BEFORE THE TARANAKI REGIONAL COUNCIL AND NEW PLYMOUTH DISTRICT COUNCIL

MT MESSENGER BYPASS PROJECT

In the matter	of the Resource Management Act 1991
and	
In the matter	of applications for resource consents, and a notice of requirement by the NZ Transport Agency for an alteration to the State Highway 3 designation in the New Plymouth District Plan, to carry out the Mt Messenger Bypass Project

STATEMENT OF EVIDENCE OF HUGH JOHN MILLIKEN (PROJECT CONSTRUCTION) ON BEHALF OF THE NZ TRANSPORT AGENCY

25 May 2018

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QUALIFICATIONS AND EXPERIENCE

1. My name is Hugh John Milliken.

2. I am a Senior Project Manager and I hold a Bachelor of Engineering (Civil, Hons) from Canterbury University. I am employed by Downer NZ as a Senior Project Manager. My role on the Mt Messenger Bypass Project ("**Project**") is Alliance Manager.

3. I have extensive experience in the management of construction sites in both New Zealand and Australia, with a strong record of compliance through consultation and risk management with external and internal stakeholders through the construction process.

4. Since 2002, I have been a senior member of the construction teams of a number of significant building and infrastructure projects. These include:

   (a) Museum Hotel Apartments development, Wellington, New Zealand;

   (b) North Auckland Line rail project, Auckland, New Zealand;

   (c) Tugun Desalination Project, New South Wales, Australia;

   (d) AirportLink, Queensland, Australia;

   (e) Ballina Wastewater Treatment Plant, New South Wales, Australia;

   (f) Bowraville Off River Storage Project, New South Wales, Australia; and

   (g) Waitangi Wharf Upgrade Project, Chatham Islands, New Zealand.

5. My role as a senior member in those teams was to manage part, or all, of the sites which included planning and compliance around all aspect of environmental compliance and construction methodology. On-site management involves understanding the requirements of the contract and project stakeholders and then delivering the project within that framework, as well as ensuring compliance, monitoring, auditing and record keeping to show that standards and expectations have been adhered to.

6. I confirm that I have read the ‘Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to

consider material facts known to me that might alter or detract from the opinions I express.

EXECUTIVE SUMMARY

7. I have been involved in the design and review process of the Project since March 2017. Much of the Mt Messenger Alliance ("**the Alliance**") was in the previous Memorial Park Alliance, and is experienced in constructing large and complex infrastructure works having already delivered the Pukeahu National War Memorial Park project and the Chatham Island Waitangi Wharf Project.

8. The Project involves the following proposed key construction aspects:

   (a) construction of 6km of new two-lane road;

   (b) a main construction yard (with other minor yards), access and haul roads, storage and disposal sites;

   (c) a tunnel (235m in length) through the ridgeline in proximity to the existing Mt Messenger rest area, with associated tunnel control building and emergency water-supply tanks;

   (d) a 120m long bridge over a wetland on a tributary of the Mimi River;

   (e) earthworks footprint over a total area of approximately 36ha, with a cut volume of approximately 960,000m^3 and a bulk fill volume of approximately 890,000m^3;

   (f) at least 10 cuttings up to a depth of about 60m, covering a combined distance of around 2.6km (including the tunnel portals); and

   (g) at least 15 earth embankments up to about 40m in height (but typically less than 5m high), along a combined distance of approximately 2.5km.

9. The Project will be constructed in a region-based and zoned manner with works occurring in a staged manner within each zone. At any one time during the construction process, works will be carried out in multiple zones, across both regions. Works will commence in the ten different zones at different times. The general sequence of construction in each zone will be preparatory works, establishment works and construction works (including reinstatement).

10. All works will be undertaken to minimise environmental effects to the extent practicable. The primary management tool for this is the Construction Environmental Management Plan ("**CEMP**") within which all construction works must be undertaken. It provides the overarching framework for a series of management plans that appropriately control the construction effects associated with the Project.

BACKGROUND AND ROLE

11. In March 2017, the New Zealand Transport Agency ("**Transport Agency**") appointed an alliance (the Alliance) to progress the design (including options assessment), consenting and construction of the Project to improve the section of State Highway 3 ("**SH3**") between Ahititi and Uruti, to the north of New Plymouth.

12. I was appointed Alliance Manager in May 2018, prior to which I was the Earthworks Manager, a role I held since March 2017. As the Alliance Manager, I have the overall day-to-day responsibility for the delivery of the Project by the Alliance. Prior to my appointment as Alliance Manager, I provided earthworks inputs and reviews of options and general construction and constructability inputs. I have had particular involvement in the development of the Construction Water Management Plan ("**CWMP**"), Specific Construction Water Management Plans ("**SCWMPs**") (Site Access Road, Construction Yard and Fill Disposal Area 4) and the construction methodologies for Fill 12 and Fill 13.

13. Through my previous and current roles within the Alliance I have been heavily involved in the design and potential construction of the Project.

14. Initially, this was focused on options being considered for the route alignment. I was involved in assisting with working on the 3D model (Humphrey - explained in the evidence of Mr Kenneth Boam) and inputting the earthwork volumes, cuts, and so on, for the various alignments.

15. I attended the Multi Criteria Assessment long list and short list options workshops. Following on from the workshops I was involved in costing the construction of the options for consideration by the Transport Agency.

16. Since the Project alignment was selected I have been heavily involved in refining its design (and the preparation of the design drawings attached to the Assessment of Environmental Effects ("**AEE**")) and construction techniques to ensure the Project's construction can be implemented efficiently and in accordance with all statutory requirements.

17. I have been to the site at least six times, in varying seasons and weather conditions, on both the east and west sides of the existing State Highway.

SCOPE OF EVIDENCE

18. The purpose of my evidence is to outline the methodology and programme of construction for the Project, and to discuss at a high level the potential construction effects of the Project.

19. My evidence addresses:

    (a) background to the Alliance;

(b) project description;

(c) the construction programme;

(d) construction establishment;

(e) general construction activities;

(f) the overall approach to construction including management plans; and

(g) responses to the Section 42A Reports.

20. My evidence should be read in conjunction with the AEE for the Project, particularly section 5 of the AEE (Construction).

BACKGROUND TO AND THE ROLE OF THE ALLIANCE

21. As mentioned in the evidence of Mr Robert Napier, the Transport Agency selected the current Mt Messenger Alliance team in March 2017. It consists of the Transport Agency, Downer NZ (constructor), HEB Construction (constructor), Tonkin and Taylor (consulting engineers), and WSP Opus (consulting engineers). This team is responsible for assisting the Transport Agency in obtaining its consents and the designation for the Project, as well its design and construction.

22. I have been involved in Alliance projects before, including with most of the same team for the Chatham Island Waitangi Wharf Project. That project was undertaken within time and within all of its statutory requirements. Although I was not then part of it, that Alliance was responsible for delivering the Pukeahu National War Memorial Park project. Again, this project was delivered on time, and complied with all of its consent conditions (which in the middle of a highly populated urban area required careful management). The Alliance, and its members, are used to working collaboratively to construct difficult projects in full compliance with all environmental (and other) requirements.

23. The Alliance model is different from the normal design and construct model as the success of the Project is not judged solely on cost and programme. The Alliance model has a requirement to identify key resource areas and to meet key performance indicators related to those matters.

24. The key result areas for the Project are resilience and safe network, operational excellence, enduring legacy, strong relationships and sound financial management. As Alliance Manager on other alliances, I have been part of teams that have worked to and achieved similar key result areas before.

PROJECT DESCRIPTION

25. In summary, the Project involves construction of a new 6km two-lane road with an operational design speed of 100km/hr (the design details of which are set out in the evidence of Mr Boam). The road will replace the existing length of SH3 over Mt Messenger between Uruti and Ahititi, north of New Plymouth. The route will tie back to the existing SH3 corridor at the north and south of the alignment.

26. The Project involves the following proposed key construction aspects:

    (a) a tunnel (235m in length) through the ridgeline in proximity to the existing Mt Messenger rest area, with associated tunnel control building and emergency water-supply tanks;

    (b) a 120m long bridge over a wetland on a tributary of the Mimi River;

    (c) earthworks footprint over a total area of approximately 36ha, with a cut volume of approximately 960,000m^3 and a bulk fill volume of approximately 890,000m^3;

    (d) at least 10 cuttings up to a depth of about 60m, covering a combined distance of around 2.6km (including the tunnel portals);

    (e) at least 15 earth embankments up to about 40m in height (but typically less than 5m high), along a combined distance of approximately 2.5km;

    (f) mechanically stabilised earth ("**MSE**") embankments;

    (g) stormwater drainage (including the installation of approximately 1,200m of culverts), treatment and attenuation facilities (including stormwater retention ponds, swales and road drainage network);

    (h) pavement and surfacing activities; and

    (i) site reinstatement and landscape planting.

27. Based on my experience within the construction industry, the Project, although significant, is not a particularly large scale project. The total earthworks volume, the total length of roadway to be constructed as well as the total area of the site are not on the scale of several high profile projects currently underway in New Zealand.

28. A fundamental part of the overall Project is the restoration package set out in the evidence of Mr Roger MacGibbon.

29. The Project is anticipated to take four years to construct (see below). Construction works are programmed to commence in Quarter 4 2018 and be complete around the end of 2022.[1]

CONSTRUCTION PROGRAMME

30. The programme of construction for the Project has been planned on an indicative basis, including and allowing for:

    (a) working hours;

    (b) splitting the Project area into construction 'regions' and 'zones'; and

    (c) the sequencing of works across the anticipated four year construction period in each region and zone.

31. The programme also recognises the poorer weather conditions likely to be encountered in winter, and has used a higher number of stand-down days for earthworks in those periods to allow for managing sediment and erosion risks by employing the SCWMP process.

Working hours

32. The general working hours for the Project will be Monday to Sunday from 6:30am - 9:00pm. Some activities are likely to take place outside of these hours. The types of activities that might occur outside the general working hours include:

    (a) work on the existing SH3 corridor including site access points and tie-ins connecting the new road to the existing SH3 to minimise disruption to SH3 traffic;

    (b) the delivery of oversized material and equipment (such as bridge and tunnelling equipment), to minimise disruption to SH3 traffic;

    (c) tunnelling works, which will be undertaken around the clock during the construction of the tunnel. The ability to work at all hours on the tunnel is a significant program and cost advantage, for example allowing the tunnel supports time to cure and gain the required concrete strength before the construction team is able to work under it to progress the tunnel excavation again;

    (d) early morning concrete pours, to allow for efficient use of people and resources; and

    (e) servicing of plant and equipment onsite, to minimise impacts on the construction programme.

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[1] This is of course subject to Resource Management Act and other statutory processes.

33. Potential noise effects on dwellings close to the Project will be managed by:

(a) scheduling works near those dwellings during the hours of Monday - Saturday (and not on public holidays), 7:30am to 6:00pm. Mr Damian Ellerton, explains in his evidence that all works are predicted to comply with the relevant noise standards during those hours; and

(b) where works near dwellings are required to take place outside those hours, managing the works in accordance with the Construction Noise Management Plan ("**CNMP**") (which has been developed primarily to address these circumstances). Mr Ellerton and Mr Peter Roan discuss the CNMP in their evidence.

Construction regions and zones

34. The Project has been split into two construction regions:

(a) north of the proposed new tunnel (including the tunnel itself); and

(b) south of the proposed new tunnel (including the proposed bridge).

35. The construction regions have been further split into ten total zones. The Project construction regions and zones, and the works to be carried out in each zone, are outlined in **Table 1** below.[2]

Table 1: Construction regions and zones

Construction Regions and Zones	**Overview of Main Construction Features / Activities***
NORTHERN CONSTRUCTION REGION - Chainage 0 - Chainage 3635 Cuts and fills of structural fill are balanced in the northern region, with buttress fill to be imported from the southern region once the tunnel and bridge are complete.	
Zone 1- Chainage 0 - 350	Northern tie-in to existing SH3 on alignment Note: Zone includes additional 400 m on the existing SH3 for construction works which will cross over into Zone 2
Zone 2 - Chainage 350 - 2375	Cuts and fills, drainage works Establishment and operation of main construction yard Stream diversions Access tracks / haul roads Spoil disposal site
Zone 3 - Chainage 2375 - 3400	Cuts and fills, including a large fill on the tunnel approach Drainage works Piling under fills Temporary storage of fill material Stream diversions Access tracks / haul roads

[2] The regions and zones are shown on drawings included in Volume 2 to the AEE.

Construction Regions and Zones	Overview of Main Construction Features / Activities*
Zone 4 - Chainage 3400 - 3635 (the tunnel)	Tunnel portal construction Tunnel construction yard establishment and operation Tunnelling operations Installation of tunnel lighting, ventilation, and so on. Construction of tunnel control room and water tanks
SOUTHERN CONSTRUCTION REGION - Chainage 3635 to Chainage 5955 Excess fill from the southern zone will amount to approximately 145,000m^3 of structural fill and unsuitable material. This will likely be moved from the south to the north or taken to nearby spoil disposal sites depending on programme.	
Zone 5 - Chainage 3635 - 4150 (the bridge)	Large cut and fill works between the tunnel and the bridge Access tracks Drainage works
Zone 6 - Chainage 4150 - 4270	Access tracks to the bridge work site Bridge construction yard establishment and operation Bridge construction, which will comprise: – Piling works – In-situ pour concrete – Steel erection – Deck slab construction
Zone 7 - Chainage 4270 - 4825	Cuts and fills Access tracks Drainage works Spoil disposal site
Zone 8 - Chainage 4825 - 5250	Cuts and fills Drainage works Access tracks Southern tie-in to existing SH3
Zone 9 - Chainage 5250 - 5955	Cuts and fills Drainage works Access tracks Tie-in to existing SH3
Zone 10 (no Chainage)	Spoil disposal site

** Some construction activities, such as pavement and surfacing, landscaping and so on will be undertaken across multiple construction zones.*

Construction sequence

36. At any one time during the construction process, works will be carried out in multiple zones, across both regions. Works will commence in the ten different zones at different times. The general sequence of construction in each zone will be:

    (a) Preparatory Works will be carried out (such as surveys and investigations; monitoring; removal of stock and pests such as pigs and goats and fencing off of construction area; and initial earthworks to begin to establish site access, tracks, construction yards and laydown areas, soil disposal sites and erosion and sediment control);

(b) that will be followed by Establishment Works to open up the site through vegetation clearance, stream diversions and construction of access tracks and construction yards; and

(c) the main Construction Works will then follow (such as bulk earthworks, drainage installation, bridge and tunnel construction, pavements and surfacing, and reinstatement and finishing works).

37. **Figure 1** below provides an outline of the construction sequence for the Project, while the details are shown in the construction staging drawings in Volume 2 of the AEE.

38. Throughout the construction programme, the management measures set out in the CEMP and other management plans will be followed, and the programme does consider these actions in the construction durations shown.

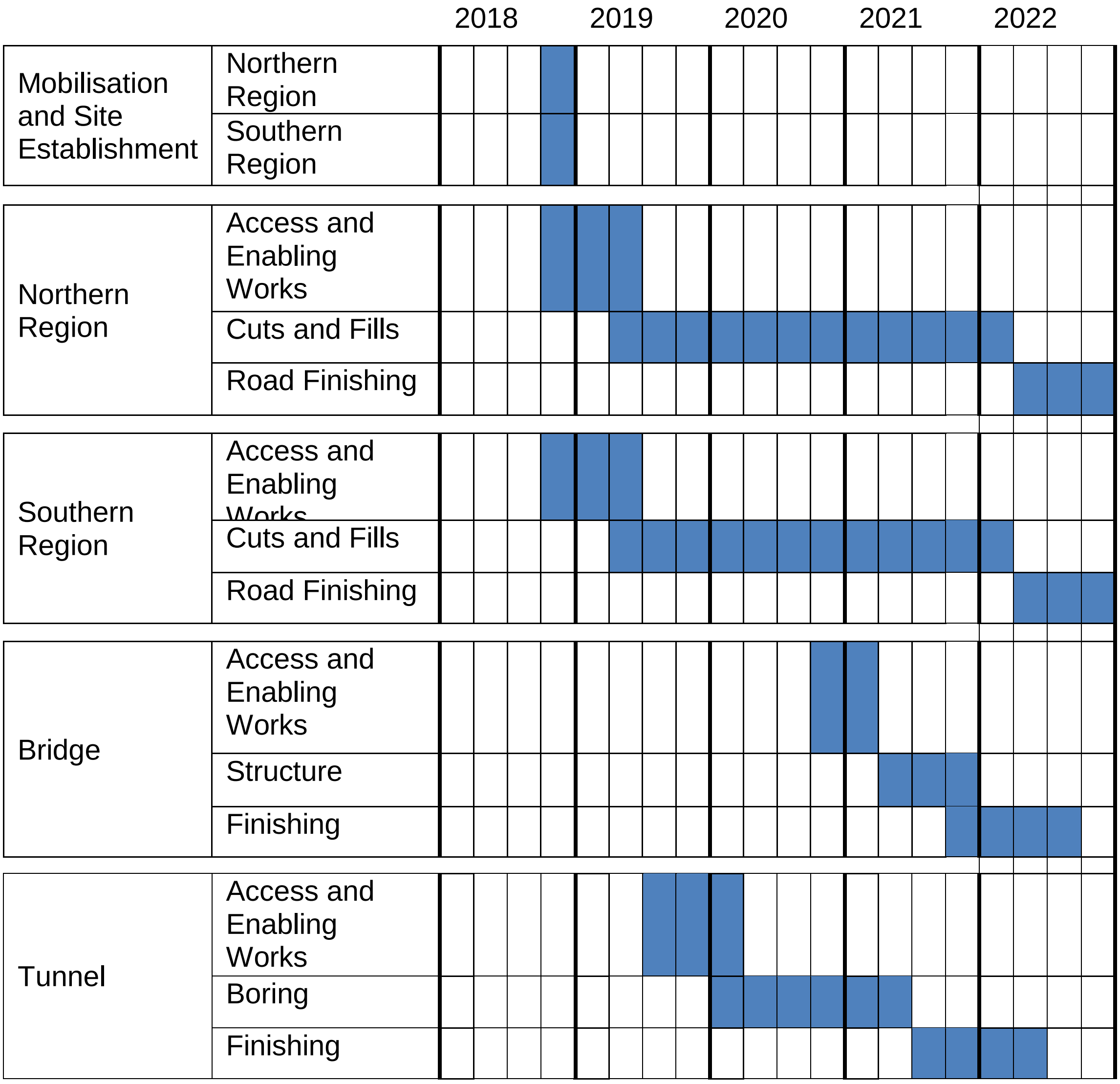


Figure 1: Indicative construction programme and sequence

CONSTRUCTION ESTABLISHMENT

39. Key measures that will be taken to establish the Project site in preparation for the main Construction Works include:

    (a) preparing construction yards, water and wastewater facilities, establish site communications and construction lighting;

    (b) establishing site access points, access roads and access tracks;

    (c) setting up temporary traffic management measures;

    (d) delivering site specific inductions training to the workforce;

    (e) sourcing construction material and water, and providing for the management of wastewater;

    (f) providing for the construction workforce;

(g) establishing site communications; and

(h) providing for construction lighting.

Construction yards

40. The main construction yard will be at the northern end of the alignment (in zone 10), and will be accessed from SH3. This 5,000m^2 (approximately) construction yard will be the central hub for the construction of the Project.[3]

41. There will be smaller (2,500m^2 approximately) construction yards at the bridge and tunnel work areas, and at other remote areas along the Project alignment.

Site access, haul roads and construction traffic management

42. Ten site access points off SH3, and associated access tracks and roads, will allow for direct access to work areas and for work to progress in multiple locations at once. The site access points will be developed and managed in accordance with the Construction Traffic Management Plan ("**CTMP**"), to ensure the safety of access to and from the site from SH3 (and the safety of other SH3 users). The site access points, construction traffic flows and discussion of the CTMP (including temporary traffic management) is set out in the evidence of Mr Peter McCombs.

43. The site access points required would be built to applicable standards and code requirements, acting on the advice of traffic engineering professionals. I consider that approaches such as those outlined within **Figure 2**, that range from temporary and short term solutions to ones that are semi-permanent and more extensive, and based on the length of time and number of traffic movements required, are a practical solution to managing site access and egress.

[3] The indicative layout of the main construction yard, and its key functions, are shown on Figure 5.3 of the AEE and Figure 5.2 of the CEMP.

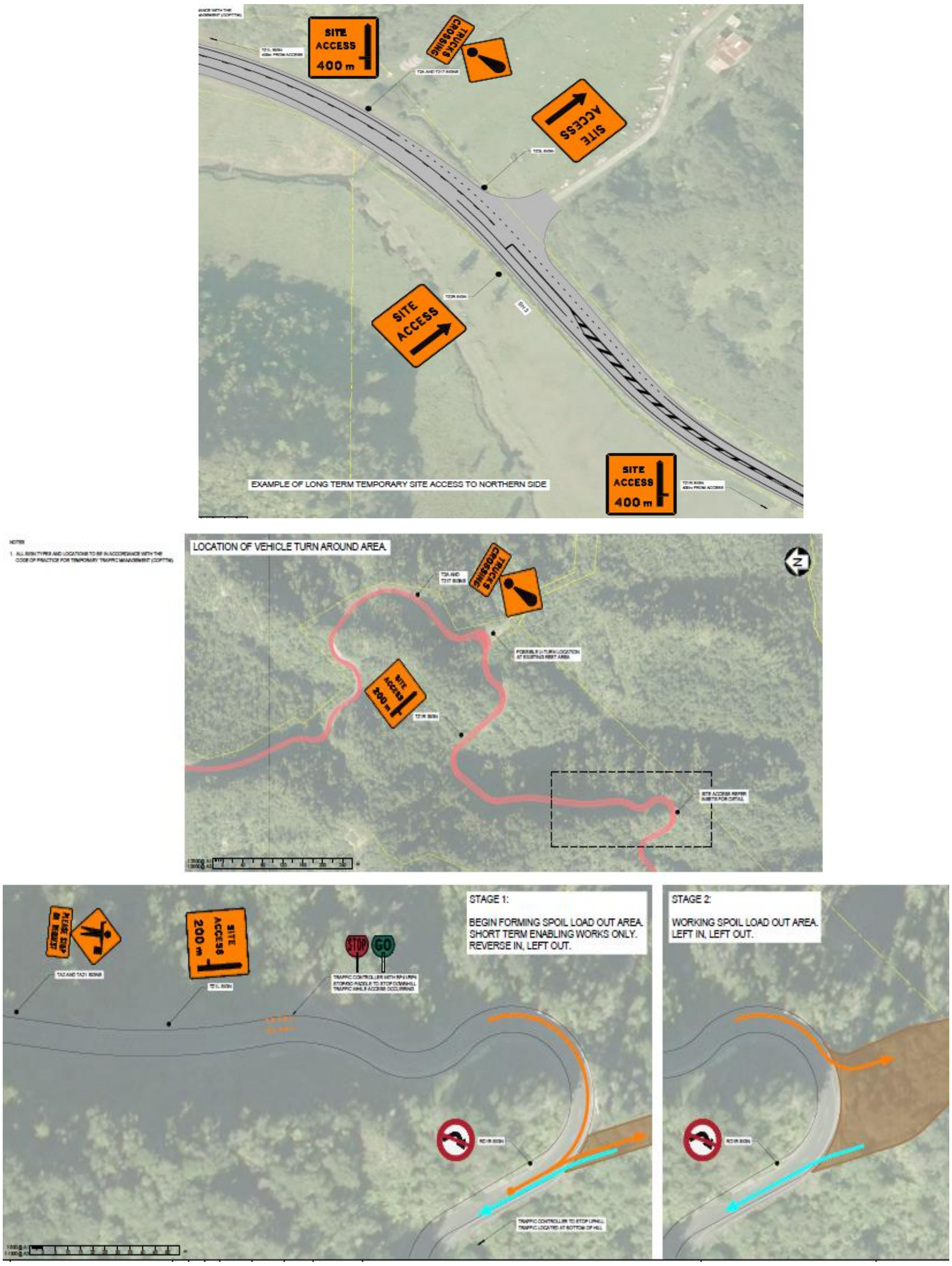


Figure 2: Indicative site access points layouts

44. This offline route solution requires a small amount of site access points. This has many advantages to managing traffic disruption, as a reduction both in the number and total duration of points where a project interacts with public road is always a benefit to both the project and the public.

45. Temporary construction access tracks and haul roads will provide for the transport of equipment and materials throughout the Project area. They will, where practicable, be constructed along the permanent alignment to minimise disturbance and vegetation clearance. The access tracks and haul roads are

shown on the construction staging drawings in Volume 2 of the AEE.[4] All construction tracks and haul roads off the main alignment will be rehabilitated after they are no longer required.

Construction materials

46. Bulk fill will mostly be accessed from cuts carried out as part of construction.[5] Aggregates, concrete, pavement and surfacing materials, general construction items and fuel will be delivered to the site via SH3.

Water and wastewater

47. Water will be required for dust suppression and other construction activities, and will be abstracted from one site in each of the Mimi River and Mangapepeke Stream. Abstracted water will be pumped or trucked from the abstraction points to holding tanks around the Project area. Water abstraction will be carefully managed and limited to prevent adverse effects on water quality and instream ecological values, in accordance with the Construction Dust Management Plan ("**CDMP**").

48. Wastewater (sewage) will be removed from site via tankers, with no wastewater treatment or disposal to occur. Truck washout[6] areas will be provided onsite, in accordance with the CWMP, and drain to sediment ponds for treatment.

Construction workforce and communications

49. During peak periods, 200-250 staff are likely to be on site at any one time. Staff will travel from nearby towns and settlements by private vehicle (carpooling and minivan use will be encouraged), with parking to be provided onsite in the construction yards.

50. Staff will communicate across the site via dedicated radio channels as cell phone coverage is unreliable.

Construction lighting

51. Temporary lighting will be required at the construction yards, and at working areas during hours of darkness. Lighting and potential light spill effects will be managed so they point down. Construction yard lighting will be reduced when yards are not in use. Glare from lighting will be kept below the recommendations of AS 4282-1997 *"Control of the Obtrusive Effects of Outdoor Lighting".*

[4] And in more detail in the erosion and sediment control conceptual plans in Volume 2 of the AEE.
[5] Approximately 87,000m^3 of cut material may be transported to fill sites at the southern end of the Project, involving approximately 80 truck movements per day along SH3 over a six-month period.
[6] Concrete washouts are used as the area where concrete trucks are washed clean of concrete after they have done a load delivery to site.

GENERAL CONSTRUCTION ACTIVITIES

52. The key substantive construction activities that will be carried out include:

    (a) demolition and vegetation clearance;

    (b) earthworks, including the main cut slopes and fill embankments;

    (c) works in streams and drainage installation;

    (d) the construction of the bridge and tunnel;

    (e) paving and surfacing;

    (f) landscape restoration; and

    (g) network utility infrastructure (not part of the Project as such).

53. Section 5 of the AEE describes the construction method for each of these activities. A brief summary is provided below.

Demolition and vegetation clearance

54. Only a relatively small number of existing buildings will require demolition. Demolition will be carried out in accordance with the CEMP and Ecology and Landscape Management Plan ("**ELMP**").

55. While vegetation clearance has been minimised as much as practicable, a large amount of clearance is required. Protocols for clearing vegetation and dewatering streams have been carefully considered, and are detailed in the CEMP and ELMP.

56. Before vegetation clearance the area being cleared will have stock and large pests (such as pigs) removed and, where necessary, fenced to ensure their exclusion from work areas and erosion and sediment control structures.

Earthworks

57. The Project has been designed in order to minimise earthworks, and to optimise the balance between cut and fill (so that large amounts of material are not required to be either imported, or disposed of offsite).

58. Earthworks will primarily be required to create the cut slopes and rock cuttings, and fill embankments as described by Mr Boam in his evidence. Earthworks will also be necessary as part of other construction activities, including creating access tracks, haul roads and construction yards. The earthworks methodology for the Project, including construction water management, is outlined in section 5 of the AEE, in the CEMP and the CWMP and in relation to construction water management explained in the evidence of Mr Graeme Ridley.

59. The earthworks areas to the north and south of the tunnel have had constructability options developed that demonstrate we are able to construct these fills in a way that manages erosion and sediment control (discussed in the evidence of Mr Ridley).

60. The staging methods devised are consistent with best practice construction industry Erosion and Sediment Control, and broadly follow the following methodology:

(a) A SCWMP is developed for each stage of the works, detailing the steps to be taken during the works to manage Erosion and Sediment Control. The SCWMP is developed with the construction and environmental teams having input in to its development.

(b) The work area has initial erosion and sediment controls installed, including cleanwater diversions.

(c) The works are progressed using a staged approach, where each section of works is undertaken in suitable weather, then that area protected or stabilised. A significant part of managing erosion is to divert or capture cleanwater entering the works area, and the staged methodologies developed represent good methods for doing this.

(d) Once an area has been constructed and will not be worked again for some time (with recognition of the 14 day stabilisation period), it is stabilised to minimise erosion and sediment yield.

(e) Once earthworks are underway erosion control is undertaken as part of the earthworks, for example by creating cleanwater capture structures as the fill increases in height.

(f) Regular ongoing maintenance of erosion and sediment control structures, testing and observation of the performance of those controls, and continuous adjustment or improvements (including through the provisions of the CWDMP) are all detailed in the evidence of Mr Ridley, and represent good workable solutions to managing effects.

Excess fill disposal

61. Approximately 960,000m^3 of excavated (cut) material will be generated, and 890,000m^3 of that material will be placed in fill embankments on site. An excess of approximately 145,000m^3 of surplus fill material will be generated by the Project, due to the bulking of cut material as it is excavated.[7]

62. Excess material will be disposed of in soil disposal sites within the designation area, located in both construction regions and shown on drawings MMA-DES-ESC-C0-DRG-1000-1010 (Volume 2 of AEE). The identified soil disposal

[7] 70,000m^3 of structural fill and 75,000m^3 of unsuitable material.

sites together have sufficient capacity to accommodate all surplus fill, though it may be that some excess fill can be placed in fill embankments or used productively offsite.

63. Temporary stockpiling areas will be established to hold imported fill, topsoil and other unsuitable fill, as well as construction equipment, during construction. These areas, which are shown on MMA-DES-ESC-C0-DRG-1000-1010 (Volume 2 of AEE), will be used until permanent disposal sites are established. Temporary stockpiles will be removed once construction is complete.

64. Fill disposal sites and temporary stockpiling areas will be subject to erosion and sediment controls set out in the CWMP and relevant SCWMPs and discussed in the evidence of Mr Ridley. Following construction, the disposal sites will be contoured, landscaped and vegetated in accordance with the ELMP and Landscape and Environment Design Framework ("**LEDF**").

Works in streams and drainage

65. Temporary stream diversions are required to allow for construction and access to construction areas. Permanent stream diversions are required to divert streams through or around Project features such as embankments, bridges and culverts.

66. Temporary culverts will be constructed to allow construction vehicles to cross watercourses and flowpaths, and will be removed when they are no longer needed. A number of permanent culverts will be constructed, to allow existing watercourses to cross the Project alignment.

67. Diversions and works in streams will be carefully managed in accordance with:

    (a) the ELMP and the LEDF, as discussed in the evidence of Mr Keith Hamill, Mr Gavin Lister and Mr Boam; and

    (b) the CWMP and the SCWMPs (see the evidence of Mr Ridley) which will specifically address each individual diversion and culvert.

68. Permanent stream diversions along the alignment will be completed during or prior to ground improvements and earthworks.

69. These stream diversion culvert placement (and removal) works can be undertaken in a way that minimises effects sediment generation, and the CWMP/SCWMP process represents a good practical approach to doing that.

70. The evidence of Mr Hamill details culvert sizes for permanent stream diversions and the evidence of Mr Boam comments on culvert design.

Bridge construction

71. As discussed by Mr Boam in his evidence, the Project features a 120 metre long bridge across the Mimi Wetland, in construction zone 6. The sequence for constructing the bridge is described in section 5.16 of the AEE, and is shown in **Figure 3** below. In summary:

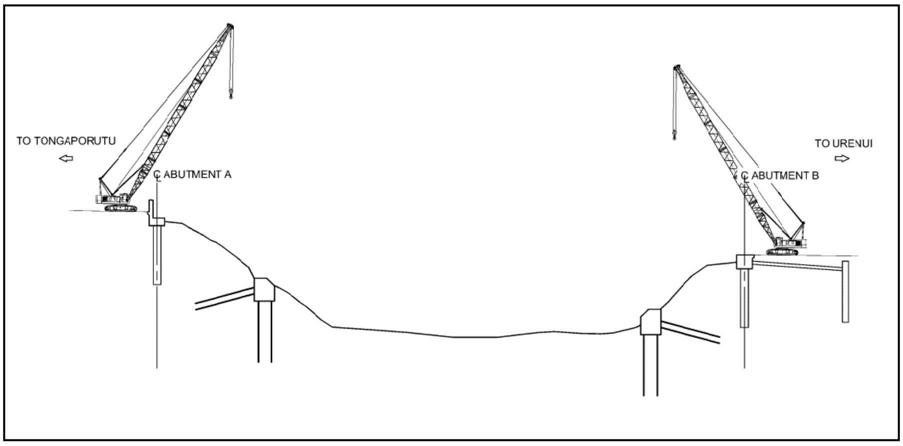
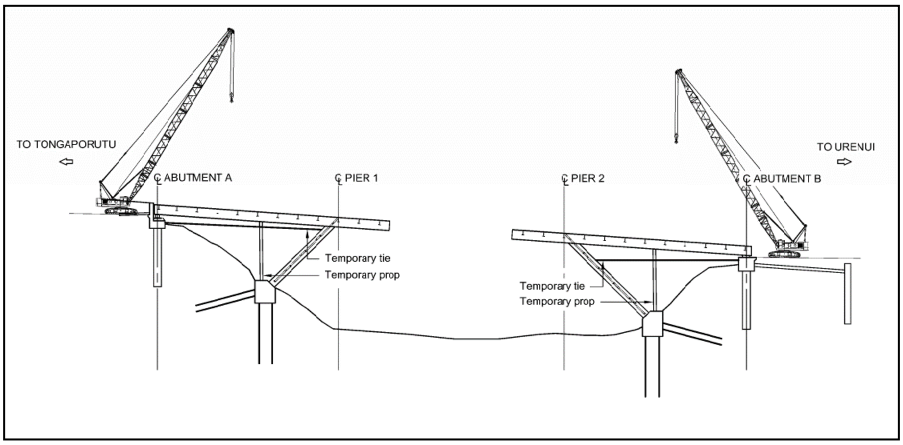
    (a) Stage 1 is the construction of bridge pier and abutment foundations;

    (b) Stage 2 is the construction of the bridge piers and superstructure; and

    (c) Stage 3 is the construction of the bridge deck.

72. The bridge type and construction method has been selected specifically to minimise effects on the surrounding environment. The bridge type and construction are a good solution to achieve this outcome, because they eliminate the need for works in the valley floor below the bridge.

73. The lower bridge pier foundations, although lower down in the valley, are excavated structures, making sediment and erosion control more manageable as the excavation creates its own sediment retention structure. These pier foundations are a good solution to allow the construction works to progress without requiring vehicle access to the valley floor.

Stage	Proposed Works
Stage 1	**Bridge Abutment Foundations** Construction of the bridge abutment foundations will be as follows: Construct access to the bridge abutments for all plant and equipment for example piling rig, service crane, excavators and so on. The drill rig or excavator will be positioned at the abutment locations. The pile will be drilled and material excavated to the required depths, following which reinforcement and concrete will be installed. If a pile cap is required, the pile cap will be excavated and the concrete will be placed connecting the piles to the pile cap. All excavated spoil will be utilised as construction fill. **Bridge Pier Foundations** Construction of the bridge pier foundations will be as follows: Micropiles or shallow foundations are proposed to limit the construction footprint of the piers. Plant and equipment (drill rig and excavator) will be craned into place from the abutments. Excavation for the piles will occur using a rotary drill ("wash-drill") technique, or with an excavator for the shallow foundations. Reinforced piles and concrete/grout will be installed. All excavated spoil will be utilised as construction fill.  *Indicative Stage 1 Construction*
Stage 2	**Bridge Piers** Erect braced piers at both ends Place steel superstructure to both ends.  *Indicative Stage 2 Construction*

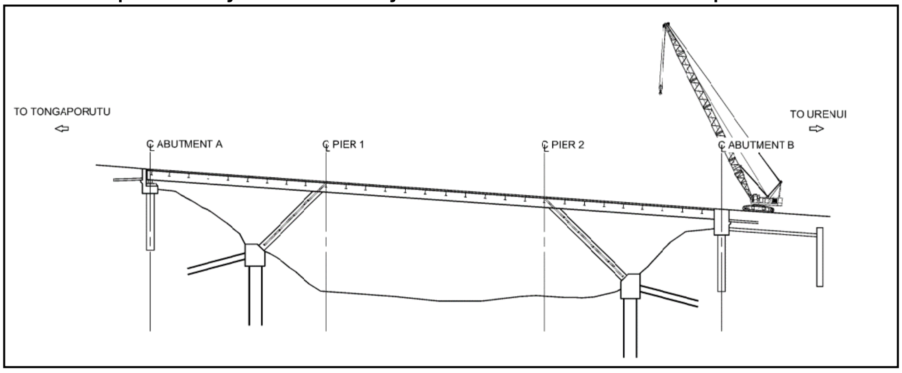
Stage 3	**<u>Bridge Deck</u>** Erect central steel superstructure span Complete temporary deck bracing Remove temporary ties and props Erect deck slab panels Construction in-situ deck and concrete barriers Install expansion joint, barrier joints and barrier steel top rail.  *Indicative Stage 3 Construction*

Figure 3: Bridge construction sequence

Tunnel construction

74. Mr Boam's evidence describes the 235 metre long tunnel design that will be constructed to the north of the bridge, through the ridgeline to the east of Mt Messenger. The tunnel will be constructed with a roadheader excavation machine, similar to that shown in **Figure 4** and the tunnel construction sequence is shown in **Figure 5**.

Figure 4: Roadheader excavation machine

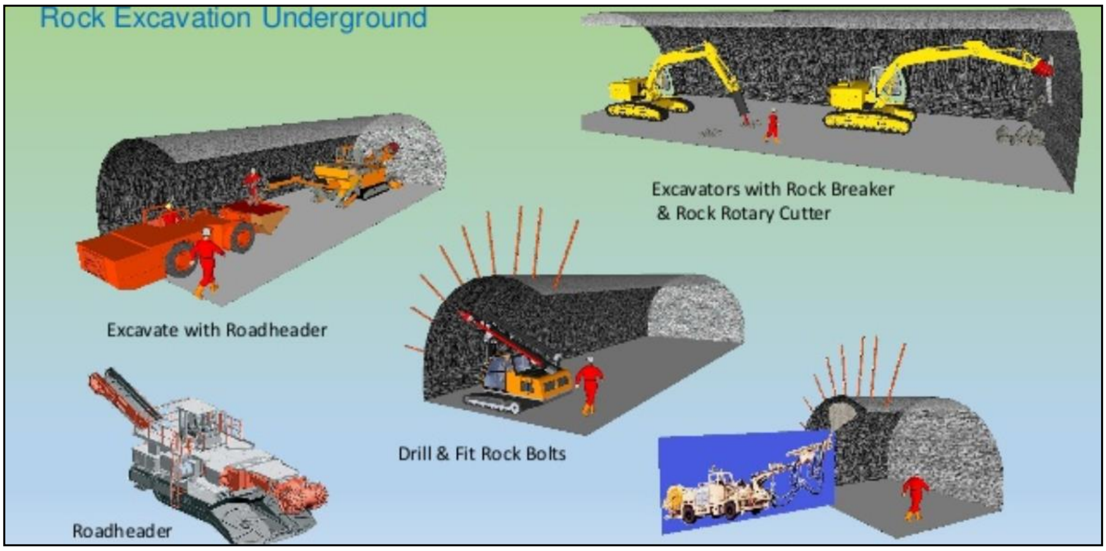


Figure 5: Typical tunnel construction using a roadheader

75. The sequence for constructing the tunnel is described in section 5.17 of the AEE. In summary:

(a) Stage 1 includes establishing the working site and assembling equipment, constructing the tunnel portals, and beginning construction of the tunnel itself, beginning with the heading drive, with the lower bench to be progressed along with it as much as possible;

(b) Stage 2 is the completion of the lower part of the tunnel (the bench), and providing for construction traffic to use the tunnel to access other construction zones; and

(c) Stage 3 is the construction of the tunnel control building, installation of the water supply tank for the fire hydrant system, and adding permanent pavements, structures and tunnel furniture.

76. Construction effects of the tunnelling works can be well managed, due in part to the location, and also to the types of soil and rock that will be encountered. The rock is mudstone and sandstone, as outlined in the evidence by Mr Bruce Symmans, which, in my opinion, is very unlikely to produce large quantities of dust or water. However, dust and water will be managed through the CDMP and the CWMP.

77. Although there are no nearby sensitive receivers, the tunnelling works will require its own power source, which will require refuelling and noise suppression. Both of these are achievable by good site layout, refuelling methodologies, and generator selection.

Pavement and surfacing

78. As the main construction activities progress for each section of the alignment, the road carriageway will be completed to a standard to allow it to be used by construction traffic.

79. Once all works are complete within each section of the alignment, the final road pavement materials, traffic services, roadside furniture and landscaping will be added.

80. Final pavement placement will be done as soon as practically possible, as the seal also acts as a good surface erosion control.

Landscape restoration

81. The Project includes an important focus on the restoration of the landscape that is directly affected by the construction, and on a wider landscape and ecological restoration package to mitigate and offset the effects of the Project. That programme will be carried out in accordance with the LEDF and ELMP.

Network utilities

82. Network utility operators will be able to lay new services in the road corridor as it is constructed. That process will be carried out in accordance with the Code of Practice for Utility Operators.

Hazardous substances

83. The importation and use of hazardous substances will occur during the main construction works. The CEMP includes that industry best practice will be used for the storage, handling, transport and disposal of hazardous substances during construction as required by guidelines set up under the Hazardous Substances and New Organisms Act 1996. In my opinion the systems and approaches in the CEMP are workable and effective controls for the use of such substances.

OVERVIEW OF APPROACH TO CONSTRUCTION INCLUDING MANAGEMENT PLANS

Introduction

84. The construction of the Project is expected to take approximately four years. The intention is that construction will commence in the fourth quarter of 2018, and be completed at about the end of 2022. Construction will be progressed at several locations (in different construction 'zones'), often simultaneously, along the Project alignment. This simultaneous staged approach enables the program to be progressed in an efficient manner, reducing the overall costs as well as managing the overall total period of construction disturbance. As with all large-scale infrastructure projects, the construction of the Project will result in environmental effects, and potential effects, that need to be addressed and managed.

85. The construction methodology for the Project has been carefully developed to consider and address adverse effects and potential adverse effects, including

in particular through discussions with the team of subject-matter experts (for example, ecologists) working on the Project, and with tangata whenua.

86. The intention of the construction methodology has been to avoid adverse effects where practicable, taking into account engineering and construction requirements and programme implications. Examples of these are the use of, and construction methodology for, the bridge over the tributary to the Mimi Wetland. As explained in Mr Boam's evidence the use of a bridge avoids a large fill over the valley immediately above the Mimi Wetland. The construction methodology removes the need for works on the valley floor. This method, although providing improved environmental outcomes, is a more expensive construction option as, for example, the size of the cranes required is significantly larger.

87. However, given the scale of the Project, and the length of time required to construct it, where avoiding effects is not practicable, methods have been developed to remedy or mitigate those effects. The evidence of Mr Boam describes the design methods to mitigate the effects of the road.

88. The CEMP is critical in describing how construction related effects will be mitigated and managed (and the linkages to all the other management plans that sit under it). However, a key part to the conservatism of the assessment of construction related effects, and to provide some flexibility in final design, is the use of the Additional Works Area ("**AWA**"). This is a width of 20m on each side of the anticipated works footprint along the entire route (except adjacent to high value ecological areas). As explained in the evidence of Mr Nicholas Singers, the vegetation clearance, and offset, calculations assume that this area will be cleared for construction. In reality however, limited amounts of this area will be affected during construction.

89. In line with the CEMP, construction activities will be undertaken to avoid or reduce as much as possible ecological effects. There are numerous ecological breeding and migration seasons, as well as potential winter earthwork season restrictions. It is unfortunately not feasible to avoid all such periods and construct the Project. However, the Project will be constructed in accordance with the ELMP and the ecological and erosion and sediment control experts on behalf of the Transport Agency have assessed these construction effects.

Management Plans

90. A suite of management plans are proposed for the Project to ensure that adverse effects of the Project are appropriately avoided, remedied or mitigated and also offset or compensated.

91. The approach is that fully developed management plans have been prepared to present during the hearing and to be approved through the hearing

process.[8] This approach is being taken as the Alliance would like to commence construction on the Project this spring/summer season. Therefore, considerable work has gone into getting the Project design to a level that enables the management plans to be provided in a final format (subject to change through the hearing process).

92. As set out in the evidence of Mr Roan, it is also intended that the management plans provide the detailed environmental controls for the Project. While the conditions provide the key parameters and management plan frameworks, the key provision linking the conditions and management plans is that the conditions, as proposed, require compliance with the CEMP and all other management plans listed in the conditions.

93. Significant time and effort has been directed toward making the management plans comprehensive and robust so that they appropriately manage the effects of the Project. Each management plan has incorporated feedback from relevant stakeholders such as the Department of Conservation, Project neighbours, Taranaki Regional Council ("**TRC**") and New Plymouth District Council ("**NPDC**") expert advisors and the Alliance's subject matter experts.

94. The key management plan is the CEMP. It provides the overarching framework for the management of construction effects associated with the Project. Specific environmental controls for particular aspects of the Project are included as appendices to the CEMP (as explained in the evidence of Mr Roan) and illustrated in **Figure 6**.

[8] With the exception that not all of the SCWMPs have been developed in advance of the exchange of evidence.

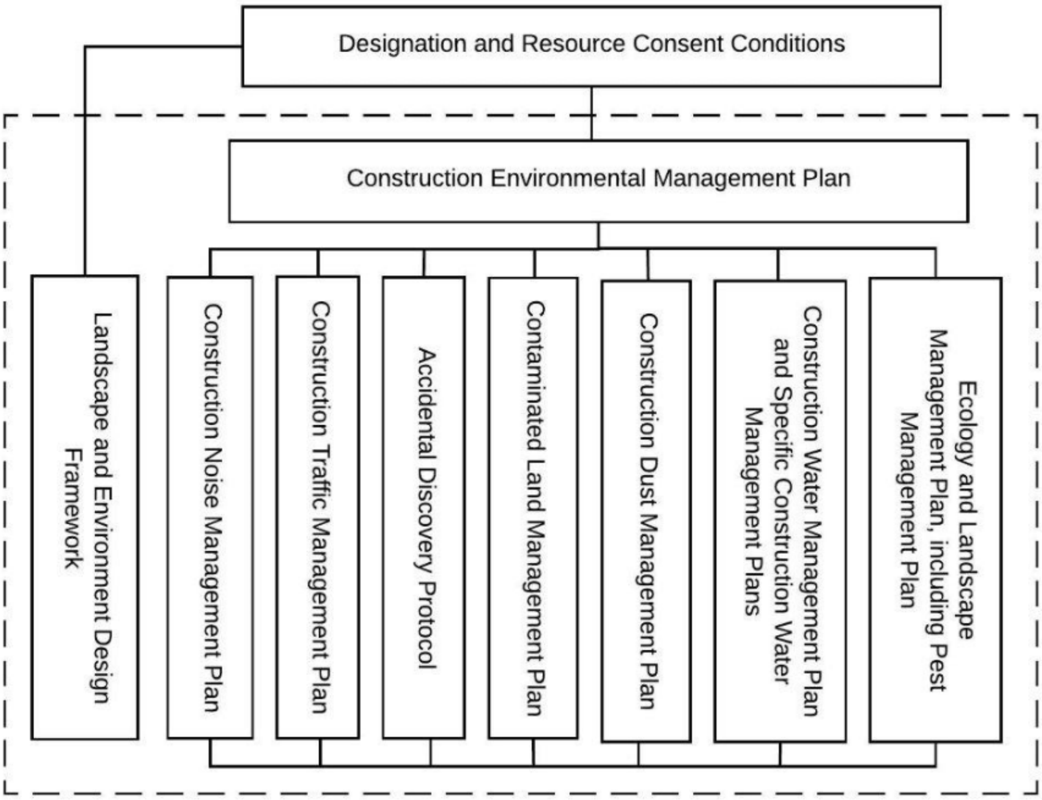


Figure 6 - CEMP and management plans framework.
(Taken from Figure 1.2 of the CEMP)

95. The objective of the CEMP is to effectively manage[9] adverse environmental, cultural and social effects associated with construction of the Project, so far as reasonably practicable. The CEMP and its appendices will be implemented throughout the entire construction period for the Project, and updated as necessary. I have experience working with management plans, including within a CEMP structure, and have found them efficient and effective in providing all the necessary information and regulatory framework while enabling innovation. It is important that the management plans and their structure are kept as simple as possible so they remain usable by, and meaningful to, the construction team and all workers onsite.

96. Overall, implementation of the CEMP will ensure:

(a) appropriate management of adverse environmental, cultural and social effects associated with construction of the Project;

(b) compliance with the conditions of the designation and resource consents and that the Project remains within the limits and standards required by these conditions;

(c) more than minor adverse effects on the environment arising from the Project are appropriately avoided, remedied, mitigated or offset; and

9 Avoid, remedy, mitigate or offset.

(d) compliance with environmental legislation.

97. All construction works must be carried out in accordance with the CEMP, or any authorised changes to it.

Greenroads

98. As part of its commitment to environmental and social responsibility the Transport Agency uses Greenroads, an international sustainability rating system. The Alliance is targeting Greenroads accreditation for the final design, construction and operation of the Project. This will require assessment of the Project against a number of criteria[1] including environmentally responsible decision-making and promoting environmental, social and economically responsible construction practices.

99. To date, no construction projects within New Zealand have gained Greenroads accreditation although Peka Peka to Otaki, SH73 Mingha Bluff Realignment and Transmission Gully projects are all targeting accreditation.

Communication and engagement during construction

100. The Alliance and Transport Agency recognise the importance of keeping local residents, the broader community, tangata whenua and other key stakeholders informed of progress with construction of the Project, and to responding to concerns and complaints voiced by stakeholders. This includes both generally, and more specifically in respect of the small number of local residents who will be directly affected by specific construction activities.

101. To that end the CEMP prescribes communication protocols that will be closely followed during construction. The CEMP also sets out complaints protocols, and requires proactive responses to complaints about construction activities.

102. The CEMP provides likely processes[10] for involving Ngāti Tama as kaitiaki in the design, and construction of the Project. How Ngāti Tama is involved will be developed in accordance with the provisions of the CEMP through direct discussions with them.

RESPONSE TO SECTION 42A REPORTS

103. I respond below to construction issues raised in the NPDC Section 42A Report on the Project. These issues relate primarily to the construction implications of MCA2 (shortlist) Option Z.[11]

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[10] Section 1.4.
[11] The Multicriteria Analysis (MCA) processes are described in the evidence of Mr Roan on alternatives.

Cost differences between Z options

104. Paragraph 105 of the NPDC Section 42A Report requests more information to verify the cost differences between the MCA1 Option Z and the MCA2 Option Z.

105. The cost differences are most significantly due to a higher level of geotechnical knowledge gained by the project in between the MCA1 and MCA2 processes. This led to the Option Z design having a very significant additional element added, namely 14, 000m^2 of high retaining walls and ground anchors. Mr Symmans addresses these issues in his evidence (**Figure 7: Retaining walls leading into the northern tunnel portal**). These walls would require:

(a) significant temporary works to move the existing road (highlighted in red) far enough away to be able to form and backfill the new walls;

(b) large, deep and numerous tie-back anchoring to create structural tie-backs, which are slow and expensive to install, as they require very significant heavy machinery; and

(c) sustained periods of large and complex work on or very near traffic, which would lead to disruption both to the works and the road users.

106. I consider the costs of the retaining walls and ground anchors ($112,799,200) in the MCA2 process appears to fairly represent the cost of the work of this nature.

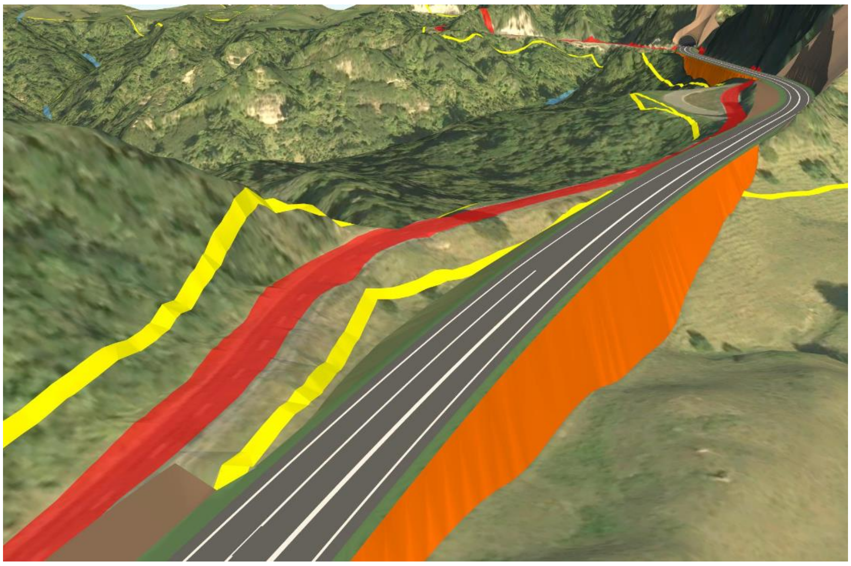

Figure 7: MCA2 - Online Z Option (Orange elements show the extent of retaining walls, which were up to 25 m high.[12] The red line represents the existing SH3 road.)

[12] All images within this section are snapshots taken from the Humphrey model (the model is outlined in detail within Mr Boam's evidence).

Managing interactions between existing traffic and the construction of an online option

107. Paragraph 107a of NPDC's Section 42A Report notes that the complex traffic interactions between an online option and the existing road would be manageable. My opinion is that the "online" options (including the MCA2 Option Z) included a series of very difficult interactions, where the new alignment had to pass just over, just under, or at the same height as the existing road. Many of these points, such as any abutments for bridges, or access to tunnel portals, would be areas that would be serving as site access or egress for very significant periods of time (one year or more), often in conjunction with other similar access points also being used for the same period.

108. In my opinion the interaction of existing traffic with an online option would be very disruptive to both the work being done and to road users. Offline options all require a much reduced number of access points, and length of time for them, reducing impacts on road users and the construction teams.

109. To illustrate the traffic management point, I note that I recently witnessed the maintenance contractor doing resealing works on the southern side of Mt Messenger. Despite their very good program of traffic management, this work still lead to heavy traffic having to stop and wait for minutes at a time, as they were working both sides of the road at times. An online alignment option, where multiple workfaces might be under way at any one time, would lead to extended periods of such heavy traffic management (many months, if not more than two years).

Comparative bridge costs and constructability

110. Paragraph 107a asks for more detail on why the 862m of bridges on Option E are considered cheaper than 580m on option Z. **Figures 8, 9** and **10** outline the design of some of the bridge abutments and pier locations on Bridges 1 and 2. As shown on these figure MCA2 Option Z included bridges and bridge abutments in very close proximity to the existing road (red line), increasing difficulty and cost. The type of bridges on the Option Z also should be pointed out, as they are of much larger unsupported spans than the bridges on the offline Option E. In my opinion the bridge costing and the constructability assessments supports the online Option Z as being a much more expensive bridging package to deliver.

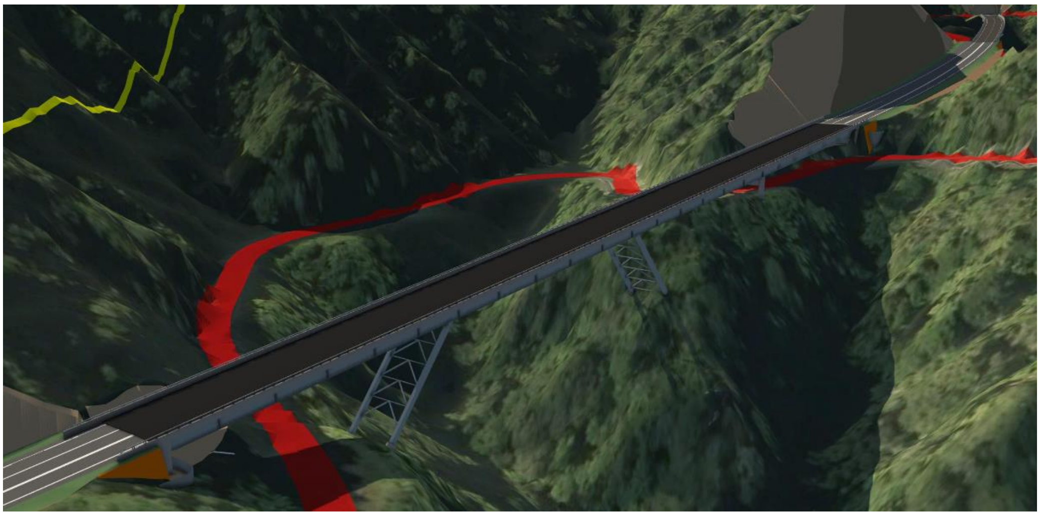

Figure 8: MCA2 - Online Z Option. Bridge 2 on southern side of tunnel looking northwards (The red line represents the existing SH3 road)

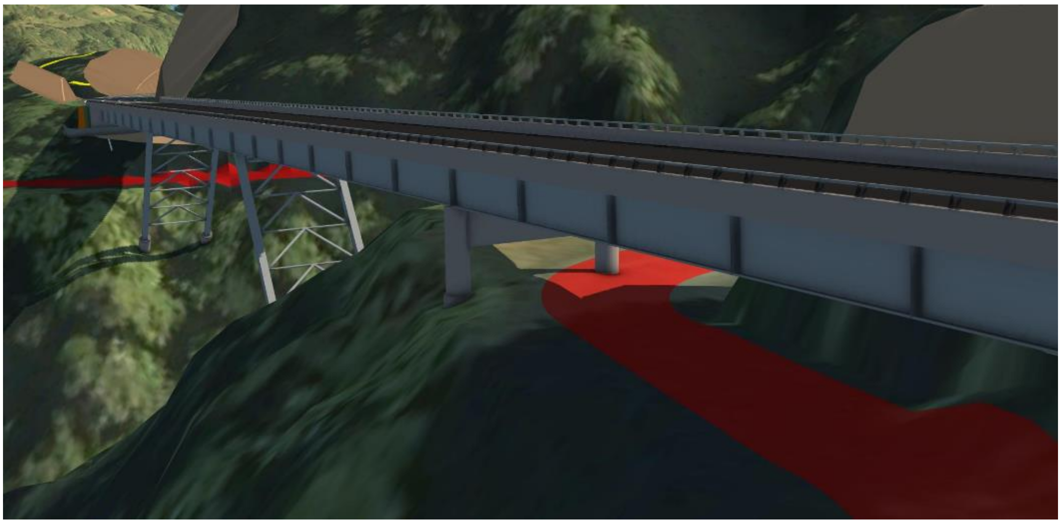

Figure 9: MCA2 - Online Z Option. Bridge 2 on southern side of tunnel looking southwards (The red line represents the existing SH3 road)

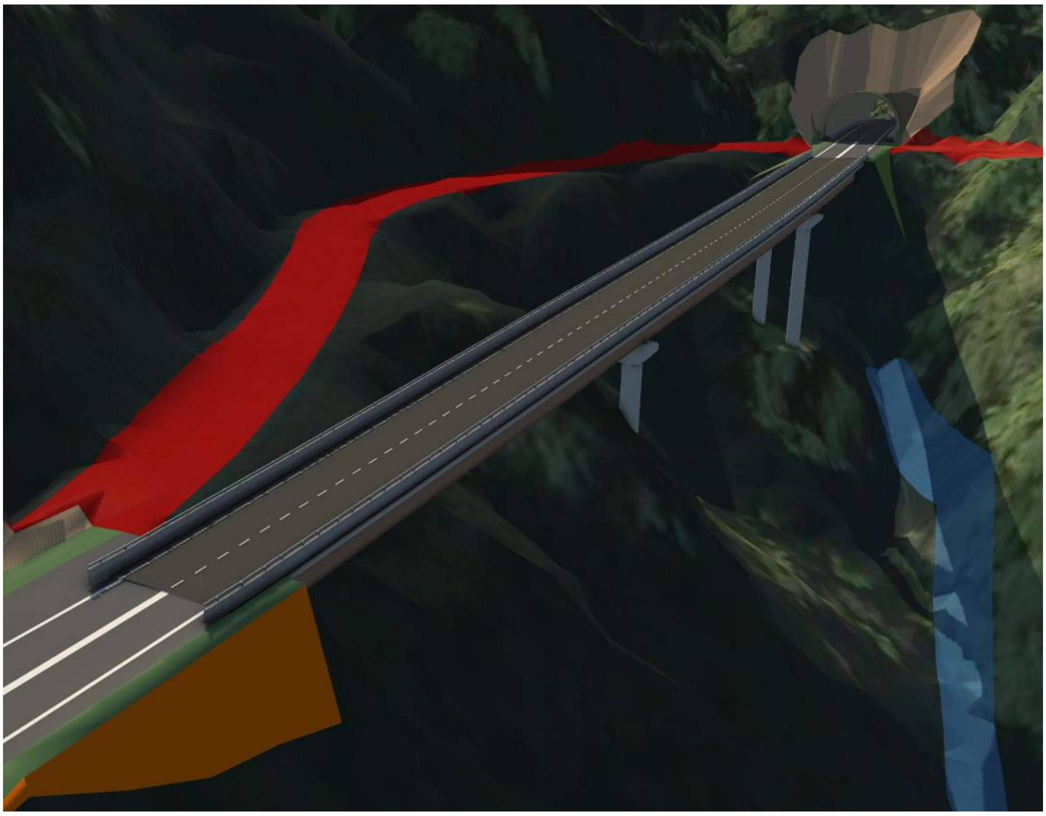

Figure 10: MCA2 - Online Z Option. Bridge 1 to the southern tunnel portal, looking northwards (The red line represents the existing SH3 road)

111. **Figures 11** and **12** (photographs) demonstrate the erection of a bridge very similar to the one shown on the southern end of the tunnel on MCA2 Option Z. In particular I note:

(a) the large amount of area required;

(b) the equipment required; and

(c) the Option Z arrangement would also require that the launch site is directly adjacent to a working road.

Figure 11: Photograph showing similar construction footprint required for Z option Bridges 1 and 2

Figure 12: Photograph showing similar size of large crane required for Z option Bridges 1 and 2

112. What is not shown clearly in the photographs is the area required to assemble the bridge section before they are lifted in to place. I consider that this is a difficult constructability problem, and the constructability scoring for Option Z in MCA2 rightly reflected these kinds of practical construction problems with that option.

Overall Option Z constructability issues

113. NPDC's Section 42A Report, at paragraph 107F, asks why online MCA2 Option Z scored worse than Option E for constructability. This has been addressed in the points above, but should be further clarified by the illustrations shown below (**Figures 13** to **15**). They demonstrate the Option Z alignment was very challenging for a number of reasons, such as:

(a) The extent of the alignment that is close to, or crossing, the existing alignment.

(b) The type of works required including the need to construct very significant structures in very close proximity to existing traffic. Examples include the tunnel portals, the tunnel itself, up to 25m retaining walls, and the construction of large bridges.

(c) To answer this question more fully a series of screenshots of Option Z are shown below, and in my experience each section would contain one or more areas of high difficulty.

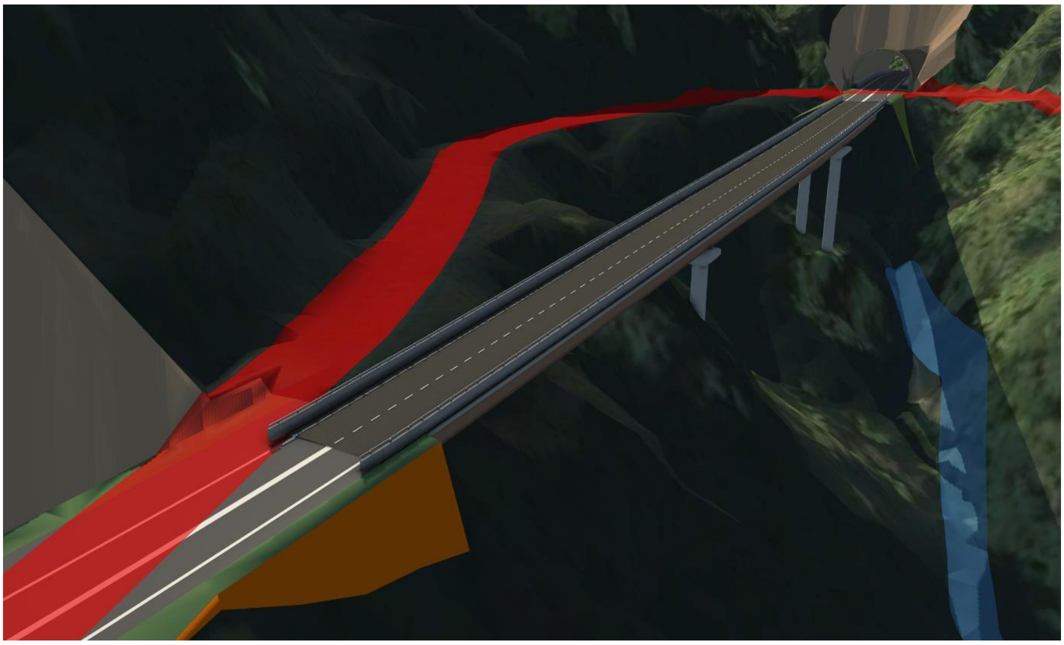

Figure 13: MCA2 - Online Z Option: Bridge 1 showing very significant structure in very close proximity to existing traffic (red line is the existing road)

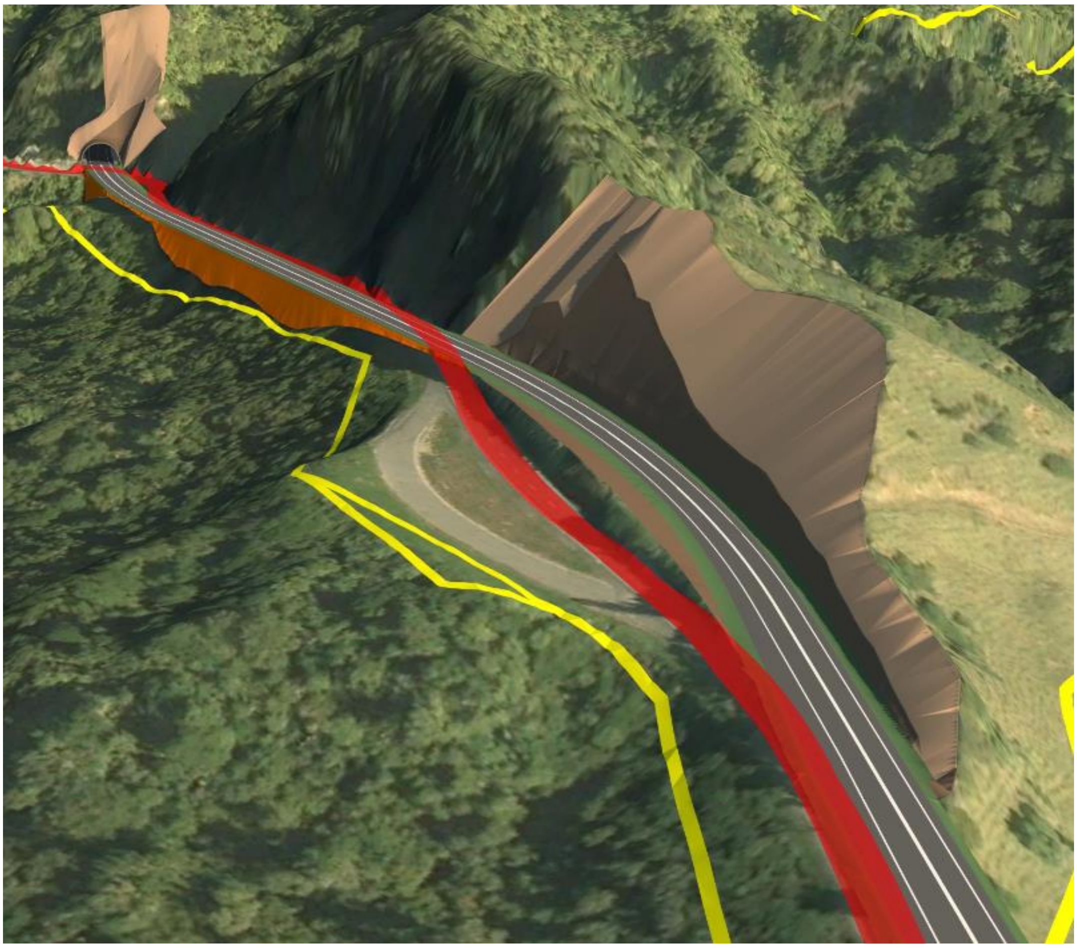

Figure 14: MCA2 - Online Z Option: Northern tunnel portal showing large extent of the Z option retaining wall structure (orange) along the existing alignment (red) which will create significant delays to existing traffic during construction.

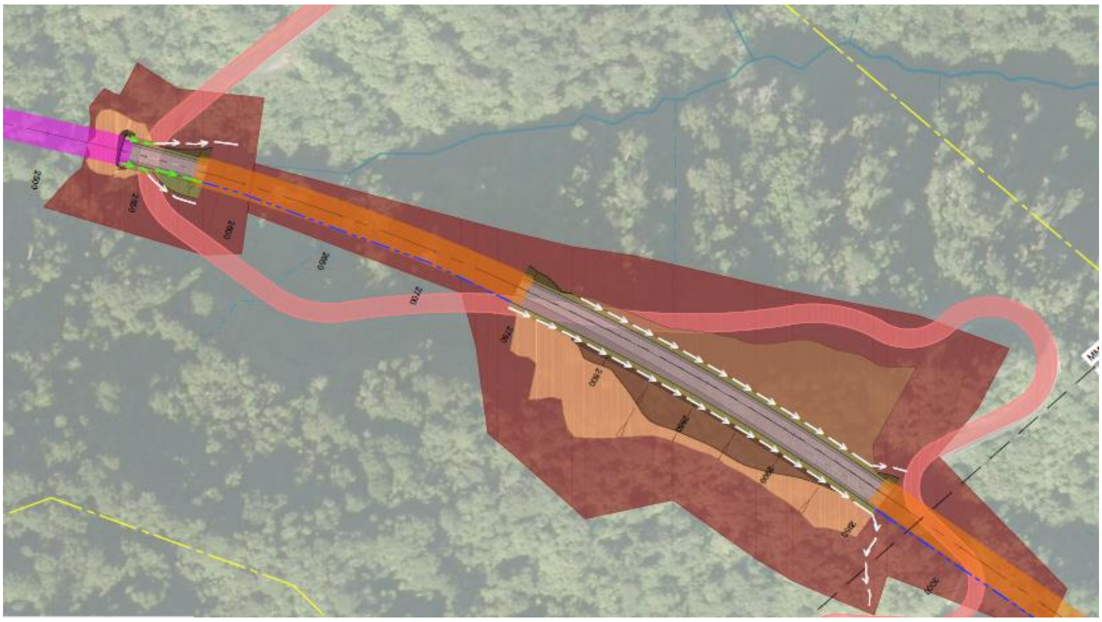

Figure 15: MCA2 – Online Z Option: Showing outline of construction footprint in tunnel, Bridges 1 and 2.

114. Paragraph 110 of the NPDC's Section 42A Report notes that the Transport Agency was encouraged to provide further information to the hearing regarding MCA2 Option Z constructability issues. I note that additional information has already been given above, from paragraph 104 onward.

115. Having been involved in the MCA scoring process,[13] I note that the constructability of Option Z would be affected strongly by the following:

(a) The retaining wall works on the northern side of the tunnel.

(b) Complex access requirements. The Option Z had bridges being launched from over or near working roads out in to very significant valleys. It also had a tunnel where both ends of the tunnel were on the existing alignment, making every tunnel movement a planned activity. The retaining walls had a similar problem where they are so close to the existing road that all construction works would be impacted. Any one of these issues would be a significant problem on any project, but the combination of several of them at one time was in my opinion correctly flagged as a significant issue for this option.

(c) Complexity of tasks. The solution requires multiple bridge types, a tunnel, large retaining structures and a high meterage of online works. This means it was a considerably more difficult constructability problem than other options (including Option E), and was rightly marked less favourably for that.

(d) Option Z was an online solution, where available working area, proximity to traffic, and number and length of intersections/interactions was again scored against it in comparison to offline options. Any increase in heavy lifting of bridge sections and retaining wall elements in proximity to the public is not regarded favourably from a health and safety management perspective.

(e) Option Z required multiple bridges of high complexity, which require increasingly specialised equipment and staff. A solution where less bridges, with shorter spans, over fairly flat ground (for example) would be much preferable to the two bridges on the southern side approaching the tunnel portal.

(f) Option Z would have created high volumes of construction traffic on public roads. The most efficient and effective way to move construction spoil is via heavy off-road earthmoving equipment. Options which lead to high volumes of spoil being handled by road trucks are a significant constructability constraint, as all haul roads and access tracks need to be suitable for these less able machines, and road trucks have a much reduced carrying capacity, which is a constraint on programme. Spoil

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[13] I was involved through discussions with my colleagues Duncan Kenderdine and Stephane Riot, who provided the formal constructability scores.

trucks in large volumes often have a detrimental impact on the existing road surface, which would have the potential to increase the need for surface repairs, again adding to road-user disruptions.

Hugh Milliken

25 May 2018