of the construction will take place away from or adjacent to the existing State highway so that it is able to be built with a minimum of disturbance to other traffic.

284. Construction will involve additional traffic movements on portions of the adjoining SH1, SH57 and local road network while the work is being done.

285. The site is likely to operate as a series of mostly independent construction zones delivering separate sections of the new corridor with movement between construction zones (including earthworks) being undertaken via internal construction haul and access roads/ tracks. The precise construction methodology will be determined by the contractor when they are procured who will consider how and when to establish such a route across major watercourses, notably the Ohau River, and the Waikawa, Manakau, Kuku and Waiauti Streams.

286. The principal construction traffic elements are, as follows:

    (a) Staff: The number of staff employed at the site will vary as the work progresses involving an average over the course of the project of some 280 vehicles (560 movements) per day to and from the site, and up to 800 movements per day at busiest times. Minibuses, work vans, and car-pooling will be used where practicable.

    (b) Site parking: On-site parking for staff and for contractor vehicles will be provided for each work location as the work progresses, away from the existing SH1 and SH57. Individual access points will be positioned and constructed to ensure sufficient visibility and appropriate safety for all entering and exiting traffic. Appropriate traffic management will be provided where required.

(c) Cut and Fill: During the earthworks periods of the construction phase, potentially over half a million cubic meters of earth will be excavated from some areas of the site and transported to other construction zones either on haul roads along the alignment or via the existing road network. This figure excludes earthwork movements within each construction zone. Whilst much of the earthworks transfer should be able to occur on the alignment, there are still a significant volume that needs to move longer distances and therefore may use existing roads. This is estimated to be a peak of around 80 truck movements per day in the northern part of the designation (160 movements) and around 90 truck movements per day in the southern sections (180 movements) per day. As the earthworks planning has indicated that material is not expected to need to cross the Ohau River, these volumes of trucks are not expected to interact.

(d) Aggregates: Aggregate will likely be sourced from quarries in the Wellington and Manawatu-Whanganui regions using standard high-productivity truck and trailer units. Outside of the concrete and paving related movements below, there will be a low level of aggregate deliveries throughout the Ō2NL Project of up to 20 vehicles per day (40 movements) across the entire proposed designations. These movements are likely to overlap with some of the wind down of earthworks activities, as peak aggregate demands relate to pavement laying activities which would only commence once the main earthworks were complete.

(e) Concrete: Concrete will be brought to the site throughout the Project area, although some may be batched on site. Compared to aggregate and earthworks movements these are expected to be comparatively low and not significant. Delivery of pre-cast beams may require over dimension permits and hence may be scheduled to use the road network outside of peak hours.

(f) Paving: The delivery of paving materials to the site will involve an expected peak of 90 heavy vehicles per day (180 movements) over the paving period of the Project.

(g) Deliveries of Components: As the work advances, other occasional truck movements to and from portions of the Project will be involved

with the delivery of machinery and plant, as well as material such as culverts and barriers. Some will require over dimension permits.

(h) Servicing: Other movements such as couriers, daily delivery of fuel and water, and the routine servicing of staff needs and the like will amount to a further 20 to 40 vehicles per day (40 - 80 movements), mostly to and from Ōtaki, Ohau and Levin.

287. Taken together, and in considering the overlap of activities through the five years these works will take to complete, the total amount of truck traffic associated with the Project is expected to vary between 70 and 340 trucks per day (680 movements) as the work advances, with an overall average of around 250 trucks per day (500 movements) and approximately 650 light vehicles (1,300 movements) per day.

288. Some of these movements may be able to be made entirely within the proposed designation boundaries without utilising public roads. Internal haul roads are proposed to be constructed to transport staff, earthworks and materials along the alignment and temporary bridges (or early construction of the final bridges) are proposed to enable these movements along the corridor. However, the exact proportion of movements that will be able to be undertaken within the site is unknown at this stage.

289. This assessment is indicative as the final construction methodology will be developed once a contractor has been appointed.

Construction site access points

290. Due to the site's size and number of vehicle movements, it is proposed to have numerous site access points to mitigate the impacts of vehicles on the road network. The sites identified and peak additional heavy vehicle movements per day are outlined below. This assessment has focused on heavy vehicles as they will have a bigger impact on the safe operation and efficiency of the existing network than light vehicles. Movements have been estimated by assuming that the Project will be split into seven construction zones and that there would be at least 2 accesses into each zone. Other accesses were considered but discarded as the transport effects would be greater and access would not be needed based on there being at least two other accesses for the zone. These assumptions have shown that the negative impacts from the construction traffic can be appropriately managed with the identified site access points and that other accesses would not be

needed. However, as the construction methodology is developed by the contractor, new points could be considered which would be assessed and considered through the proposed CTMP (discussed below).

291. While there are many light vehicle movements associated with the construction, many of these are staff accessing the site at the start and end of each day which predominantly do not overlap with the peak hours. When turning into and off the existing network, light vehicles can accept smaller gaps in traffic and have a smaller impact on the existing traffic.

292. The current daily traffic volumes presented below are the latest counts available from KCDC, HDC or Waka Kotahi databases. The construction movement numbers presented below assume that all of the access points in Figure A.28 would be used. They are an estimate and provide a basis for establishing relevant management processes and protocols. If the contractor wished to use fewer or a greater number of access points, or use the existing ones for greater movements, eg for night-time movements, this would be managed through the CTMP (discussed below).

Figure A.28: Indicative Site Access Locations

293. The indicative site access locations to the designation and construction zone are shown in Figure A.28 are discussed below, from north to south:

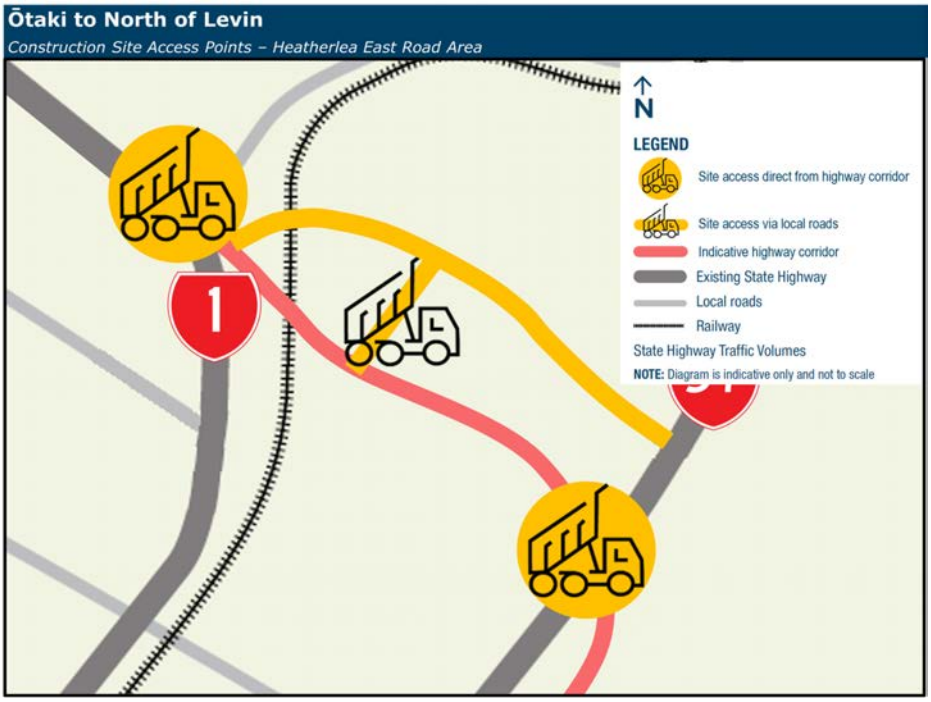


Figure A.29: Indicative Site Access Locations – North of Levin

(a) SH1 northern boundary (including Heatherlea East Road): This is the northernmost extent of the site and is expected to see a peak of generally around 20 heavy vehicles (40 movements) per day. There will be day to day variation to accommodate specific construction phase requirements. This is a negligible increase in the volume of traffic over the existing 11,200 vpd on SH1. As this site is part of the proposed designation, it will be under temporary traffic management, which will help facilitate access to and from the site and therefore no safety issues are expected for access or egress.

(b) Sorensons Road: This is located near the northern tie in for the new highway and will be used to transport materials for the rail overbridge's southern abutment as well as general construction traffic for the local area. It is expected to see a peak of generally around 25 heavy vehicles (50 movements) per day. There will be day to day variation to accommodate specific construction phase requirements. As Sorensons Road only has a reported traffic volume of approximately 100 vpd, this additional traffic is easily accommodated by the road. Access to Sorensons Road comes from Heatherlea East Road, which has a reported daily traffic volume of approximately 370 vpd. Both roads have spare capacity for the construction traffic and there are no safety issues which are expected to be exacerbated by this access.

(c) The above two access locations will mean that construction traffic will need to use Heatherlea East Road for some movements. This will primarily be at the western end between SH1 and Sorensons Road where an at-grade railway crossing is present. The CTMP will include traffic management to safely accommodate additional movements at this location without increasing the risk of a rail incident.

(d) SH57 crossing (including MacDonald Road): Located where the proposed highway designation crosses the existing SH57. It is expected to see a peak of generally around 85 heavy vehicles (170 movements) per day - a negligible increase in the volume of traffic. There will be day to day variation to accommodate specific construction phase requirements. As this site is part of the designation corridor it will be under temporary traffic management. The existing traffic volume on this part of SH57 is approximately 8,900 vpd and therefore SH57 will be able to accommodate the additional traffic and the temporary traffic management will ensure that access and egress will be accommodated safely.

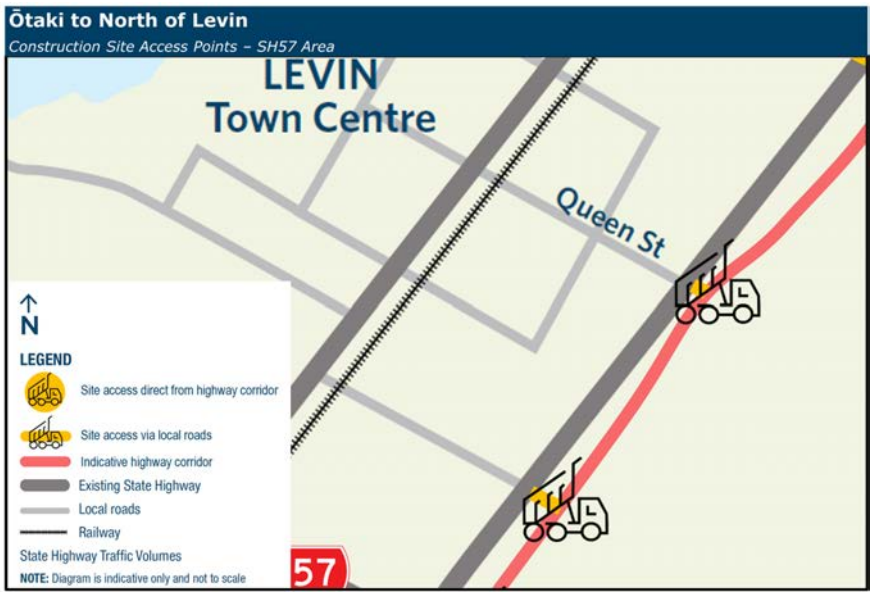


Figure A.30: Indicative Site Access Locations – SH57 Area

(e) Queen Street East: Located east of SH57 and is expected to see a peak of generally around 90 heavy vehicles (180 movements) per day. Queen Street East has a reported daily traffic volume of approximately 1020 vpd at this location and can comfortably accommodate the additional traffic. There will be day to day variation to accommodate specific construction phase requirements. The new roundabout at

SH57/Queen Street will help accommodate the turning movements safely from the highway and the temporary traffic management will ensure site access and egress can be conducted safely.

(f) Tararua Road: This site access point is east of SH57. It is expected to see a peak of generally around 45 heavy vehicles (90 movements) per day. There will be day to day variation to accommodate specific construction phase requirements. Tararua Road has a reported daily traffic volume of approximately 1400 vpd at this location and can comfortably accommodate the additional traffic. The new roundabout proposed at SH57/Tararua Road will help accommodate the turning movements safety.

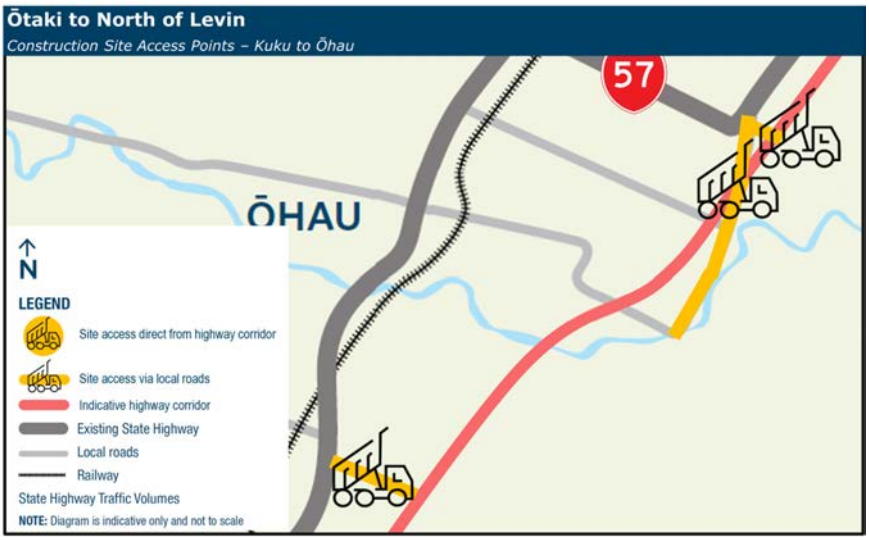


Figure A.31: Indicative Site Access Locations – Kuku to Ohau

(g) Kimberley Road: This is east of the current SH57 intersection with Kimberley and Arapaepae Road south of Levin. It is expected to see a peak of generally around 15 heavy vehicles (30 movements) per day. Site access here will generally be for specific construction activities and not general earthmoving purposes. There will be day to day variation to accommodate specific construction phase requirements. Kimberley Road has a reported traffic volume of approximately 200vpd at this location and can comfortably accommodate the additional traffic. The CTMP will need to give consideration to traffic management at the SH57 intersection of Kimberley and Arapaepae Roads during construction as this area has a history of crashes.

(h) Arapaepae Road: Arapaepae Road will provide access from the material supply sites to the northern sections of the proposed designations. It is expected that this access will have a peak of generally around 60 trucks (120 movements) per day, which assumes that each material supply site's peak movements do not occur at the same time. There will be day to day variation to accommodate specific construction phase requirements . Arapaepae Road has a reported daily traffic volume of 640 vpd and will easily be able to accommodate the additional movements, but, as above, the intersection with SH57 may benefit from traffic management during peak construction movements if internal haul roads are not available.

(i) Muhunoa East/Bishops Road: Heavy vehicles cannot use Muhunoa East Road to access SH1 due to the undersized railway underpass. The alternate route is Bishops Road, but this has safety concerns associated with the railway crossing in terms of stacking length and also the lack of rail crossing safety infrastructure at the crossing itself. Accordingly, no truck movements will be allowed at either of these two locations and movements into this location have been assumed to occur at Arapaepae Road. This should not be problematic as access is not needed for general earthworks movements, as material from the site north of Ohau River, at this stage, is expected to be moved to the north only. If Bishops Road was to be used by the contractor for heavy vehicle movements, then it would need a significant upgrade. This might be delivered by realignment to the north along the line of a previously designated road corridor and crossing of NIMT, which is located closer to the Ohau domain playing fields. The requirements for these improvements are matters to be considered during the detailed design phase, in advance of construction, once methodology and traffic requirement are known. Light construction vehicles should also not use Bishops Road due to the lack of rail crossing safety infrastructure, but could use Muhunoa East Road, preferably outside of school start and end times.

(j) Kuku East Road: Located midway between Manakau and Ohau. It is expected to see a peak of generally around 20 heavy vehicles (40 movements) per day. Kuku East Road has a reported traffic volume of approximately 240vpd at this location and can comfortably

accommodate the additional traffic. The intersection onto SH1 is planned for upgrade as part of the online SIP works.

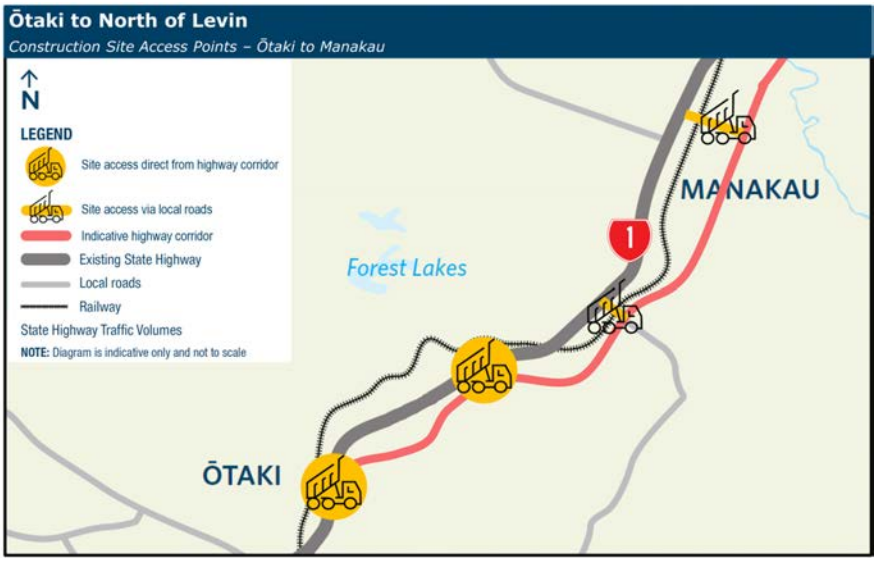


Figure A.32: Indicative Site Access Locations – Ōtaki to Manakau

(k) North Manakau Road: Located north of the Manakau township. It is expected to see a peak of generally around 90 heavy vehicles (180 movements) per day. There will be day to day variation to accommodate specific construction phase requirements. It is expected that many of these movements (up to 100 movements per day) will be trucks moving material from the north to the south and simply crossing the road, not accessing the wider road network. North Manakau Road has a reported daily traffic volume of approximately 400 vpd at this location and can comfortably accommodate the additional traffic. Due to the proximity of the railway corridor to the intersection of North Manakau Road and SH1, construction traffic will need to be managed to prevent queuing when accessing the wider network. The process for this will be detailed in the CTMP (discussed below).

(l) South Manakau Road: Located south of the Manakau township. It is expected to see a peak of generally around 65 heavy vehicles (130 movements) per day. It is expected that many of these movements (up to 90 movements per day) will be trucks moving material from the south to the north and simply crossing the road. There will be day to day variation to accommodate specific construction phase requirements. South Manakau Road has a reported traffic volume of approximately 230vpd at this location and can comfortably accommodate the additional traffic. Due to the proximity of the railway corridor to the

intersection of South Manakau Road and SH1, when construction traffic is accessing the highway, it will need to be managed to prevent queuing. The process for using internal haul roads will be detailed in the CTMP, but it is noted that some construction traffic may need to use Manakau Heights Drive.

(m) SH1 southern boundary: This is the southernmost extent of the site and is likely to have two access points - one near the southern tie in and another south of the Pukehou Rail overbridge. Together these are expected to see a peak of generally around 35 heavy vehicles (70 movements) per day. There will be day to day variation to accommodate specific construction phase requirements. This is a negligible increase in the volume of traffic over the existing 16,400 vpd. As this site is part of the corridor it will be under temporary traffic management, which will help facilitate safe access to and from the site. It may be appropriate to restrict these to left-in left-out operation only due to visibility and capacity constraints – vehicles would then turn around at the north Ōtaki interchange (being provided by PP2Ō).

(n) Private Accessways: Access via private property may become available, such as the quarry access road (immediately south of Ohau River) and other locations. The volume of vehicles using this will be agreed with the landowner and will be reflective of any safety considerations accessing the right of way. This will reduce the volume used at other locations.

294. Site access points will be managed to ensure safety and minimise disruption. In particular:

(a) Access to each site access will be controlled, so that entry will only be possible for those authorised to access the site (including workers, and movement of materials and plant).

(b) The individual access locations have each been positioned to ensure good visibility so as to not create a safety hazard. All truck and machinery manoeuvring, and parking, will be provided for clear of the State Highway and within the project designations.

(c) Where practicable, the access will be sealed for the first 10m to prevent detritus spreading onto the road.

(d) Where site access points will be accessed directly from a public road, a Temporary Traffic Management Plan ("**TMP**") will be prepared and the road setup in accordance with this TMP.

(e) Due to the proximity of the railway line to some of the intersections with SH1, there is a risk of traffic queueing back over the railway line. Truck drivers will therefore need to have radio contact with site crews and other drivers from this point and be able to check that the intersection they are heading to is clear, and wait if need be. Details about communications will be outlined in the CTMP.

(f) As identified above, there will be lengths of the existing SH1 and SH57 at each end of the Project where online works will be needed to tie the construction into the existing State highway. These parts of the network will be subject to construction traffic management measures which will affect traffic efficiency. These will also be used as site access points. Access at these locations will be controlled using an appropriately approved TMP.

295. These measures will be required to be provided for in the CTMP, which is discussed below.

Managing the potential effects of construction traffic

Construction Traffic Management Plan

296. It is recommended that a CTMP be required to be prepared once details around the construction of Ō2NL Project are confirmed. CTMPs are common practice and were part of the management regime for Mackays to Peka Peka and PP2Ō.

297. The objective of the CTMP will be to minimise adverse effects on property access, traffic safety and efficiency as a result of work activities through the construction of all stages.

298. In line with common practice, the CTMP will be prepared by a suitably qualified and experienced person once a construction programme and methodology are available and construction activities are confirmed. Typically, a CTMP includes the following details:

(a) The numbers, frequencies, routes, and timing of construction works traffic movements.

(b) Identification of site access routes, site access arrangements and access points for heavy vehicles in a manner consistent with the Waka Kotahi's Code of Practice for Temporary Traffic Management and measures to manage the movements of heavy vehicles during peak times (Traffic Management Plans will be prepared as required and recorded as sub plans to the CTMP).

(c) Methods to manage local and network wide traffic effects of the construction, including temporary traffic management measures, such as traffic detours and temporary speed limits.

(d) Plans to limit the heavy vehicle construction traffic movements through key areas during night and peak times.

(e) Details of how safe pedestrian and cyclist access movements will be maintained in the vicinity of the site.

(f) Demonstrating how construction vehicle noise will be managed and requirements for effective noise suppression will be implemented.

(g) Details of how on-going vehicle access to private and adjacent properties will be maintained.

(h) Provisions for new permanent accesses to be formed at the earliest opportunity to limit the adverse effects of construction and severance.

(i) Management of fine material loads (e.g., covers) and the timely removal of any material deposited or spilled on public roads.

299. Traffic management communications requirements will be outlined in the Construction Environmental Management Plan and Communication and Engagement Plan.

300. Temporary Traffic Management Plans will be developed where the construction will have impacts on normal road operation and will be approved by Waka Kotahi and the relevant Road Controlling Authority where applicable. These will be considered part of the CTMP and will detail site specific layouts for site access.

SUMMARY RATING OF EFFECTS

301. Table A.11 below summarises the transport effects assessed for the Ō2NL Project on the study area. The effects are almost all positive, and most or all

of the individual positive effects are fairly classed as significantly positive. The summary shows that, overall, the Ō2NL Project will significantly improve the transportation environment across several measures.

Table A.11: Summary of Transport Effects

Effects	Measure	Measure Rating	Effects Rating
Safety	Deaths and Serious Injuries (DSI)	Positive	Positive
	Infrastructure Risk (KiwiRAP Star Rating, IRR)	Positive	
	Crash Risk (Collective Risk and SAAS)	Positive	
	Level crossing safety	Positive	
Resilience	Number of detour routes available	Positive	Positive
	Number of crash closures	Positive	
	Risk of closures and journeys impacted by events	Positive	
Travel Times	Travel times on key routes	Positive	Positive
	Side road delays	Positive	
Community Connectivity	Travel times for side roads accessing SH and travel times between areas	Positive	Positive
Property Connectivity	Travel times for properties impacted by the Project	Less than Minor Adverse Effects	Less than Minor Adverse Effects
Induced Traffic	Induced daily traffic volumes, network wide daily trips and vehicle kilometres travelled	Effects considered under other measures	N/A
Construction	Impact to network as a result of construction	Minor Adverse Effects	Minor Adverse Effects
Walking and Cycling	Walking and cycling safety on SH	Positive	Positive
	Project shared path	Positive	
Public Transport	PT travel times and reliability on SH1	Positive	Positive
OVERALL		**SIGNIFICANTLY POSITIVE**	

CONCLUSION

302. The current State highway network is not fit for purpose and is causing high levels of harm that cannot be significantly reduced by treating the current roads. Forecast strategic growth will exacerbate the existing issues further.

303. The Ō2NL Project will have significant and wide-ranging benefits for the local, and regional community in terms of safety, resilience and access and provide a much needed safe and resilient connection in the national network.

304. I consider that any adverse effects are minor and insignificant in relation to the positive benefits the Ō2NL Project will bring.

Philip Peet

14 October 2022