ITA TUNNELLING AWARDS 2019

MTR Shatin to Central Link
Contract 1121
Immersed Tube Tunnels
Hong Kong, China

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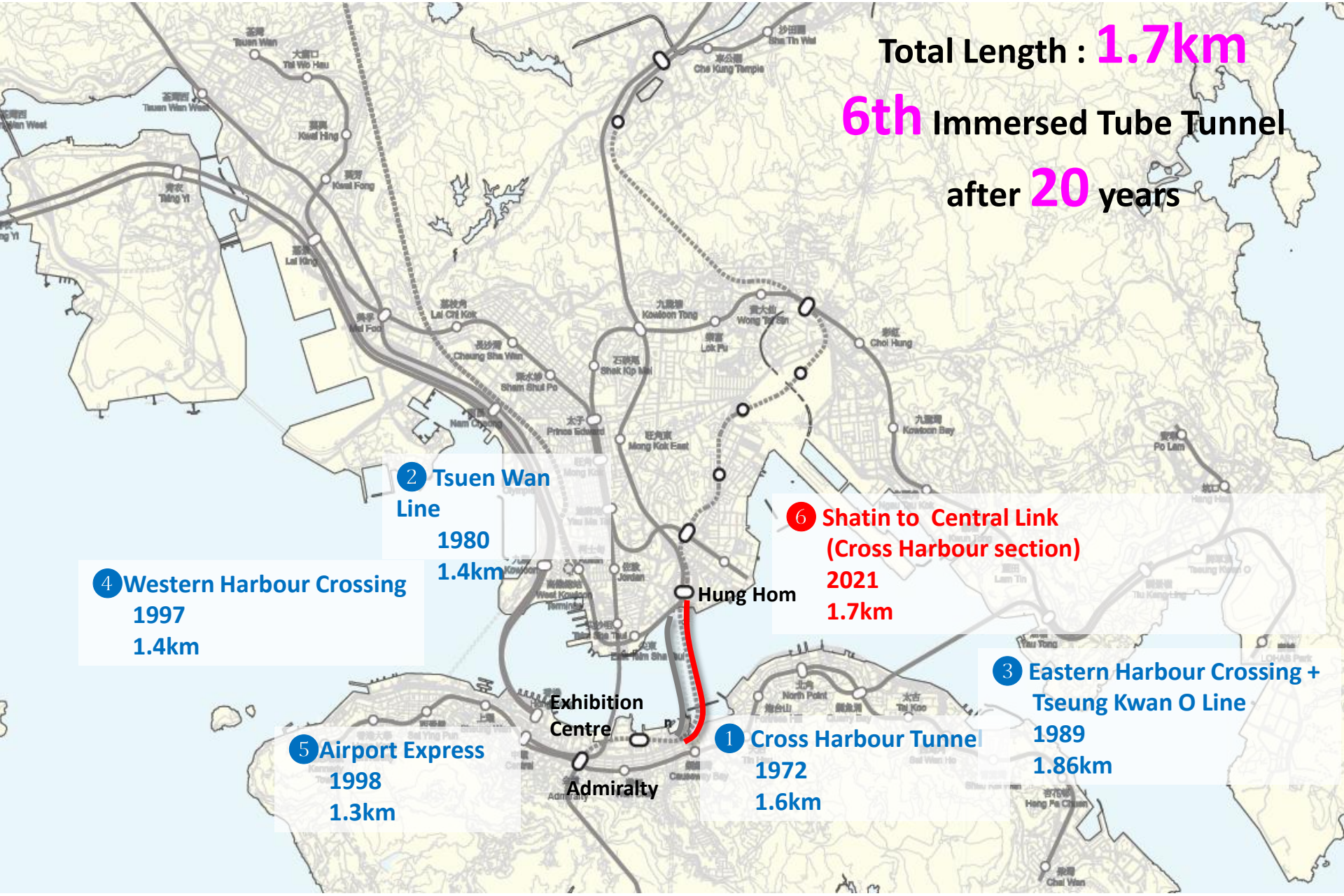
Introduction of SCL

	Existing Journey Time	Estimated Journey time
Hung Hom <-> Admiralty	About 18 mins	About 5 mins


Total Length : 1.7km
6th Immersed Tube Tunnel
after 20 years
2 Tsuen Wan Line
1980
1.4km
4 Western Harbour Crossing
1997
1.4km
6 Shatin to Central Link
(Cross Harbour section)
2021
1.7km
Hung Hom
Exhibition Centre
Admiralty
5 Airport Express
1998
1.3km
1 Cross Harbour Tunnel
1972
1.6km
3 Eastern Harbour Crossing + Tseung Kwan O Line
1989
1.86km

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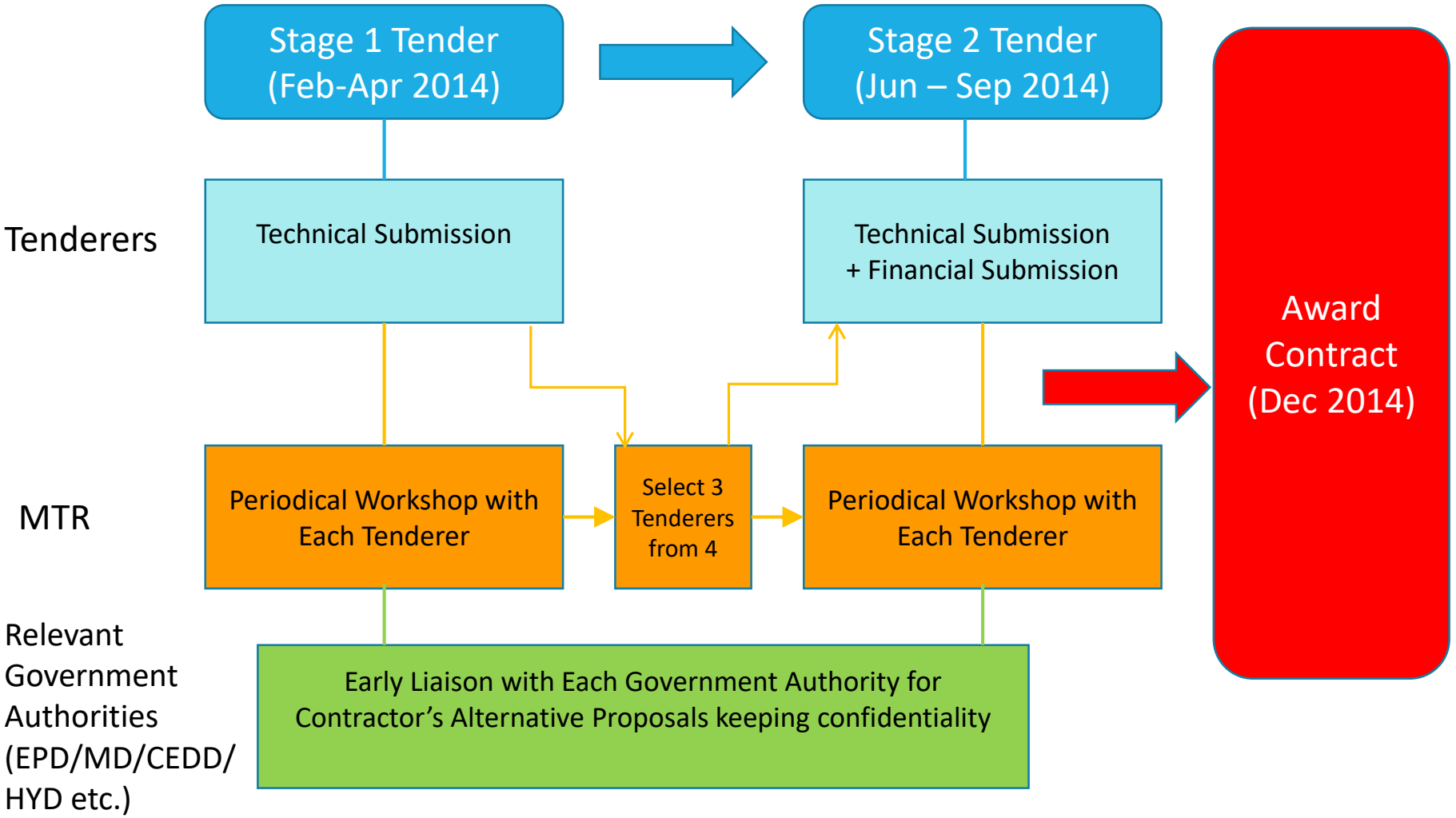
Procurement Process

Early Contractor's Involvement



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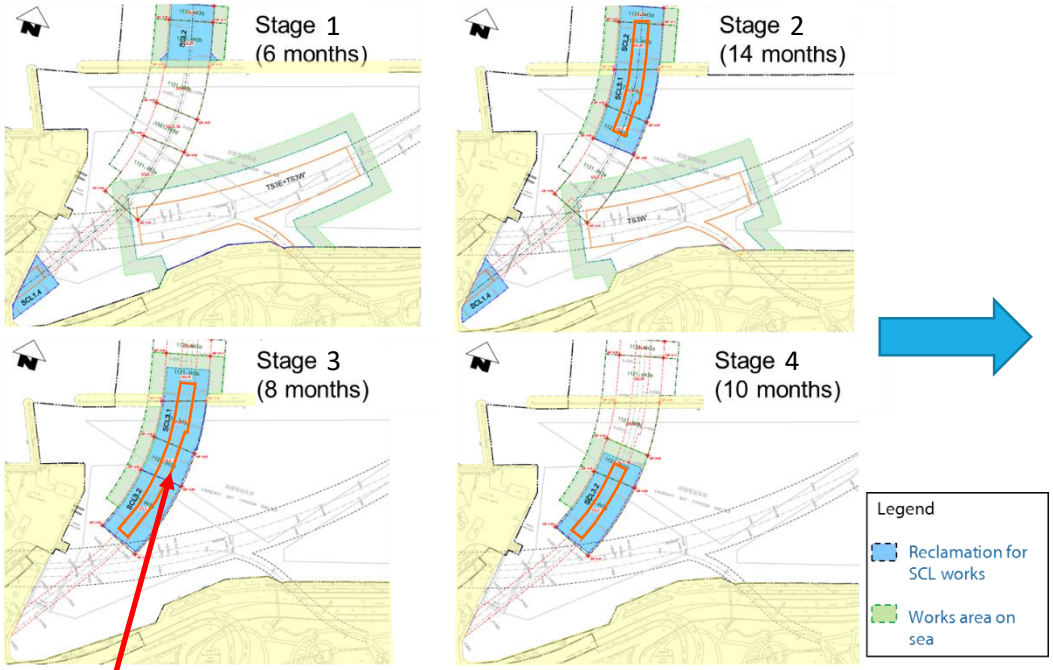
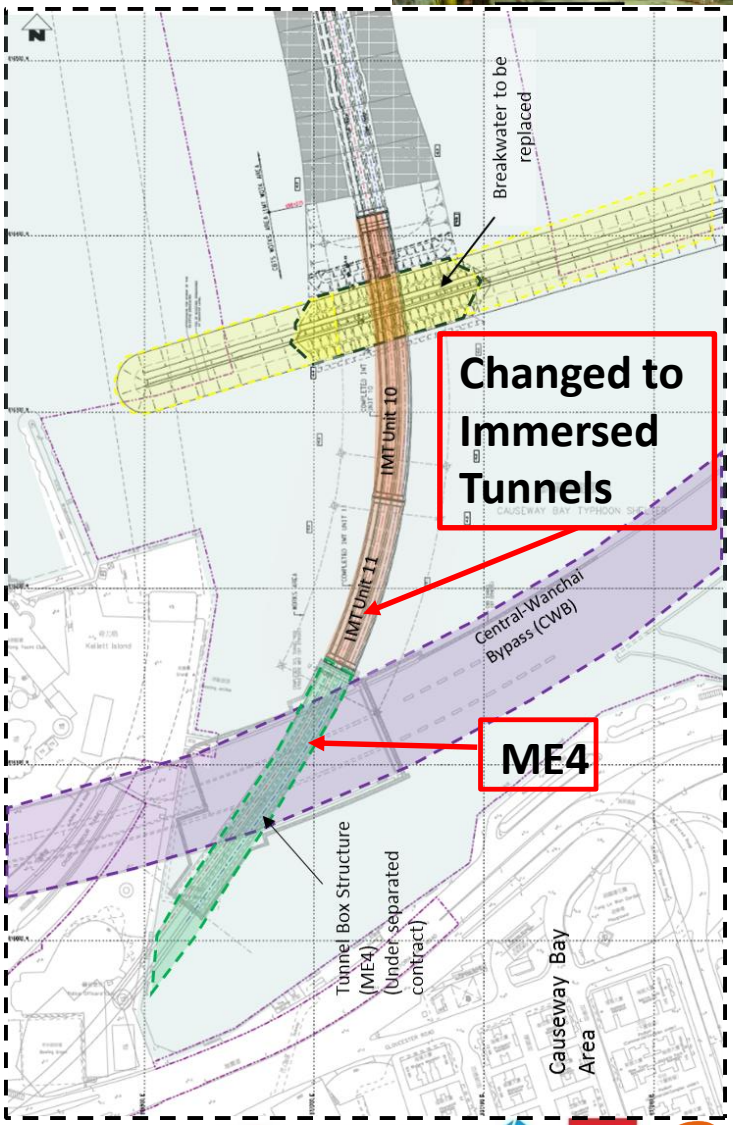
Scope of works: Design and Construction of 1.66km of Immersed Tube Tunnel under Victoria Harbour including 94m of cut and cover tunnel at the Northern Landfall and associated ventilation building.
Client : MTR Corporation Limited
Owner: Hong Kong SAR Government
Client's Designer: AECOM
Contractor: Penta-Ocean – China State JV
Contractor's Designer: Arcadis supported by Capita
Contract Value: HKD 4,350M (€500M)
Contract Duration: Dec 2014 – April 2019

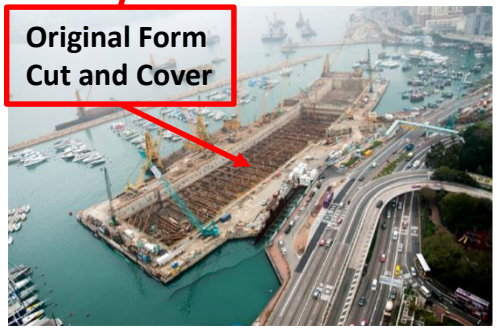
Other key stakeholders: Marine Department / Cross Harbour Tunnel / Central Wanchai Bypass Project / Royal Hong Kong Yacht Club & other typhoon shelter users

Contractor's Alternative Scheme

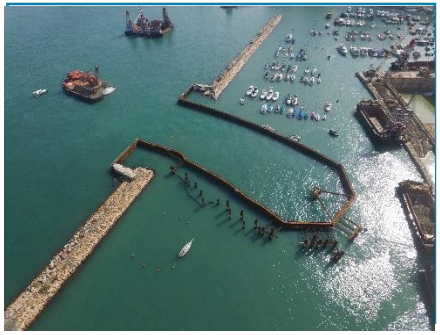




Original Form Cut and Cover



Central Wanchai Bypass (CWB) Under Construction



Temporary Marine Cofferdam

Shortened HUH Cut & Cover Tunnel (From 154m to 94m)

KCRC Freight Head Office

Central - Wanchai Bypass

Replaced CBTS CCT by IMT extension (269m)
Radius = 350m

Cross Harbour Tunnel

Finger Pier

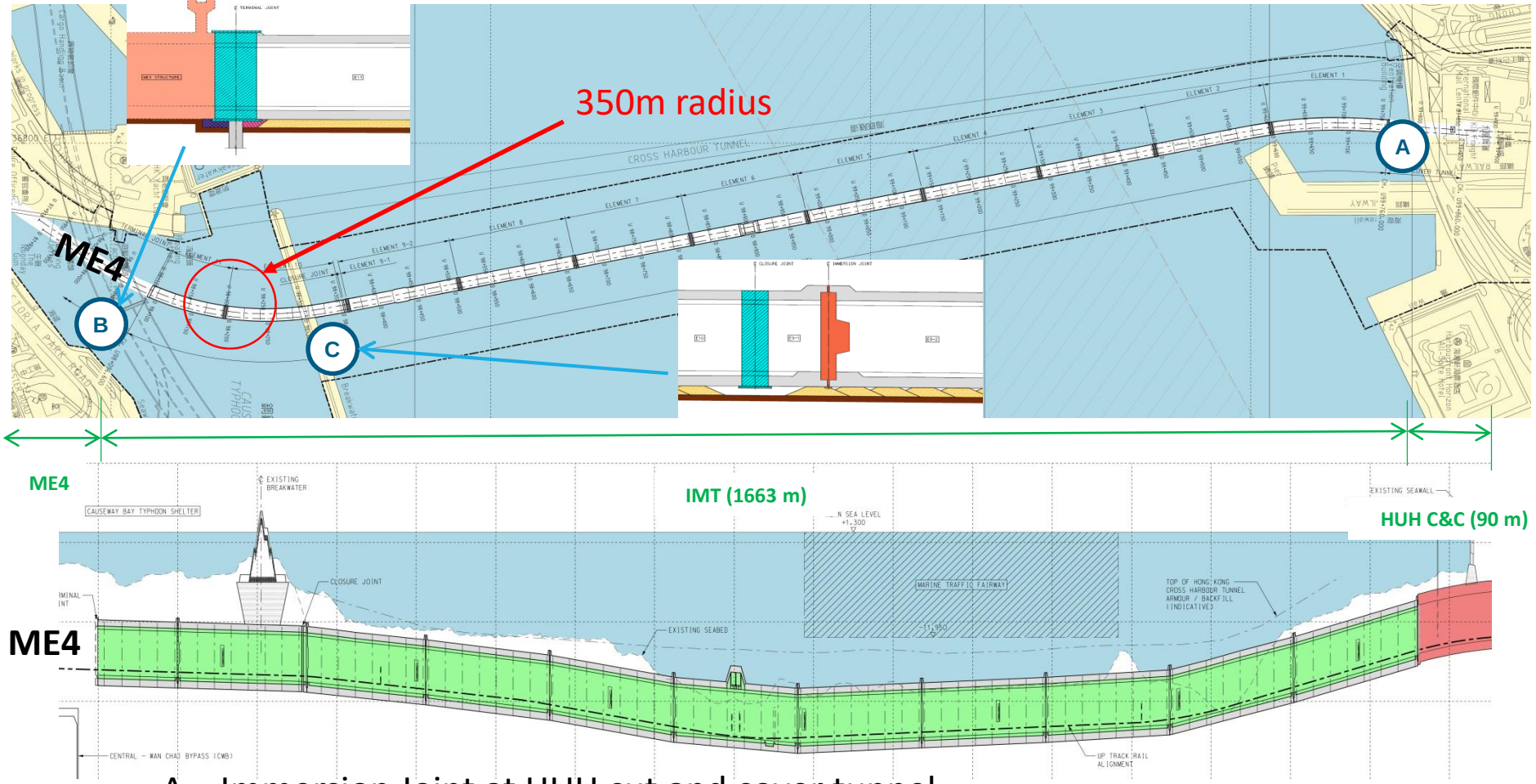
Total Immersed Tube Tunnel
1334 + 269 + 60 = 1663

Hung Hom Bypass

Causeway Bay Typhoon Shelter

Fairway

Contract awarded based on Alternative Tender



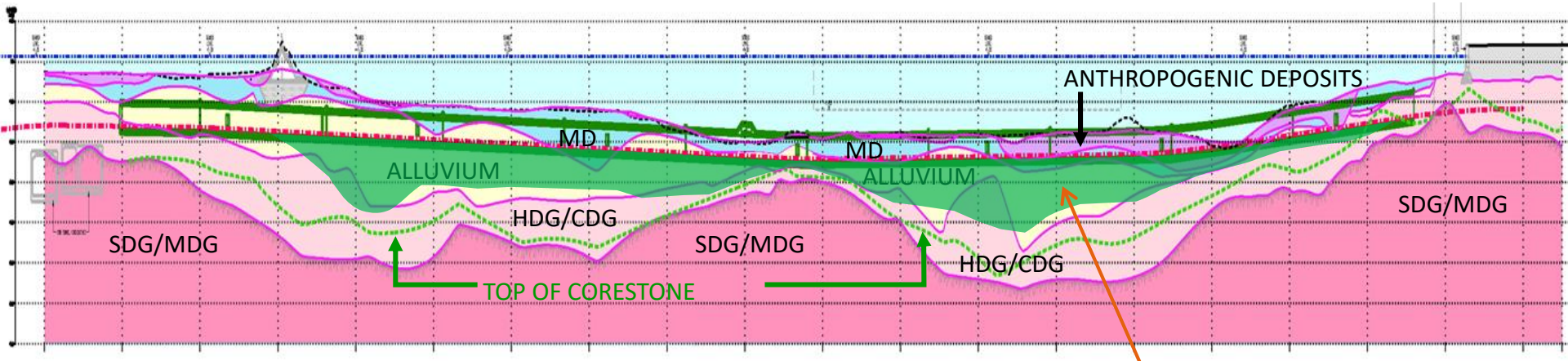
A. Immersion Joint at HUH cut and cover tunnel.

B. Under Water Closure Joint at ME4.

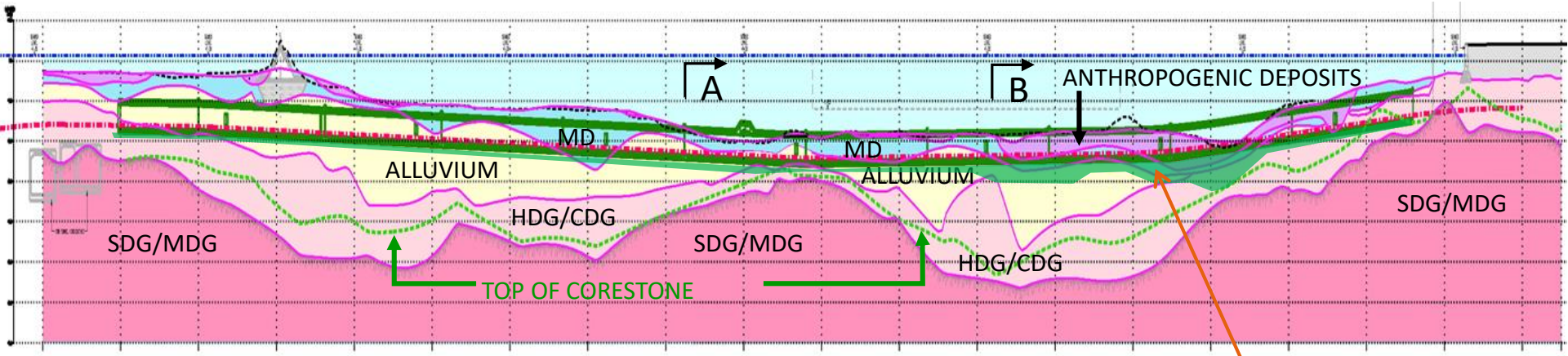
C. Under Water Closure Joint between E9 and E10.

Final IMT Configuration

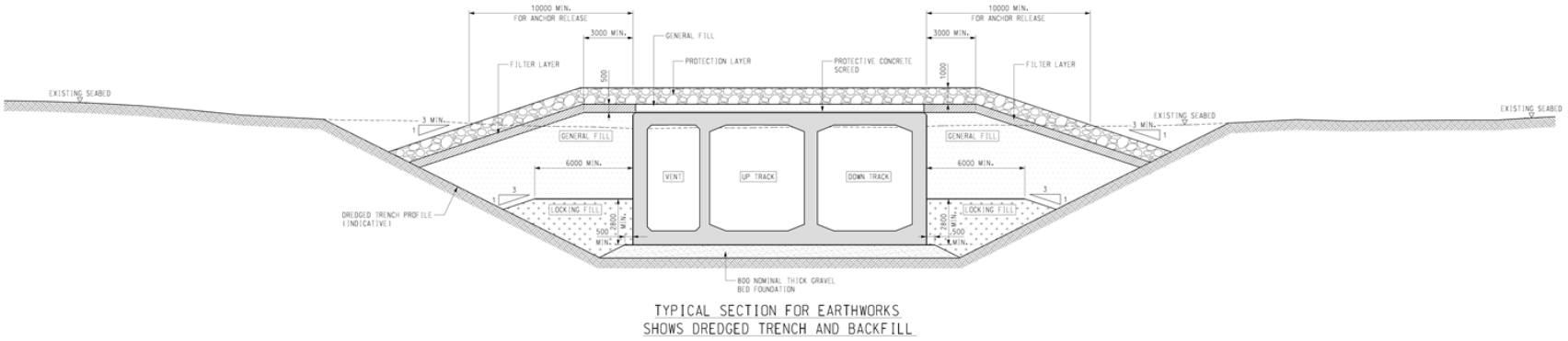
Understanding the Geology



Contract requirement: Dredging profile based on Specification q_c<2MPa

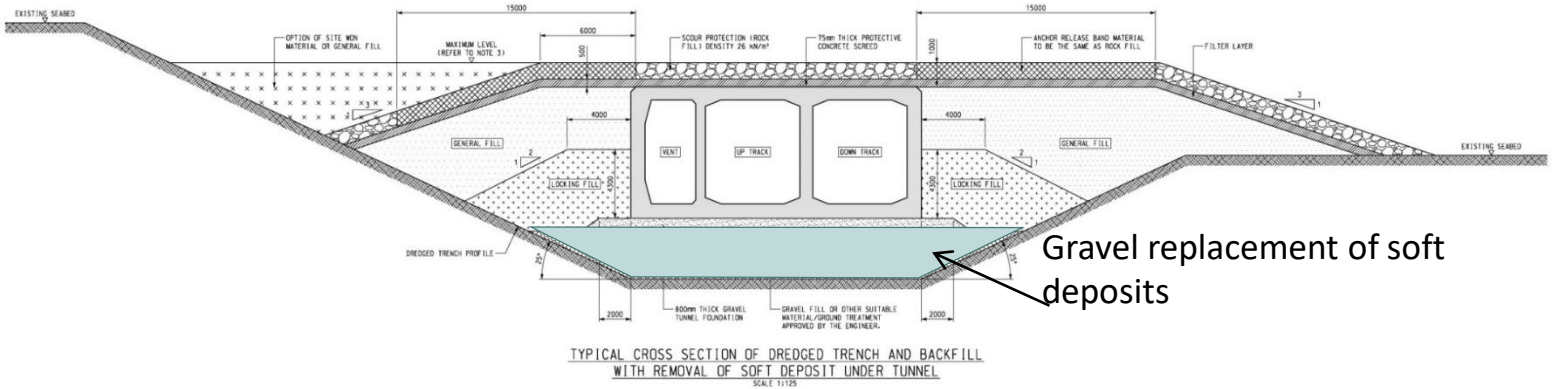


Alternative approach: Dredging profile based on settlement analysis



TYPICAL SECTION FOR EARTHWORKS
SHOWS DREDGED TRENCH AND BACKFILL

Section A-A (Typical Section)



TYPICAL CROSS SECTION OF DREDGED TRENCH AND BACKFILL
WITH REMOVAL OF SOFT DEPOSIT UNDER TUNNEL
SCALE 1:125

Section B-B (Section at soft deposits)

Additional settlement
Chainage

98000 98100 98200 98300 98400 98500 98600 98700 98800 98900 99000 99100 99200 99300 99400 99500 99600 99700 99800 99900

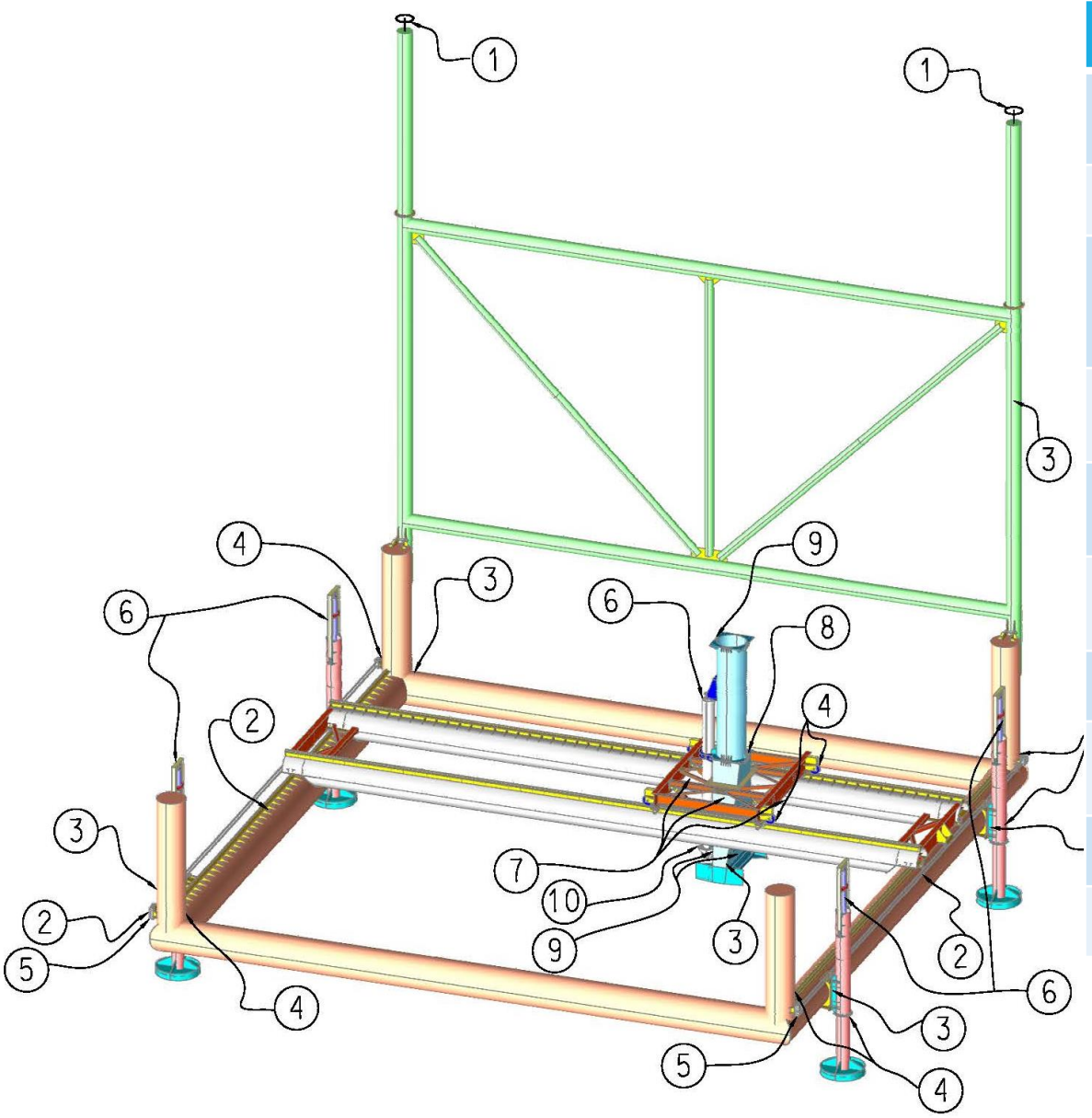
Settlement (mm)

0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100

Total settlement (with siltation) - Design Parameter

ME4 Element 11 Element 10 Element 9 Elemnt 8 Element 7 Element 6 Element 5 Element 4 Element 3 Element 2 Element 1 C&CT

Shek O casting basin



	Major Equipment List	
1	GPS-RTK	2 Rovers, 1 Base (Z +/- 15mm)
2	Inclinometer	2 nos (0.005%)
3	Water pressure sensors	4 nos (0.01% FS)
4	Proximity sensor	6 nos (Hopper position check)
5	Encoder	4 nos (Hopper position check)
6	Stroke sensor	4 nos (Hydraulic jack stroke check)
7	Altimeter	2 nos (For survey)
8	Light sensor	4 nos (Check gravel content in hopper)
9	Subsea camera	4 no. (Monitoring)

Gravel Spreader Overview


211-38

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Guidance Display for Gravel Placement

Gravel Level inside Tremie Pipe

Frame Position

Survey Data

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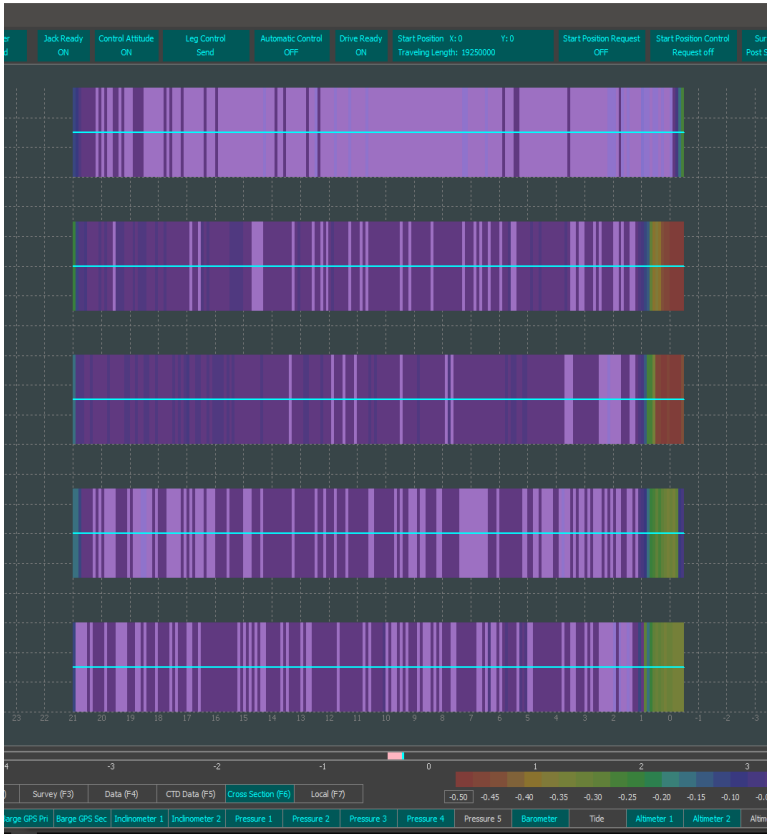
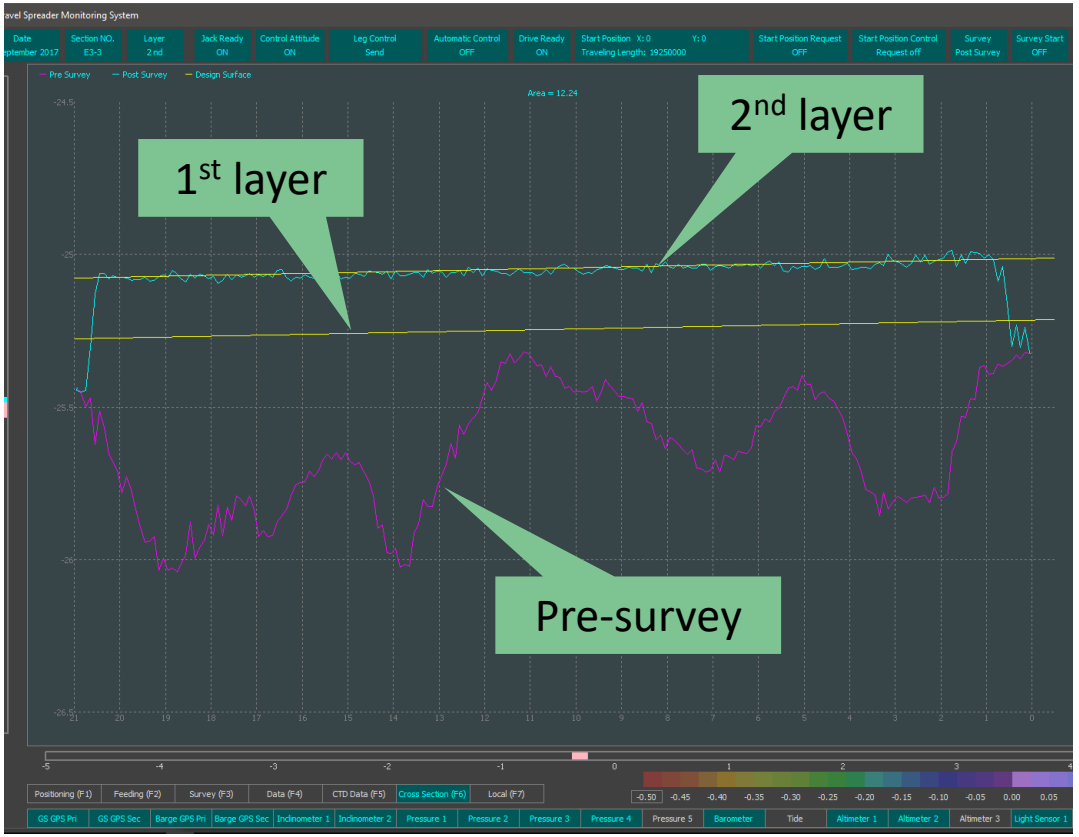
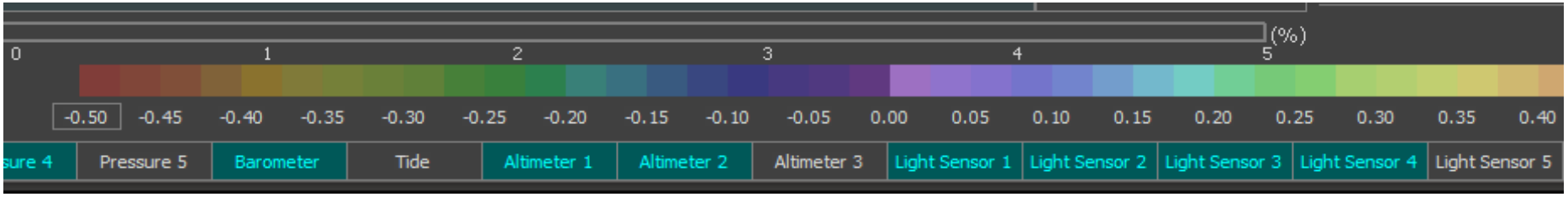
Altimeter Readout







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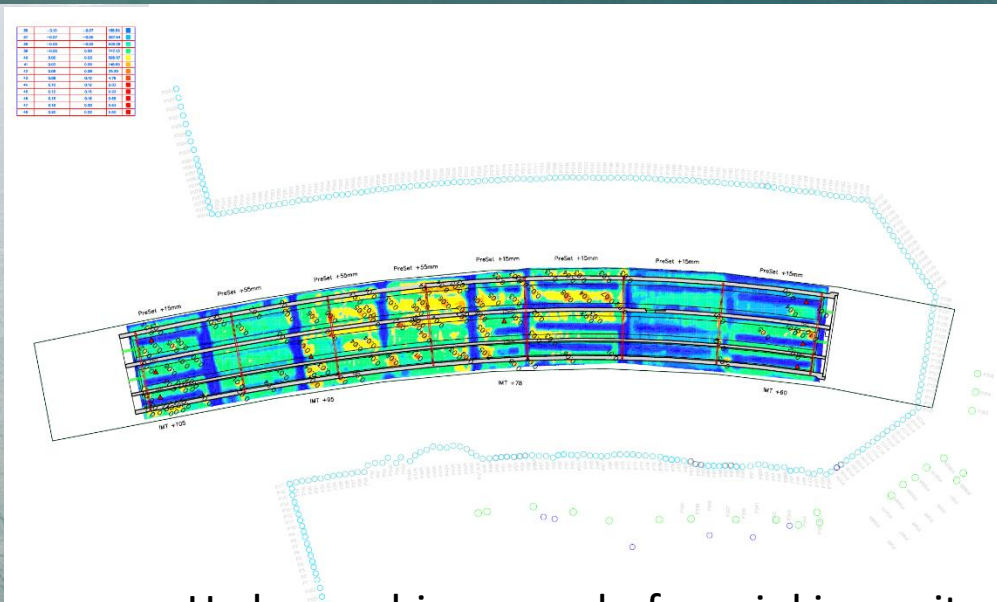
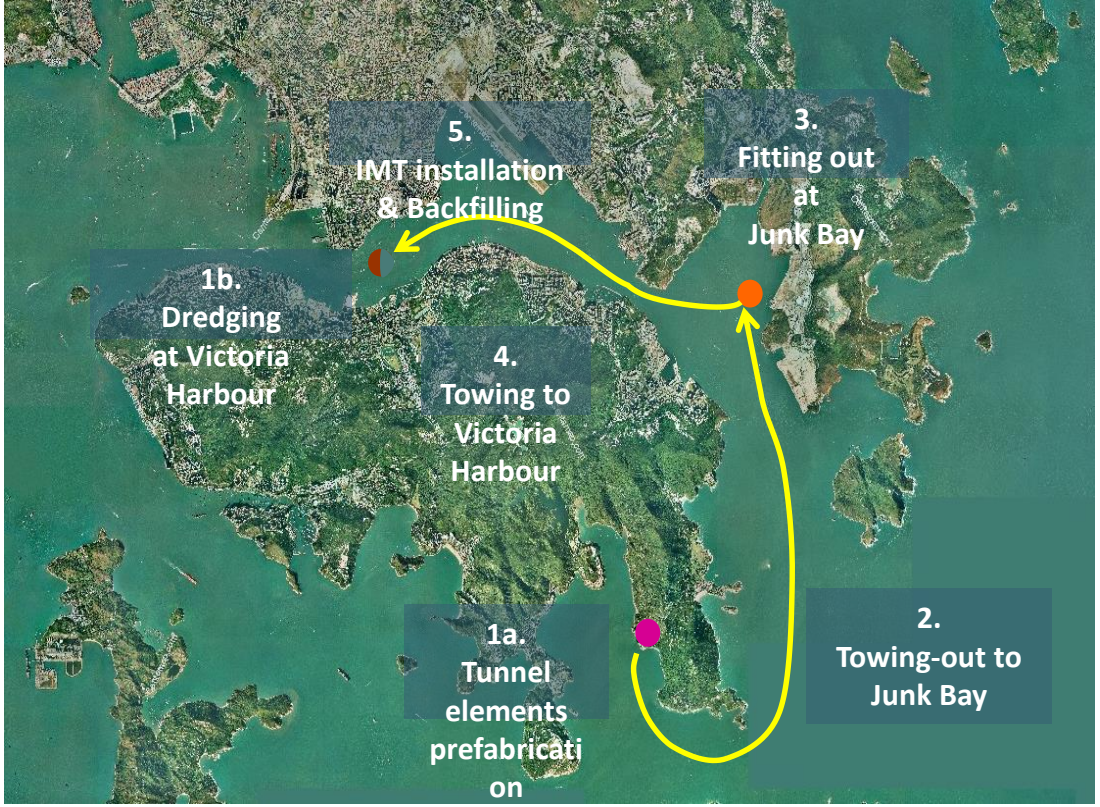
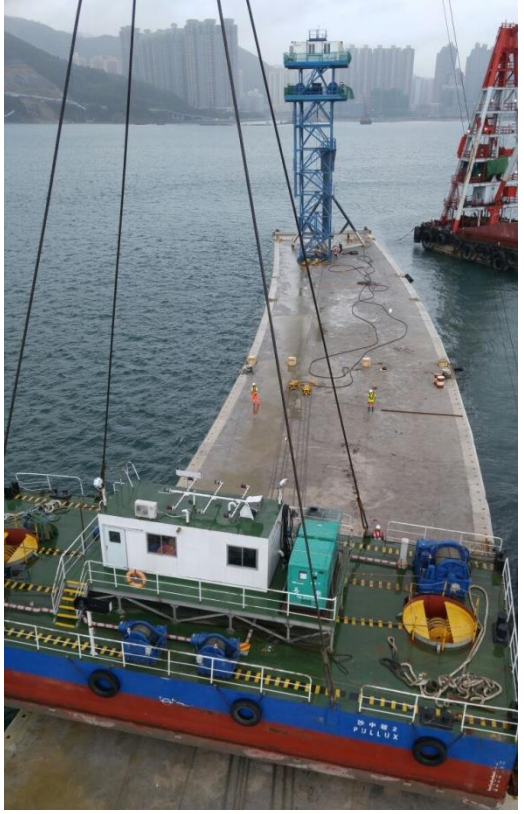
Gravel spreader in operation at E10

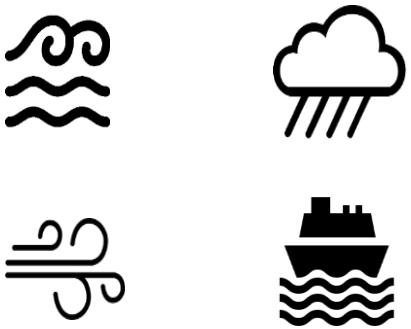
Initial Placement of gravel spreader

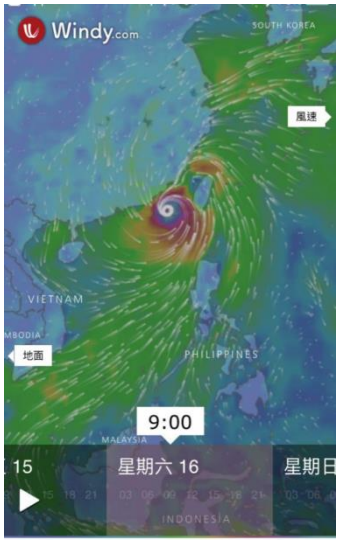


Hydrographic survey before sinking unit


5.
IMT installation
& Backfilling
3.
Fitting out
at
Junk Bay
1b.
Dredging
at Victoria
Harbour
4.
Towing to
Victoria
Harbour
1a.
Tunnel
elements
prefabricati
on
2.
Towing-out to
Junk Bay



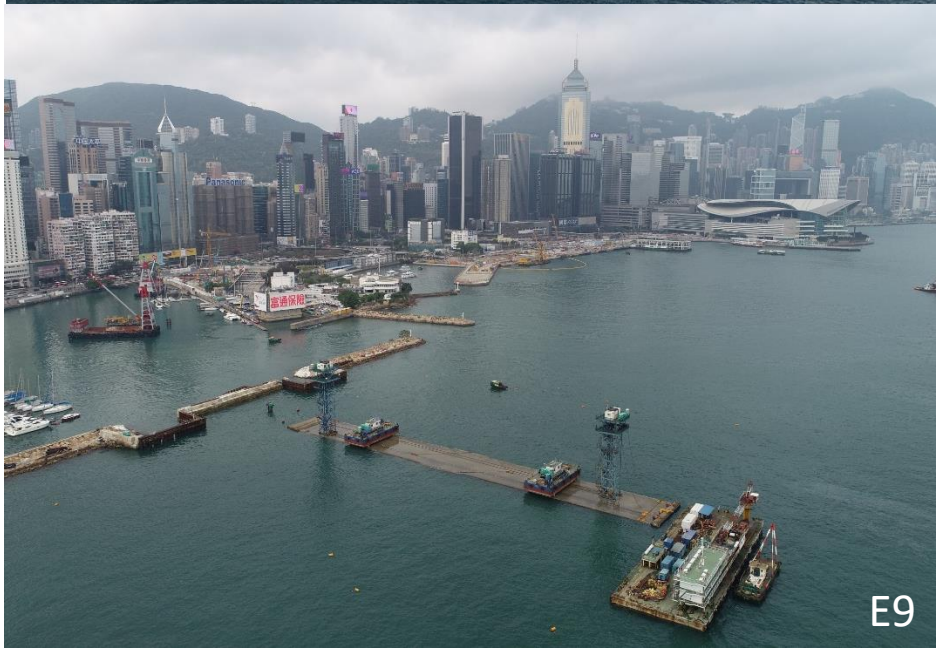



Windy.com
SOUTH KOREA
VIETNAM
PHILIPPINES
9:00
星期六 16

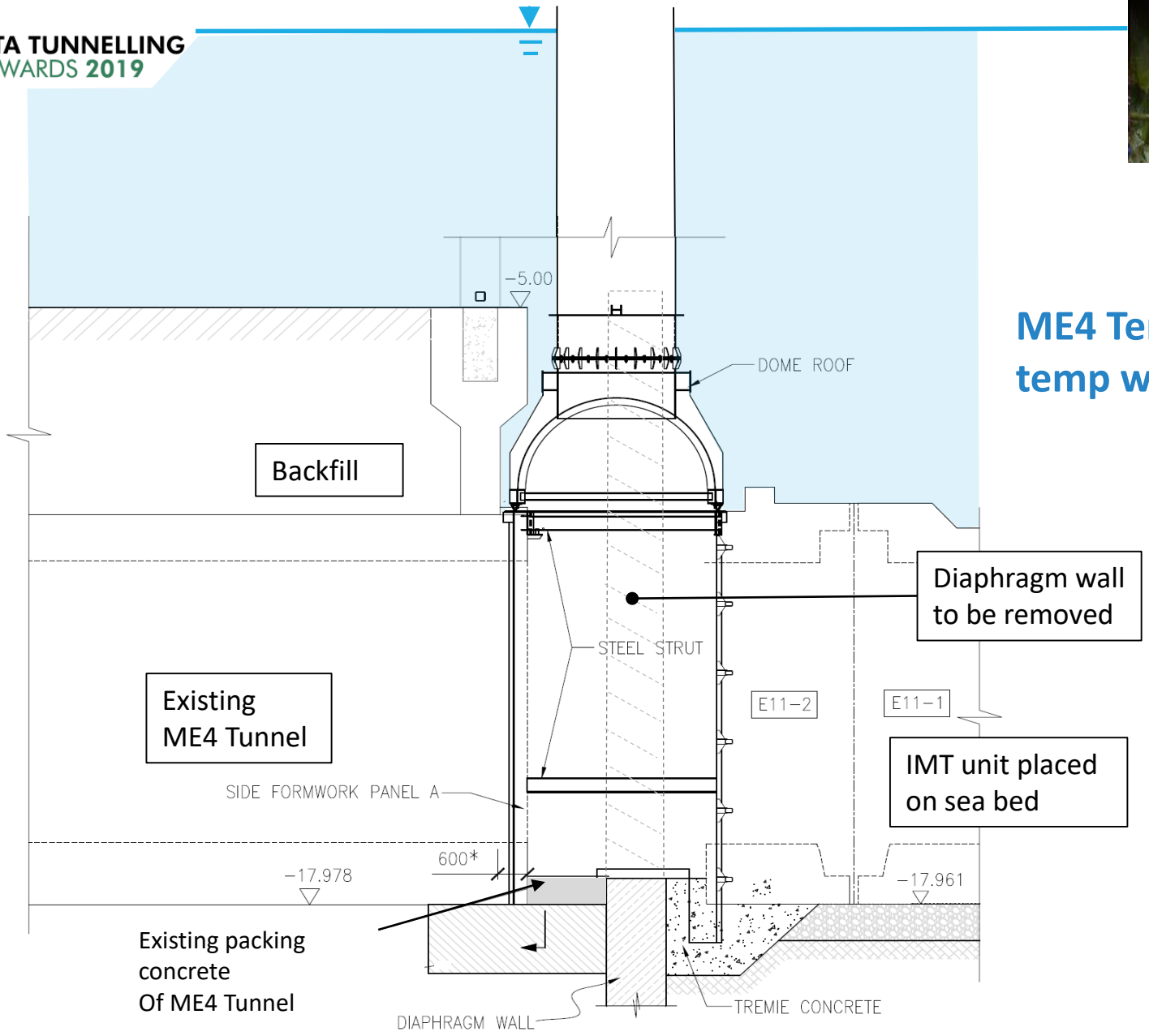

E1

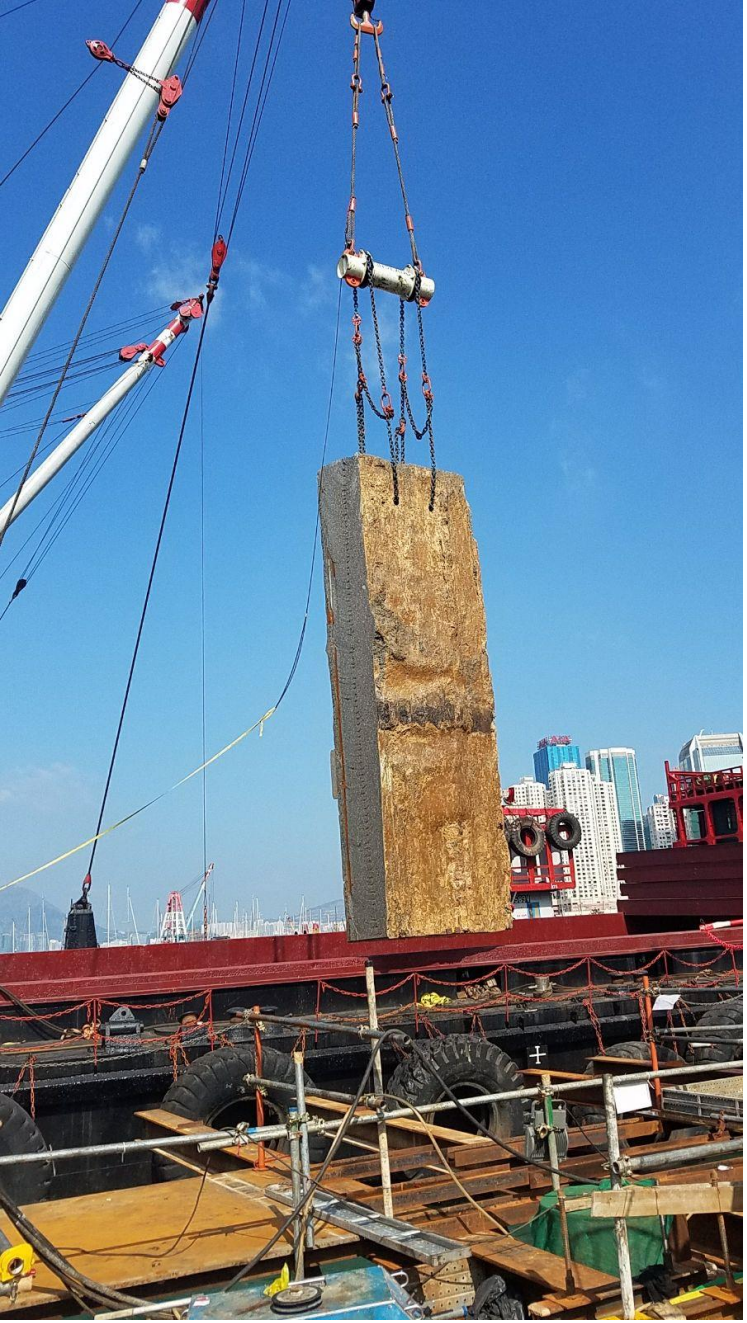

E5


E11

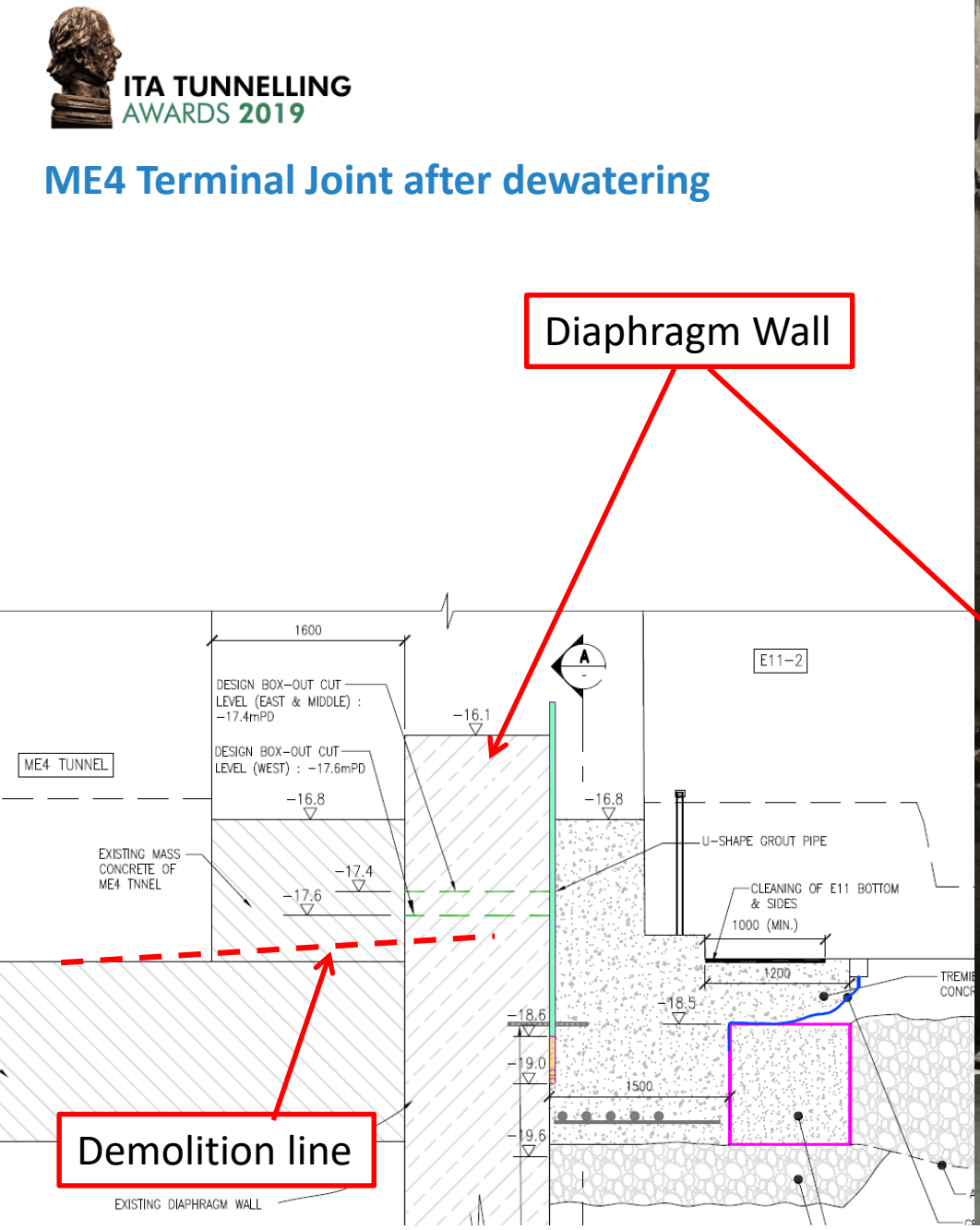

E9

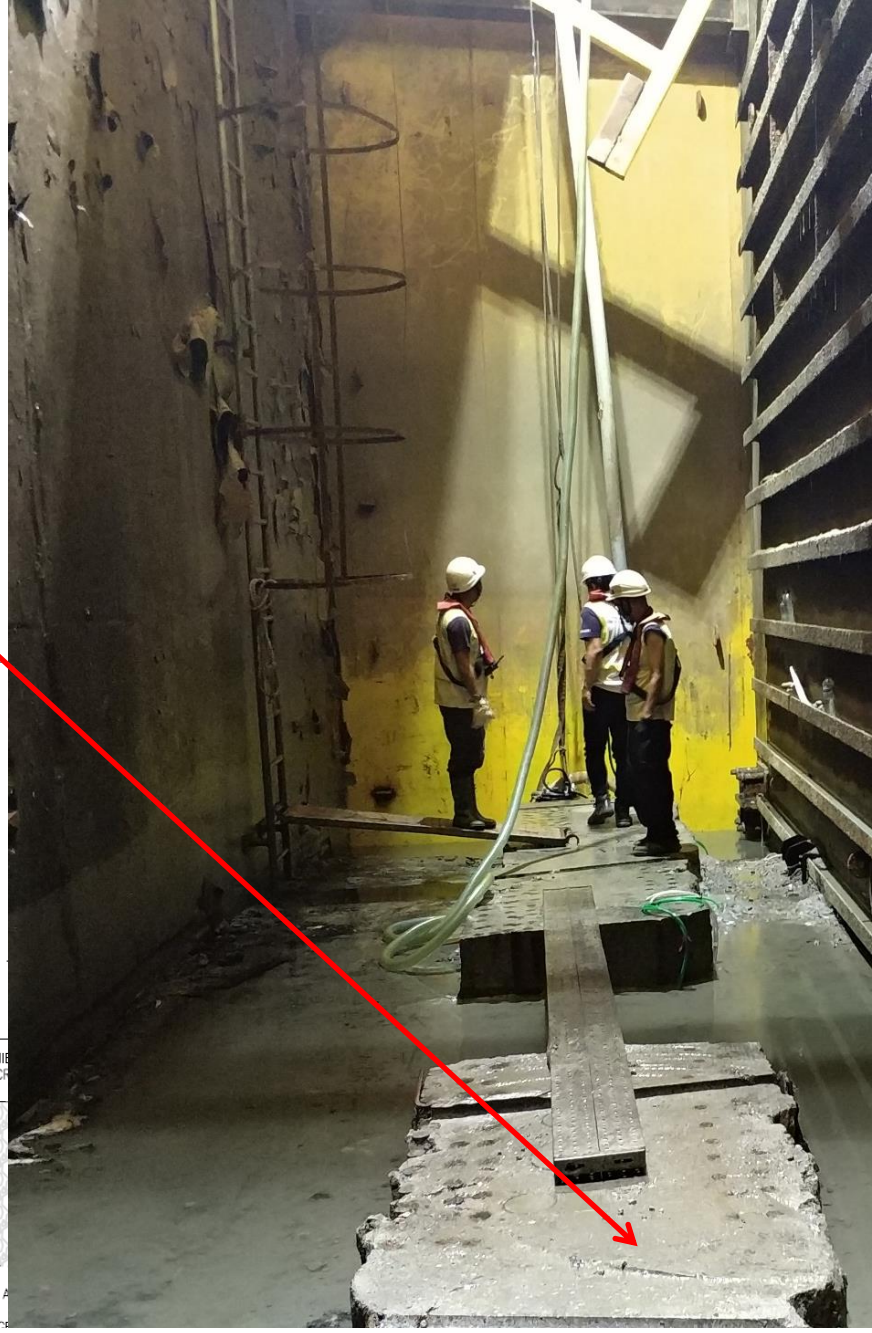
ME4 Terminal Joint temp works design





ME4 Terminal Joint after dewatering





Environmental/Sustainability measure in the project

- Saving in reclamation in CBTS=> significant reduction in waste disposal
- On site batching plant and marine deliveries at Shek O
- IMT Precast construction in Hong Kong rather than in China => Achieve tight quality control
- Extensive CPT and analysis to save dredging and disposal quantities

Engagement of the community

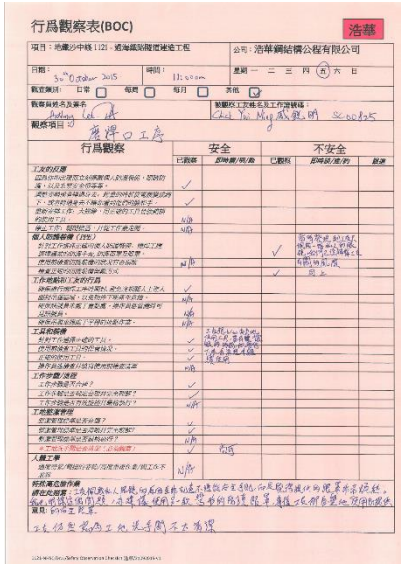
- Good relationship with the stakeholders in the Typhoon shelter
- Upgrading of the yacht club pontoon and facilities
- Regular stakeholder engagement meetings and briefings
- No complaint for any of the fairway diversions

Safety

- The safety awards received during the project
  - MTR Gold Safety Award (2018)
  - MTR The Best Site Condition Award (2016)
  - MTR "Hands Off" Safety Innovation Awards - Bronze Award (2016)
  - Development Bureau Considerate Contractors Site Award Scheme in "Merit" (2016)
  - OSHC Construction Safety Day "The Best Safety Culture Construction Site Golden Award (2016)

Behavioural Based Safety

- Implementation of a behavioural based safety initiative which is now being used by other clients on other projects in Hong Kong
- Daily observation and engagement with workers
- Build mutual respect and trust
- 360° engagement (not top down or bottom up)


行爲觀察表(BOC)

浩華

行爲觀察

安全

不安全

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Client Satisfaction

- Completed the installation of 11 IMT units including the works through the breakwater within a 10 month period
- No adverse impact to the adjacent sensitive structures, Cross Harbour Tunnel and Hung Hom bypass
- Handed over to all of the designated and interfacing contractors on time.
- Delivered a high quality product with no leakage inside the IMT tunnels
- Co-located in the office to achieve a successful collaborative working environment.

In Summary

- Alternative solution to the cut and cover works inside the typhoon shelter delivering time and cost savings to the client and reducing disruption to the stakeholders
- Through design and analysis process reduced the amount of dredging required.
- Quality in construction – achieved to the tight tolerances to ensure no re-work required and each of the units placed right first time every time
- Designed and built an automatic gravel spreader to ensure successful placement of the gravel bed prior to positioning the IMT units
- Successfully implemented temporary works scheme for the very challenging Terminal Joint consisting of tremie concrete and dome formwork
- Completed the works to the original schedule

THANKYOU