WAKA KOTAHI
NZ TRANSPORT AGENCY

DRURY ACCESS RAMP PROJECT

Appendix C – Design and Construction Report

Revision No: A

Published Date: 13/07/2023

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Reference: 523844-W00001-REP-EN-0004

New Zealand Government

More information

NZ Transport Agency
June 2021

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Document Control

Rev No	Date	Description	Author	Reviewer	Verifier	Approver
A	13.07.2023	First Draft Client Review	R Tay	M Laing	R. Nutton	

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Abbreviations

Abbreviation	Term
AEE	Assessment of Environmental Effects
AUP	Auckland Unitary Plan (Operative in Part 2016)
CEMP	Construction Environment Management Plan
CIA	Cultural Impact Assessment
CNVMP	Construction Noise and Vibration Management Plan
CTMP	Construction Traffic Management Plan
CVA	Cultural Values Assessment
DSI	Detailed Site Investigation
ESCP	Erosion Sediment Control Plan
GD05	Guideline Document 2016/005
HNZPT	Heritage New Zealand Pouhere Taonga
LVA	Landscape and Visual Assessment
NES Contaminated Soil	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011
NES Freshwater	National Environmental Standards for Freshwater 2020
NIMT	North Island Main Trunk
NOR	Notice of Requirement
NPSFM	National Policy Statement for Freshwater Management 2020
NPSUD	National Policy Statement for Urban Development 2020

NUMP	Network Utilities Management Plan
NUO	Network Utility Operator
P2B	SH1 Upgrades Project between Papakura to Bombay
RMA	Resource Management Act 1991
RIA	Relevant Iwi Authorities
SH1	State Highway 1 Motorway, the Southern Motorway
SH22	State Highway 22, Great South Road
SMAF-1	Stormwater Management Areas – Flow 1
Southern IIG	Southern Iwi Integration Group
SUP	Shared Use Path
TEAP	Transport Emissions Action Plan 2021
the Project	Drury Access Ramp Project
Waka Kotahi	Waka Kotahi NZ Transport Agency

EXECUTIVE SUMMARY

This report comprises a *Design and Construction Report* to support the Drury Access Ramp Project (the Project).

The report provides a high-level summary of the proposed design and an indicative construction methodology. The report is intended to provide sufficient detail on the design to support the consent application however will be further developed in a subsequent detailed design phase.

1 Introduction

1.1 Project Background Drury Interchange

This report supports the application lodged by Waka Kotahi NZ Transport Agency (Waka Kotahi) for the construction of a new southbound access ramp at Drury Interchange (the Project).

The proposal is considered in the context of the Papakura to Drury Project (P2D). P2D is a Waka Kotahi project set to improve the safety and functionality of State Highway 1 (SH1) and provide for long term growth in the south of Auckland. Waka Kotahi has structured P2B in to five stages. The most pertinent of these is Stage 1B1, which pertains to the approved upgrades of Drury Interchange. Stage 1B1 was approved under the COVID-19 Recovery (Fast Track Consenting) Act 2020 ("FTA").

In addition, the proposed site for the Project interfaces the following consented and future developments in the area:

- Realigned SH1 corridor and SH22 / Great South Road as consented in Stage 1B1 of the Papakura to Drury ("P2D") project by Waka Kotahi;
- Future proofing works along North Island Main Trunk (NIMT) rail corridor by KiwiRail as part of Papakura to Pukekōhe (P2P) rail electrification works; and

1.2 Project Description Drury Centre Access Ramp

The proposal is for the construction of a new southbound access ramp from SH1 to provide direct connection to future development areas in Drury Town Centre. The approximate location of the proposed off-ramp in relation to the surrounding existing and planned environment is referred to in the AEE and shown in Figure 1-2 below.

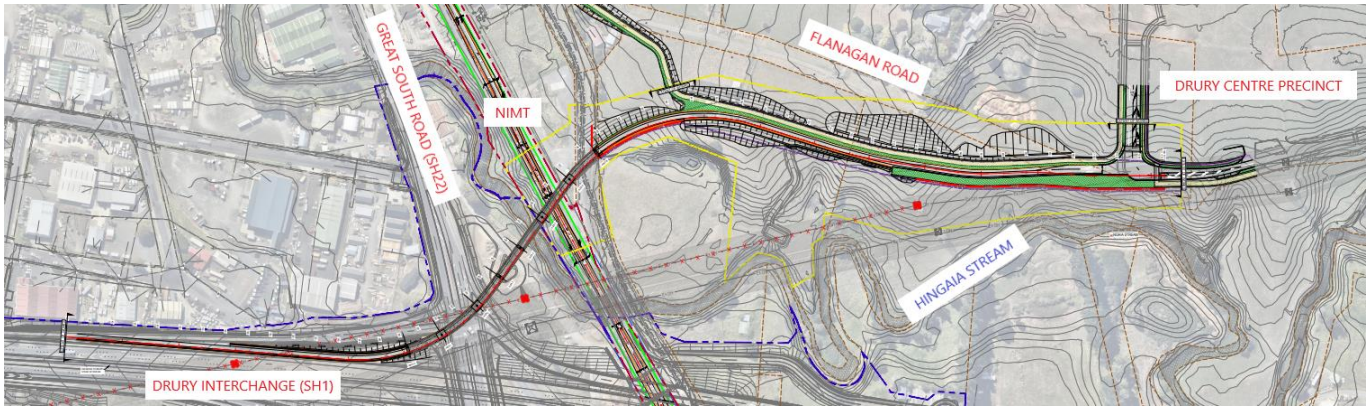

Figure 1-2 Indicative location plan of the Drury Access Ramp Project

The following is proposed for the Project:

- Construction of a 245m long seven span structure bridge from southbound lane of SH1 to an area off Flanagan Road;
- Foundation piling works for bridge support; and
- Construction of a 500m long road on the southern approach to the bridge, including associated earthworks, stormwater system and retaining walls to support the road.

Further details of the proposed off-ramp are shown on the plans attached as **Appendix B**.

The Project crosses the existing Flanagan Road (considered as a local road in the AUP) and existing services and utilities, which include: 1200mm diameter underground Waikato watermain parallel to the NIMT corridor; underground sewer and watermain pipes along Flanagan Road; and high voltage overhead lines located directly above the proposed ramp, which is planned to be removed.

1.3 Purpose of this Report

This report describes the indicative design, construction and operation of the Project in order to provide a clear understanding of the Project's components. This information will in turn assist in understanding the scale of the potential effects on the environment as a result of the Project.

1.4 Consultation and Engagement with Mana Whenua

Engagement for the Project design and consenting phase in relation to the design with Mana Whenua has occurred through the relevant Mana Whenua forums. Of particular relevance to the design are the following interactions:

- March 2022 meeting and site visit to review possible alignment options and agree preferred alignment
- 23 May 2022 meeting to present bridge design alignment, and indicative pier locations
- March 2023 site visit to view alignment and wider development plans
- April 2023 meeting to discuss design and environment assessments prepared for the consent application
- 14 June 2023 site visit to review proposed stormwater outfall locations

Additionally, Mana Whenua have been actively engaged on the P2D project and associated Drury Interchange upgrade works.

Ongoing engagement is anticipated throughout the detailed design phase. Mana whenua have a particular interest in opportunities for cultural design that can be incorporated into the structure.

2 Project Considerations

The Project considerations include physical constraints which predominantly affect the development of the design solution, and time constraints which may impact the anticipated construction staging and methodology.

2.1 Physical Constraints

The Project design has taken into consideration the following physical constraints.

- The need to cross over the following:
  - Great South Road;
  - NIMT rail lines;
  - Hingaia Stream; and
  - Flanagan Road.
- The need to avoid a 220kv overhead power line. A current 110kV line is proposed to be removed prior to this project.
- A desire to avoid a section remnant stream and native vegetation located to the south of Flanagan Road
- A desire to step over the flood plain to connect into the proposed Kiwi Property Stage 1 development road layout

2.2 Time Constraints

The proposed works are to be delivered as efficiently as possible following consents approval, detailed design and property acquisition required for the works. As described in earlier sections of this report, the ramp overlaps with P2D Stage 1B1 and therefore for construction efficiency it is desired to undertake this ramp in conjunction with the works at Drury Interchange.

2.3 Future Upgrades

It is anticipated that the segment of the off ramp south of Ch. 650 will be modified in the future to accommodate access to future development areas north of that currently proposed. These modifications are anticipated to be subject to future consents.

3 Description of Works

The following sections describe the proposed design of the Project. This proposed design is outlined in the following sets of drawings, which are contained in Appendix F of the AEE supporting the Waka Kotahi application for regional resource consents and NORs for the Project:

- General Arrangement Plans — 523844-WW00001-DRG-RO-0101 to 0104
- Plan and Longitudinal Section — 523844-WW00001-DRG-RO-0201
- Typical Cross Sections — 523844-WW00001-DRG-RO-0301
- Stormwater Drainage Layouts — 523844-WW00001-DRG-WD-0101 to 0104
- Bridges General Arrangement — 523844-WW00001-DRG-BG-0101.

3.1 Geometry

3.1.1 Existing Situation

Stage 1B1 of the P2D project has already been consented and will be under construction during the detailed design and construction of the Project. The Stage 1B1 works include provision to upgrade the southbound off ramp at Drury Interchange and Great South Road beneath the southern motorway.

Stage 1B1 of the P2D project has already been consented. The development at the southern end of the ramp and associated road network is being consented as part of the Drury Precinct Fast Track application.

3.1.2 Proposed Works

The proposed works for the Project will run for approximately 1km and tie into the P2D project Stage 1B1 at the northern end and the Drury Precinct development at the southern end.

The following are key features of the road geometry:

- A diverge from the Drury southbound off ramp.
- The vertical geometry has been set to pass over Great South Road, the NIMT and Flanagan Road. The Great South Road crossing presents the greatest constraint with a 6m clearance required to match the proposed SH1 crossing of Great South Road in order to accommodate over dimensional vehicles.
- The ramp will consist of a single 3.5m wide lane, a left hand shoulder (2m) and a right hand shoulder (1m). A second lane is proposed at the southern end on the approach to the Pitt Road intersection.
- The ramp will terminate at a signalised intersection with Pitt Road.

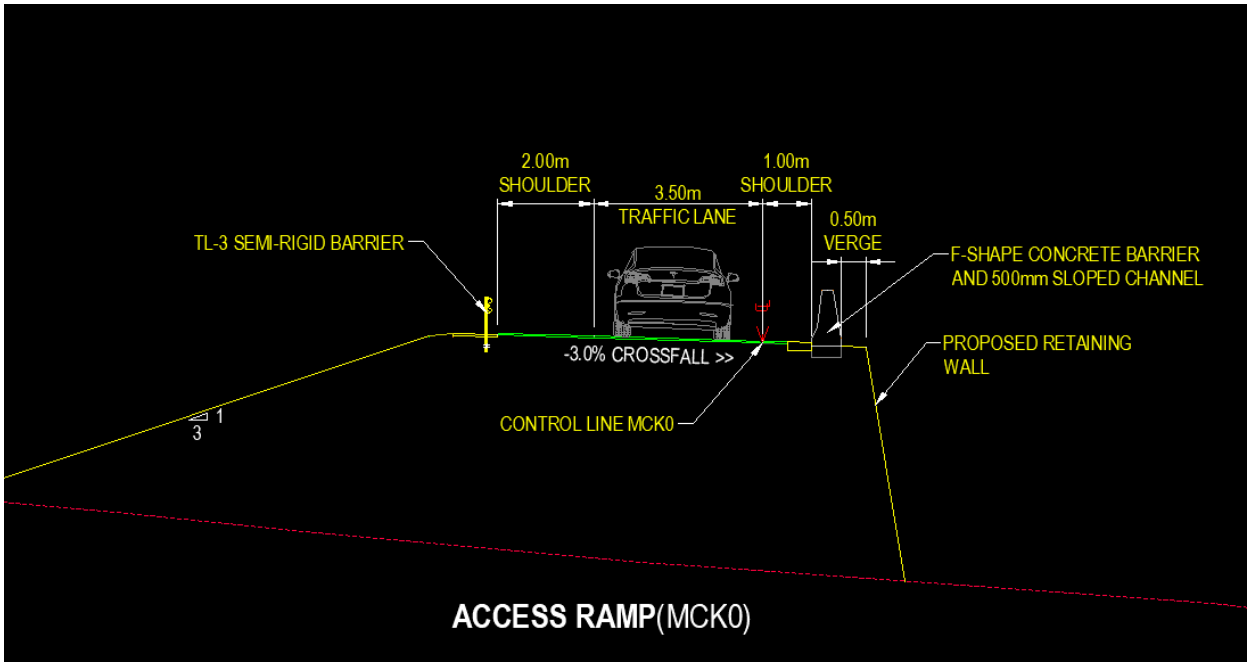

Figure 3-1: Indicative Ramp Cross Section

3.1.3 Shared Use Path

The Project will modify a 3.0 m wide SUP approved as part of the Drury Precinct development and connecting with the Drury Railway Station. The SUP will be provided to east of the proposed off ramp. Retaining walls will be installed to allow walking and cycling facilities on the eastern side of the off ramp if required in the future.

No walking and cycling facilities are proposed on the viaduct or motorway off ramp.

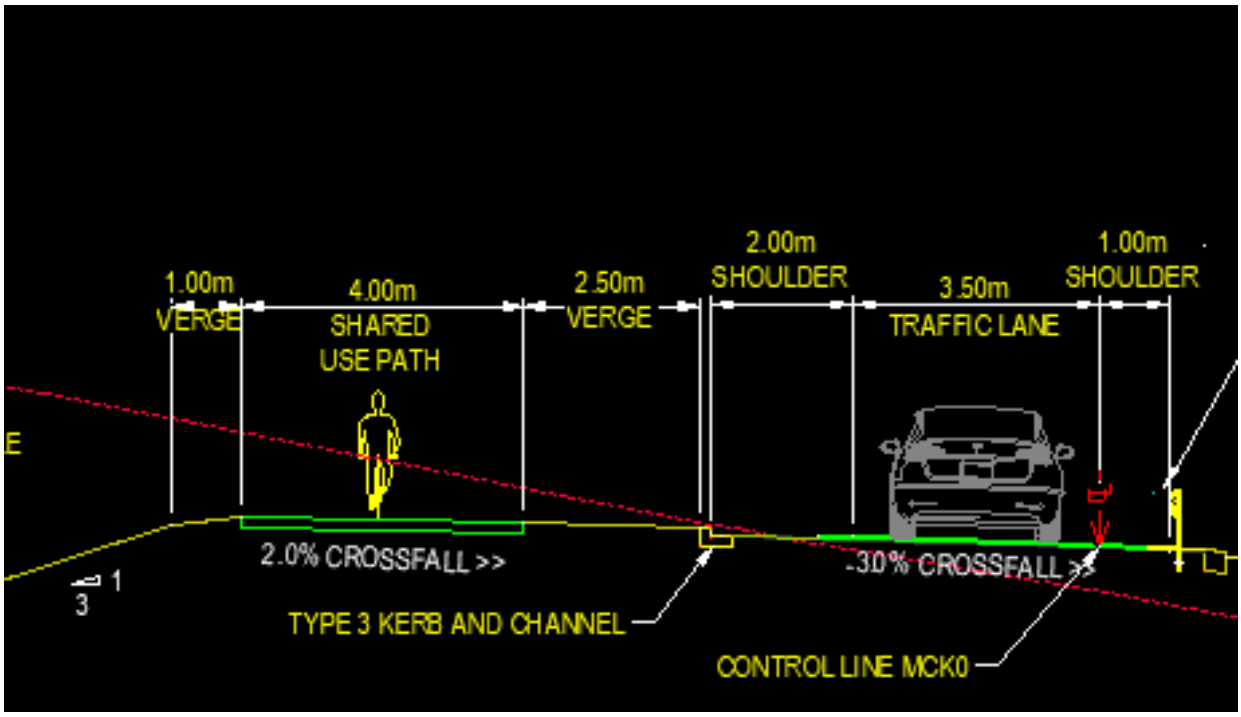

Figure 3-2: Typical cross section of ramp with a SUP on the western side

3.2 Stormwater

In context of stormwater drainage and hydrology, the Project proposes the following:

- Riprap erosion protection at the discharge to the receiving environment;
- Cut-off drains to convey external flow to the upstream inlets of proposed drainage system; and
- Installation of stormwater collection and reticulation infrastructure (piped and surface) and water quality treatment devices to treat all runoff prior to discharge to the receiving environment.

Refer to the Stormwater and Hydrology Assessment report in **Appendix D** of the AEE and the Stormwater Drainage design drawings in **Appendix B** of the AEE for more detailed information on proposed stormwater drainage works.

3.3 Structures

The Project proposes the construction of a new viaduct. The key features of the viaduct are described in **Table 3-1** below. The new bridge will be designed to meet current earthquake standards. Refer to drawing set at **Appendix B** for further details.

3.3.1 Off Ramp Viaduct

Table 3-1: Off Ramp Viaduct Key Features

BR01 Otuuwairoa Stream Bridges Key Features	
Obstacles crossed	Great South Road, NIMT rail line, Hingaia Stream, Flanagan Road
Number of lanes carried	1 x 3.5m (2m left side shoulder, 1m right side shoulder)
Footpaths/cycle ways	None on the bridge
Edge barrier type and width	TL-5 HT concrete barrier
Overall bridge width	6.5 m
Overall bridge length and skew	Approximately 245m
Spans	7 spans (31m to 41m)
Superstructure	Precast concrete Super-T beams 1525mm deep with in-situ concrete slab. Two “table-top” piers of approximately 6m long to achieve 41m spans
Abutment type	Reinforced concrete abutment supported on bored piles, bored pile/MSE wall approaches
Services	Street lighting and ITS ducting on bridge
Geotechnical	Bored piles at the piers and abutments.

Vertical clearance	Min. soffit = RL 6.2m (including 100mm construction tolerance)

A general description of geotechnical features associated with the proposal are summarised in **Table 3-2** below and noted on the general arrangement drawings. The information is indicative only, and the extent and form of retaining structures, ground improvements and bridge abutments is likely to be adjusted through the design process as a result of pricing and constructability feedback and further geometric adjustments. A summary of required geotechnical works is contained in **Table 3-3** below.

Table 3-2: Geotechnical Key Features

Activity	Location	Description and Purpose
Retaining Walls	Ch 550 to 620	This is a 70m long retaining wall up to 8m high retaining a fill to the west of the ramp. This is likely to be a mechanically-stabilised earth (MSE) wall. Ground improvements may be required beneath the wall.
	Ch 830 to 1050	This is a 220m long retaining wall with a height of up to 8m retaining to the west of the ramp. This is likely to be a mechanically-stabilised earth (MSE) wall. Ground improvements may be required beneath the wall.
Earthworks	Full project extents, refer to earthwork volumes listed in Table 3-3.	Required project earthworks are likely to include: ▪ Benched cuts into the existing embankments and slopes to allow construction of proposed new retaining structures and fill embankments. ▪ Undercutting of soft ground and replacement with engineered fill to allow plant access, construction of working platforms, and undercutting of permanent pavements. ▪ Cut/Fill slopes in general agreement with Waka Kotahi Landscape guidelines (Max 1V:2H; preferred 1V:3H). ▪ Embankment fill to form the carriageway and large embankments.
Ground Improvements	Bridge approaches	To reduce ongoing settlement and improve the stability of the raised embankments and retaining walls adjacent to the viaduct, ground improvements may be specified. Depending on the construction duration and detailed analysis, this may comprise concrete piles or stone columns, or wick drains and surcharge to accelerate settlement of softer soils below larger embankment fills.
Piling	Bridge abutments and piers	The bridge foundations are expected to comprise either driven piles (steel or concrete) or steel reinforced concrete bored piles supporting the bridge super structure.
Stormwater swales		Construction of stormwater swales will involve excavation below existing ground level, and construction of earth-bunds above existing ground to control surface runoff. Refer Section 3.2. Refer to Groundwater Assessment in AEE for groundwater impacts

Table 3-3: Summary of approximate Earthworks

Road Segments:	Volume (m^3)	
	Fill	Cut
Project Extent	40,000	17,000

3.4 Lighting

3.4.1 Lighting Design

It is proposed that lighting columns and luminaries will be installed to comply with NZTA M30: 2014 for the new road layout.

Road lighting will be designed to comply with following category of AS/NZS 1158.1.1:2005 Lighting for Roads, as shown in **Table 3-4** below.

Table 3-4: Road Lighting Category

Road Type	Lighting Category
SH1 Motorway	V2
Local Roads	V3
Shared Path (where separate lighting is required)	P3

3.4.2 Lighting Columns

The below design philosophy will be used for lighting columns:

- Any lighting columns located behind a barrier but within the working width shall be of a frangible design, shear base lighting columns are not to be used in these locations.
- All lighting columns in locations where operating speeds of >60 and <80km/h are expected shall be barrier protected.
- Any unprotected lighting columns used on a carriageway with a design speed ≥80km/h are to be of a shear base design.
- Any unprotected lighting columns used on a carriageway with a design speed ≤60km/h are to be of a frangible design and not shear base.

3.5 Pavements

The current preliminary design is based on the proposed pavement for the motorway off ramp at Drury and will be confirmed during detailed design.

The new pavements will generally consist of a subgrade improvement layer (SIL) with a granular cement stabilised subbase and structural asphalt basecourse with 40 to 50mm of wearing course. The wearing course will generally be Epoxy Modified Open Graded Porous Asphalt (EMOGPA). Lean mix concrete will be used as an alternative to the sub-base in some sections to protect shallow laid utility pipes and cables if it is required.

3.6 Construction Programme and Methodology

3.6.1 Overview

The Project works will be undertaken over an approximately 2-year programme. Actual dates will be confirmed once detailed design is completed.

This section provides a description of the anticipated construction methodology and programme for the Project. It is intended to be indicative and does not represent a definitive methodology, which will be developed by the contractor once appointed at a later stage of design development.

The purpose of this description is to provide sufficient detail on the proposed construction activities and durations to assess their potential environmental effects and to subsequently identify any necessary measures that may be required to avoid, remedy or mitigate these effects where appropriate. The construction methodology described in this section is a realistic and feasible methodology from which the anticipated effects on the environment of these activities can be identified.

Once the Project has been awarded and a contractor (or contractors) are in place, the methodology will be further refined and developed as part of the detailed design process.

3.7 Working Hours

Construction will generally occur within daylight hours, 07:30 to 18:00, Monday to Sunday with some night works envisioned. Night works will generally be limited to key activities that cannot be undertaken during the day (due to safety and operational impact on traffic along SH1):

- General traffic switching at the Drury Interchange
- Bridge beam installation where adjacent to live traffic
- Final reseal and lane marking works on the SH1 off ramp

3.8 Temporary Traffic Management

The Project requires works on and around the live transport corridors of SH1 ramps and Great South Road. As a result, there will be a temporary disruption to the existing transport network operations running along the corridor.

All construction works for the Project will be under temporary traffic management in accordance with the Council's requirements for CTMPs and Waka Kotahi's most recent guidelines for temporary traffic management.

3.9 Structures - Construction Methodology

3.9.1 Pile Installation

The majority of piles will be installed by a drill rig where the rig can be stationed close to the pile. It is expected that this type of rig can be used for piles at both abutments and all piers except Pier 5.

The anticipated founding level (Figure 3-3:) and diameter of the piles will require larger than normal plant to achieve; a founding depth in excess of 60m and diameters of approximately 2m. These will be drilled using a support fluid (bentonite or similar).

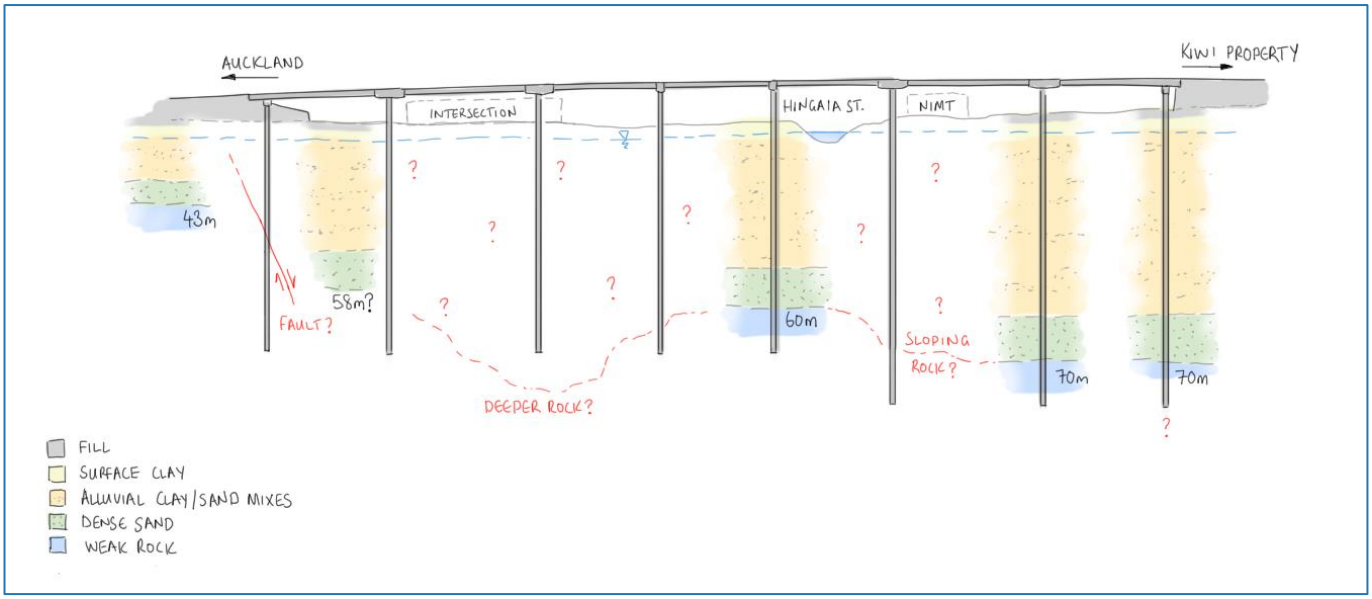

Figure 3-3: Indicative Rock Head and Founding Level

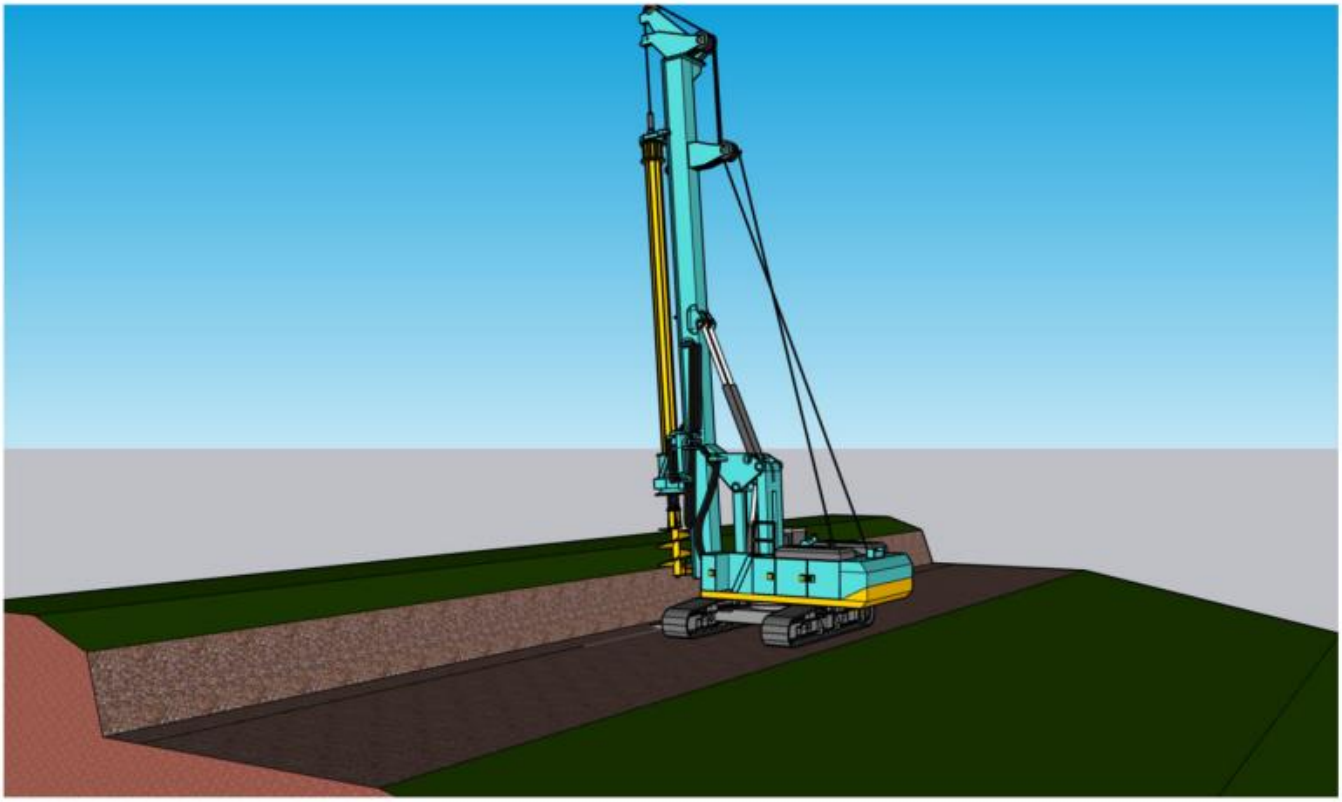

Figure 3-4: Indicative piling drill rig

As the pile at Pier 5 has to be installed from access staging (and it will not be possible to get close enough) a crane mounted drill rig will be required.

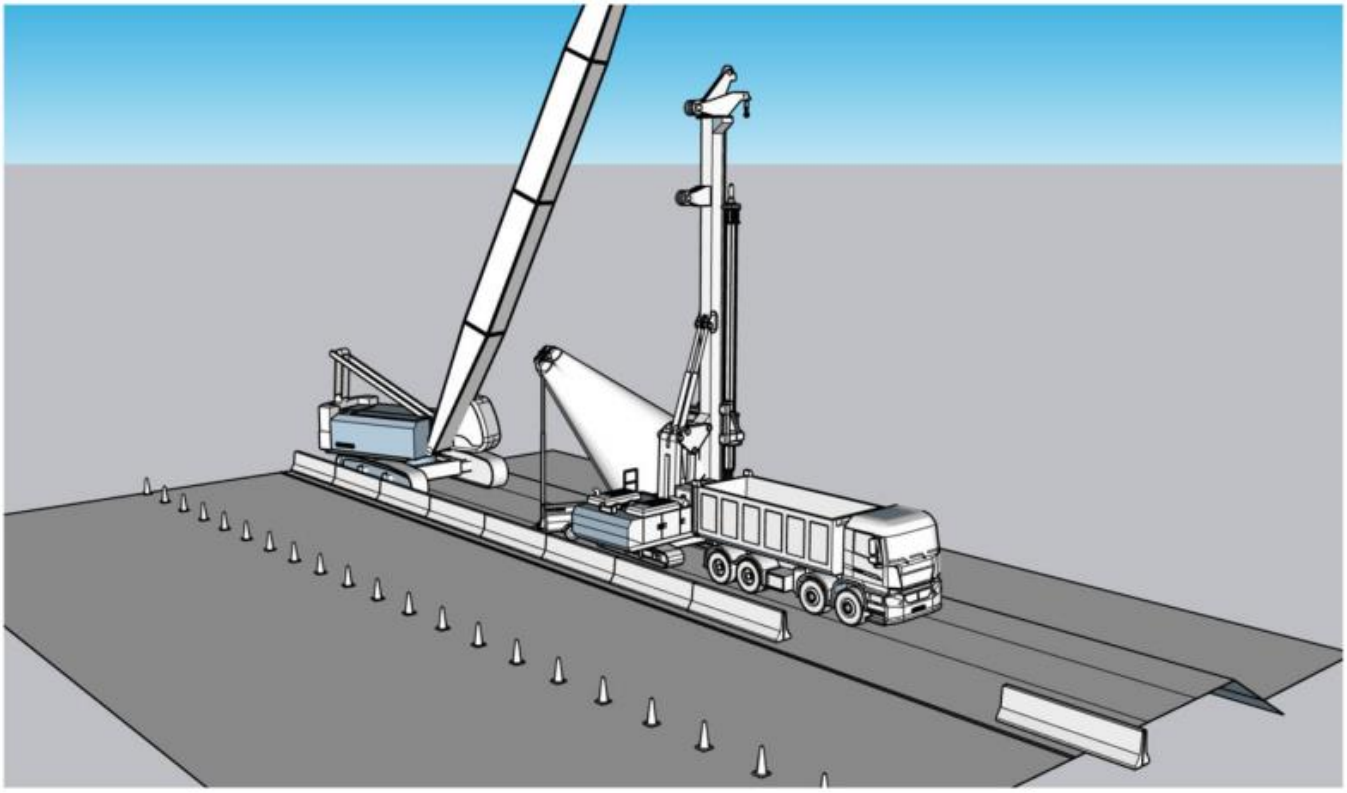

Figure 3-5: Typical equipment for pile installation

The steps for pile installation are as follows:

- Create access to pile location;
- Drill rig excavates material from pile. This is collected and disposed of; and
- When the pile is fully excavated the prefabricated reinforcing cage is lowered into the excavation and the pile is poured to ground level.

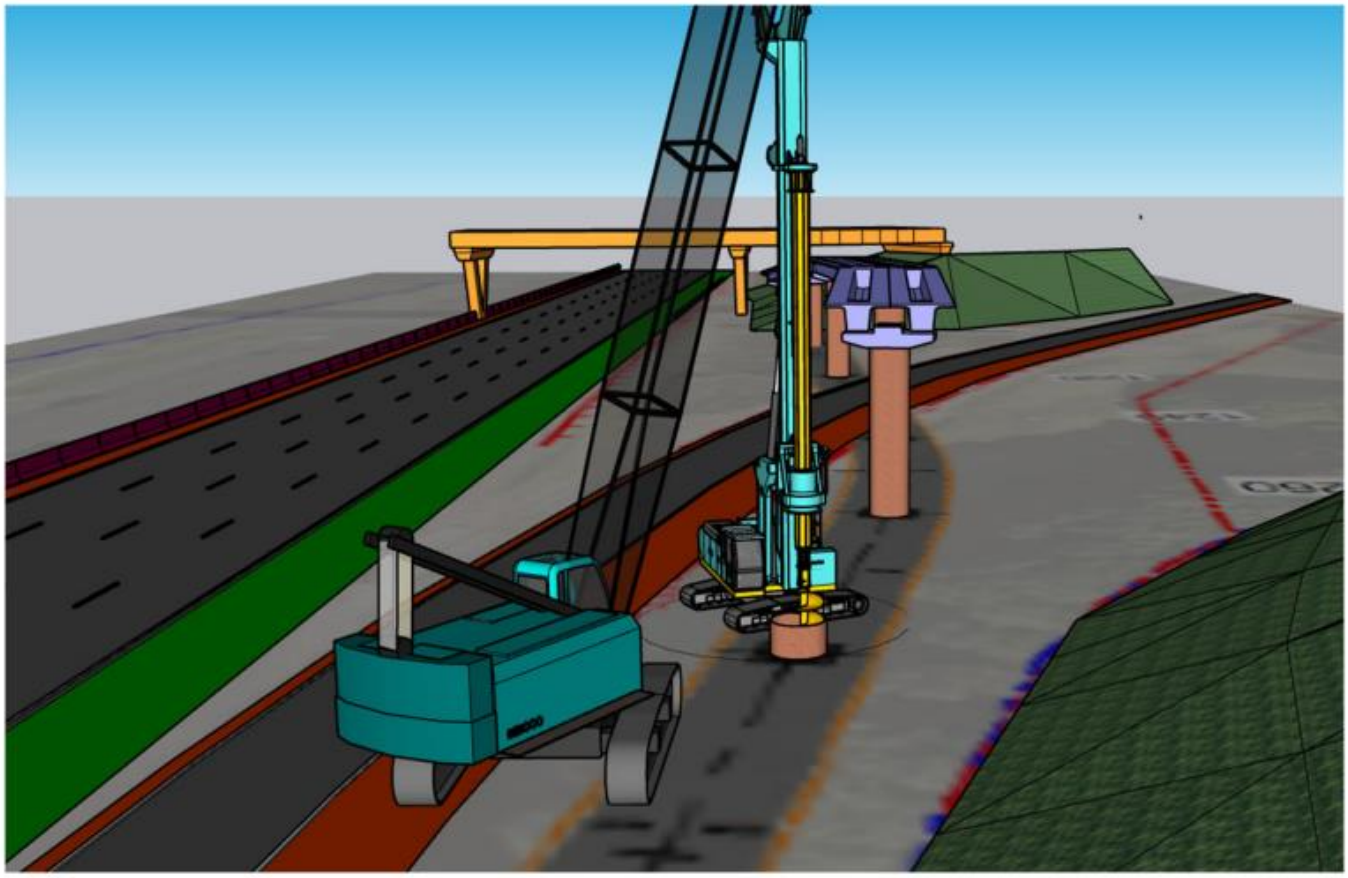

Figure 3-6: Pile being installed with support crane

3.9.2 Access Staging

The Hingaia Stream flows between Pier 4 and Pier 5. Access to Pier 5 can only be obtained from the northern side as the NIMT Rail Line blocks access from the southern side.

For this reason, Pier 5 has to be constructed with equipment traversing over Hingaia Stream on a temporary staging. This staging is required for not only the pile and pier construction but is also required for placement of the Super tee beams for the spans between Piers 4 & 5 and Piers 5 & 6.

Staging will be constructed with temporary piers located either side of the Hingaia Stream, clear of the stream bed.

3.9.3 Super Structure

Once all Piers and Abutments have been constructed, we are able to install the concrete super tee beams, pour the deck and fit barriers and other ancillary items.

Concrete super tee beams are manufactured off site and trucked to site.

Generally, the Super Tee beams will be placed as a tandem lift where two cranes are used and each crane lifts an end of each beam. This allows smaller cranes to be used.

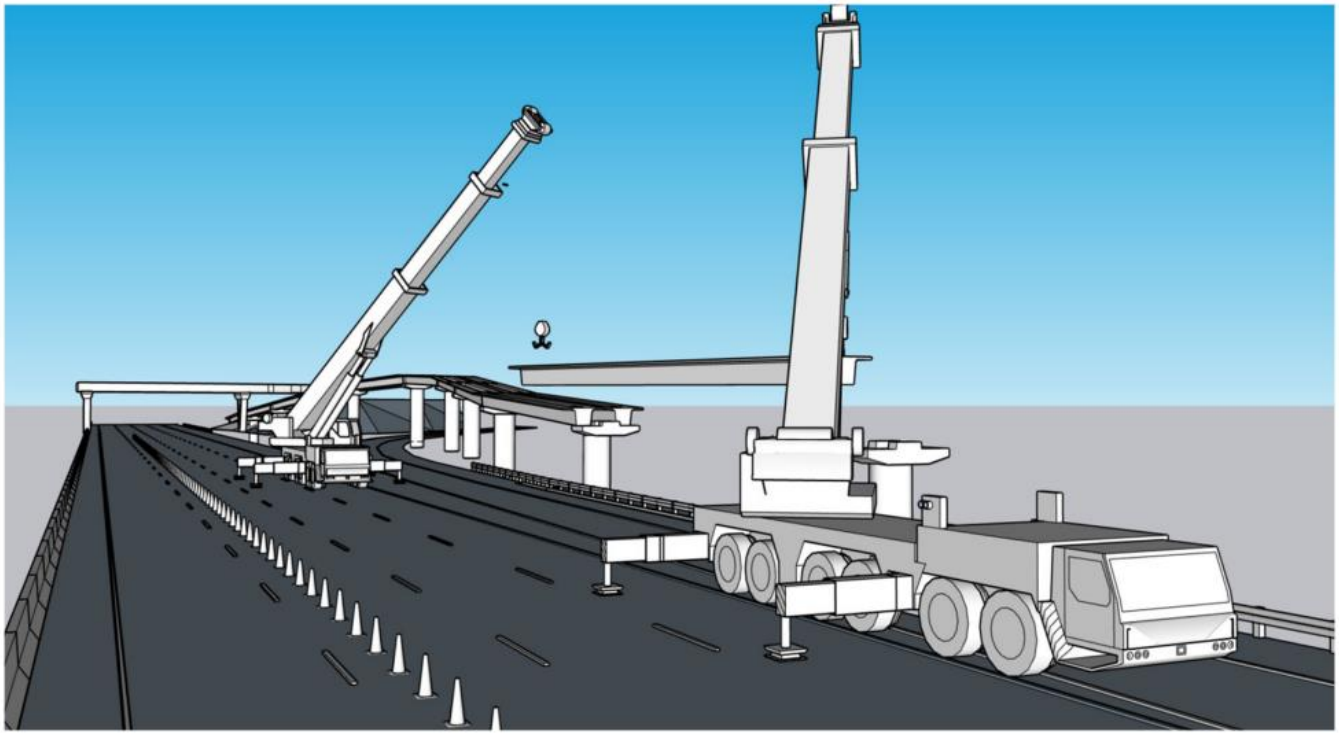

Figure 3-7: Schematic of two cranes being used to install super tee beams

The span between Pier 4 & 5 and the span between Pier 5 & 6 also tandem lifts but one of the cranes is positioned at the end of the temporary staging and the beams are lifted over either the Hingaia Stream or the NIMT rail line.

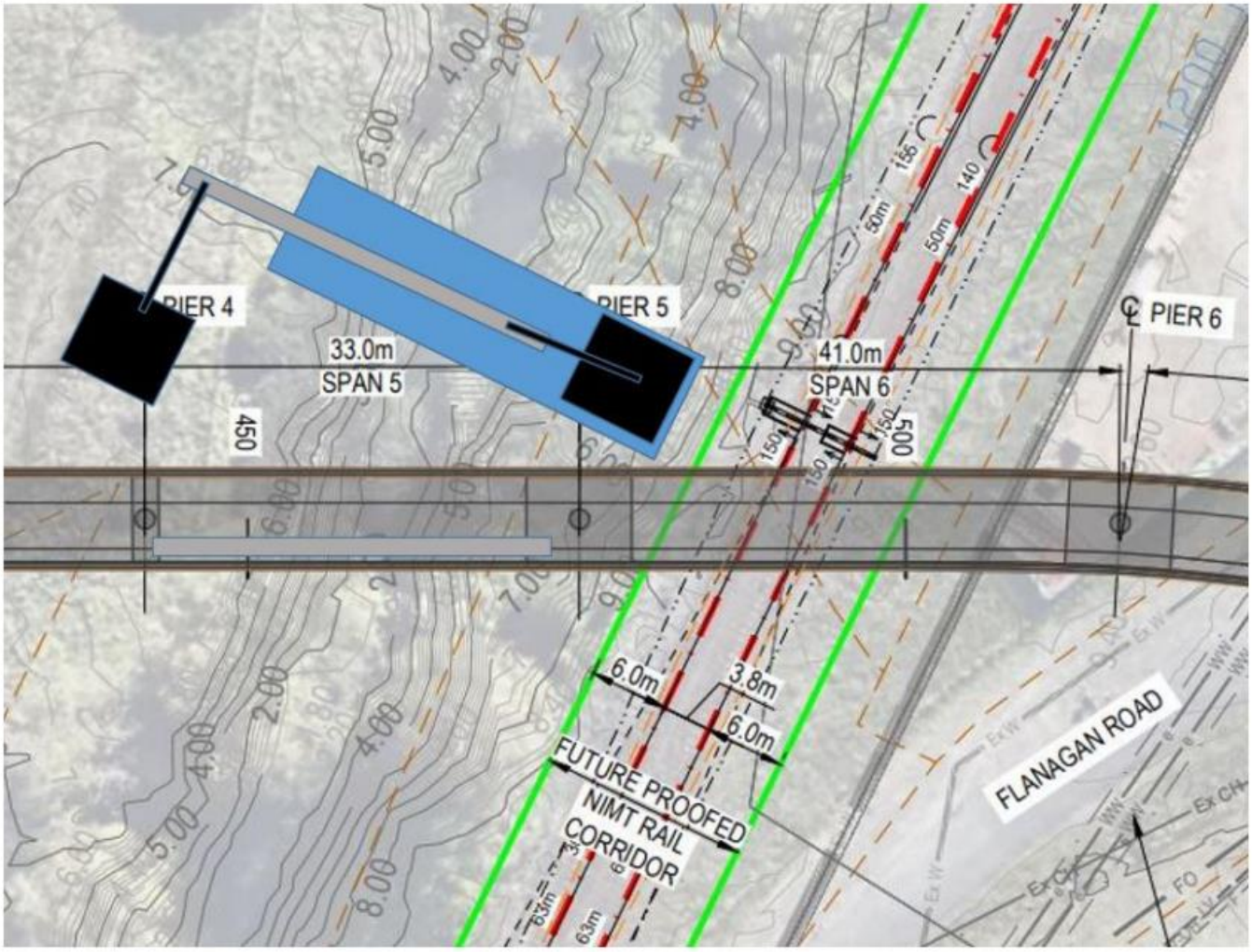

Figure 3-8: The tandem lift for beams between Pier 4 and Pier 5

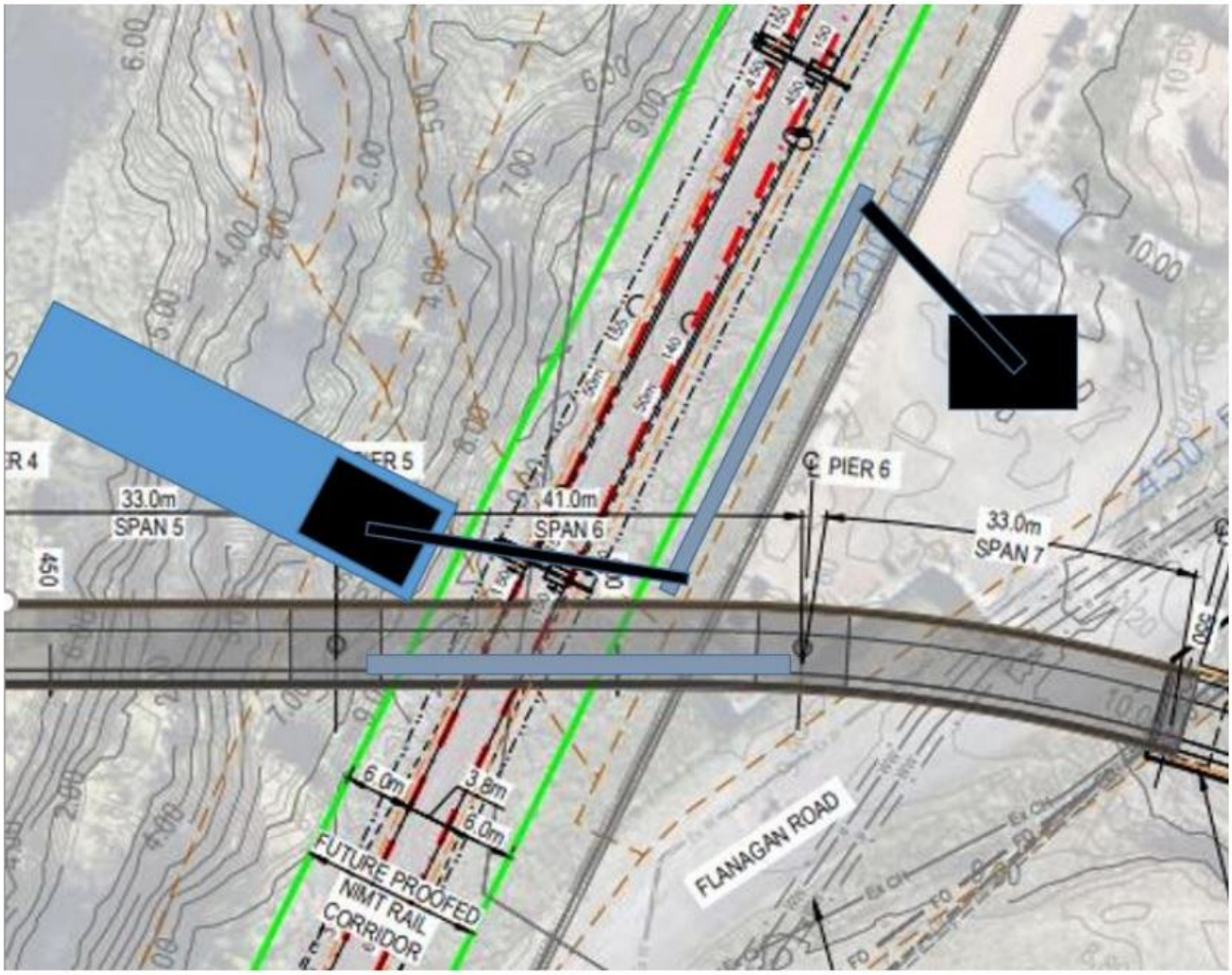

Figure 3-9: The tandem lift for beams between Pier 5 and Pier 6

3.10 Earthworks

Earthworks will comprise cutting and filling to achieve the proposed design alignment.

Standard earthworks practices will be followed in accordance with the specifications and guidelines of Waka Kotahi. The general earthworks strategy will be developed in more detail by the contractor. However, the general earthworks strategy assumed for works currently is to import fill (from local quarries where possible) for all fill embankments.

Opportunities to cut to fill on site will be considered if site materials are suitable for structural fills and free of contamination (unless adequately encapsulated as part of the contaminated land management strategy).

Larger fill embankments may undergo relatively significant settlements due to the underlying softer/organic soils and therefore either ground improvements or wick drains and/or time for consolidation will need to be allowed along with a final trim/fill before placing the final pavement surfacing makeup.

Embankments will also incorporate geogrids placed within the slopes as constructed as required to ensure slope or wall stability.

3.11 Construction Sequencing

3.11.1 Main Order of Viaduct Works

The proposed construction sequence of piling works is given in Table 3-5 below.

Table 3-5 Main order of Piling works timeline

Stage	Piling Rig	RT3 Crane Mounted	Other
1	Pier 3 and 4	Staging Pier 5	Utility Diversions Southern Abutment
2	Pier 1	Pier	MSE Wall Southern Abutment
3	Pier 6	Southern Abutment	MSE Wall Northern Abutment
4	Northern Abutment		
5	Pier 2		

The column and headstock / tabletop construction will follow on from the completion of the piling for each section – currently assumed two sets of formwork / falsework (one for tabletop arrangement and one for typical pier), as given in Table 3-6 below:

Table 3-6: Priority levels for headstock / tabletop construction

Priority	Typical Pier / Abutment	Tabletop
1	Pier 3	Pier 1
2	Pier 4	Pier 5
3	Northern Abutment	Pier 6
4	Southern Abutment	Pier 2

Once the piers and the abutments have been completed the superstructure beams will be installed starting from the southern span working to the north. The remainder of the superstructure will follow – the southern section with the railway crossing will be prioritised.

3.11.2 Creek Road

The construction of Creek Road from the southern abutment to intersection with Pitt Road will need to be timed for a summer earth moving season. The MSE wall shown on the approach to the southern abutment will need to be constructed prior to the abutment piling. A separate access haul route will be required from Flanagan Road up onto the proposed alignment of Creek Road.

The works on Creek Road can be delivered using one access off Flanagan Road. This links the bridge and road construction together particularly in relation to access. If an alternative access can be provided (i.e. via the

subdivisions development) for the road construction, this would have the advantage of decoupling the road and bridge programmes, apart from for the direct interfaces around the abutment and approach MSE wall.

3.12 Construction Support Areas

3.12.1 General

Construction support areas (CSAs) will be required for the provision of contractor and welfare facilities, plant/material storage, and earthworks stockpiling as required

3.12.2 Location and Establishment

3.12.2.1 Location

Subject to final construction method confirmation, the following sites are envisaged to be potential construction support areas for the Project:

- Within designation adjacent to Flanagan Road; and
- Within designation adjacent to Great South Road.

3.12.2.2 Establishment

It is envisaged that the CSAs may be established in the above locations as follows:

- All CSAs will be fully fenced and made secure. Site establishment activities will include site clearance, ground preparation, and establishing erosion and sediment control measures prior to any construction activities occurring. Upon completion of the works, the CSAs will be disestablished, and the areas restored to at least their previous condition prior to construction.
- All CSAs are likely to be provided with water, telecommunications and power connections, and where required, sewer connections. These services will be connected directly to the existing adjacent networks.
- All CSAs are likely to be established on compacted hard-fill, unless impervious areas exist.

3.12.3 Likely Amenities

The CSAs are likely to require some or all of the following amenities:

- Project offices.
- Welfare facilities including:
  - Toilets
  - Dining areas
  - First Aid equipment
- Employee car parking.
- Steel shipping containers for small tools/equipment storage.

Satellite welfare facilities are likely to also be required in addition to any welfare facilities provided within the CSAs. These will typically include provision of the following temporary facilities for workers in closer proximity to their immediate working area:

- Toilets.
- First aid.
- Break out / dining area.

3.12.4 Likely Storage and Site Activities

Activities likely to occur within the CSAs include but is not limited to:

- Site offices and construction personnel amenities, including car parking.
- Construction vehicle and machinery parking and maintenance.
- Loading and unloading of construction materials.
- Storage of construction materials.
- Fabrication, reinforcement cutting and bending.
- Storage of plant and equipment and building materials.
- Storage of ground improvement plant and materials.
- Storage of hazardous construction materials (if any).
- Construction vehicle wheel washing areas (where necessary).
- Stormwater and groundwater treatment facilities where required.
- Waste storage and collection.
- Spoil handling and storage.
- Storage of supplanted trees / shrubs.

Drury Access Ramp Project

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