PIANC
The World Association for Waterborne Transport Infrastructure

Wharf construction projects across Aotearoa

11 April 2024

Event sponsors

WSP Beca Brian Perry Civil

Agenda

Presentation 1	Luke Tomalin (HEB) ➢ *Napier 6 Wharf Project*
Presentation 2	Gabriela Koneski (BPC) ➢ *Seaview Wharf Renewal*
Networking break	
Presentation 3	Melvin Auld (WSP) and Chris Hewitt (BPC) ➢ *South Port Town Wharf*
Presentation 4	Kyle Marshall (BPC for DoC) ➢ *Matiu Somes Project*
Networking and BPC sponsored drinks	

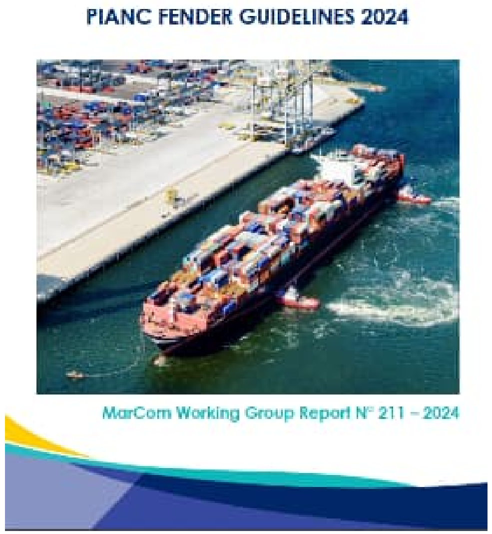
What is PIANC?

- 'The World Association for Waterborne Transport Instructure'
- Established in 1885, headquartered in Brussels
- A volunteer run not-for-profit organisation that brings together international expertise
- A forum for sharing technical knowledge through Working Groups and technical publications
- Supports career development through mentoring, networking and technical events

Member benefits

- Technical papers and working groups
- Local chapter events – tours, technical talks, networking drinks and leadership breakfasts
- Online events and webinars
- Young professional mentoring programme
- Awards

PIANC



PIANC NZ PRESENTS: PORTS TO ZERO: DECARBONIZING THE PORT INDUSTRY MULTI LOCATION LIVE EVENT AND ONLINE! THURS 16 NOV 4.30PM

PIANC NZ presents: Ports to Zero: Decarbonizing the Port Industry

Dates for your diary

- 29 Apr – 3 May, PIANC World Congress, Cape Town, South Africa
- 19 Jun, PIANC ANZ Annual General Meeting, Adelaide, Australia
- July TBC PIANC NZ – In person/online (same as this forum) Subject TBC
- 27 – 30 Aug, PIANC Asia Pacific Conference, Sydney, Australia
- Oct TBC PIANC NZ 1.5 day conference in New Plymouth – Following NZ Ports Forum 2024

- More information to come for NZ events later this year
- 2025 – Coasts & Ports Conference

Stay connected

PIANC ANZ Website https://www.pianc.org.au

LinkedIn https://www.linkedin.com/company/pianc-a-nz/

LinkedIn Group for our YPs https://www.linkedin.com/groups/5078998/

YouTube - https://www.youtube.com/@pianc_anz

Get in touch:

- Matt McKee, matt.mckee@centreport.co.nz
- Jono Stewart, jonathan.stewart@kinematic.nz
- Andy Brown, abrown@tonkintaylor.co.nz
- Alex Radcliffe alex.radcliffe@beca.com

Napier Port Te Whiti 6 Wharf Official Opening

https://youtu.be/H7UdvghxrCg

Napier 6 Wharf Presentation

1) Napier Port History and Project Conception
2) Project Scope
3) Work Steams
- Piling
- Revetment
- Deck

5) Promo Video #2
6) Questions

Historic Photos

Project Conception & Project Timeline

Why was a new wharf needed?

2006-2015 Optioneering

2016-2017 Preliminary design completed

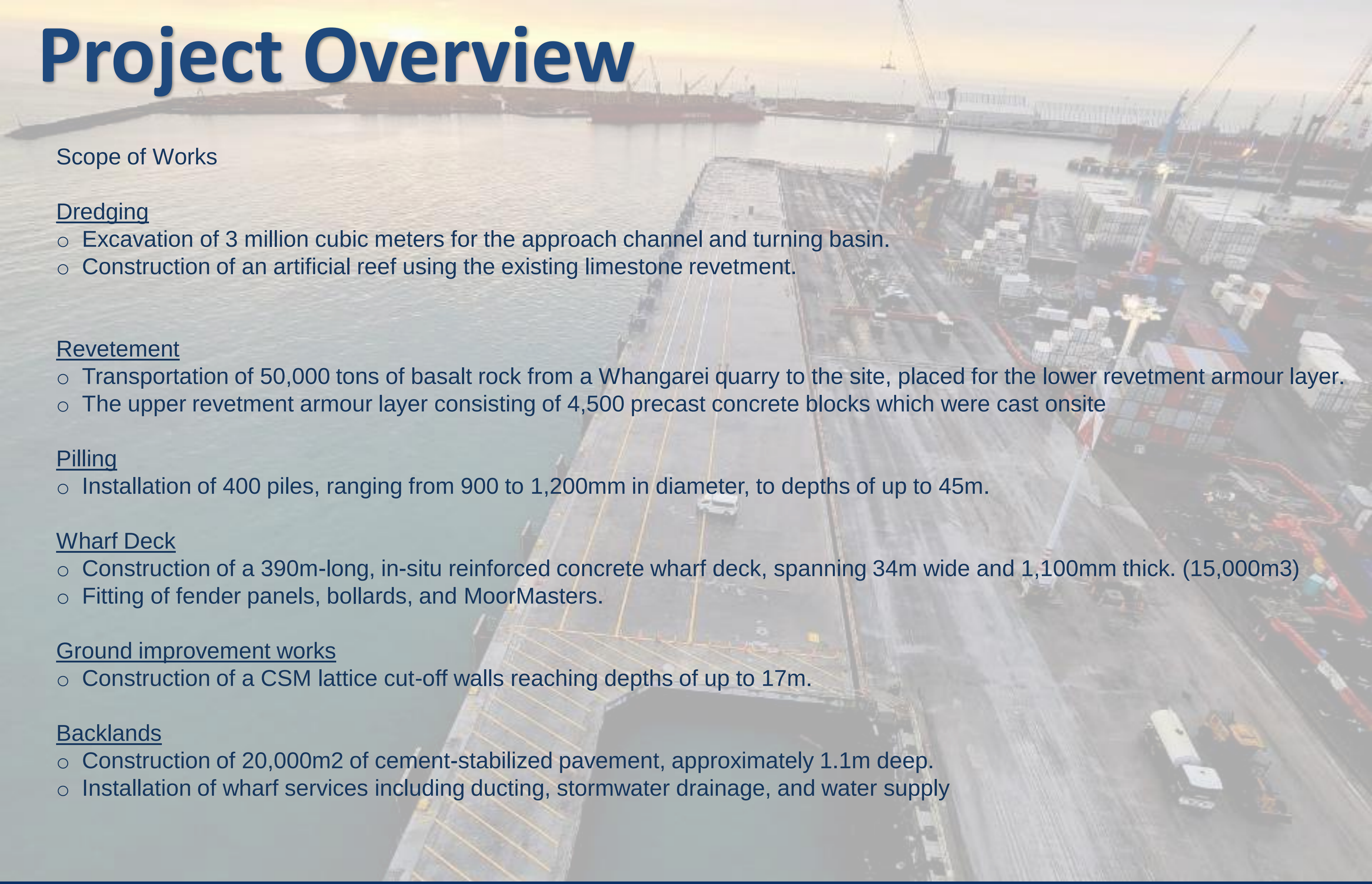
2018-2019 ECI

Late 2019 Construction Started

July 2022 First Ship Alongside Wharf 6

HEB construction together @ VINCI

Project Overview



Scope of Works

<u>Dredging</u>

- Excavation of 3 million cubic meters for the approach channel and turning basin.
- Construction of an artificial reef using the existing limestone revetment.

<u>Revetement</u>

- Transportation of 50,000 tons of basalt rock from a Whangarei quarry to the site, placed for the lower revetment armour layer.
- The upper revetment armour layer consisting of 4,500 precast concrete blocks which were cast onsite

<u>Pilling</u>

- Installation of 400 piles, ranging from 900 to 1,200mm in diameter, to depths of up to 45m.

<u>Wharf Deck</u>

- Construction of a 390m-long, in-situ reinforced concrete wharf deck, spanning 34m wide and 1,100mm thick. (15,000m3)
- Fitting of fender panels, bollards, and MoorMasters.

<u>Ground improvement works</u>

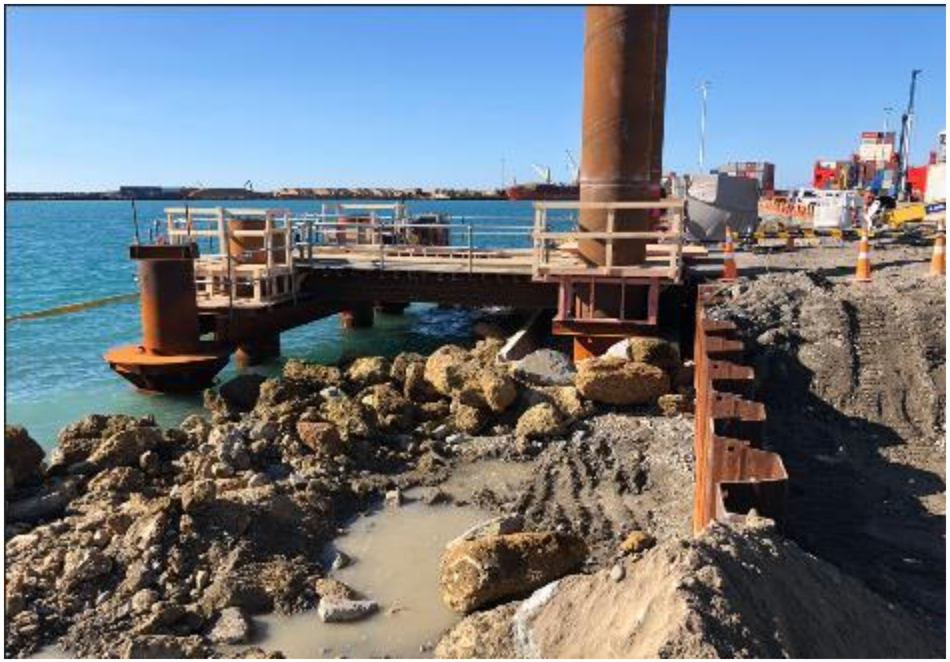
- Construction of a CSM lattice cut-off walls reaching depths of up to 17m.

<u>Backlands</u>

- Construction of 20,000m2 of cement-stabilized pavement, approximately 1.1m deep.
- Installation of wharf services including ducting, stormwater drainage, and water supply

The Construction Process - Piling

AB Piling – From Marine and Land Side



The Construction Process - Piling

CDE Piling

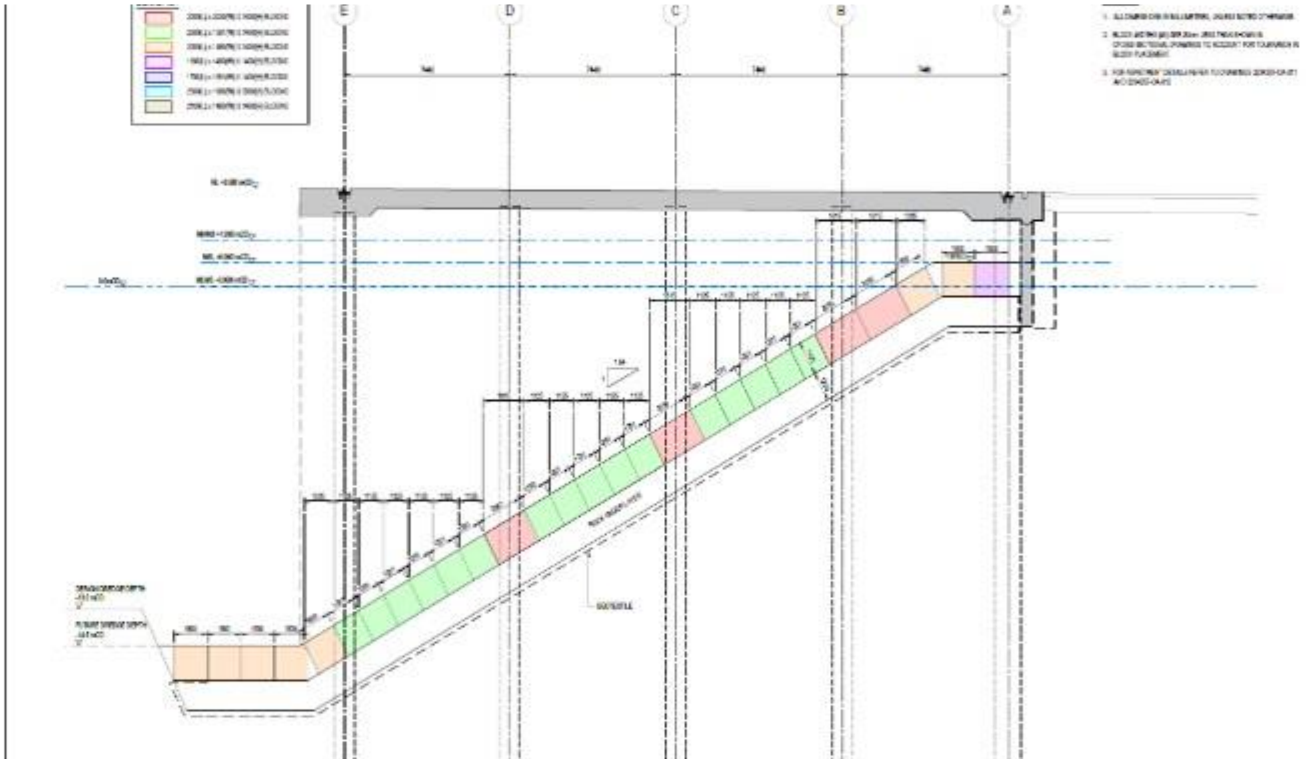
The Construction Process - Piling

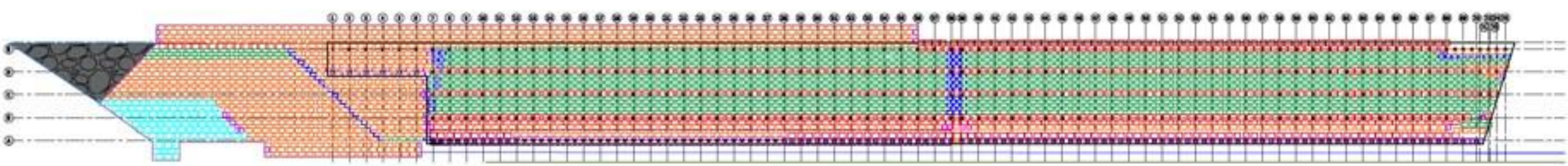
CDE Piling

The Construction Process - Piling

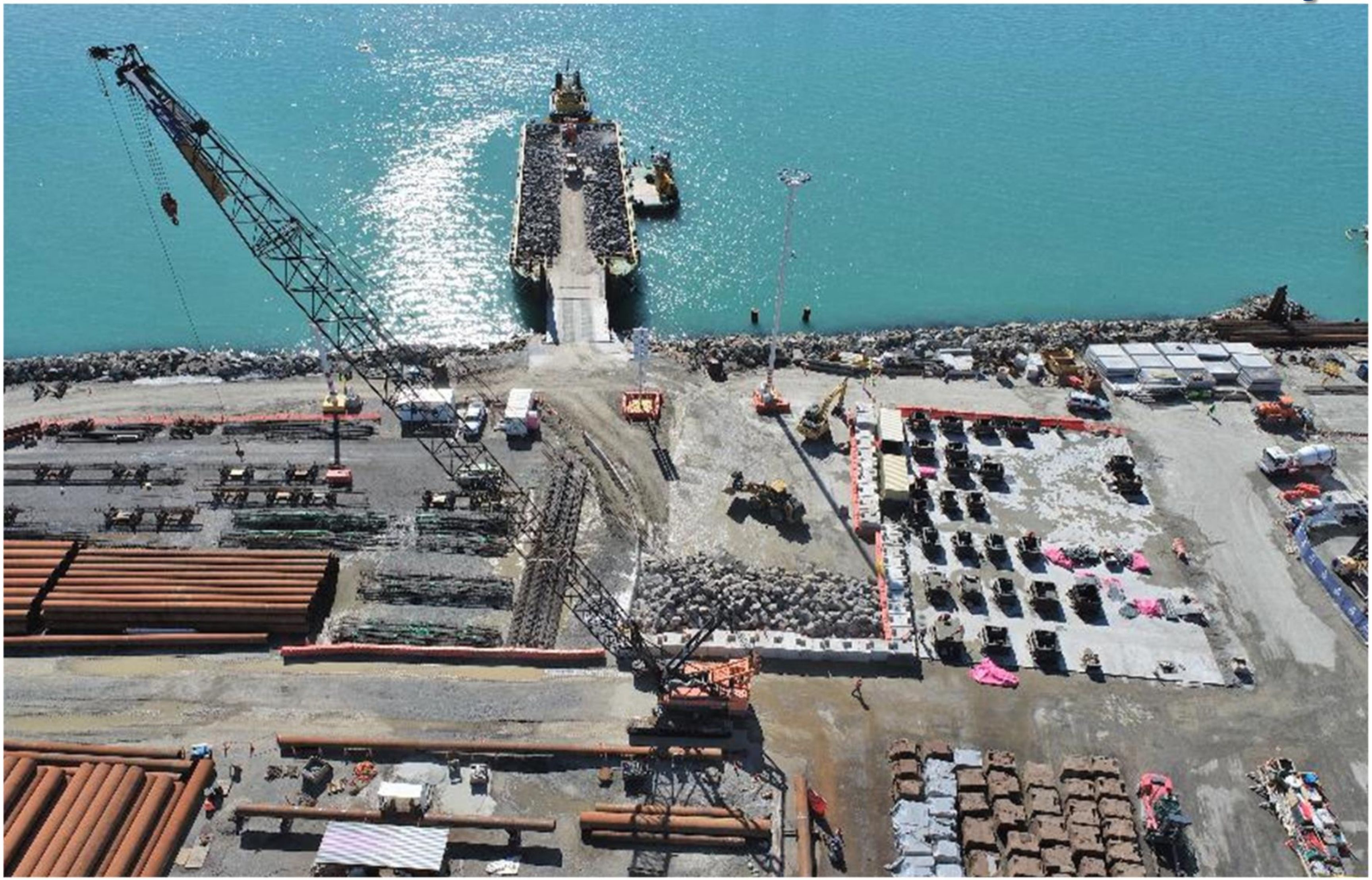
Piling Challenges – Rocks & Gas

Revetment- Scope Of Works

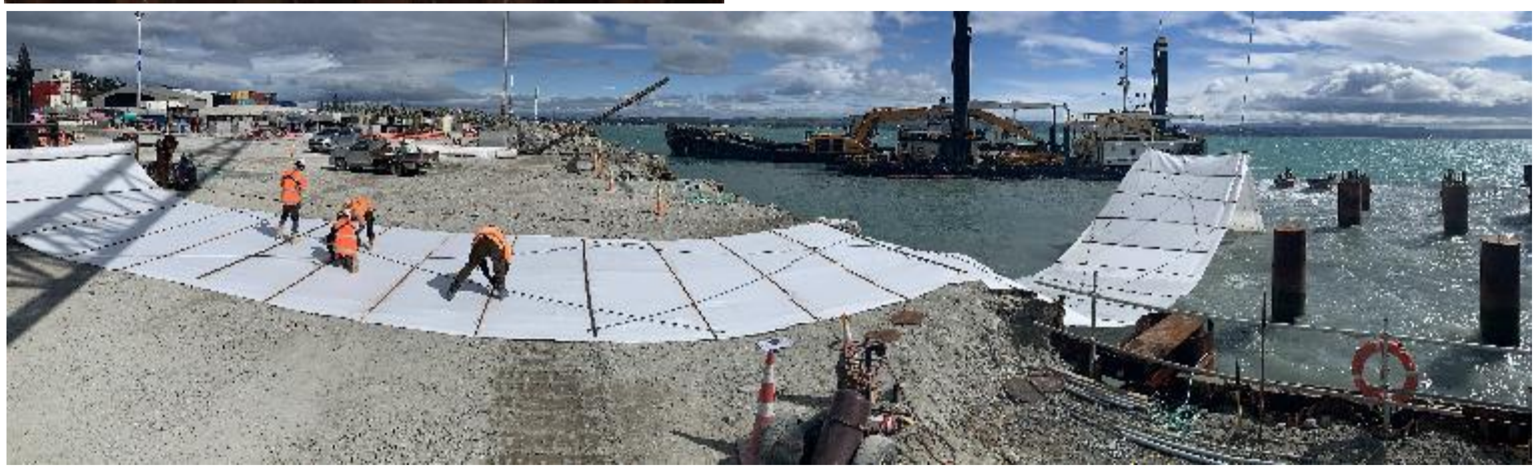




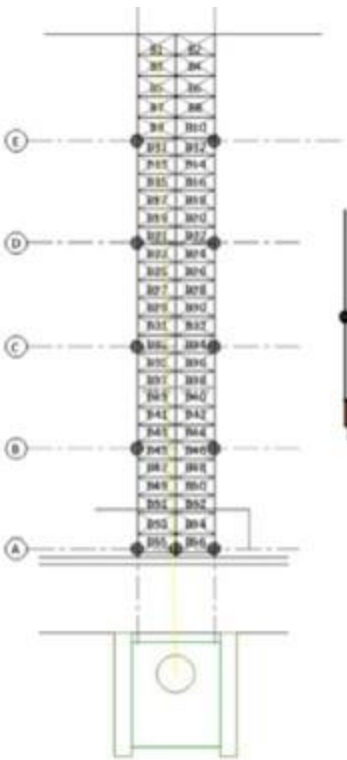
Construction Process – Rock Delivery

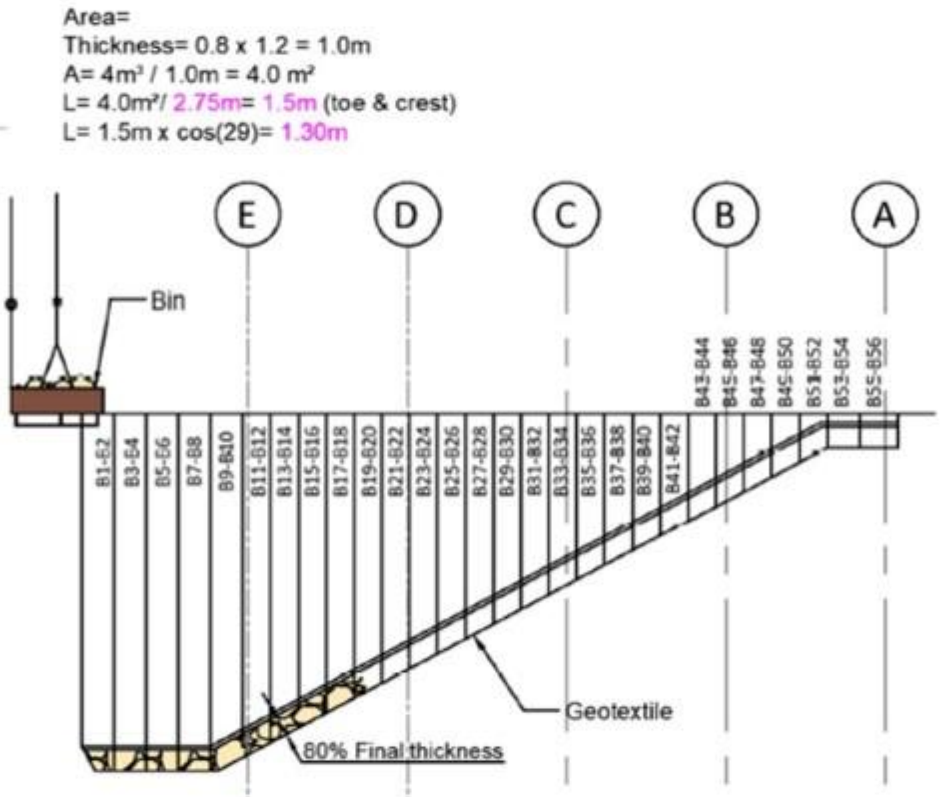


Construction Process – Cloth



Method Development – Rock Placement





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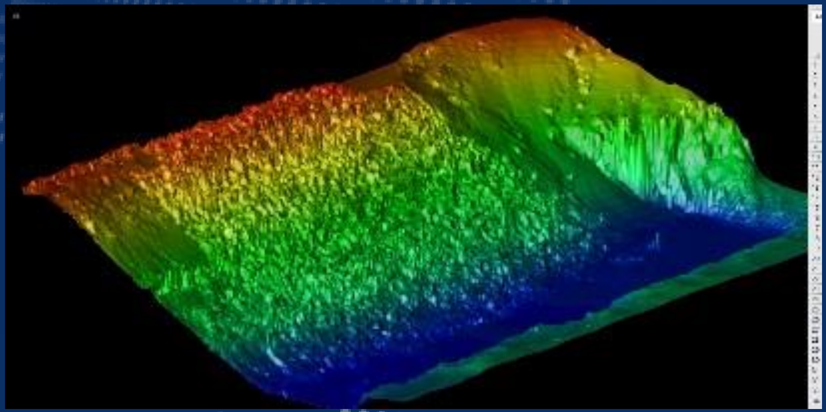
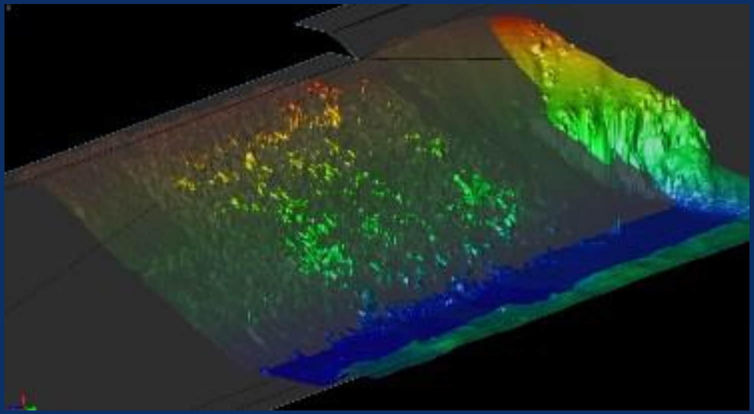
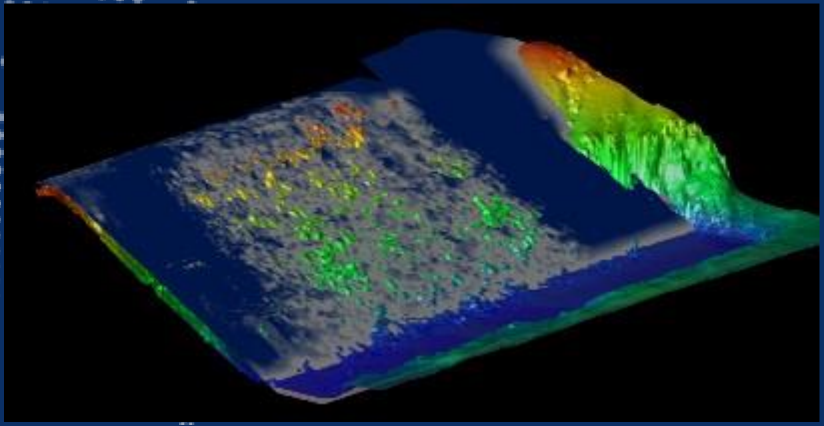
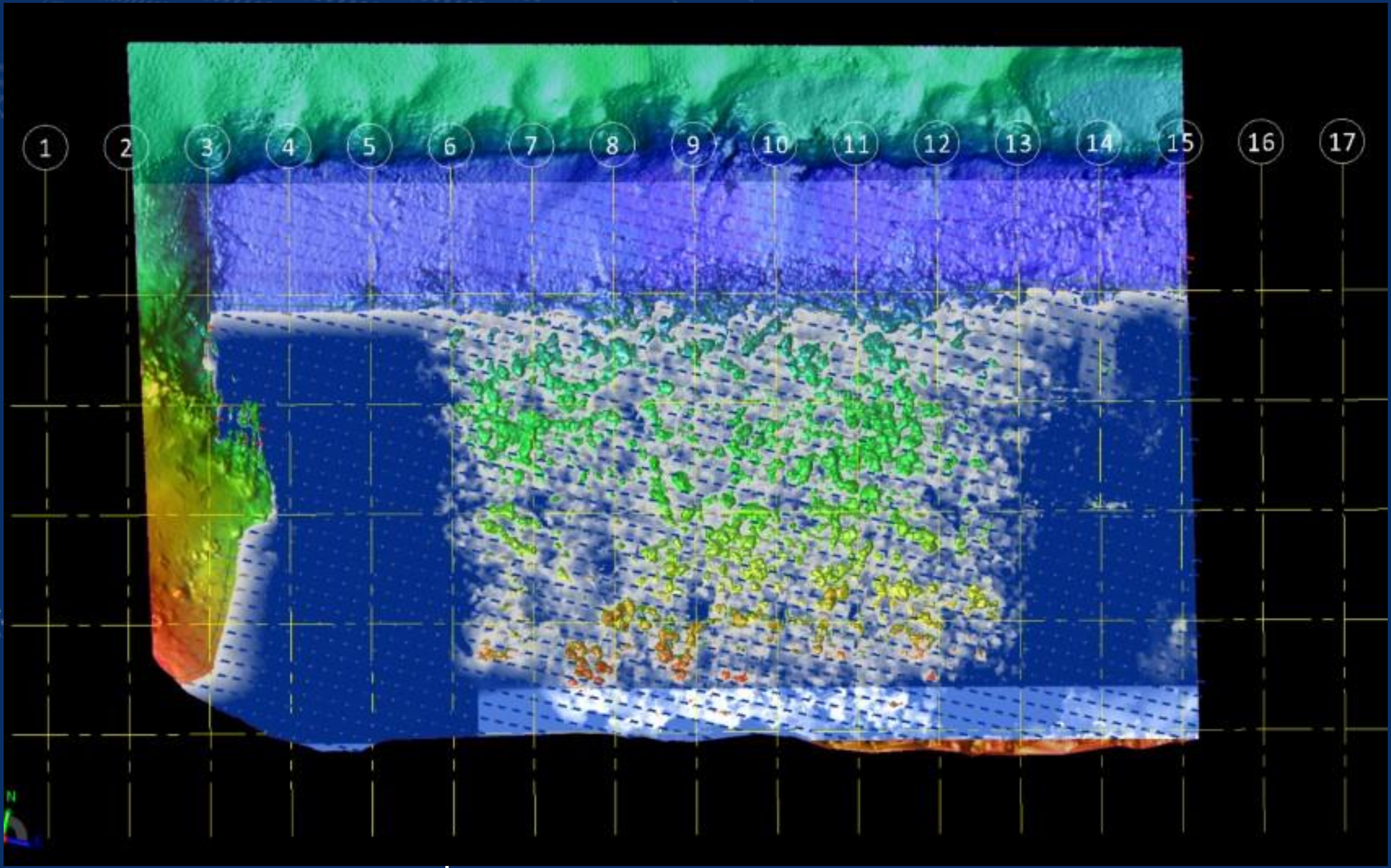






together @ VINCI

Method Development – Rock Placement



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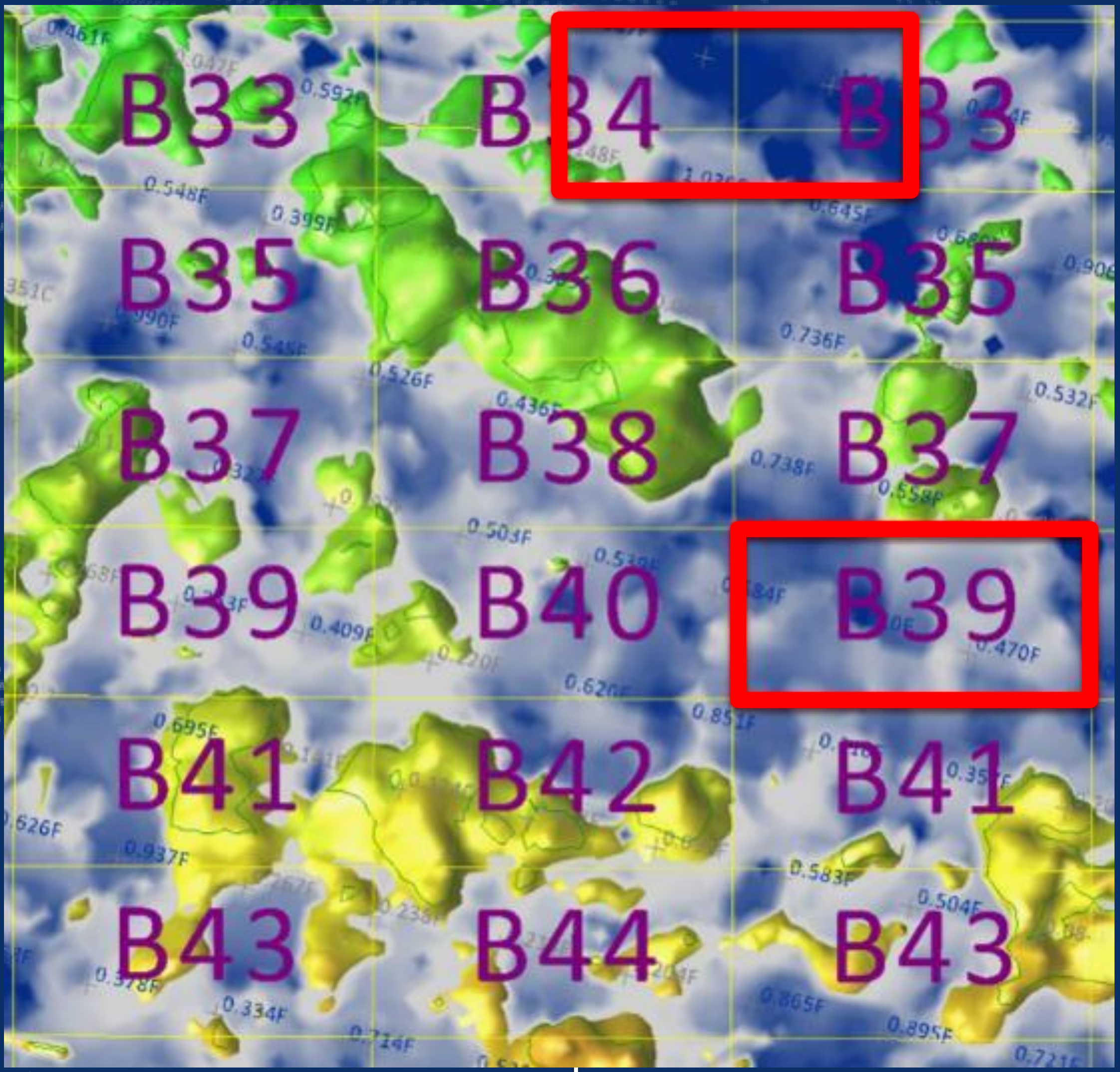
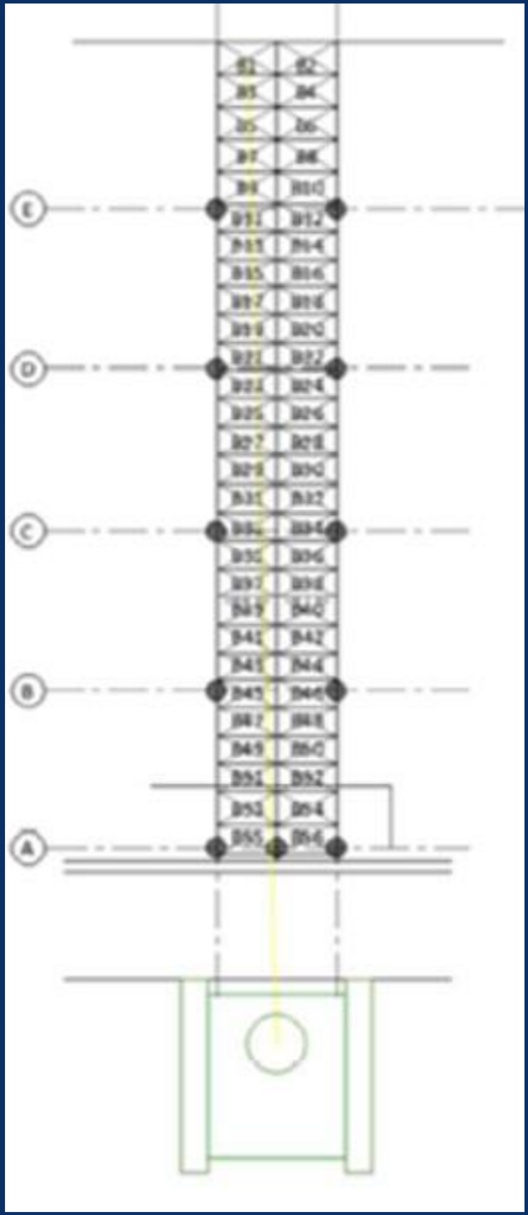
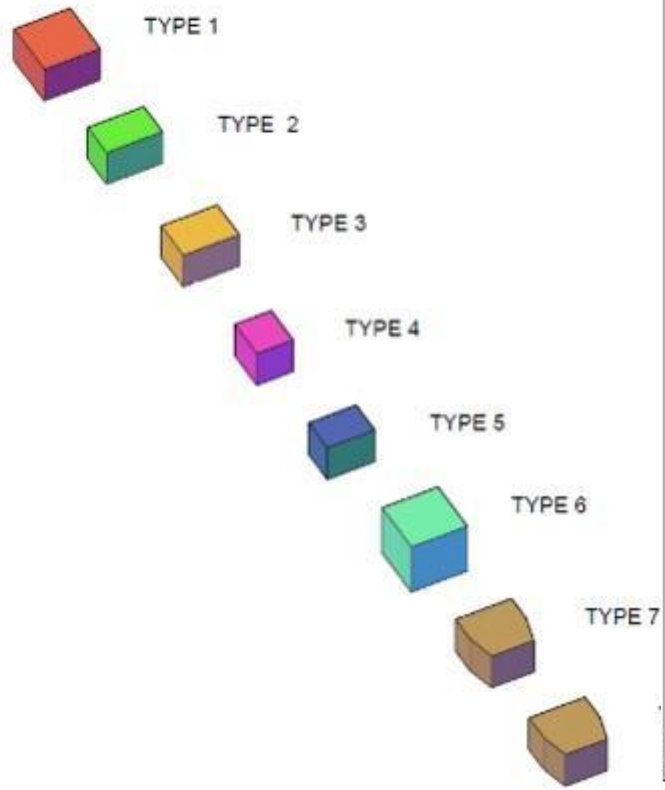


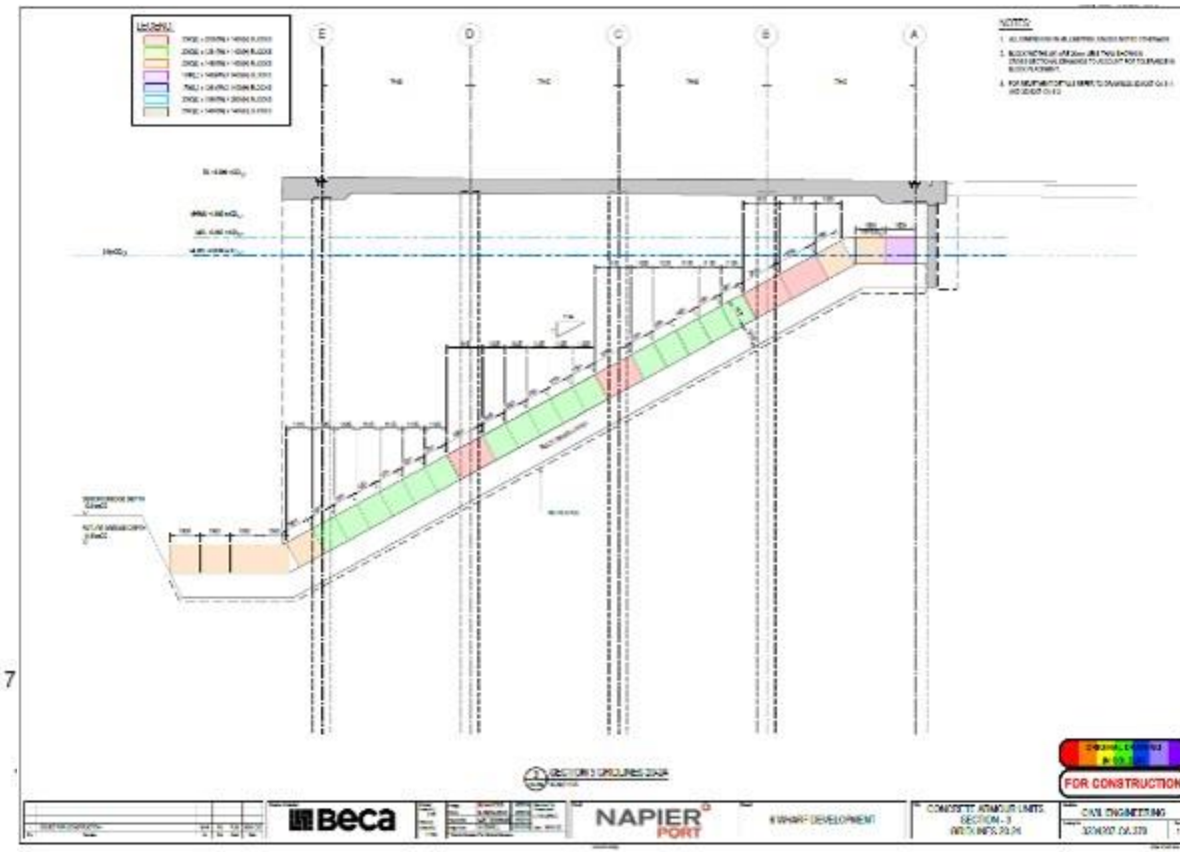


HEB construction together @ VINCI

Method Development - Amour Blocks

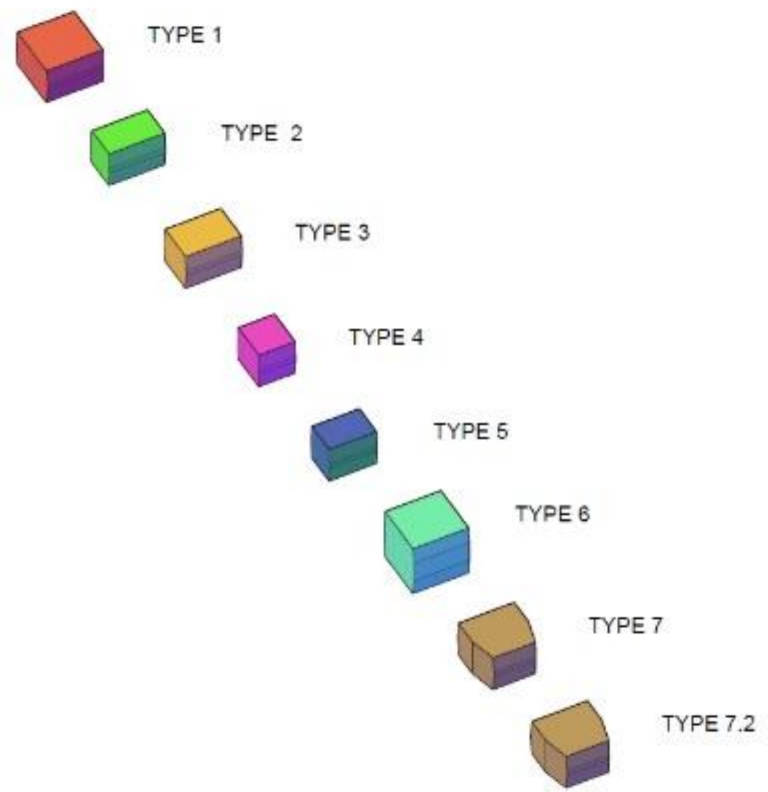
1) Original Design





Method Development - Amour Blocks

2) Redesign



Method Development - Amour Blocks

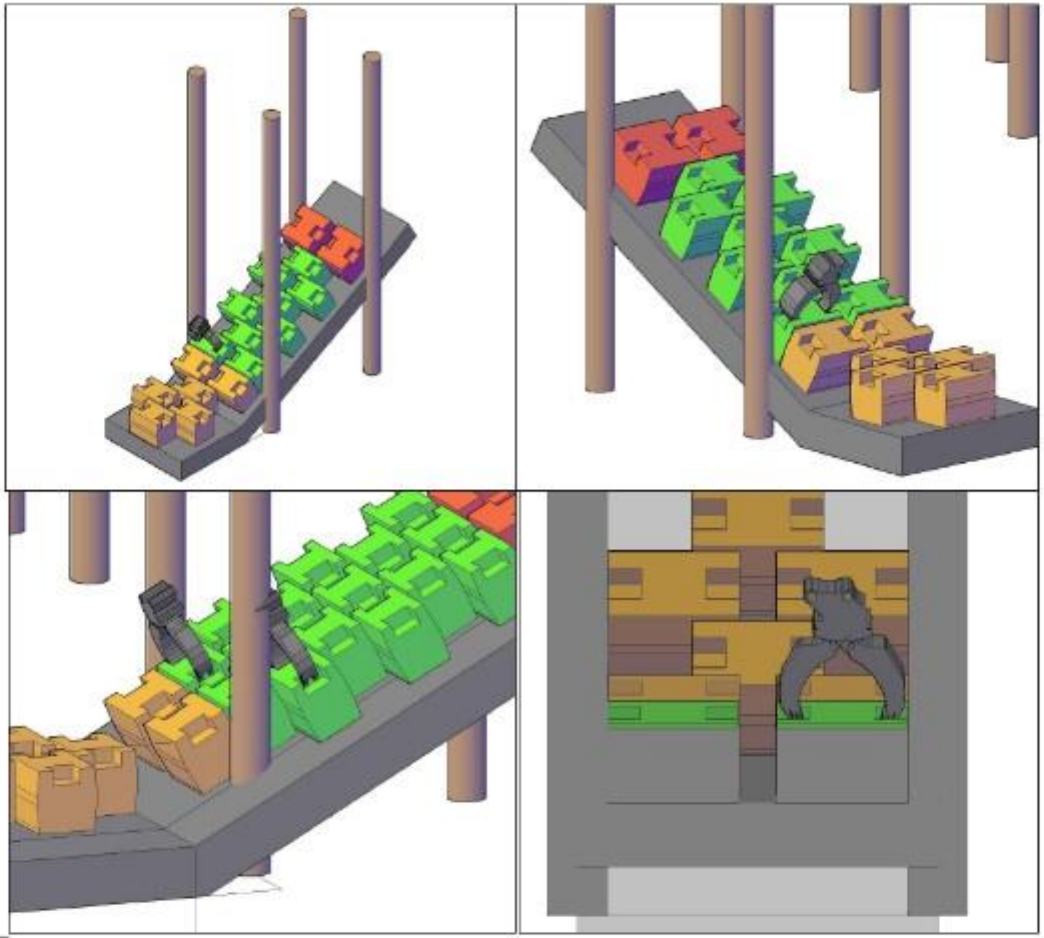
3) Placement Options

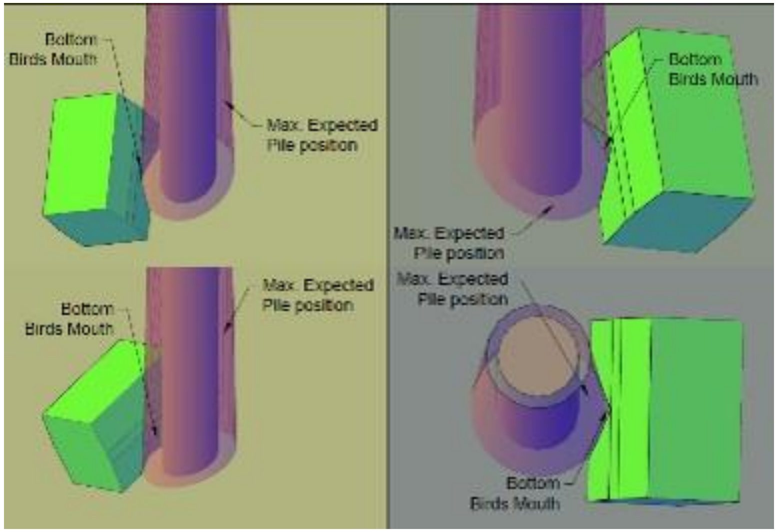
HEB construction

together @ VINCI

Method Development - Amour Blocks

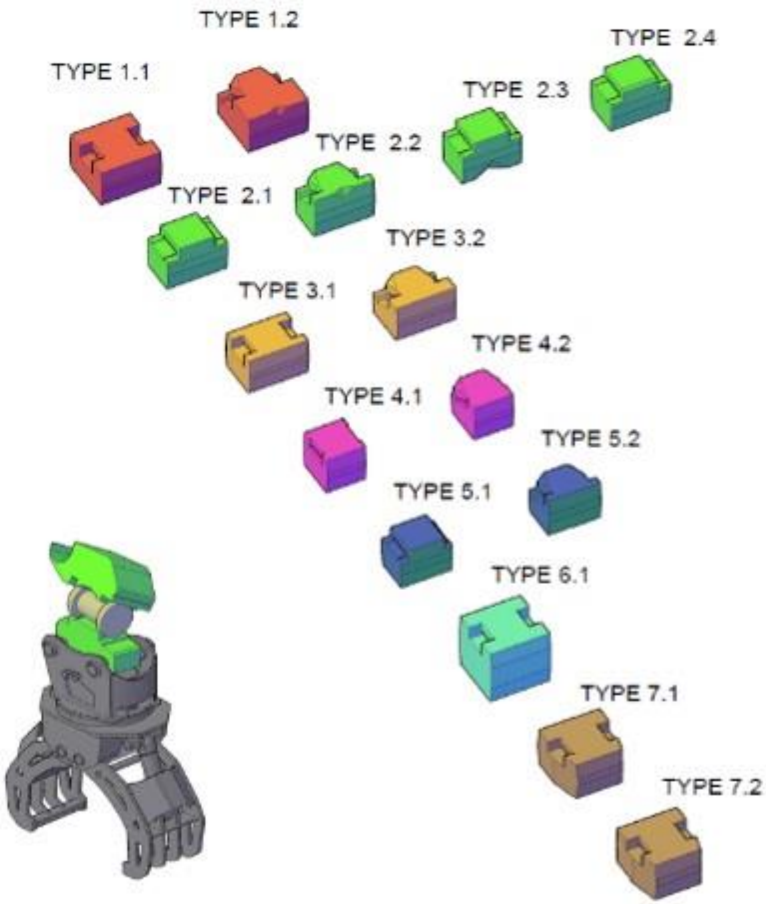
4) Further Redesign- Allowance for pile tolerance and placing blocks hard against piles





Method Development - Amour Blocks

5) Blocks Redesign Approved



15 TYPES OF BLOCKS

TO BE PLACED WITH ROTATIONAL GRAB+ TILT

ISSUES:

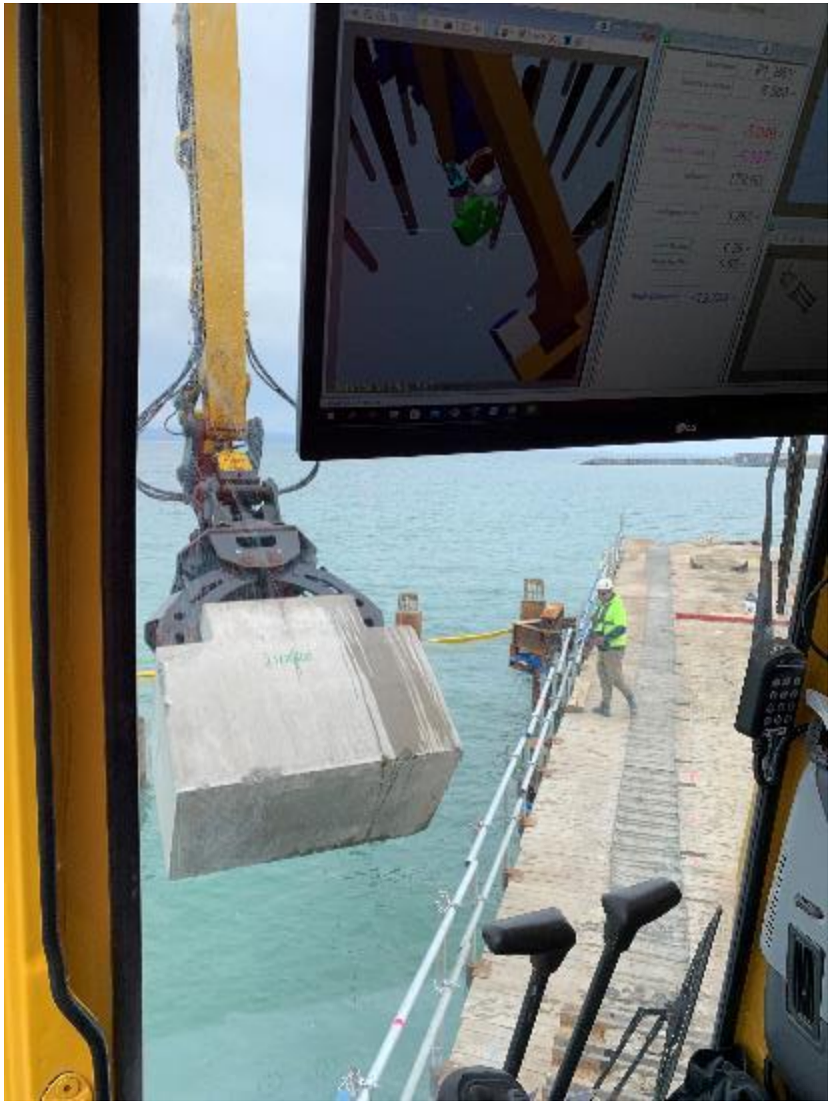
SOLVED:

INTERSECTION GRAB-PILE

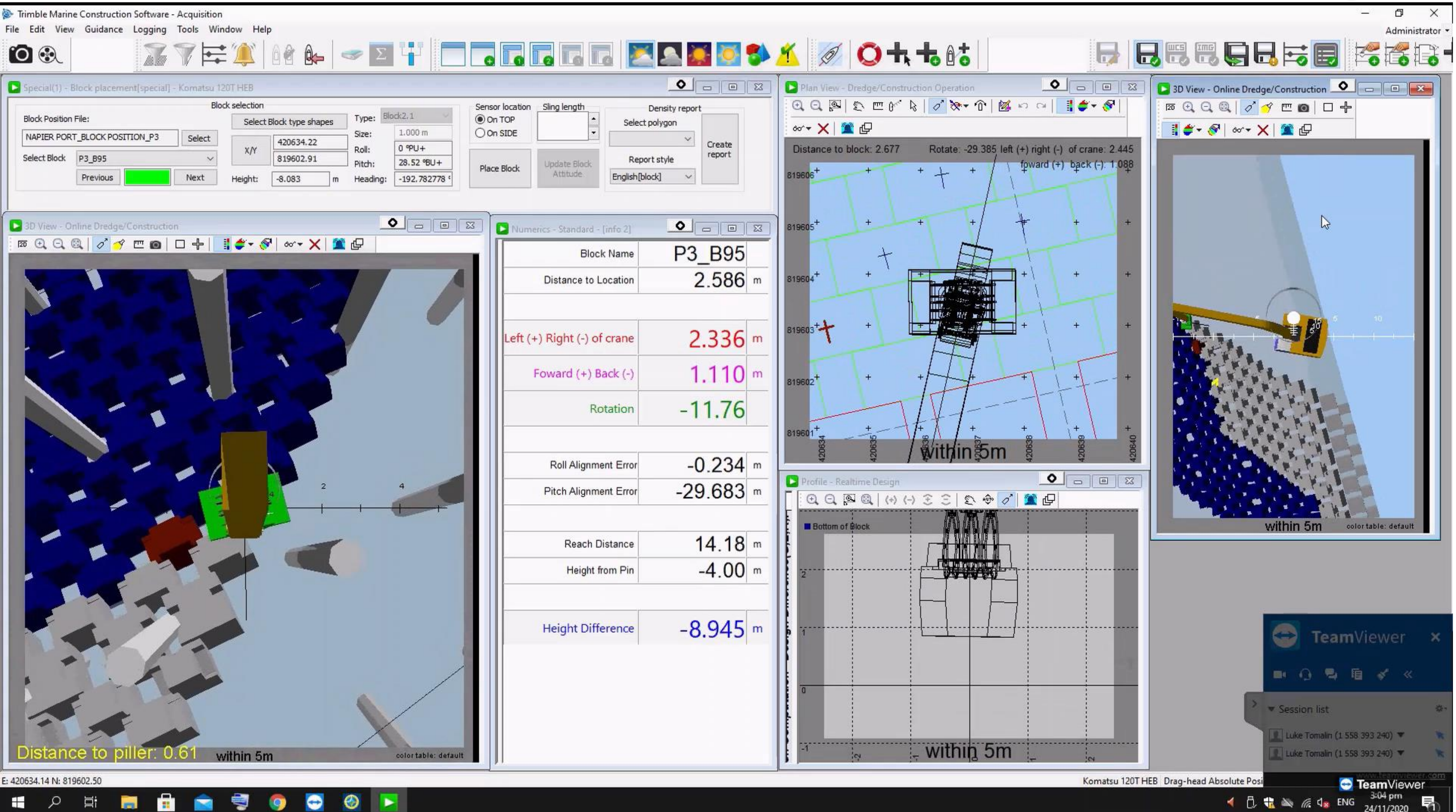
Method Development – Amour Block Survey

Method Development – Amour Block Placement

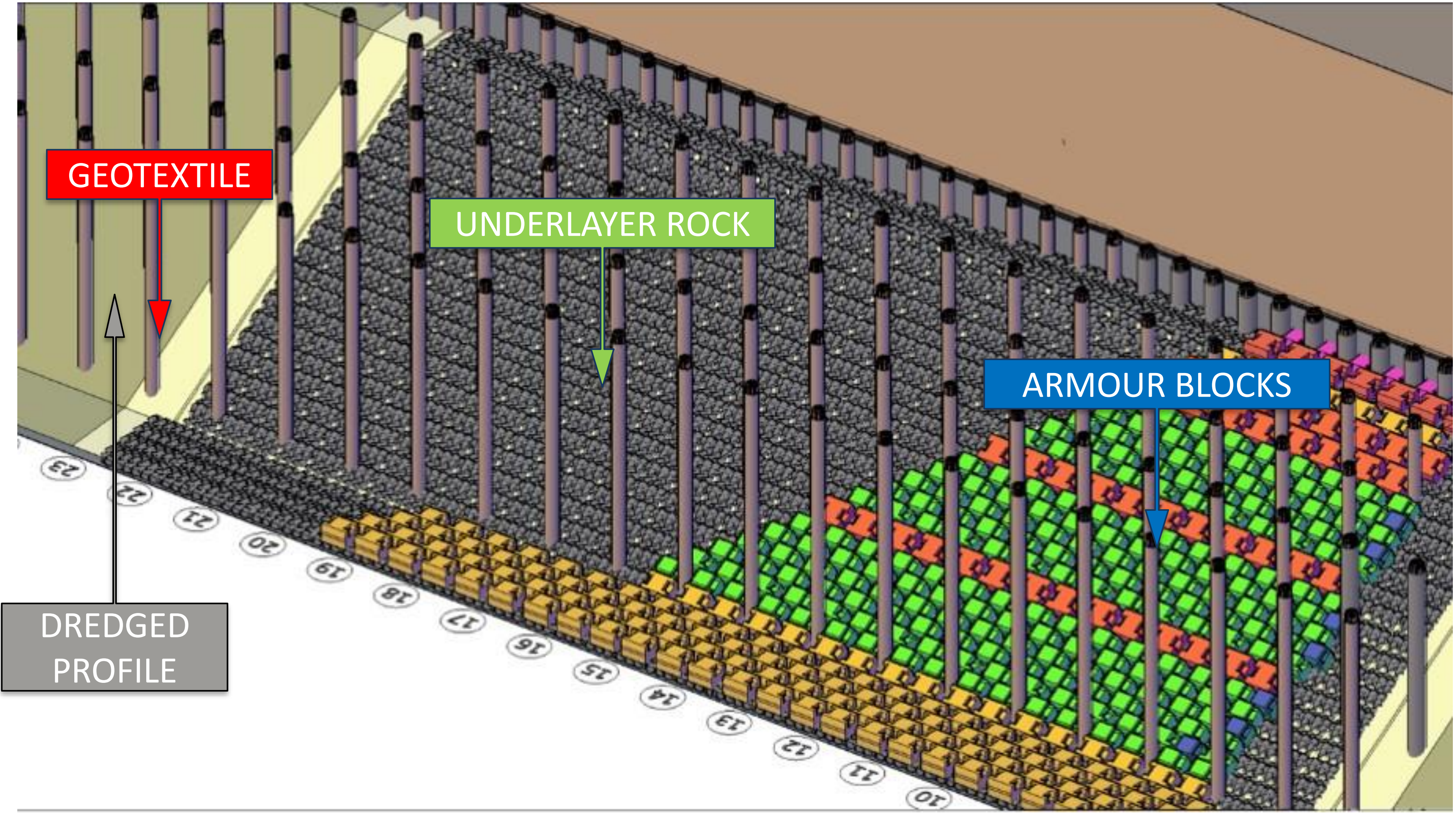

HEB
KOMATSU



Construction Process – Amour Block Survey



Method Development Tools – 3D CAD Model



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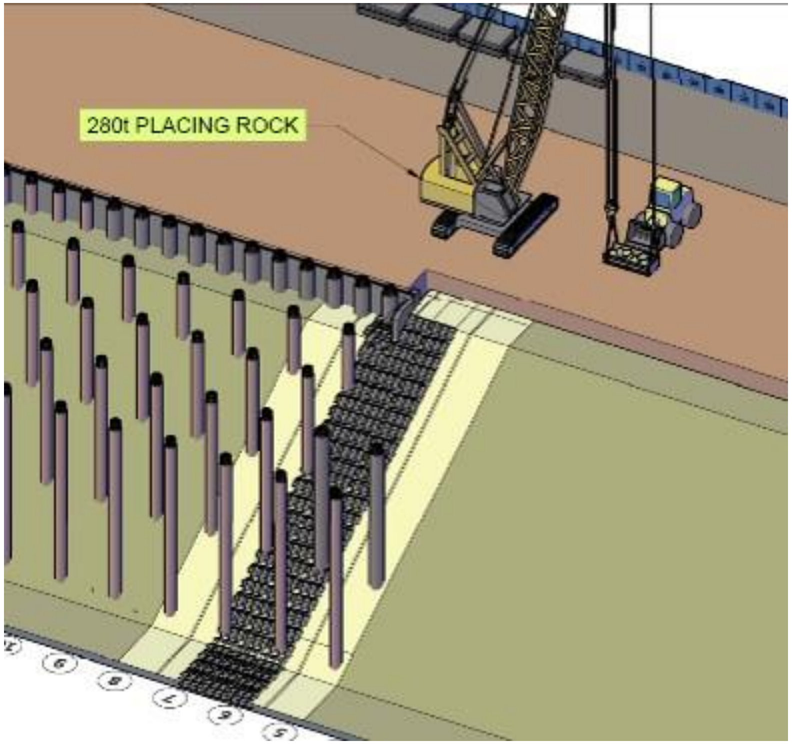
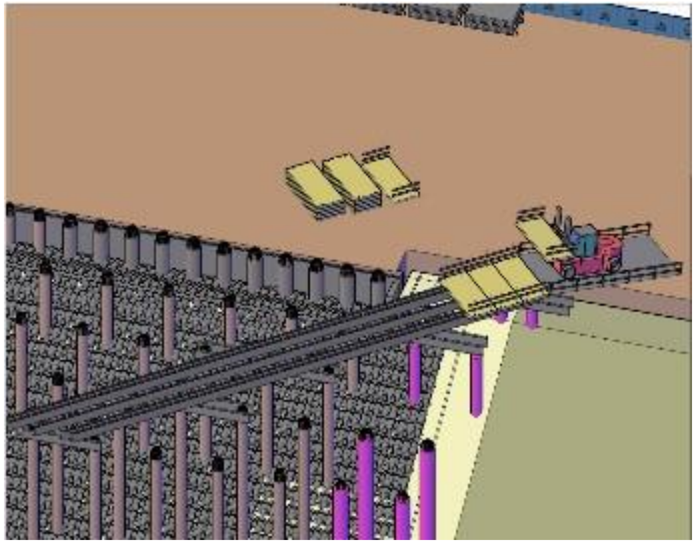
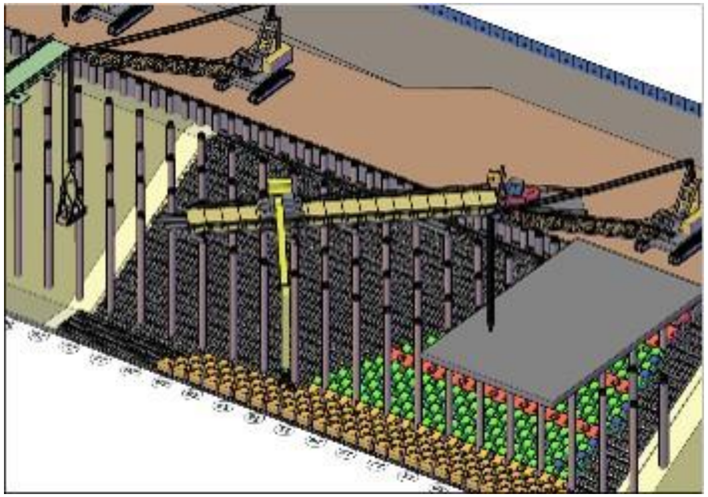
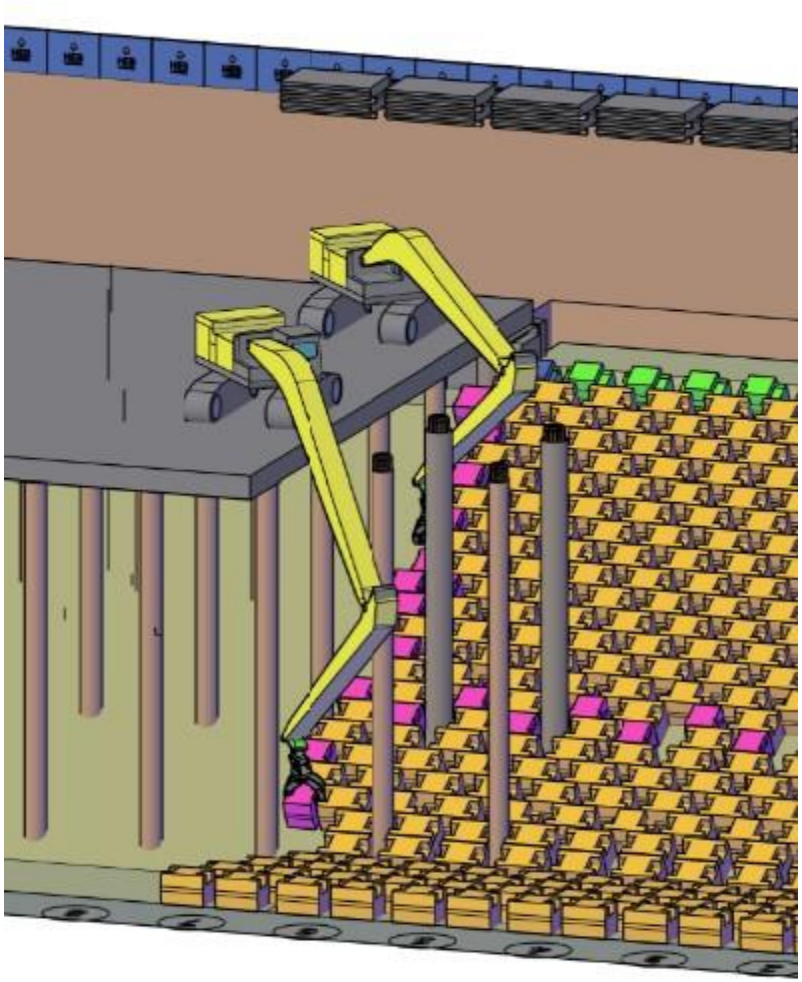
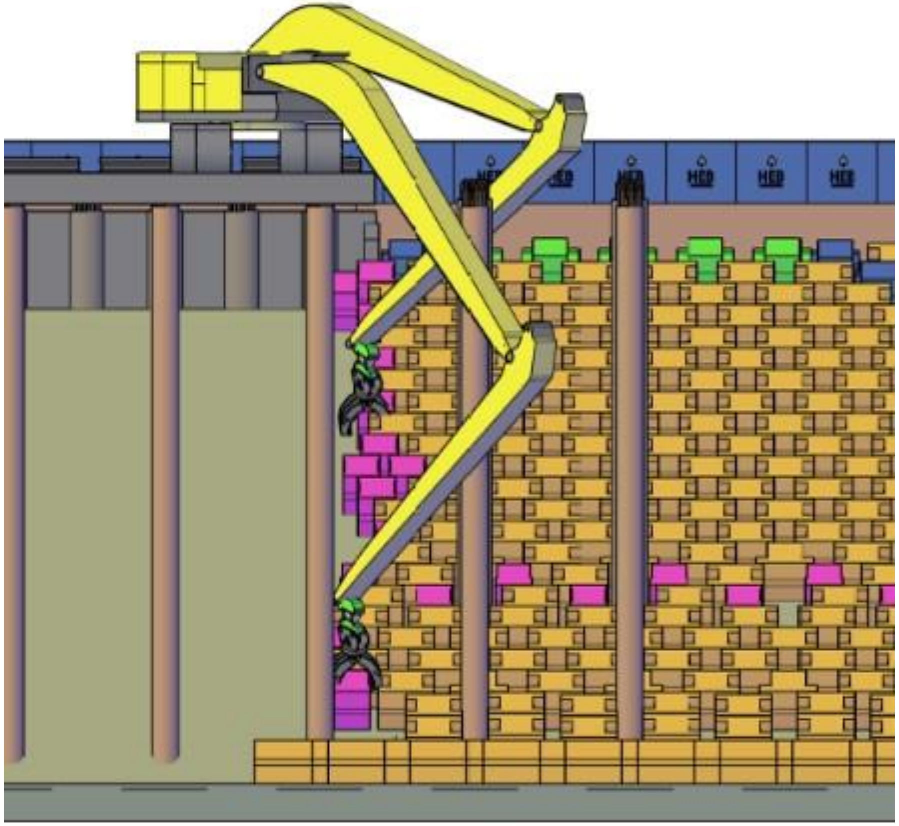






Method Development – 3D CAD Model





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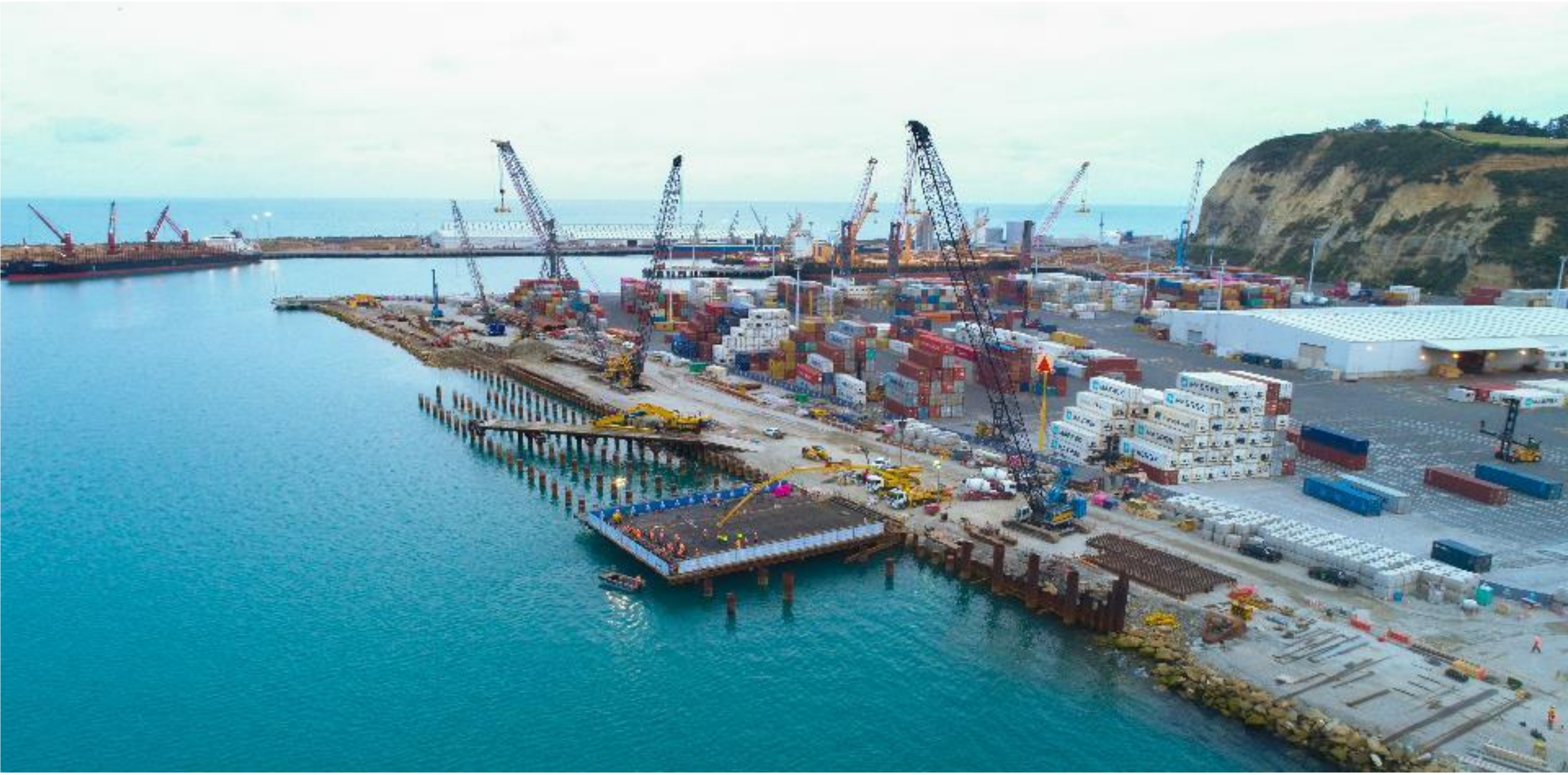
Method D

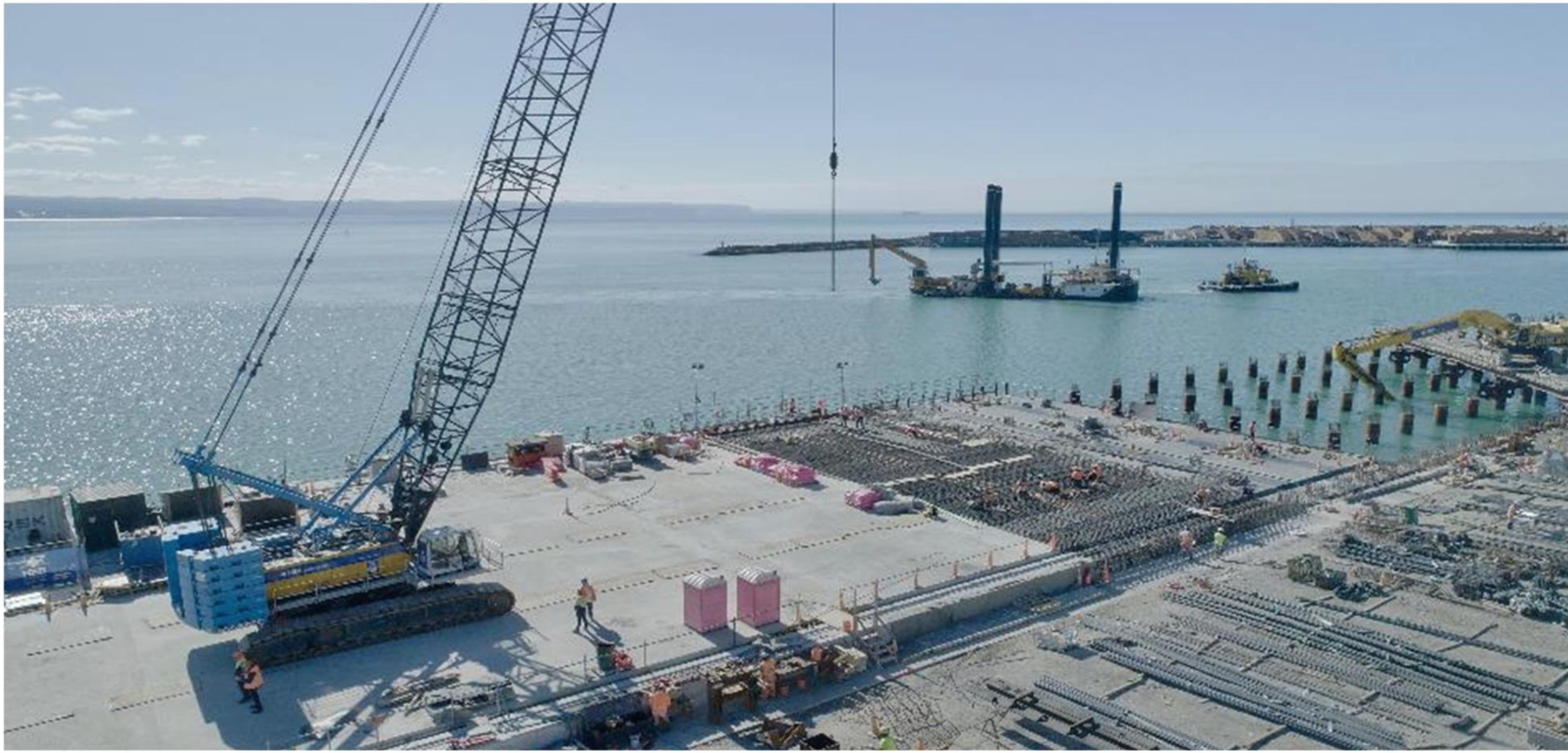
The Construction Process - Deck

Falsework

The Construction Process - Deck



The Construction Process - Deck



The Crew


Boot's
CELLENCE IN PROJECTS WITH A VALUE OF
GREATER THAN $100 MILLION
Winner

Timelapse

https://youtu.be/uySqFp71crE

QUESTIONS?

HEB construction

together @ VINCI

Need a wharf built?
Give us a bell

HEB construction together @ VINCI

Seaview Wharf Resilience Project

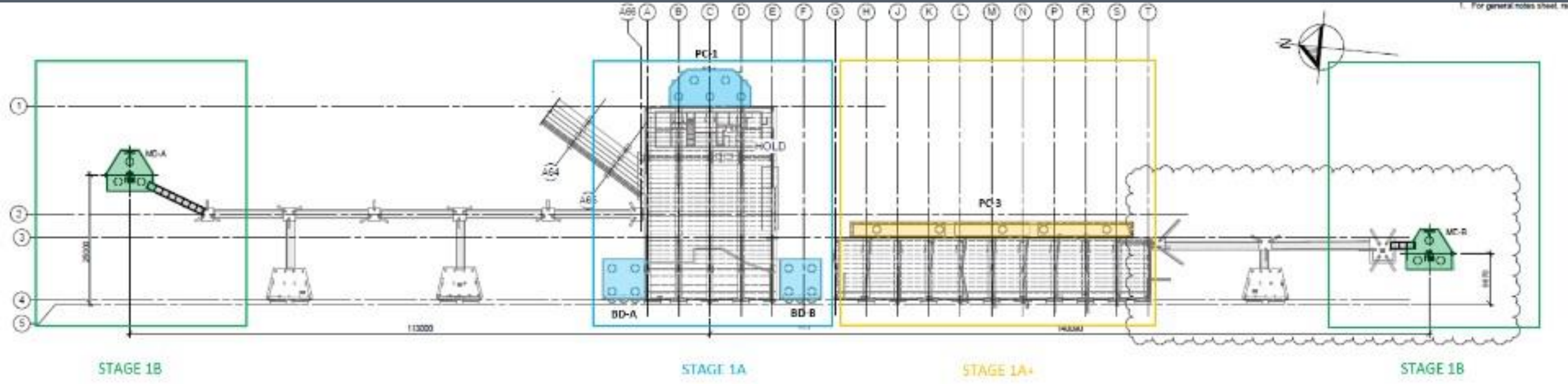
Gabriela Koneski,
Construction Manager

CentrePort Wellington

BRIAN PERRY CIVIL
Made possible

THE PROJECT: SEAVIEW WHARF RESILIENCE PROJECT

THE PROJECT: SEAVIEW WHARF RESILIENCE PROJECT

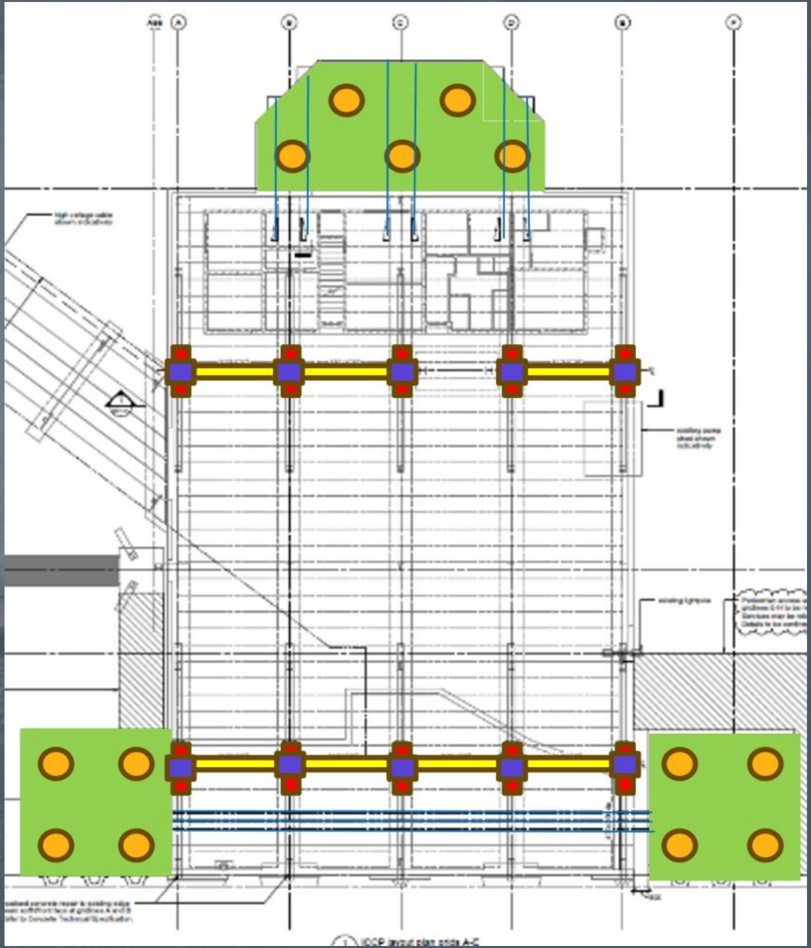


CentrePort Wellington

BRIAN PERRY CIVIL

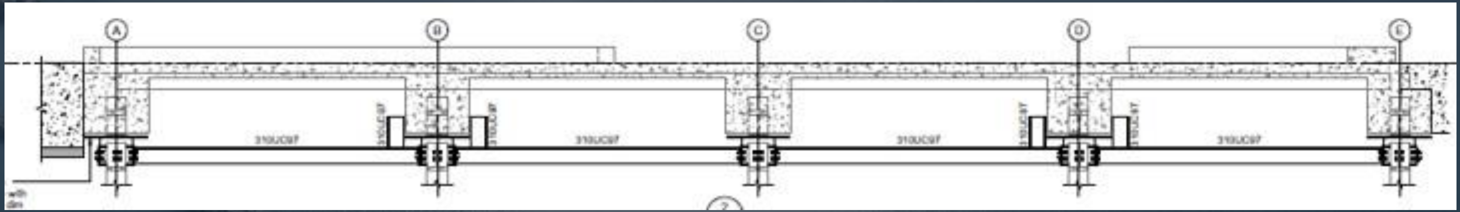
ENGINEERING ASPECTS

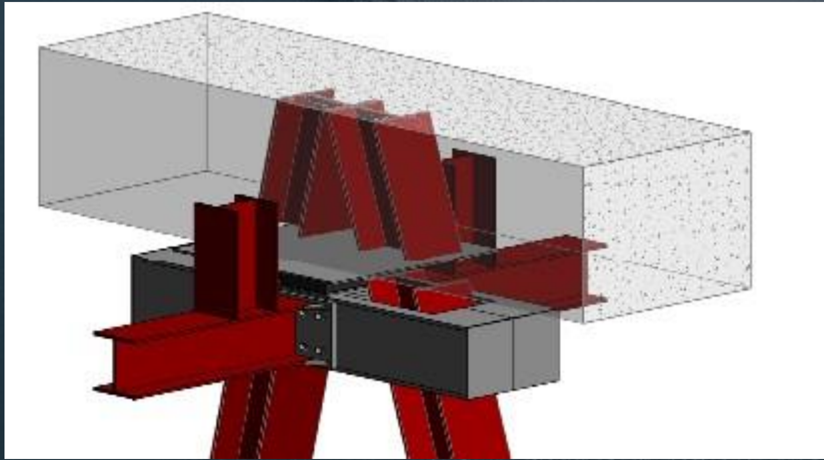
STAGE 1A

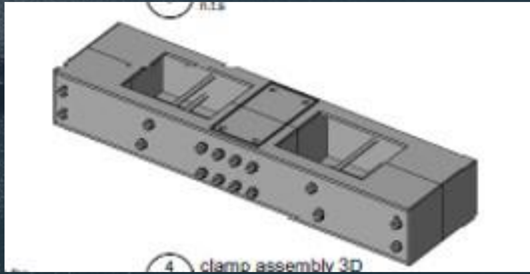


ENGINEERING ASPECTS

GRAVITY CLAMPS

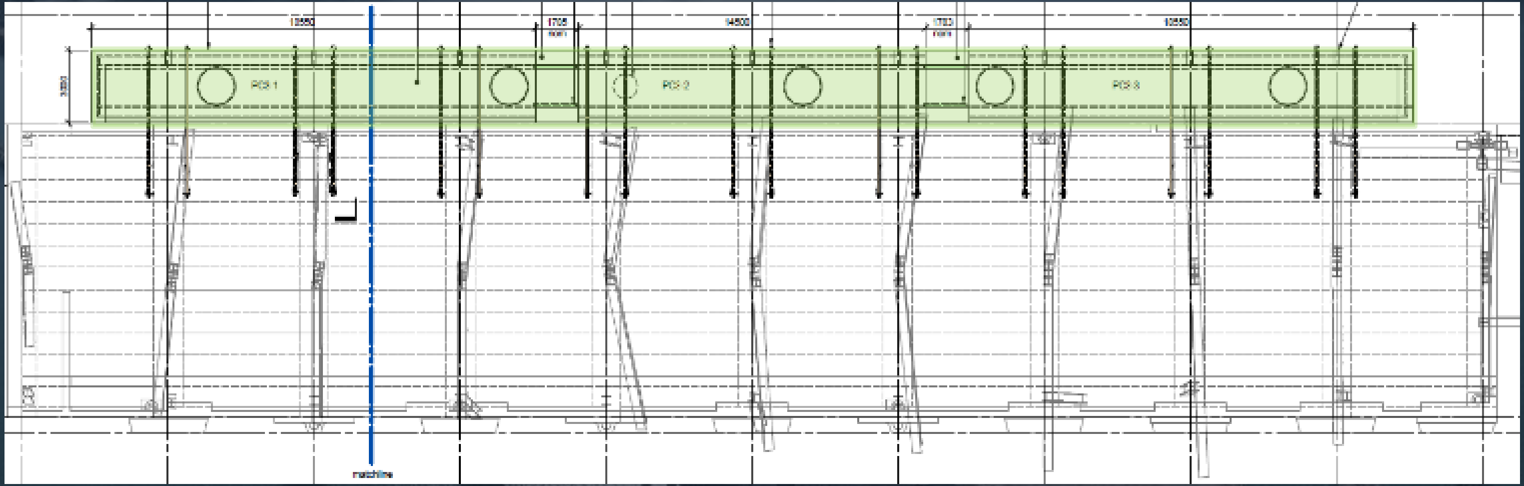






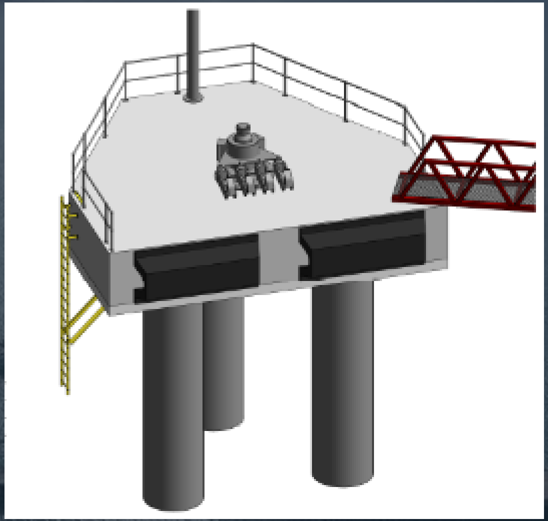
ENGINEERING ASPECTS

STAGE 1A+



ENGINEERING ASPECTS

STAGE 1B



MD-A

MD-B

THE CHALLENGES: LOCATION

CentrePort Wellington

THE CHALLENGES: LOCATION

BRIAN PERRY CIVIL

ENGINEERING ASPECTS | TEMPORARY STAGING

ENGINEERING ASPECTS

THE CHALLENGES

THE CHALLENGES: ENVIRONMENT

Work With Nature - *Species around Seaview Wharf:*

Bottlenose Dolphin

Killer Whale

Korora – Little Blue Penguin

Common Dolphin

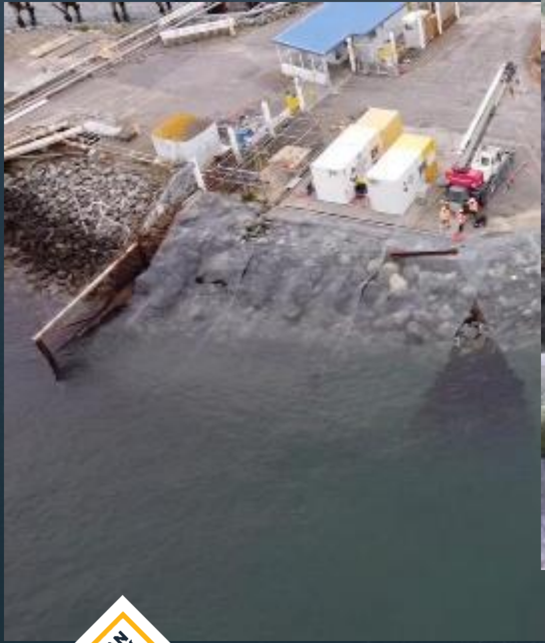
Southern Right Whale

Humpback Whale

Reference: DOC website (Department of Conservation – *Te Papa Atawhai*

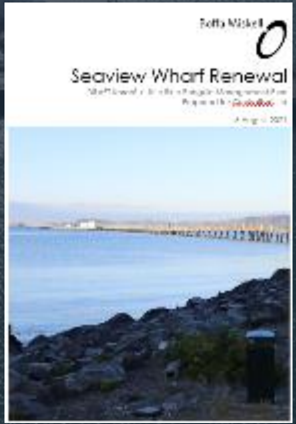
THE CHALLENGES: ENVIRONMENT

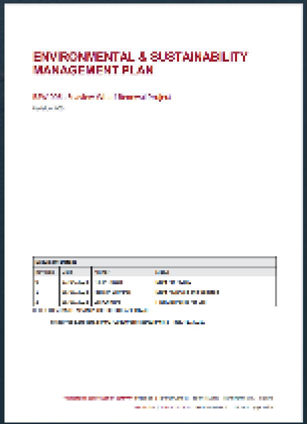
- Installation of penguin mesh to safeg
  - Physical barrier to prevent pe
    (noise effect from heavy mach



THE CHALLENGES: ENVIRONMENT

- Construction Management and Monitoring Plan (CMMP)
- Environmental and Sustainability Management Plan (ESMP)
- Blue Penguin Management Plan (BPMP)
- Marine Mammal Management Plan (MMMP)
- Construction Noise Management Plan (CNMP)

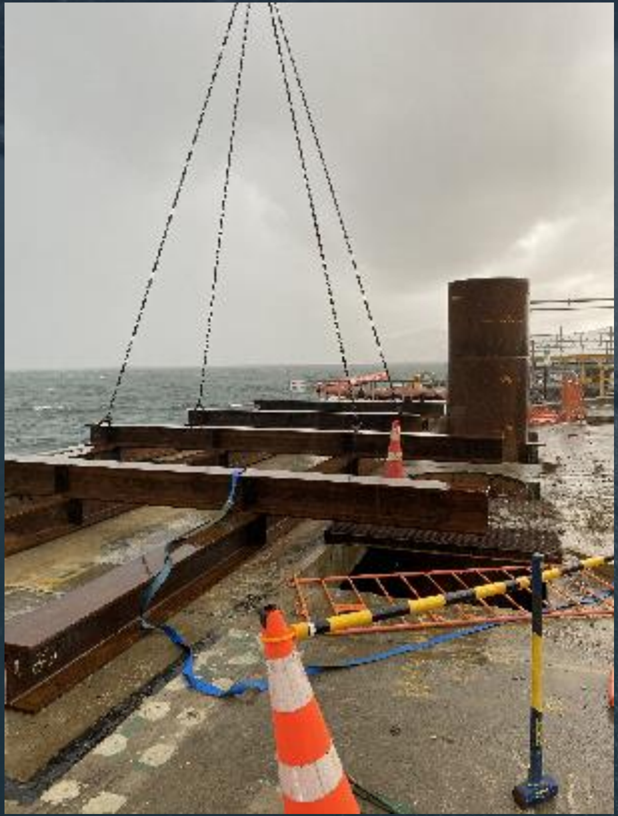




THE CHALLENGES: OPERATIONAL WHARF

ENGINEERING ASPECTS | PILING

ENGINEERING ASPECTS | PILING



ENGINEERING ASPECTS | PILING

The Super Latch

Waiwhetu Aquifer:

Greater Wellington Regional Council monitor the Waiwhetu Aquifer including:

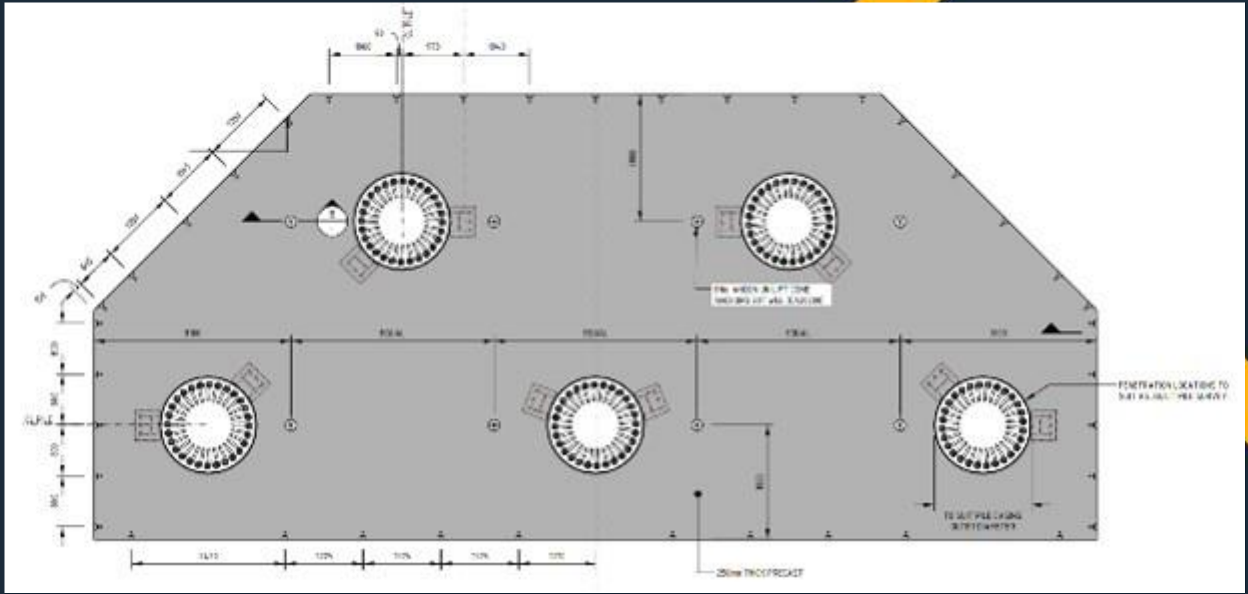
- Water Flow
- Electrical conductivity
- Water level

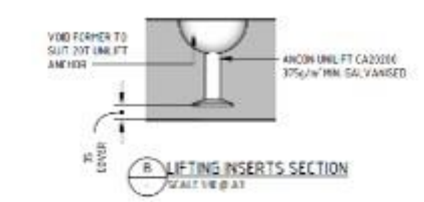
MAMMAL PROTECTION

Underwater noise monitoring for :

- Assessing the environmental risk of pilling
- Calculating the Marine Mammal Observation Zones

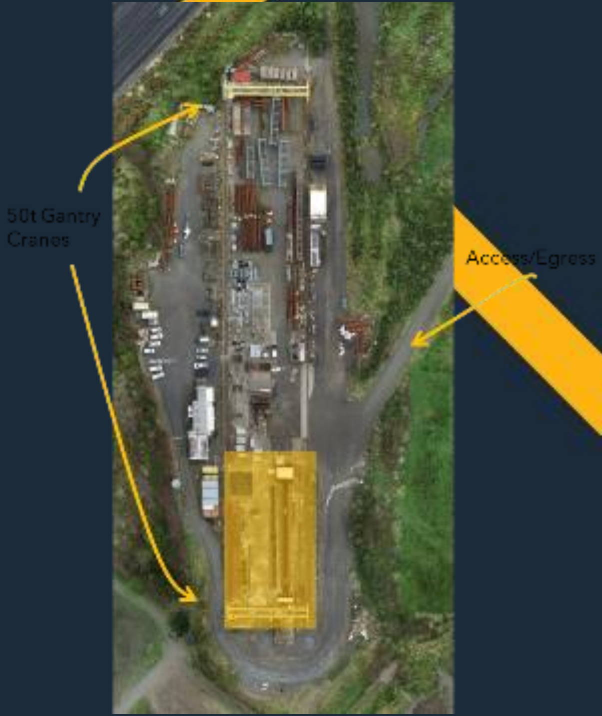
ENGINEERING ASPECTS | PRECAST ELEMENTS





ENGINEERING ASPECTS | PRECAST ELEMENTS

Manahau Barge



BPC Precast Yard

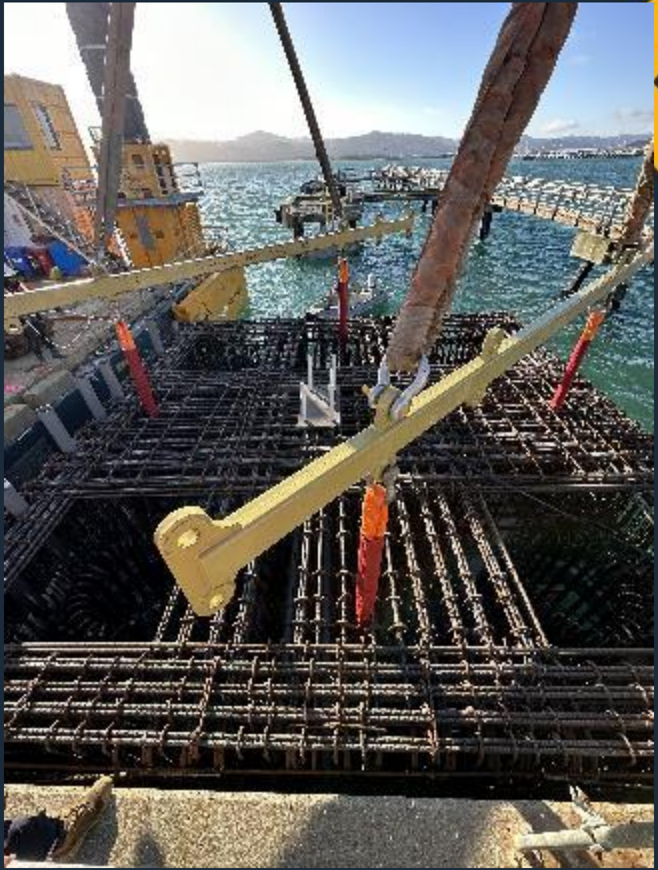
Transit Route

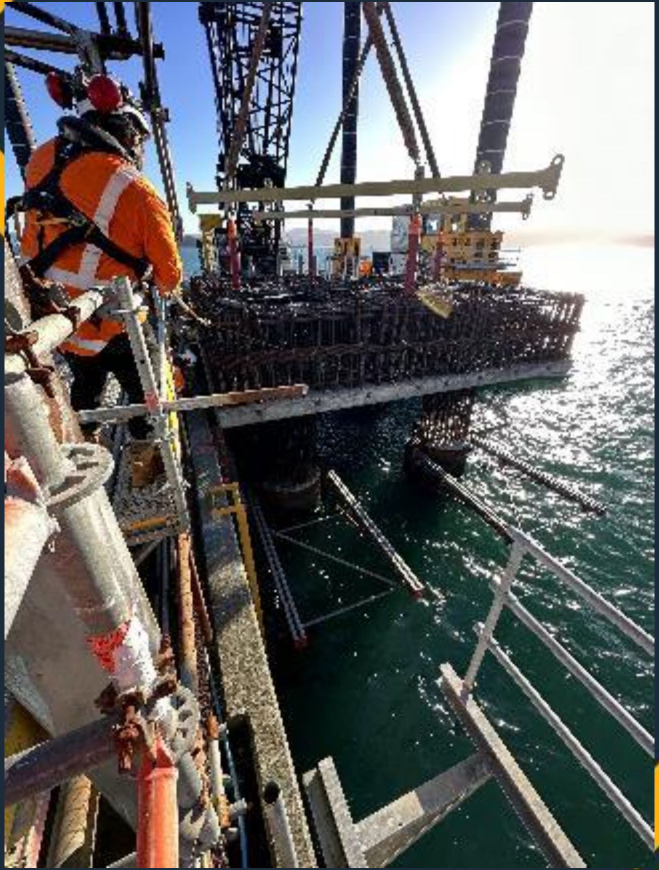
BRIAN PERRY CIVIL

ENGINEERING ASPECTS | PRECAST ELEMENTS

- Main Hook (50t)
- Master Ring
- Spreader Beam
- Delta Block
- Snatch Blocks w/ Wire ropes
- 20t Lifting Eyes

ENGINEERING ASPECTS | PRECAST ELEMENTS





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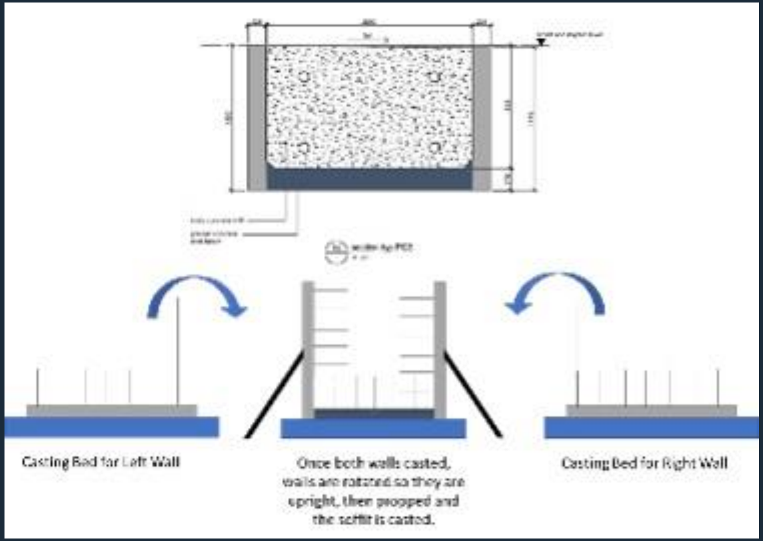

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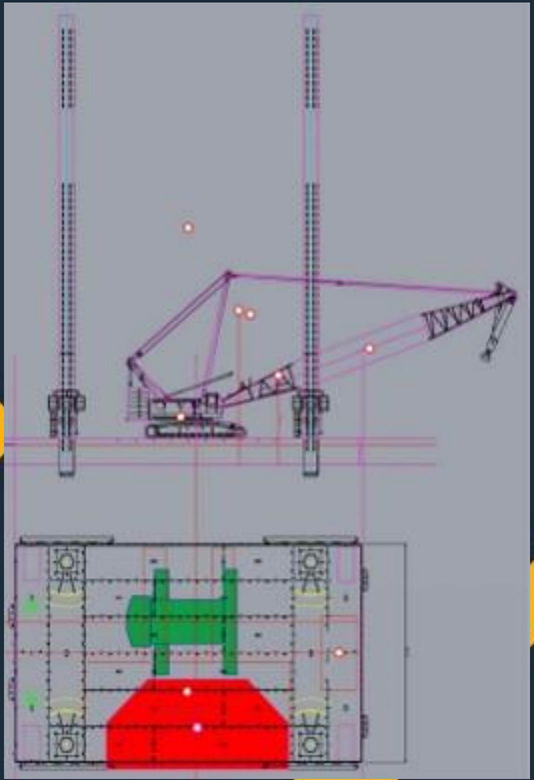

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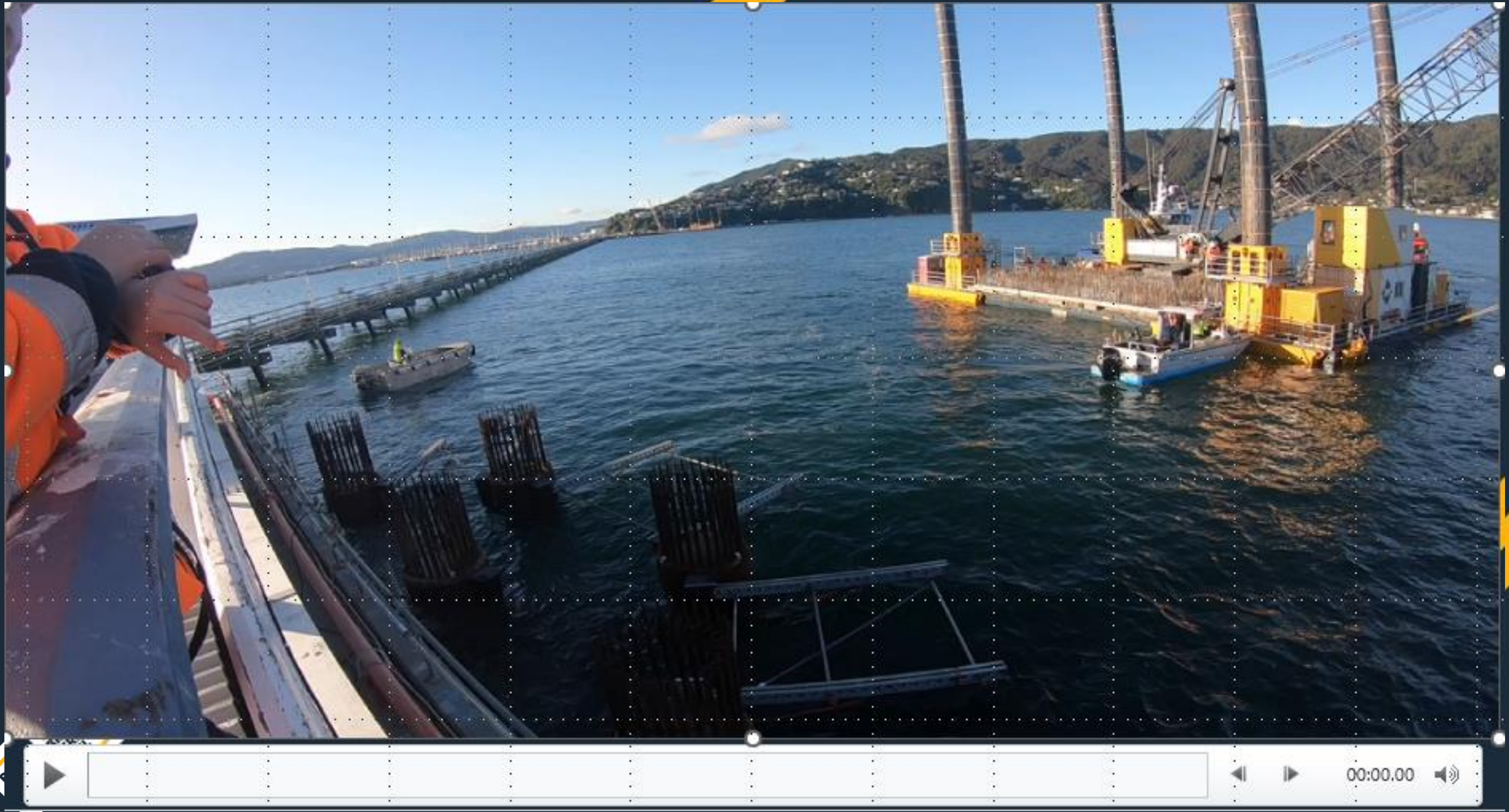
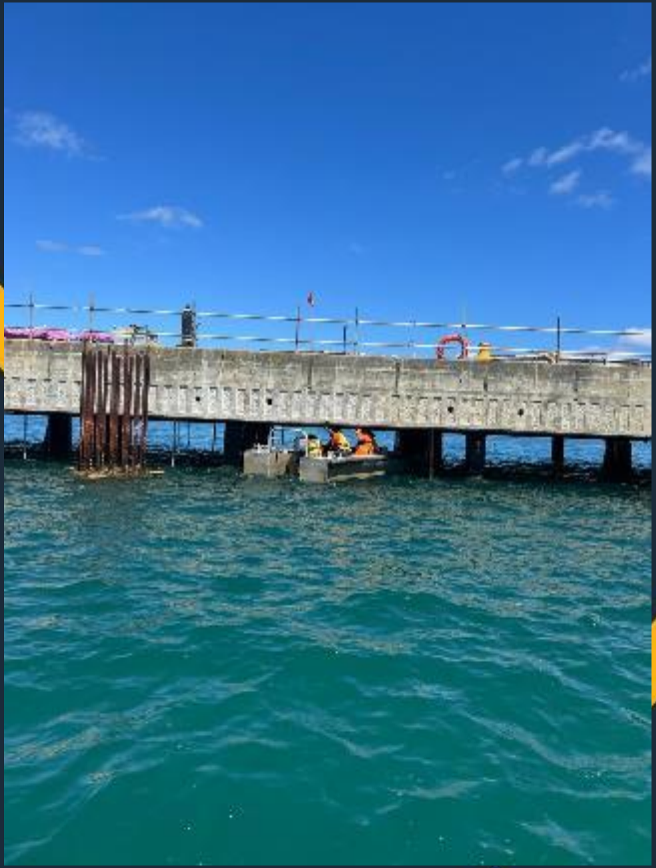


ENGINEERING ASPECTS | WORKS IN-SITU

ENGINEERING ASPECTS | WORKS IN-SITU

ENGINEERING ASPECTS | WORKS IN-SITU

ENGINEERING ASPECTS | WORKS UNDER THE WHARF



BRIAN PERRY CIVIL

ENGINEERING ASPECTS | WORKS UNDER THE WHARF

Q&A

wsp

South Port NZ
Te Pūkorokoro o Murihiku

Town Wharf Rebuild

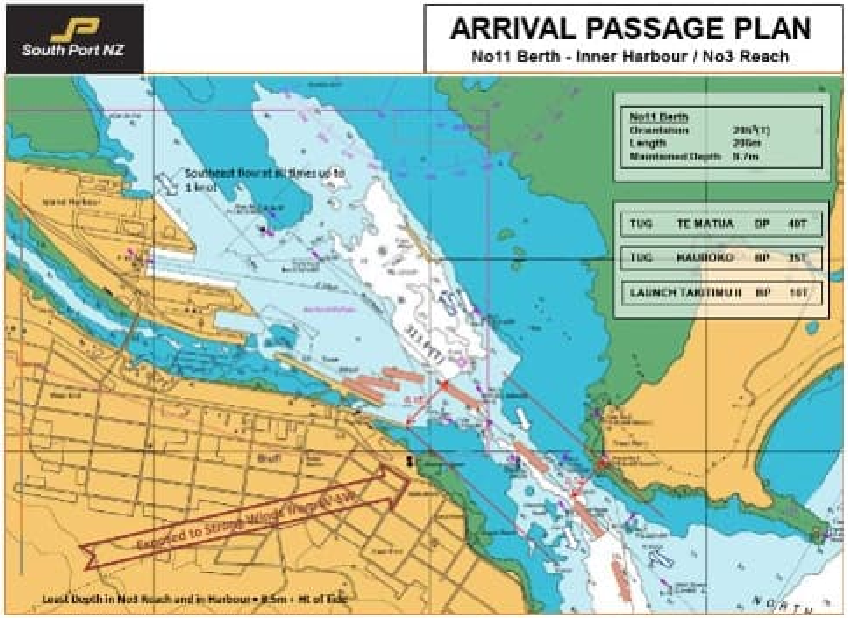
BRIAN PERRY CIVIL
Made possible

Background

- Town Wharf was constructed in 1863-67 after a vessel supply post and shore whaling station were established in the mid 1820s and 30s.
- Mooring bollards along the berth face fixed to a berth face concrete edge beam were added in 1976.
- Mooring dolphins were added in 1996.

Background

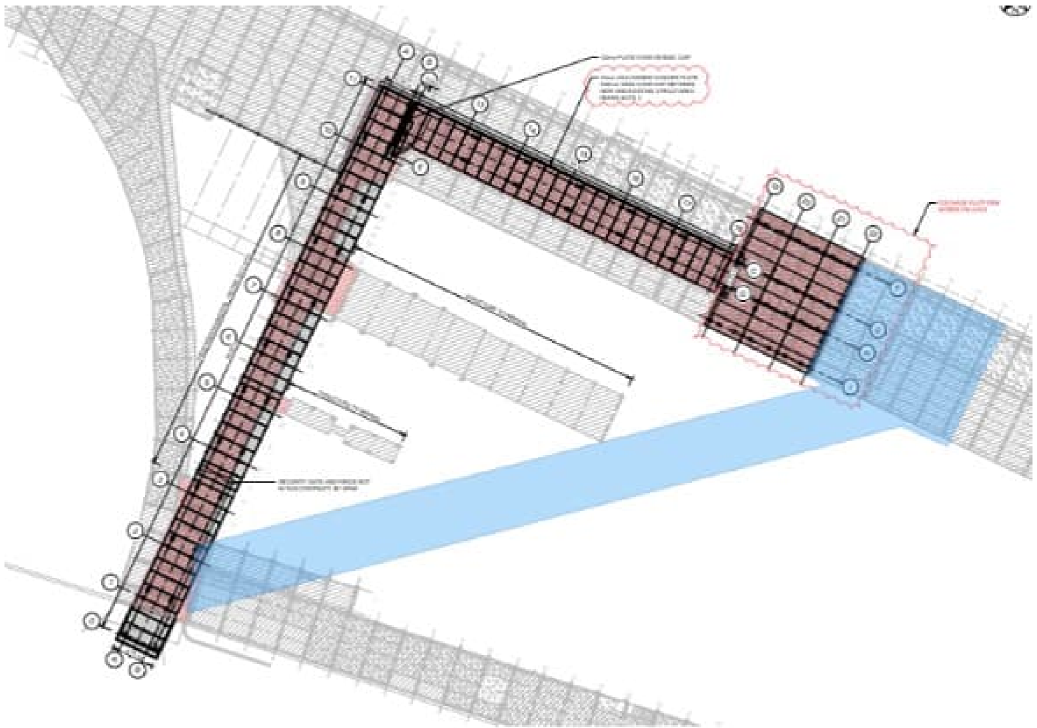
- The structure was inspected periodically.
- A reduced level of service and localised cordons were included in a condition report in 2006.
- The wharf was reported as “beyond routine maintenance”, with “physical remaining life exhausted” by 2016. Concluding that reactive and continued maintenance were required to extend the useful life.
- SPNZ commissioned the design of a new access structure and discharge platform in 2018.



Background

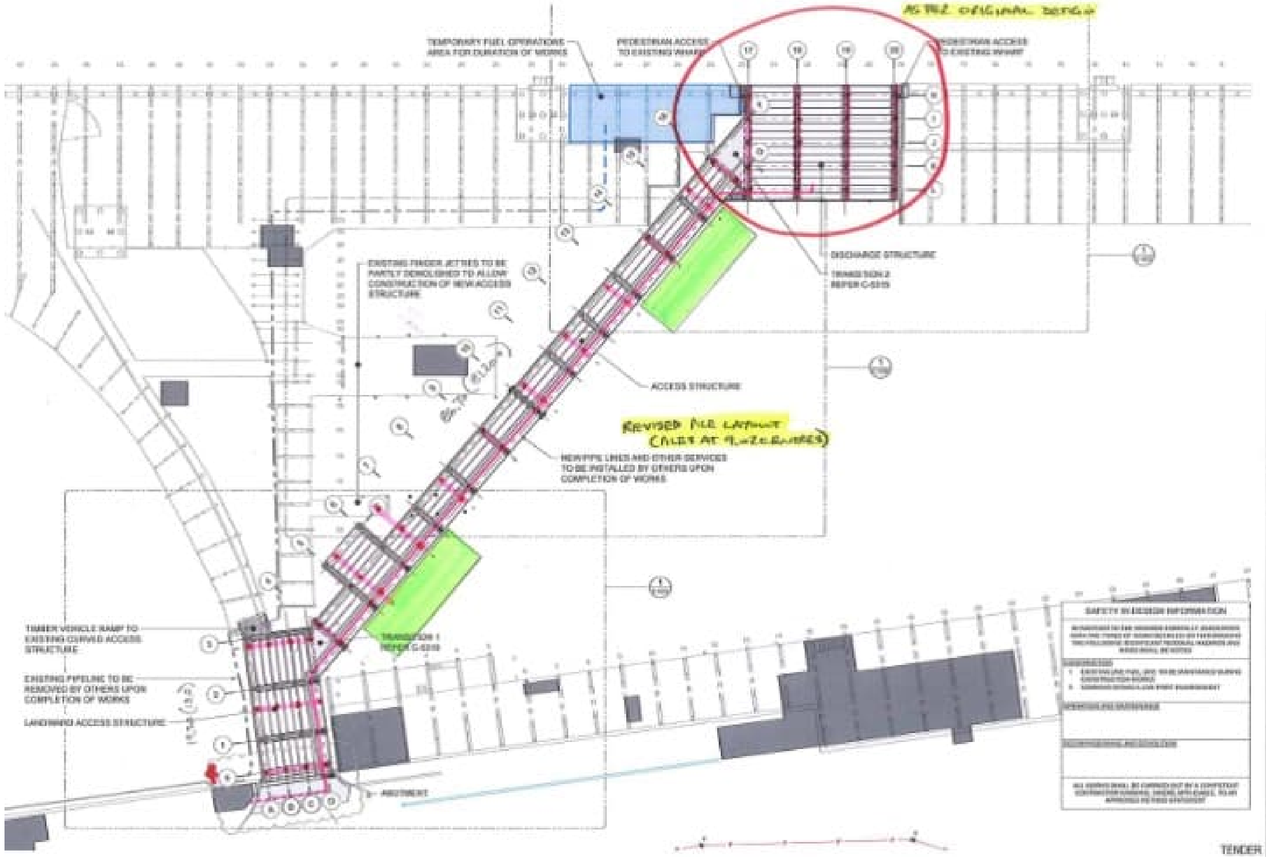
Initial Design

- 508 mm dia piles with rock sockets
- 650 mm x 900 mm concrete capping beam
- 350 mm x 1100 mm precast concrete deck units
- Temporary works
  - Temporary Staging
  - Demolition assessments
  - Pile gates
  - Falsework and Formwork over water



Background

- BPC selected as the preferred constructor following the tender process
- Offered the opportunity to save some money by reducing temporary works.



SPNZ Drivers

Must haves:

- Support the discharge pipeline
- Withstand highway vehicle load capacity
- Have a 50 year design life

Nicer to haves:

- Be a durable and maintainable structure
- High value on functionality
- Constructable in an operating port environment – able to stop at short notice.

Lower value on amenity

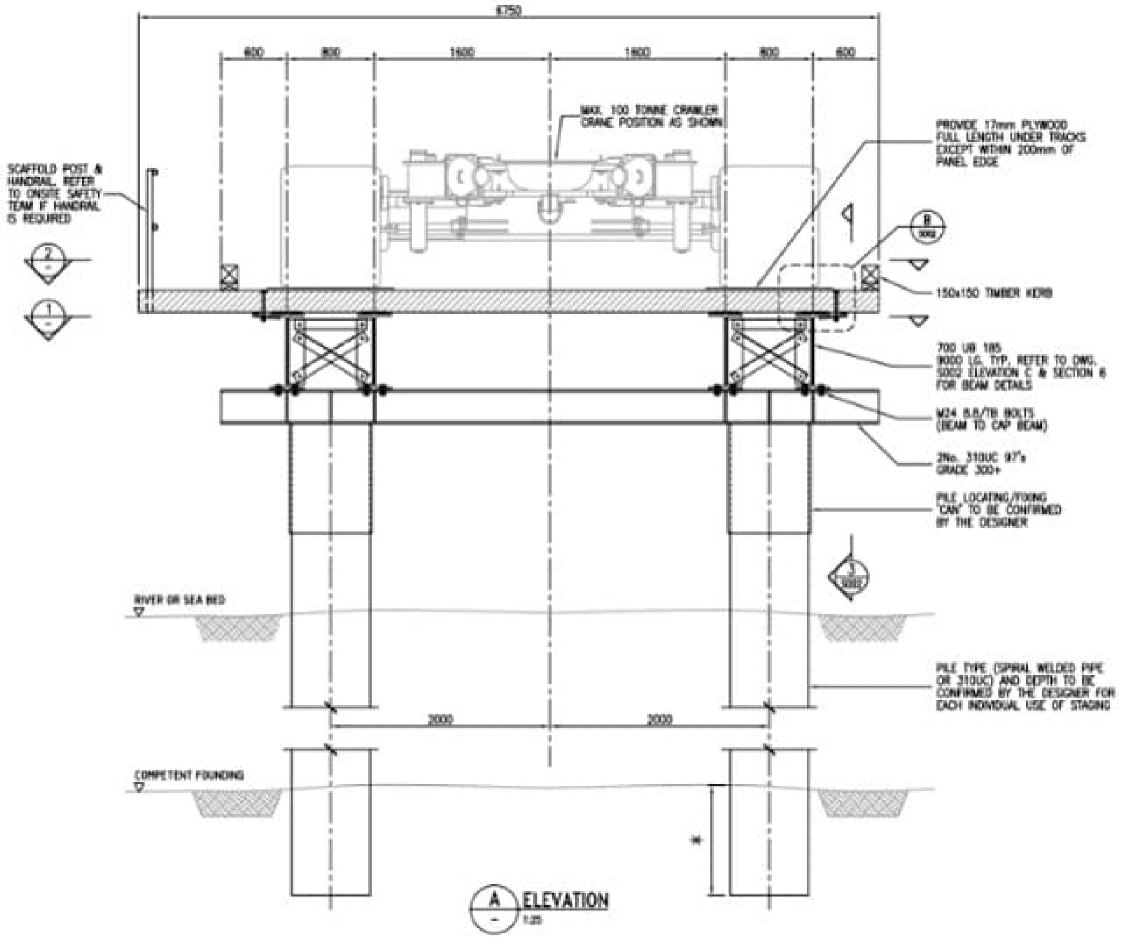
Why build it twice?

Staging can handle a 100T crawler crane so surely it can handle a ute and a pipe?

Modular so limits the amount of site/temporary works

Corrosion?

Design life/Importance Level/Annual Exceedance?



Contractor led design

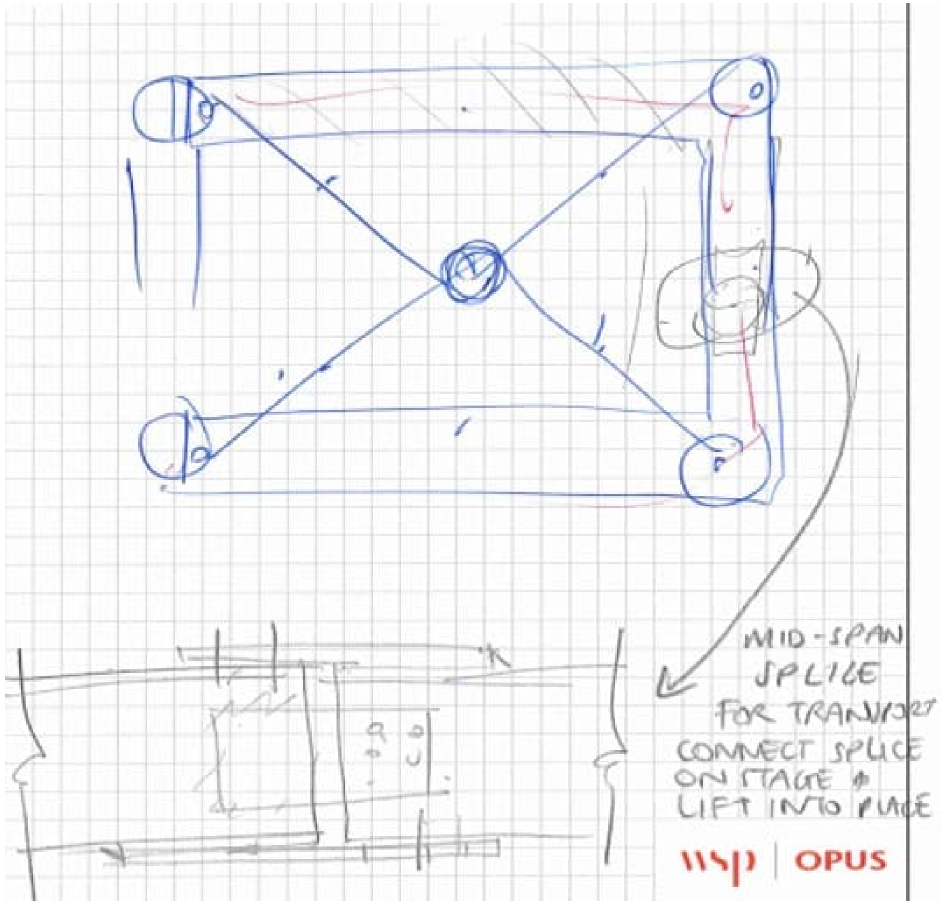
Client takes a bit of a risk as they must choose the contractor before there is any real price tension.

Worked here as BPC and WSP were shown to be cost effective on the previous design.

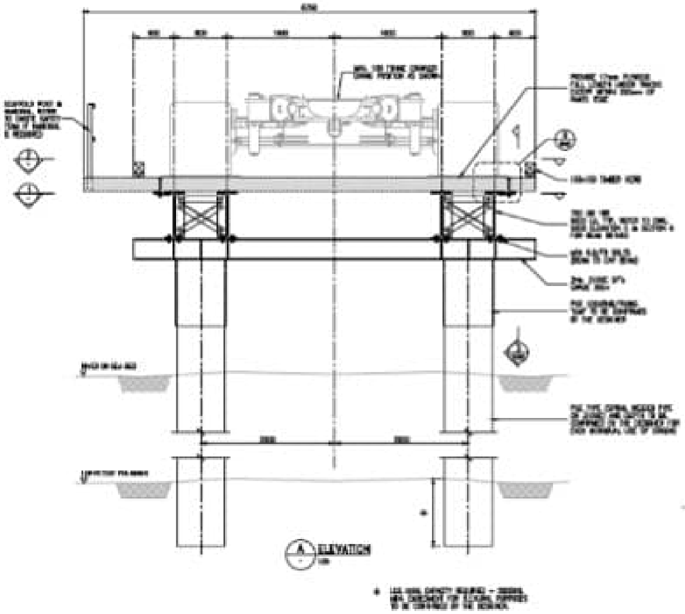
BPC and WSP started completely from scratch.

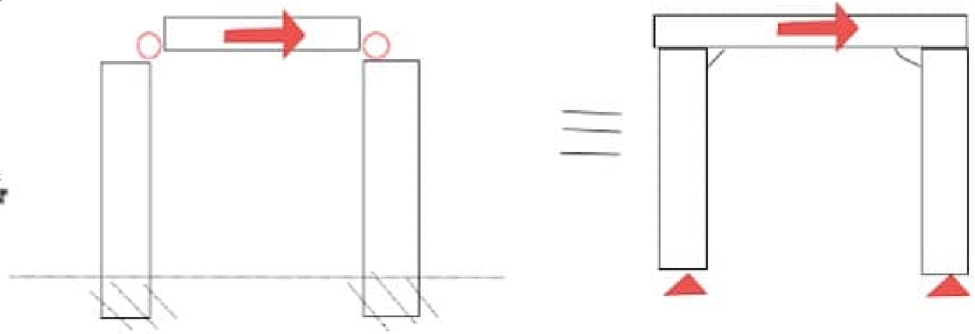
Subcontractor supply chain brought in early too.

BPC tell WSP how they would like to build it and WSP make it work.



Initial Concept





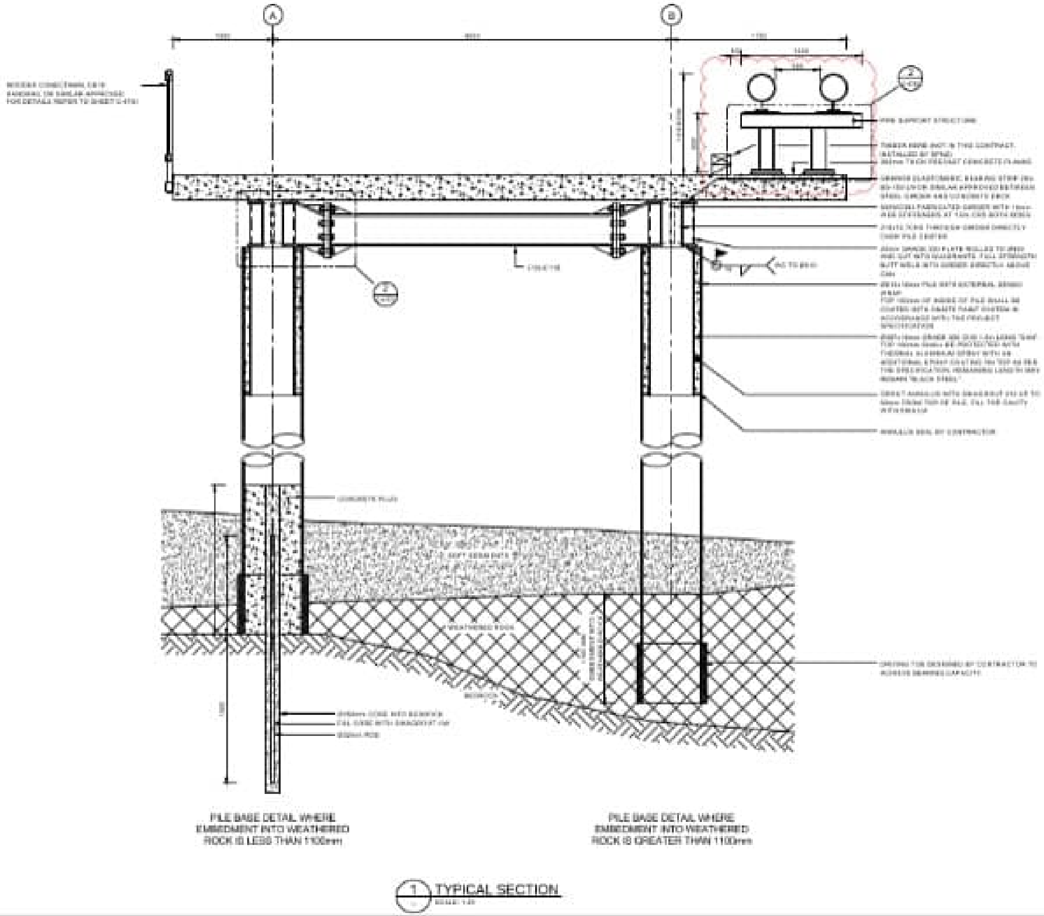
Turn the temporary works reliance on cantilever piles into pinned base portal frames.
In 2 directions

Challenges & Opportunities – (WSP Making it work)

1. Connections:
   - Steelwork details
   - 'CAN' grouting
   - Pinned base

2. 'Limited' borehole data
3. Lateral load during construction
4. Seismic Importance Level and displacements
5. Durability

Steelwork details



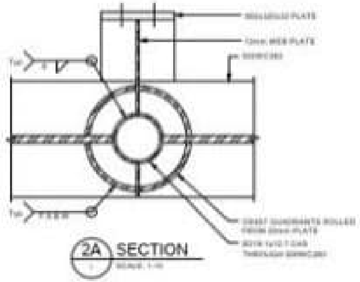
Sub-assemblies for handling and transportation

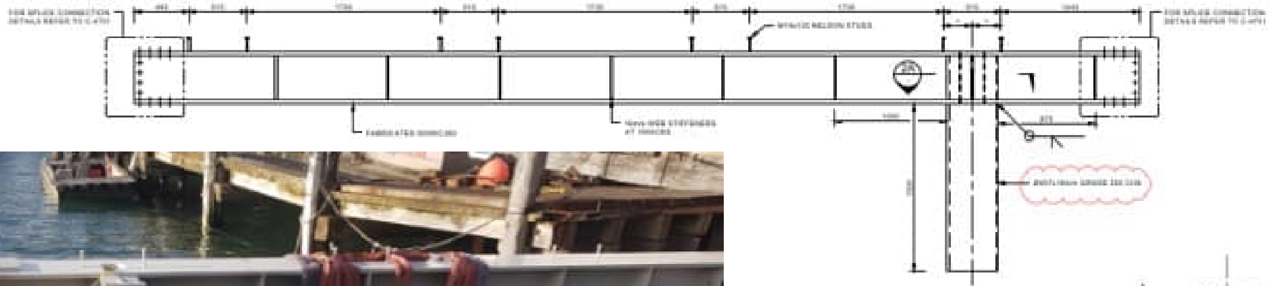
Repetition is a friend – live port environment so need to be able to stop quickly – fabricating offsite

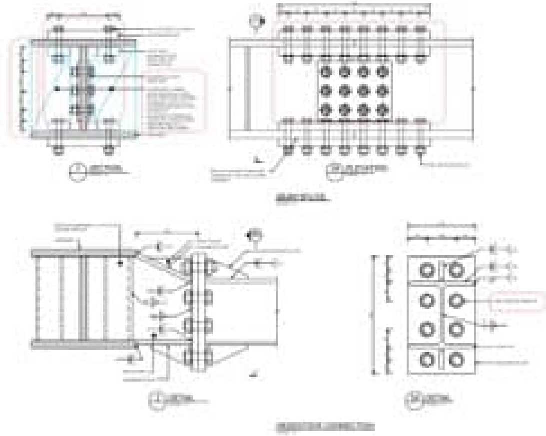
Set-out to avoid clashes with existing piles

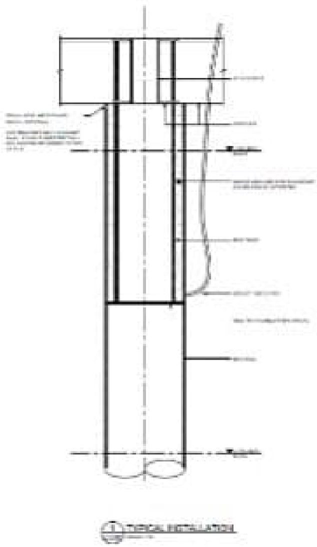
Critical Path activity is pile install. Detailing to take anchor install off the critical path as a follow on trade.

Steelwork details





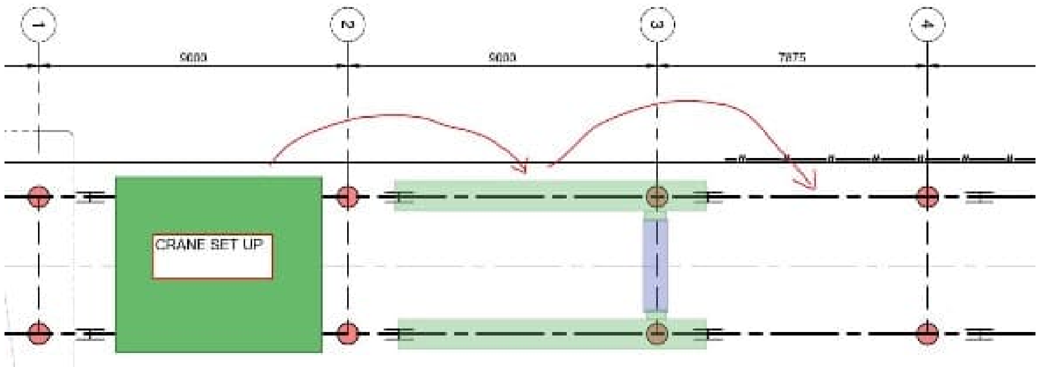


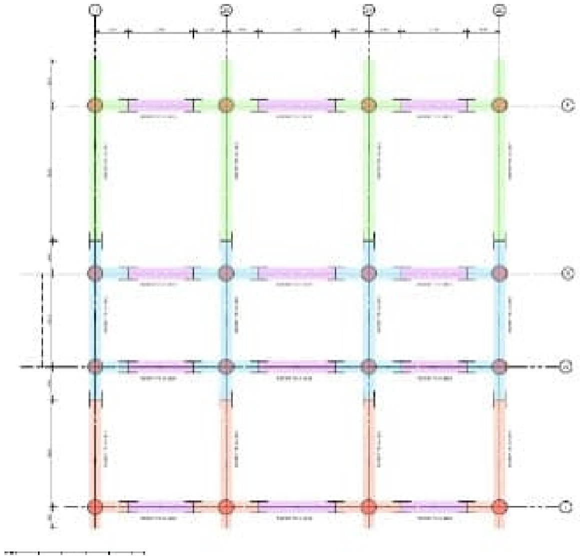


Steelwork details

Sub-assemblies for handling and transportation

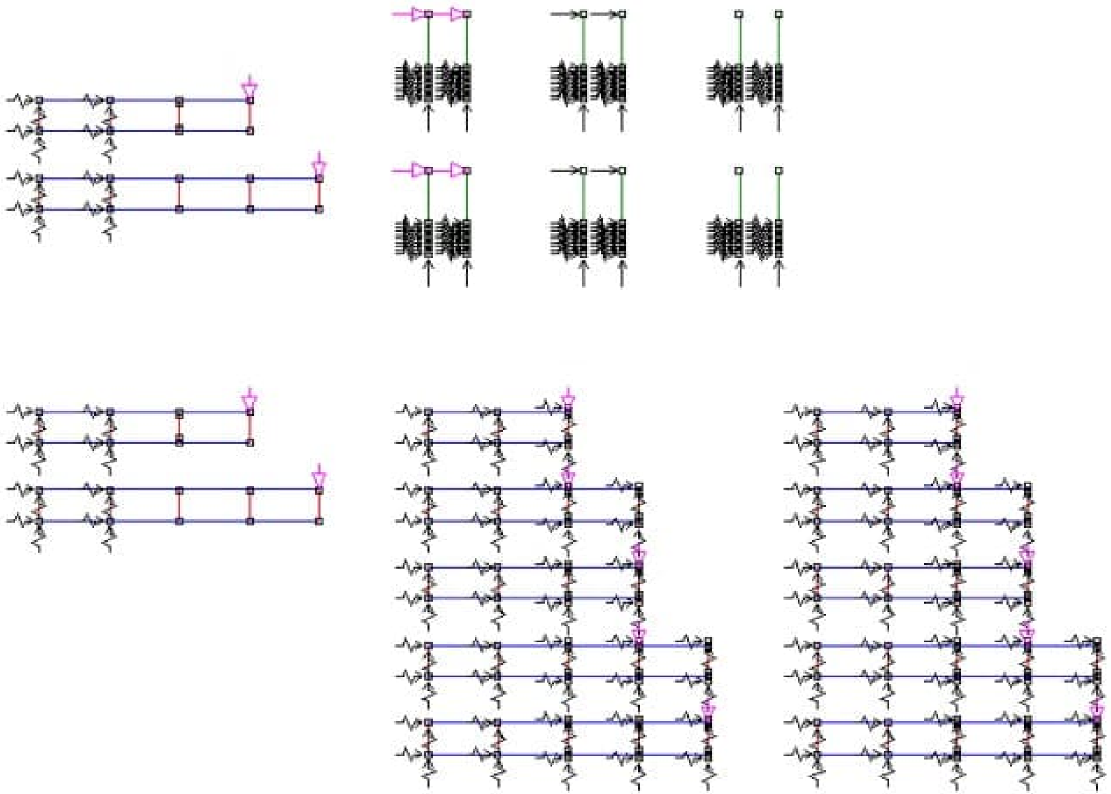
Repetition is a friend





Construction stage load demands

Take CAN grouting off the critical path



Picture frame / Vierendeel portal on plan capacity limited by weak axis bending of headstock at the corner

BRIAN PERRY CIVIL Made possible

Importance Level – NZS1170 and OCIMF, ISGOTT=> MOTEMS, 31F & Displacements and details

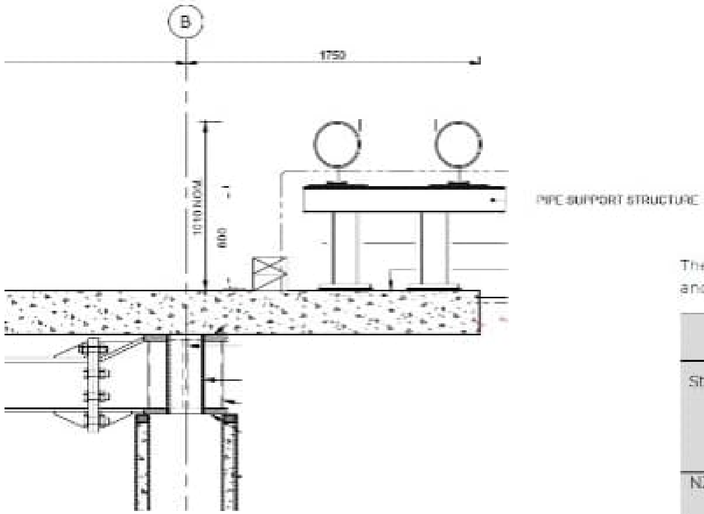


TABLE 31F-4-1
SEISMIC PERFORMANCE CRITERIA[1,2]

SPILL CLASSIFICATION[3]	SEISMIC PERFORMANCE LEVEL	PROBABILITY OF EXCEEDANCE	RETURN PERIOD
High	*Level 1*	*50% in 50 years*	*72 years*
	Level 2	*10% in 50 years*	*475 years*
Medium	*Level 1*	*65% in 50 years*	*48 years*
	Level 2	*15% in 50 years*	*308 years*
Low	*Level 1*	*75% in 50 years*	*36 years*
	Level 2	*20% in 50 years*	*224 years*

1. For new MOTs, see Section 3104F.3.
2. For marine terminals transferring LNG, return periods of 72 and 475 years shall be used for Levels 1 and 2, respectively.
3. See Section 3101F.6 for spill classification.

The following table provides a comparison of the seismic design criteria between MOTEMS and NZS 1170.0

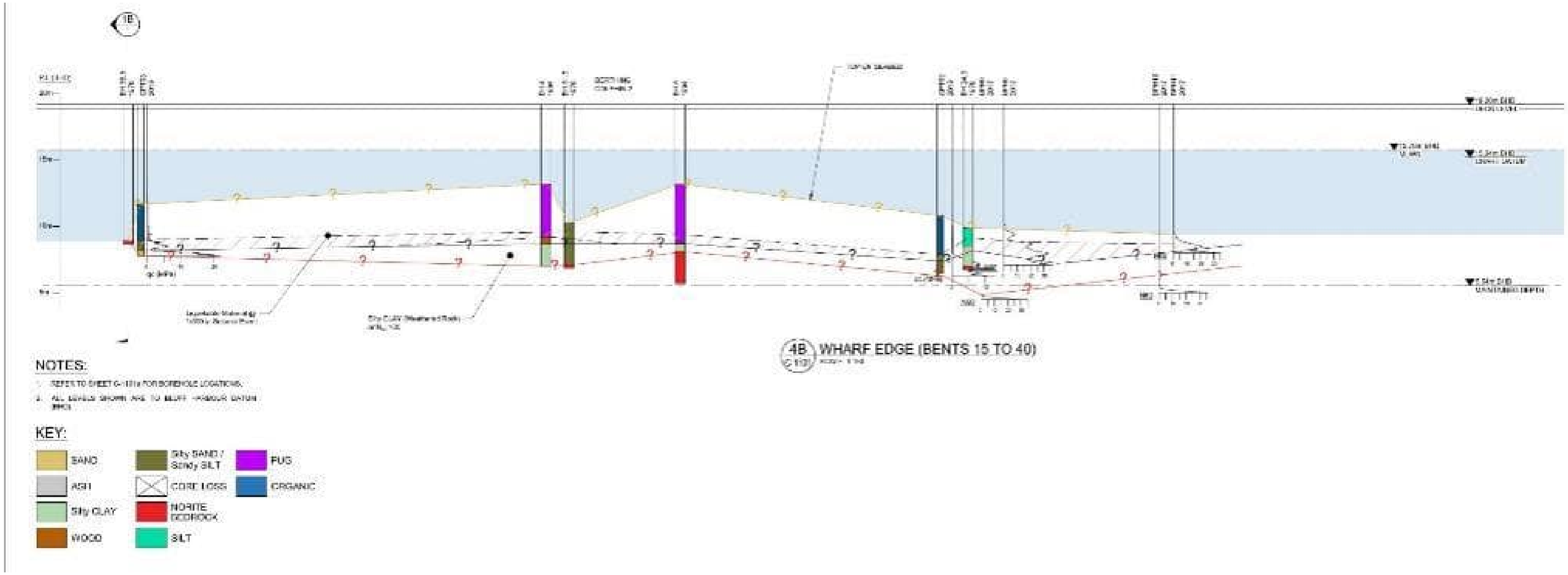
	Performance Objective Comparison		
Standard/Code	Minor/no structural damage, temp or no interruption in ops	Temp loss of ops (months), prevent major spill, repairable damage	Prevention of collapse
NZS 1170.0 (IL3)	1 in 25 years 87% prob. of exceedance in 50yrs	Not required	1 in 1,000 years 5% prob. of exceedance in 50yrs
Chapter 31F (MOTEMS)	1 in 48 years 65% prob. of exceedance in 50yrs	1 in 308 years 15% prob. of exceedance in 50yrs	1 in 308 years 15% prob. of exceedance in 50yrs

Steelwork details

Ground Model

The ground profile was variable across the site but typically comprises:

- Marine sediments between 0.0 and 5.3 m thick,
- Silty clay (weathered rock) between 0.0 and 2.9 m thick, and,
- Norite bedrock (with some variation over the length of the structure)



Geotechnical Challeges

- **Seismic Performance**

  I. Liquefaction triggering expected in marine sediments (1 in 500 years)

  II. Lateral Spreading possible due to ground profile

  III. A significant portion of marine sediment remains non-liquefiable therefore act as a crust causing significant lateral loading.

  IV. Significant at interface between wharf and reclamation due to elevation change.

- **Proving lateral pile capacity - Weathered rock density varies (N60 12 to 50+) making it difficult to confirm pile embedment.**

Solutions – Sensitivity Analysis and Observational Methods

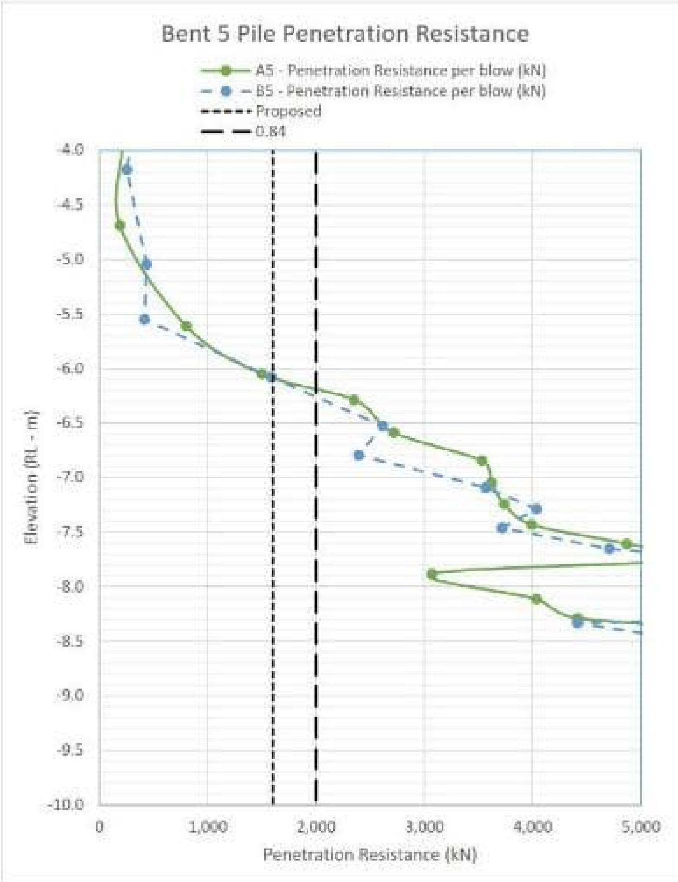
- **Embedment for lateral capacity:**
  - Assess pile embedment length required to achieve toe fixity with PDA unit
  - Anchor method developed for use if embedment could not be achieved.
- **Approach agreed at ECI stage:**
  - Only install anchors where necessary, reduced SI, not overconservative, cost per anchor sits on contingency/risk schedule

wsp

Developing Driving Correlations

BRIAN PERRY CIVIL
Made possible

Developing Driving Correlations



Continued Monitoring and Development

Temporary works

- Pile gates – just cut holes in the existing wharf.
- Bracing for the deeper water section.
- Minor formwork for discharge platform pour.
- Access structure to bolt up the connections

Acknowledgements:

SouthPort NZ
Eastbridge
Helidrill
Pipelines stakeholders
Berth users
Octa PM
WSP regional office – Engineer's Assistant and MSQA leads
WSP Survey and Geotechs

wsp.com/nz

Thank you

wsp

BRIAN PERRY CIVIL

Made possible

MATIU/ SOMES ISLAND WHARF RENEWAL

Kyle Marshall

BRIAN PERRY CIVIL
Made possible

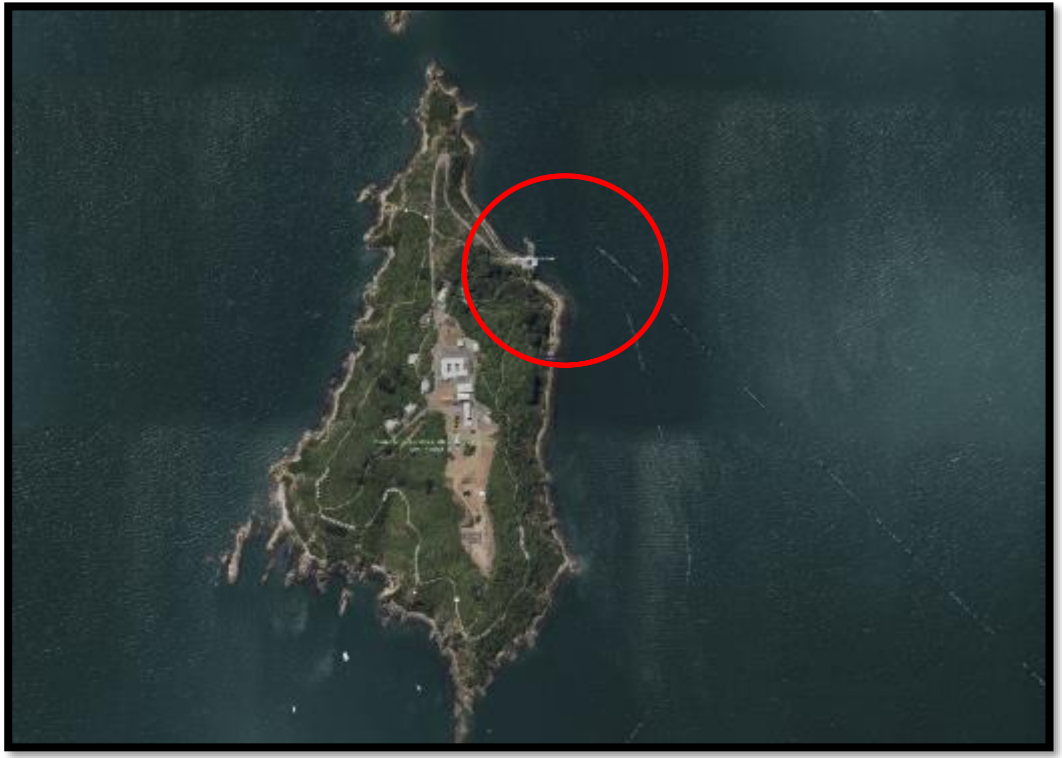
WHO'S WHO ON THE PROJECT?

Department of Conservation
Te Papa Atawhai

Holmes Consulting

BRIAN PERRY CIVIL

PROJECT LOCATION



PROJECT SCOPE

Site Establishment and Setup

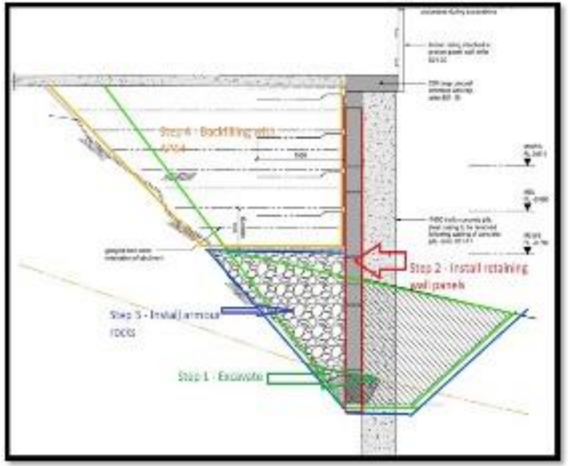
Construction of Boat Ramp

Demolition of Old Wharf

Construction of Seawall

Construction/Replacement of Abutment Wall

Piling and Structure Work for New Wharf



PROJECT SCOPE

Construction of Seawall & Abutment Replacement

Demolition of Old Wharf

Construction of New Wharf

Boat Ramp Construction

CONSTRUCTION OF THE BOAT RAMP

METHODOLOGY

- Build bund for dry working conditions
- Excavate down to formation level
- Install formwork
- Backfill sub-base inside formwork creating shear key
- Lay mesh
- Pour slab

CONSTRUCTION OF THE BOAT RAMP

CHALLENGES

Concrete mix design

- 2 Hours transport time (from batching to placing)
- 100mm slump required for pouring on a grade
- Concrete to remain workable enough to discharge
- 28m3 of concrete required

Set out

- Varying grades falling in two directions

Solution

- Create a 3D surface using AutoCAD Civil 3D software and have a surveyor monitoring as the works are completed.

Alternative Solution

- Introduce machine control for the excavation and backfill (not cost effective for the size of this project)

DEMOLITION OF EXISTING WHARF

METHODOLOGY

- Remove wharf crane
- Remove wharf furniture
- Saw cut concrete deck
- Remove deck (cut and lift using excavator)
- Remove joists
- Remove timber piles (Cut at seabed using divers

DEMOLITION OF EXISTING WHARF

CHALLENGES

<u>Structural Stability of existing wharf</u>

- Wharf is in very bad structural condition and sequencing requires approval to ensure safety when deconstructing

Solution

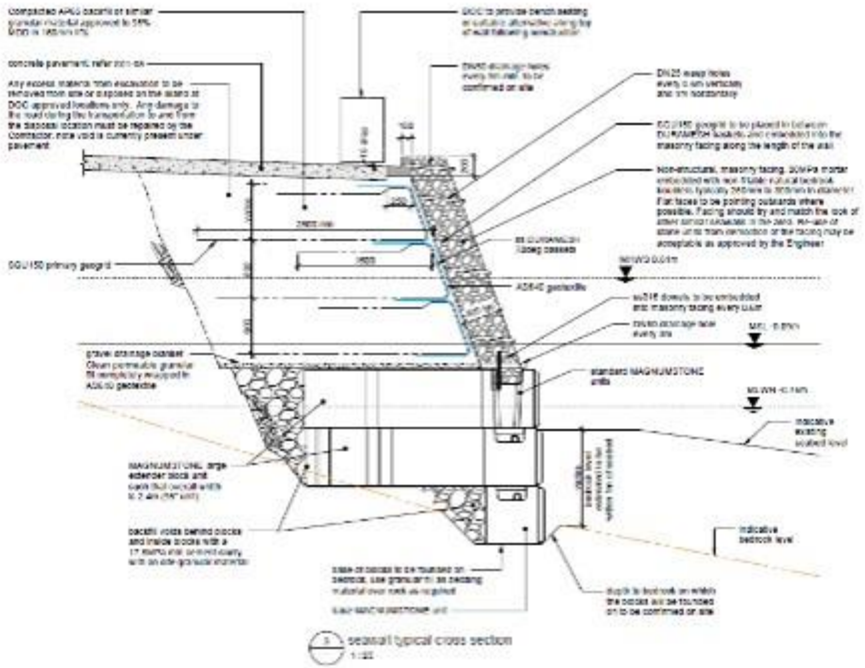
- Detailed methodology submitted to designers to complete structural analysis prior to starting the works.

<u>Environmental Control</u>

- Silt curtain placed into the water to ensure any loose debris does not float away into the harbour.

CONSTRUCTION OF THE SEAWALL

- Demolish old seawall
- Excavate existing ground back to design
- Breakout bedrock at base of Magnumstones
- Place Magnumstones in tidal zone
- Backfill behind Mangnumstones
- Place Duramesh baskets backfilling behind and placing the masonary face. (600mm each time)
- Pour new concrete slab



CONSTRUCTION OF THE SEAWALL

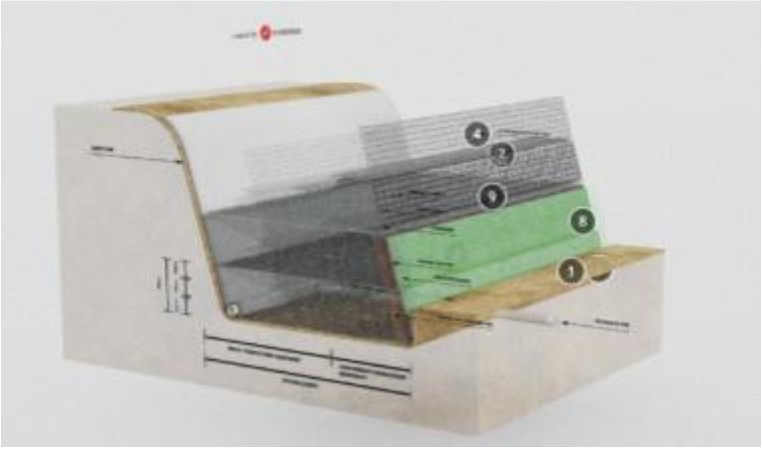
CHALLENGES

Placing Magnumstones in tidal zone

- Ensuring the bedrock is level for the first Magnumstone
- Ensuring the line of the Magnumstone is correct when working in the tidal zone

Solution

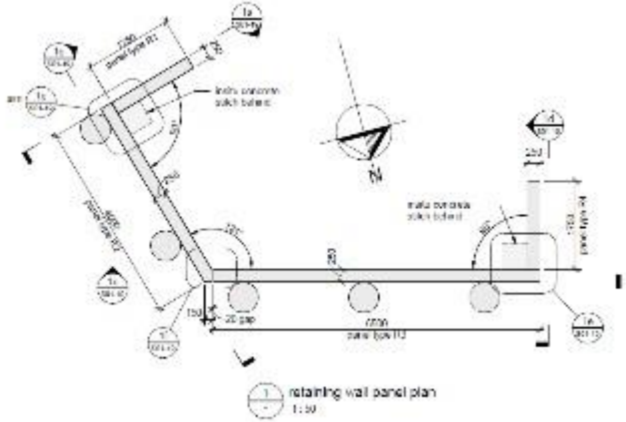
- Using divers to inspect the bedrock before landing the base blocks
- Working at low tide with a surveyor in the water to position the blocks

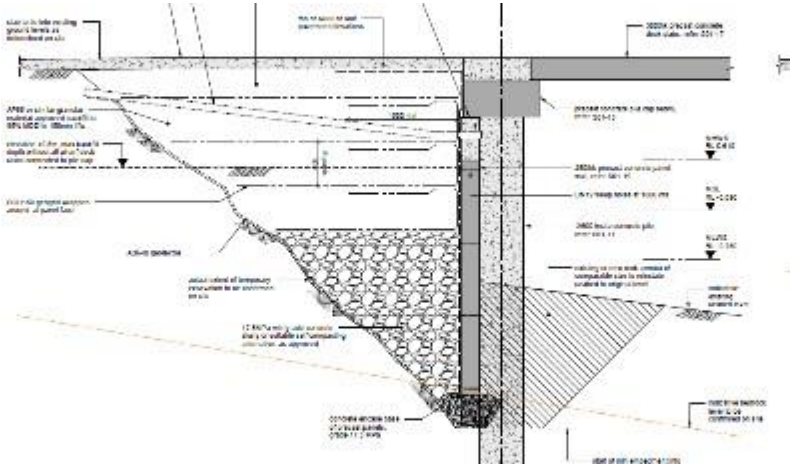


CONSTRUCTION OF ABUTMENT WALL

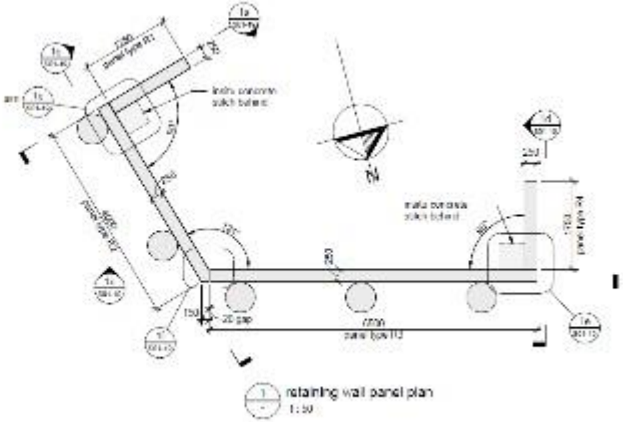
METHODOLOGY

- Demolish the existing abutment (breaking concrete & excavating)
- Pour precast abutment walls
- Install the first 5 piles along the abutment
- Breakout bedrock
- Install precast abutment walls
- Backfill behind the abutment walls using concrete slurry and AP65 stone
- Pour in-situ abutment wall to required level
- Land capping beam
- Pour new concrete slab





CONSTRUCTION OF ABUTMENT WALL



CHALLENGES

Bedrock breakout level

- Breaking out the bedrock under the water will be difficult to get level ready for the precast

Solution

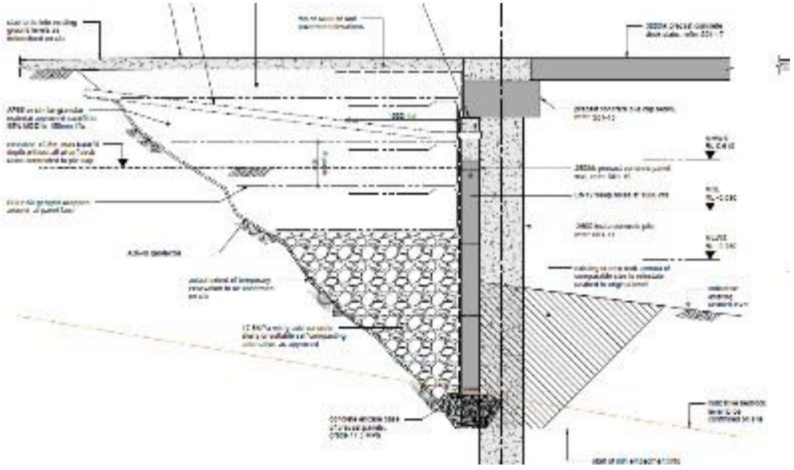
- Using divers to inspect the breakout surface prior to landing the precast walls

Temporary works to support abutment walls

- Temporary propping is required to support the walls until the backfill has been placed, this is difficult to design prior to the excavation as the extent of the excavation is to be confirmed on site.

Pouring concrete below tidal zone

- The bottom of the abutment walls is to be encased in concrete below the tidal zone.

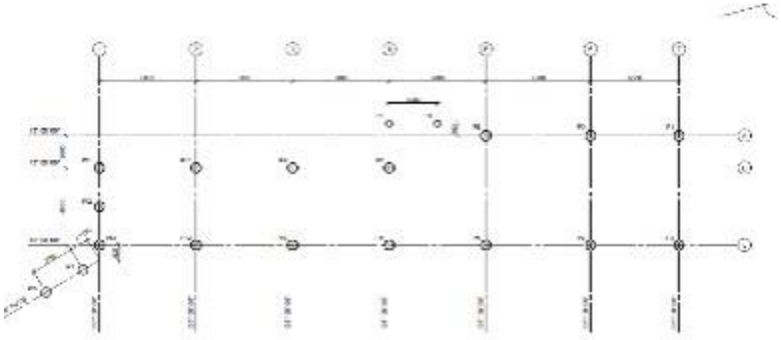


CONSTRUCTION OF NEW WHARF

METHODOLOGY

- Install 17No. Reinforced concrete piles (600mm dia)
- Install Clamping/ Bracket system to support precast capping beams
- Pour precast beams & deck panels (at precast yard)
- Place precast beams and deck panels
- In - situ concrete pours

CONSTRUCTION OF NEW WHARF



METHODOLOGY – PILING

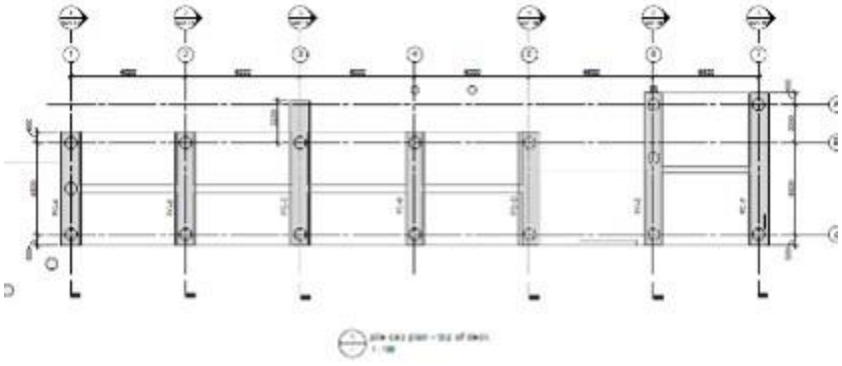
- Piling using 150Ton Jack up Barge
- Float barge into position
- Install a piling gate to the barge locks to position the pile
- Screw the casing into the ground using the drill rig
- Excavate the pile using drill rig
- Install reinforcement
- Pour the pile

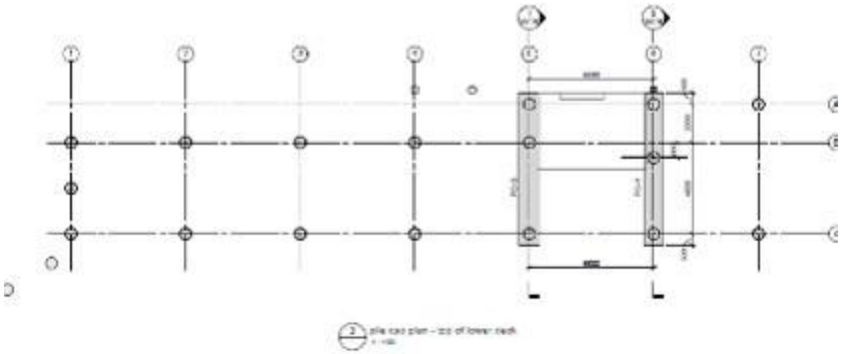
- Starting from GL1 and working out to GL7
- 40mm tolerance for piles

CONSTRUCTION OF NEW WHARF

METHODOLOGY – PRE-CASTING

- Due to tight tolerances we are going to precast the beams and panels in position at our precast yard (Build It before you Build it approach)
- This will allow us to precast at the same time as piling and not have to wait for asbuilt information
- We will land the precast panels using our 150Ton jack up barge and 100Ton crane, BPC increased the size of the precast panels to save time in the programme .
- Prior to landing the precast we will need to install pile supports to the piles





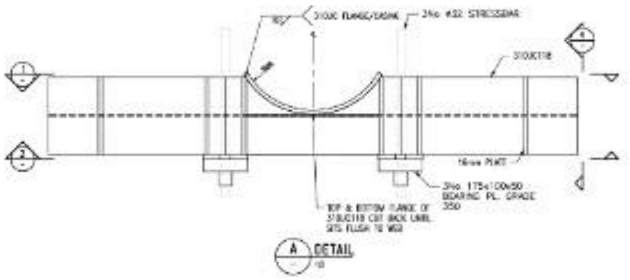
CONSTRUCTION OF NEW WHARF

METHODOLOGY – PILE CLAMPING

- Two methods – Friction clamps vs welded supports

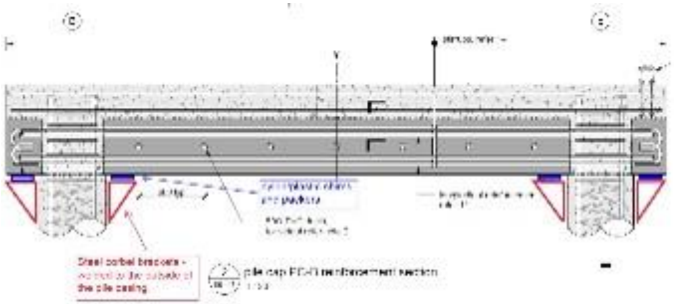
Pile clamps

- Difficult to install and remove in the marine environment
- To de stress the bar the bar would need to be protected from corrosion at all times
- Would save time in the programme if there was an effective installation method
- Expensive to fabricate



Welded pile supports

- Difficult to weld in the tidal zone, combination of normal and underwater welding required
- Easier to handle as they are not as heavy
- Can remain in place after the works
- Takes time in the programme to complete welding (increased risk of weather delay)



BIO SECURITY

Looking after the island:

DOC administers Matiu Somes Historic and Scientific Reserve for the owners Taranaki Whānui, to provide a refuge for some of New Zealand's most threatened species. One of the greatest threats to the species living on the island is the introduction of plants, animals or diseases that do not naturally occur there.

The most common way that these threats can arrive is via people - in their gear, bags and clothing.

It is possible that insects (e.g. Argentine ants or white-tailed spiders), lizards (e.g. rainbow skinks), rodents and diseases that affect birds or reptiles can be transported to islands on or in gear and equipment.

MATIU/ SOMES ISLAND WHARF RENEWAL

QUESTIONS ?

Kyle Marshall