**Project Location**

- **Name** - Liantang / Heung Yuen Wai Boundary Control Point and Site Formation and Infrastructure Works
- Seventh land crossing into Main Land China
- Project is 11km long with 5.7km of tunnel, 4.3km viaduct and 1km at grade
Contract 2 Overview

**Project Name**: Liantang / Heung Yuen Wai Boundary Control Point and Site Formation and Infrastructure Works - Contract 2

**Contract Sum**: HKD 10,313,888,888 (incl. Prov. Sum)

**Duration**: 20th December 2013 to End 2018

**Interested Parties** include:
- GEO – Geotechnical
- WSD – Water Tunnel
- DSD – Drainage
- Mines – Blasting
- MTRC – East Rail
- CLP – Cable Pylons etc.

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Contract 2 - Scope

- Earthworks 106,000 m³
- Pilot tunnel / Enlargement
- TBM Excavation
- Drill & Blast Excavation
- Earthworks 650,000 m³
- Tradi-tunnels

- 5.4km long section of the BCP Project
- 2 x 4.8km long, two-lane road tunnels
- 49 cross passages
- 3 no. Vent buildings & 1 no. Admin Building
- E&M for C2 and C6 projects
Geology

- Geological Setting – Volcanic Ash Tuff rock influenced by two regional faults
- Rock varies in strength from very strong rock to completely decomposed with sections of faulted ground and low ground cover

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South Tunnels – Drill and Blast Excavation

- Drained rock tunnel span – 14.15m / 130m² face (typical)
- Temporary support dowels (typ.4m) and FR shotcrete (typ.50 – 70mm)
- 3511m of tunnelling (two tunnels)
- 18 Cross Passages
- Pre-excavation grouting required;
  - ~26 no. primary and secondary holes (25 to 36m long)
  - Grouting duration between 2 to 6 shifts to complete

☐ Production statistics:
  - Avg. 15m/wk / Best 32m/wk
Mid Ventilation Junction

- Permanent – ventilation structure
- Temporary – used to turn the TBM around for the second drive
- Cavern span 21.7m / height 23.5m / length 50.6m
Mid Ventilation Junction – NB-N (Break-in)

- Span 17.8m
- Height 18.3m
Northern (~500m) wide span (17.8m I.D. span) tunnels to comply with sight line requirements (110m @ 80km/hr) in tight curve under Princess Hill

To achieve Project Programme:

- South bound tunnel excavated full span until TBM assembled and ready to launch
- Pilot tunnel formed by TBM through remaining section of wide span tunnel section and later enlarged to required span in “Hidden Programme Time”
- North Bound tunnel excavated full span to end of wide span tunnel and TBM dismantling chamber formed
TBM Pilot Tunnel Enlargement

Use of 300m temporary steel gallery to separate TBM logistics and Top Heading enlargement works

14m wide TBM

Enlargement of Top Heading

Enlargement of Bench RHS

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TBM Pilot Tunnel Enlargement – Heading

- Access ramp to heading work front
- Separated TBM logistics through Technical Gallery
- Safe upper working area
- Impact gantry – control falling debris onto technical gallery

Access Ramp + transition approx. 80m long

Impact Gantry
• Bench excavation commences after heading complete and TBM logistics re-located
• Enlargement completed 26\textsuperscript{th} of August 2017
TBM Excavation

- 14.1m dia. Earth Pressure Balance (EPB) TBM - Supplier NHI / NFM
- Shield 13.36 long, 4 back-up gantries
- Total installed power - 7700 KW
- 77 disc cutter and 568 tools
- Main Innovations - Telemac & Mobydic

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TBM Transfer Underground

- Overall programme improvement by turning the TBM underground rather than dismantling and relaunching from the north
- Proven methods from POMT
- February to April 2017 (10 weeks)
Mid Ventilation Junction – TBM U-Turn

Rotating from SB

Rotating to NB

BREAK IN FACE

BREAK OUT FACE

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Shield being jacked into NB-N (screw retracted or maintenance)
Mid Ventilation Junction – TBM U-Turn

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Key Technical Breakthroughs

Breakthrough of Mid-vent southbound tunnel by TBM on 1 Mar 2017

Breakthrough of South Portal northbound tunnel by D&B on 24 Jul 2017

Breakthrough of South Portal southbound tunnel by D&B on 15 Aug 2017

Breakthrough of Princess Hill northbound tunnel by TBM on 27 Apr 2018

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Current Work Status

• Tunnelling Works:
  – Excavation and Temporary Support: 100% completed
  – Permanent Lining: 100% completed
  – Internal Structures: 95% completed

• Building Works: 100% completed

• External Works: 90% completed
Safety Performance

- Total number of hours worked on this project: 16,256,030 man-hours (as of 30 Sep 2018)
- Cumulative accident frequency rate is 0.036 per 100,000 man-hours worked since project commencement.
- It is over 10 times, well below the target set by the Development Bureau, Hong Kong Government SAR of 0.6.
- Although a challenging schedule and work load, there is no reportable accident since January 2017. Accident frequency rate is hence ZERO recently.
- “Civil Engineering and Development Department (CEDD) Innovation Award for Site Safety 2016 – Merit Prize”
- “Certificate of Merit Award” in Temporary Works Excellence Award 2017
- “Lighthouse Club’s International Design for Safety Competition” in 2017
- “Recognising Excellence in Safety” in the “Safe Project Team Award 2017”
- “Site Safety Practitioner Award 2017”
Environment Protection

- Energy savings of various operations – such as conveyor belts, electric plants, Tunnel Boring Machine cooling system, etc. Total reduction of over 5,900 tonnes of CO$_2$ emission on site

- 2016 Hong Kong Awards for Environmental Excellence (HKAEE) – “Certificate of Merit”
- Hong Kong Green Organization and “Energy-wi$e Certificate” in 2018
Public Engagement

- Workshops, lobbying activities with locals, parties for work achievement which encourage communication, show appreciation towards people, welcome new members and thank people for their contributions

- Public Consultation - mail drop to the neighborhood at least one month before blasting
Awards

• “Civil Engineering and Development Department (CEDD) Innovation Award for Site Safety 2016 – Merit Prize”
• 2016 Hong Kong Awards for Environmental Excellence (HKAEE) – “Certificate of Merit”
• ITA Tunnelling and Underground Space Awards 2017 – Safety Initiative of the Year – Telemach Cutterhead Disc Robotic Changing System
• “Global Tunnelling Team of the Year” in Tunnelling Awards 2017 by New Civil Engineer (NCE)
• “Certificate of Merit Award” in Temporary Works Excellence Award 2017
• “Lighthouse Club’s International Design for Safety Competition” in 2017
• “Recognising Excellence in Safety” in the “Safe Project Team Award 2017”
• “Site Safety Practitioner Award 2017”
• Hong Kong Green Organization and “Energy-wi$e Certificate” in 2018
Thank You