Introduction about various types of Temporary Works/Falsework and its implication on work planning and cost (Part 2)

Presentation material for Seminar organized by the HKICM as part of their "Professional Practice in Construction Management" Training Course Series
12 October 2018

Some special features need to aware that concern the cost and construction planning of temporary works for complex projects

- Often needs advance engineering design and submission.
- Sometimes may require going through the EIA process.
- Often as a critical path activity in the overall work schedule involving planning, scheme assessment, design, set-up, reinstatement and making good etc.
- Often requires alterations to fit advancement of works.
- Highly dynamic to fit the progress of works.
- Very costly due to above reasons.
- Quality and accuracy of planning is valid for the success of project. A detail method statement and cost analysis can be very helpful.
- Quite a number of temporary works are for making access to work or as safety provisions.
- Cost provisions are inappropriate by the use of lump sum.

Example showing the complication and involvement for temporary work provision for constructing a tunnel portal – the case of the Nam Wan Tunnel for Route 8

Some special features of complex projects

- Cover extremely large site area that needs to carry out work, including all temporary works and the related setting-up.
- Complicated built-environment such as with extremely large construction area, complicated spatial layout, work in difficult ground and topographic environment, involve works with very high headroom, very long span or heavy structural elements etc.
- Work requires very special technology to construct.
- Site layout planning can be very complicated in order to carry out works. (temporary work vs site layout)
- Most large-scale civil works fall into this category. (In particular marine works, tunneling, ground works, mega structures and construction of plants etc.)

Preparation of an accurate method statement to help to get a more accurate cost plan

Method statements are widely used in construction as a means to arrive at a more accurate and practical work plan by specifying all works and resources that are required to accomplish a complicated construction task. This includes the identification of all the work activities (incl. all temp works), the needed resources for carrying out works (incl. labour, materials, plant and equipment), setting up and other provision for health, safety and possible risks.

Other work operations such as work at height, lifting & handling, demolition or dismantling, installing equipment, the use of plant, making good and so on that may have time and cost implication should also be included and specified.

With this kind of well-covered provisions being identified, cost can be allocated to each item in a much accurate way. Besides usual pricing errors, cost errors most likely will be coming from what it is missing because of insufficient understanding of the work process.

Continuation of Part 1 presentation with focus to more complicated works in representing project cases

Work shafts

often used for drainage works or as access to underground works. For some cases for the HATS or Mass Transit Railway projects, these shafts can be down to 80m deep.

Work shaft in Sheung Wan as part of sewage improvement scheme

Work shaft in Wanchai as part of Central-Wanchai Bypass for drainage diversions

Working shaft for Kai Tak Nullah Improvement project

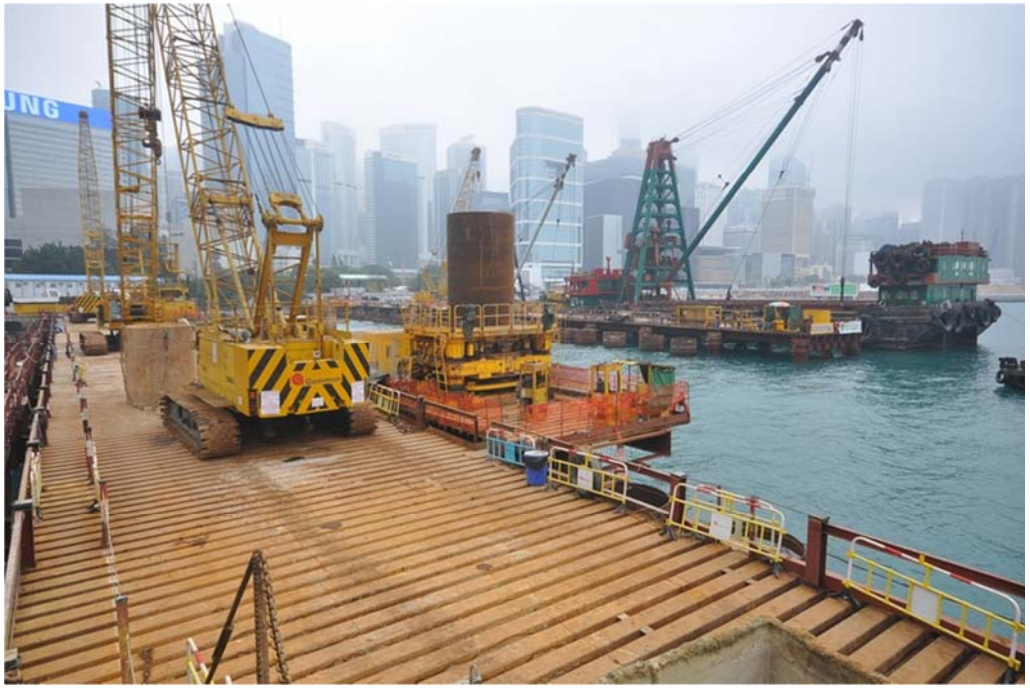
Work shaft, often used for drainage works or as access to underground works

A vertical shaft for the SYP Station, MTR West Island Line project

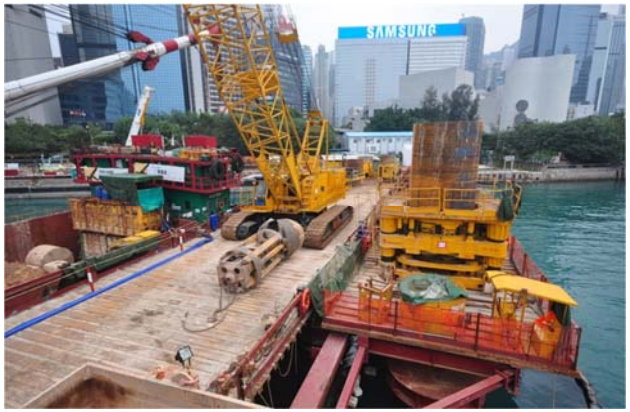
Work shaft as access point to MTR tunnel (Guangzhou Metro Line 6)

Other cases – marine works

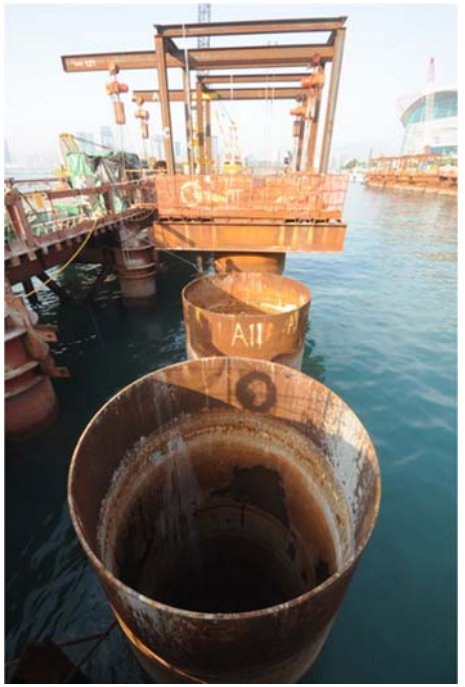
Excavation under marine environment

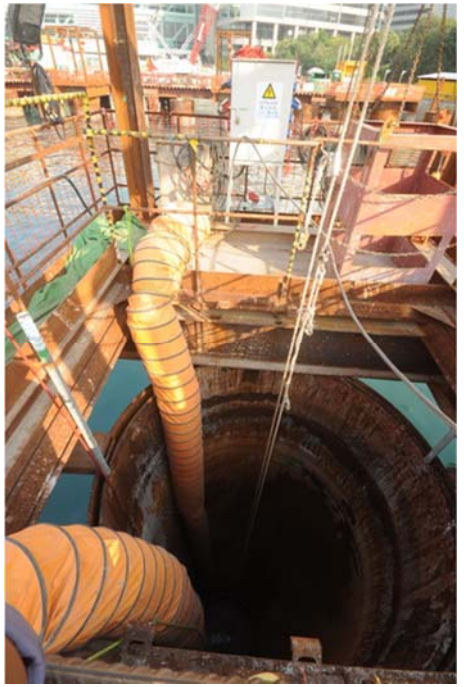


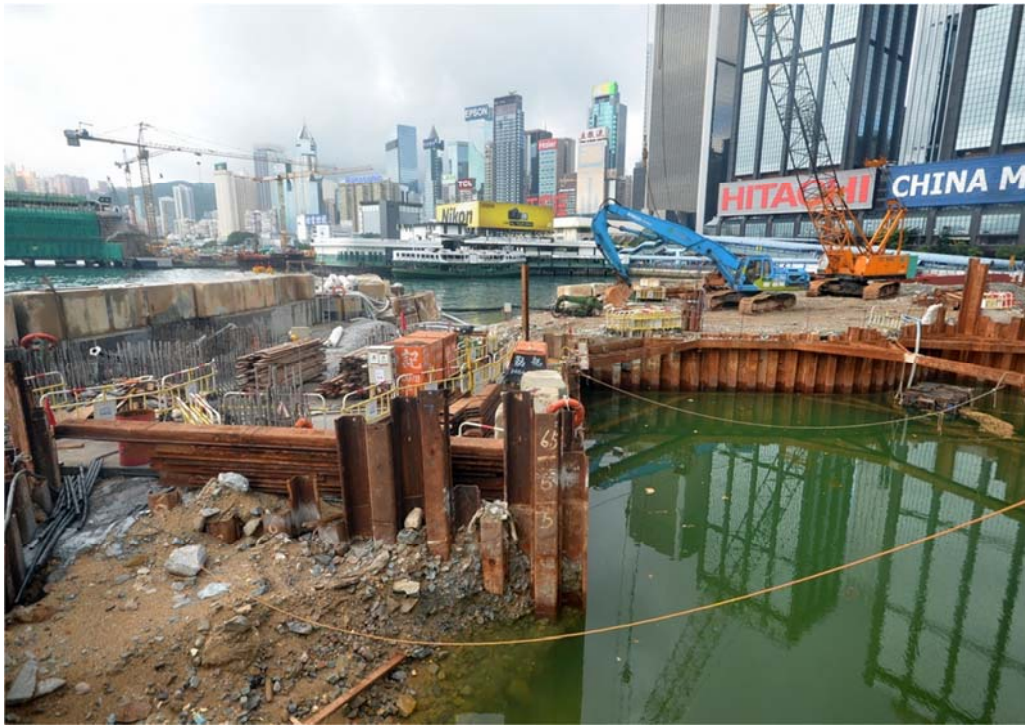
Marine work for the Central-WC bypass project, temporary accessway, marine piling etc.



Forming caisson wall to protect the MTR Tsuen Wan Line



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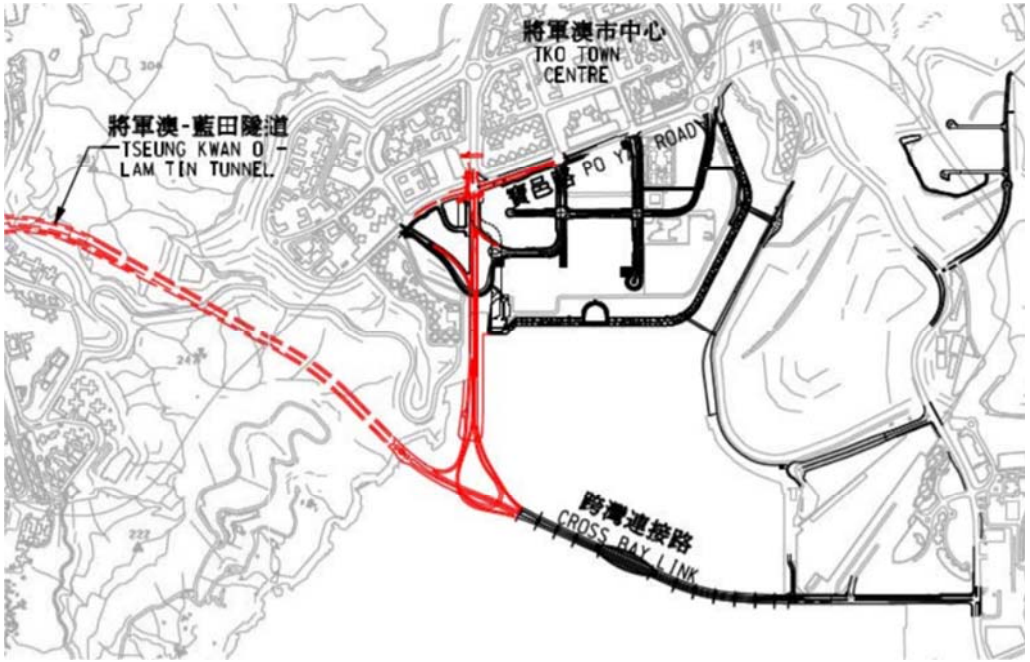

Construction of the slip road from the
new Tseung Kwan O-Lam Tin Tunnel and Cross Bay Link

HK-Zhuhai-Macau Bridge
(marine-base temporary works)


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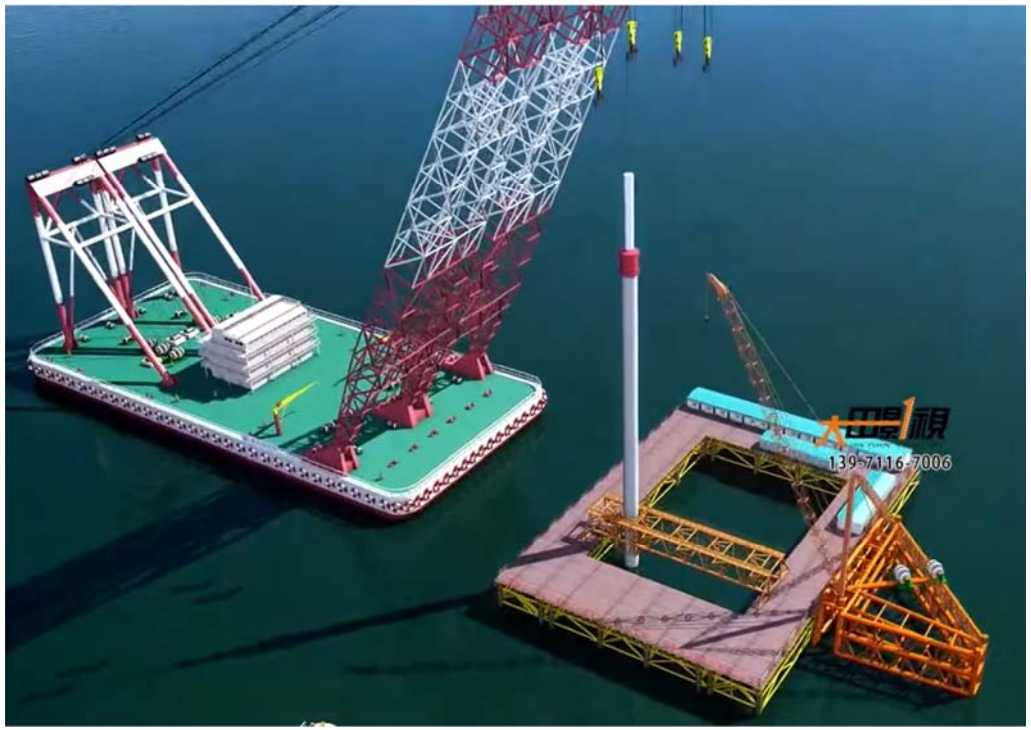
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Work platform and other logistic support to assist in the piling process (using typical RCD)

Typical setting of work platform for the on-going works (forming the raft-cap and piers)

Construction using Structural Steel

The case of The Center

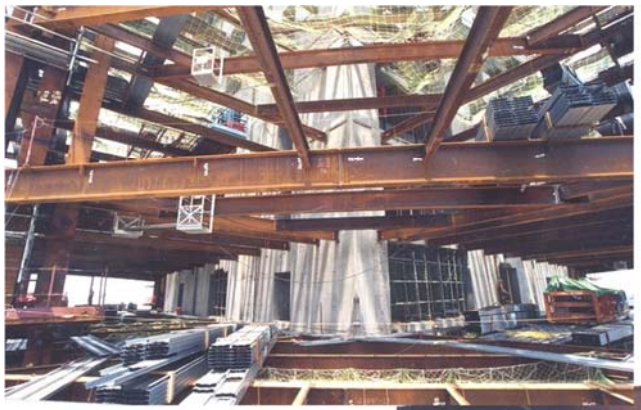
The case of The Center

Temporary work for mounting the tower crane

Temporary access way and storage

Setting up of a temporary rail for the installation of curtain wall panels

The case of IFC2



Observe the temporary for access, storage of materials and safety

Temporary diversion works (for traffic, storm water, drainage and other utilities)

Diversion work for traffic and storm water culvert for the West Rail Tsuen Wan West

Road diversion for the Kowloon Southern Link Project

Temporary traffic diversion for the Tuen Mun Highway Improvement in early 2010s

Temporary traffic diversion for the Tuen Mun Highway Improvement in early 2010s

Temporary traffic diversion for the Tuen Mun Highway Improvement in early 2010s

Road diversion to cater for the cut-and-cover work for the Central-Wanchai Bypass tunnel outside Causeway Bay

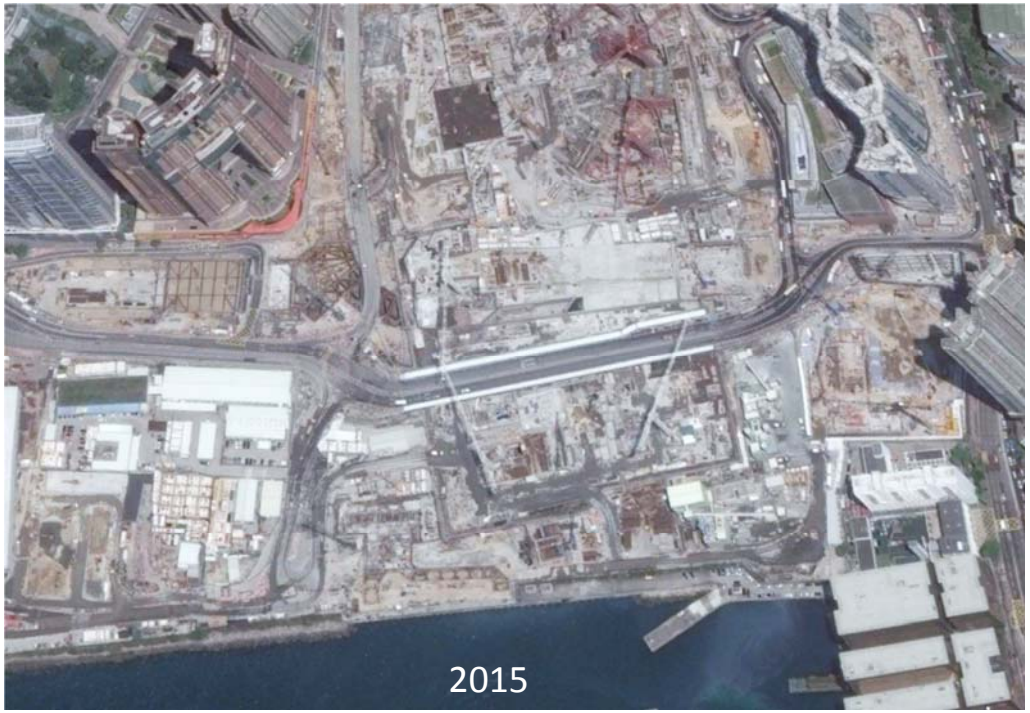
Temporary Road diversion

Temporary traffic diversion for the Shatin-Central Link at Exhibition Station

Temporary traffic diversion for the Shatin-Central Link at Exhibition Station

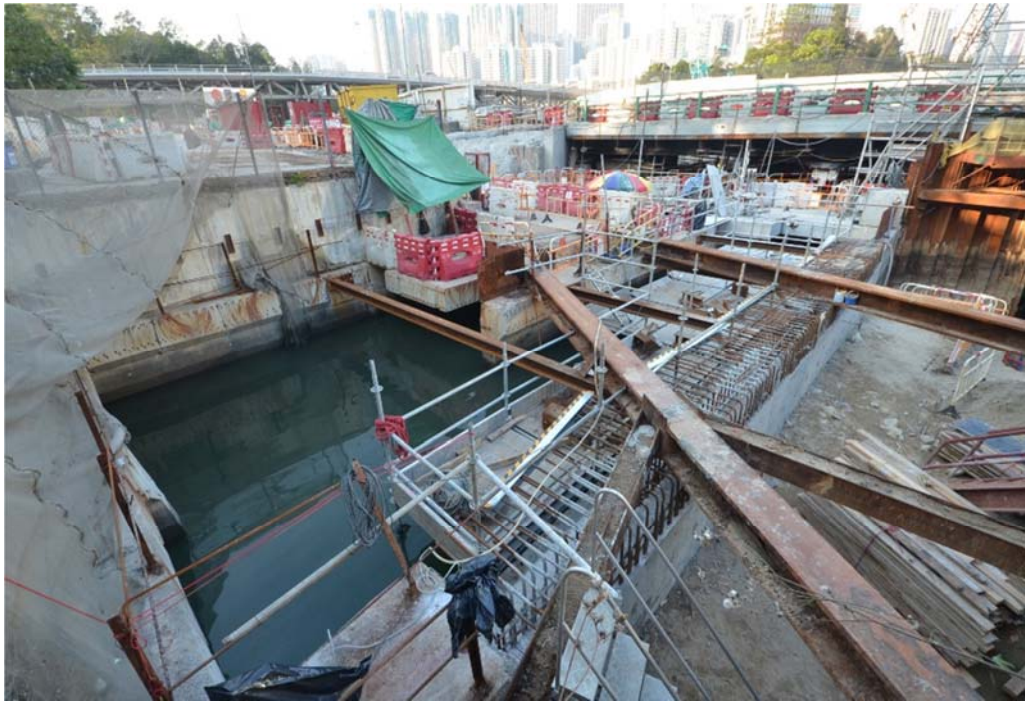
Temporary traffic diversion for the
Shatin-Central Link at Exhibition Station

Temporary road diversion from 2009 to 2018 for the Express Rail Terminus project

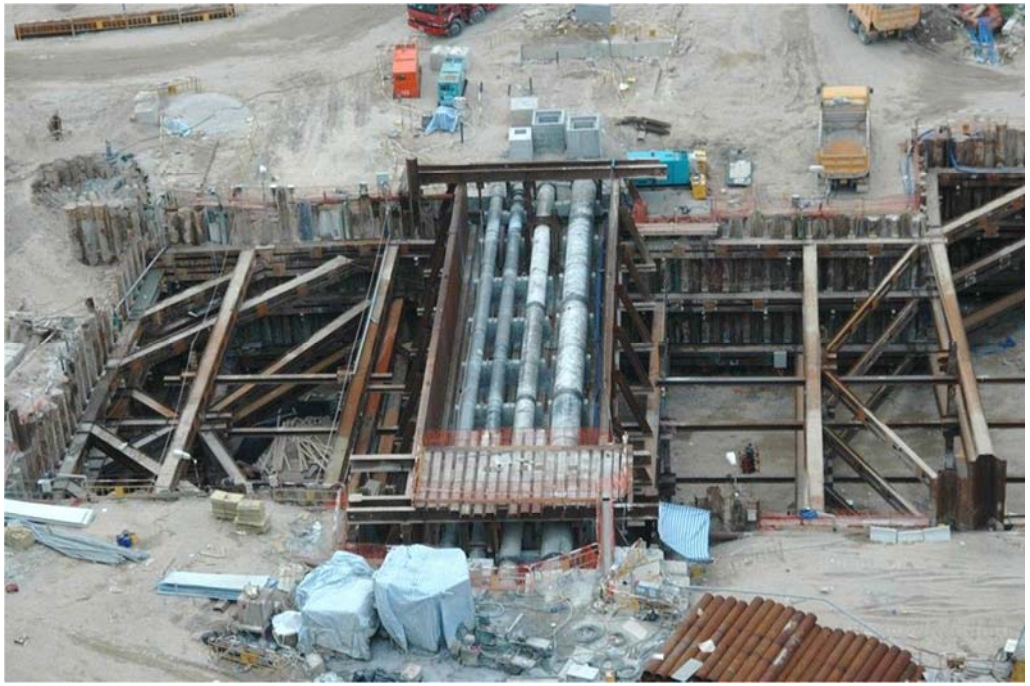


Diversion works for underground facilities, services and utilities

Diversion of storm outfalls in reclamation work along existing harbor-front

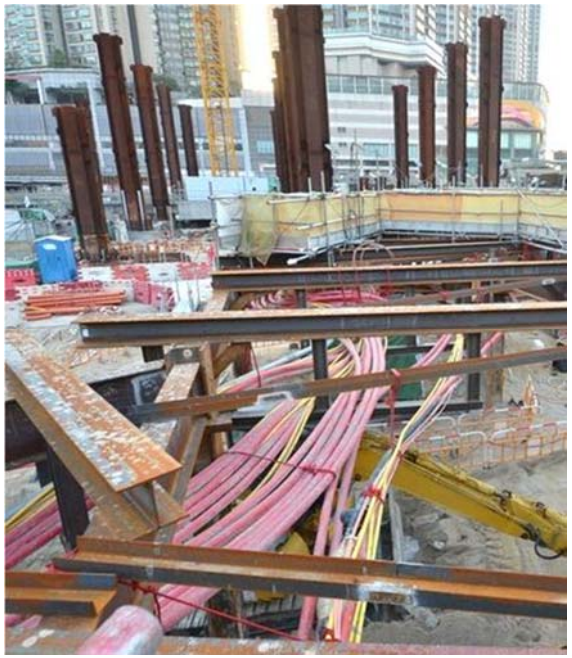


Diversion of storm outfalls



Protection of servicing pipelines during open-cut excavation

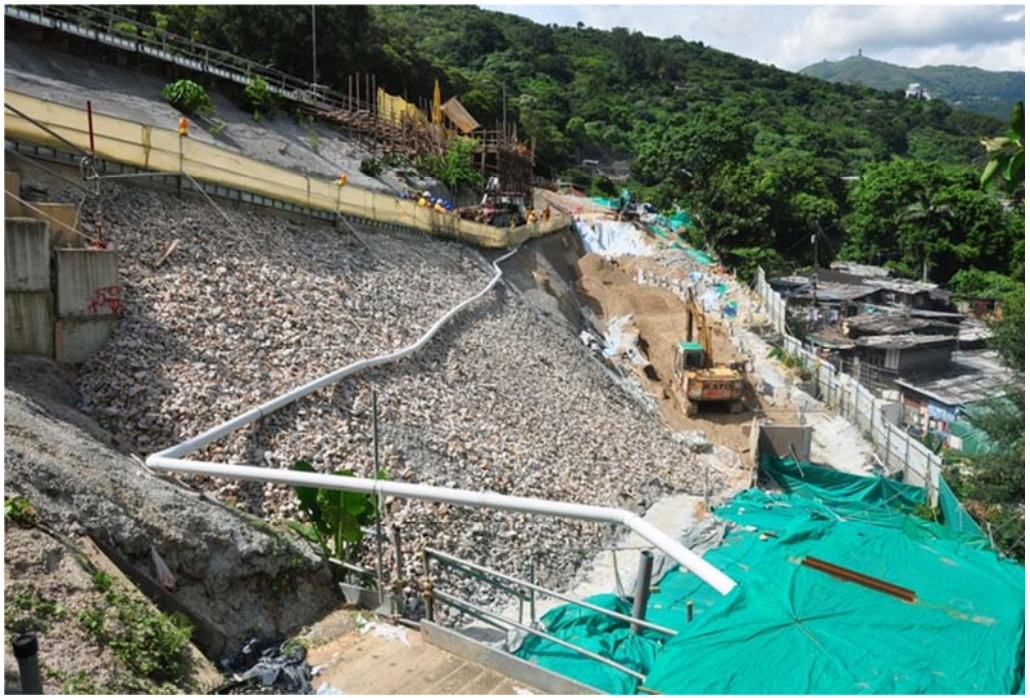
Diversion/Protection of the buried utilities



Slope work

Typical work set-up for slope works
(accessway, work platform, material delivery and temporary drains)

Scaffold and platform to facilitate the carrying out of slope work

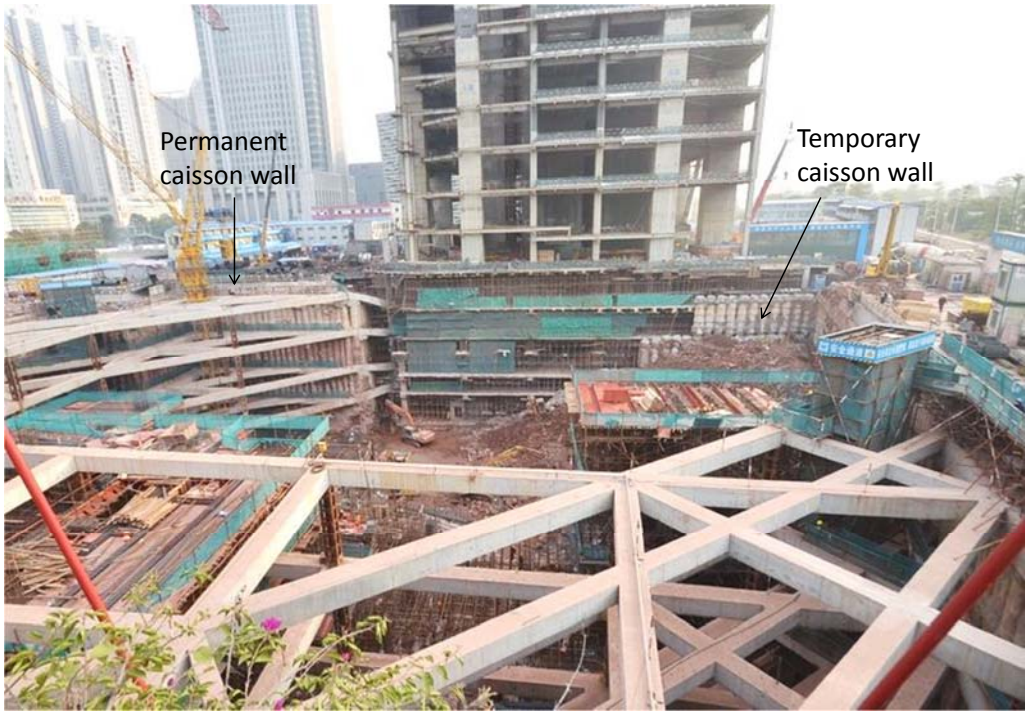


Temporary cut-off wall before the construction of the permanent retaining wall

Applying temporary shotcrete for temporary slope cutting

Temporary platform & access-way for a large scale slope-cutting & site formation work

Cut-off walling as temporary work provision



Temporary works for erecting and dismantling of tower cranes

Foundation for tower crane

Install a temporary crane to dismantle the original crane

A Representing Case

Construction of the Express Rail West Kowloon Terminus

A visual record/summary
prepared by Raymond Wong
as part of his study of the
project since 2011

The terminus site (south) as seen in mid 2012

The terminus site (north) as seen in mid 2012

Overview of site as in August 2012

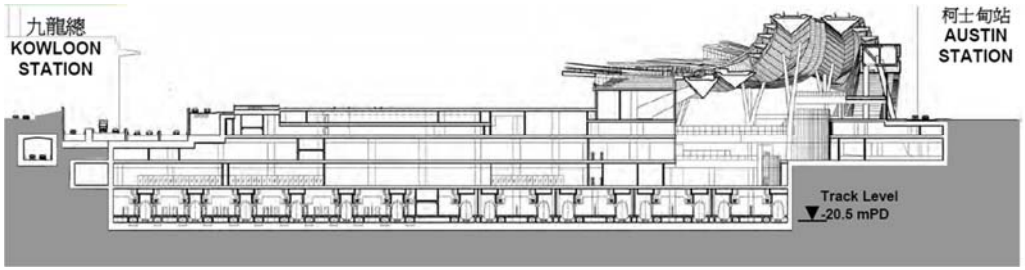
Overview of site as in December 2012

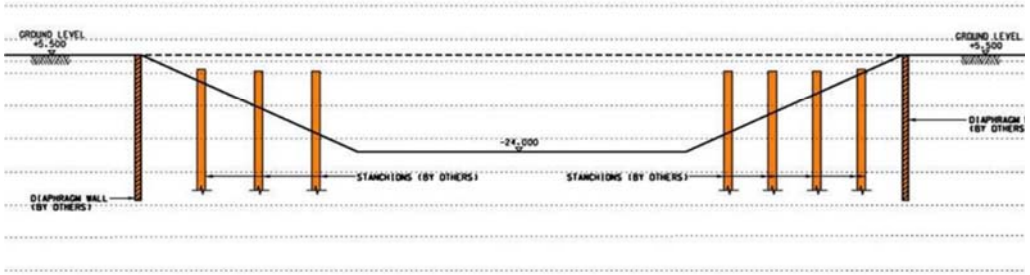
Overview of site as in May 2013

Overview of the southern tip of site as in May 2013

Overview of the southern tip of site as in August 2013

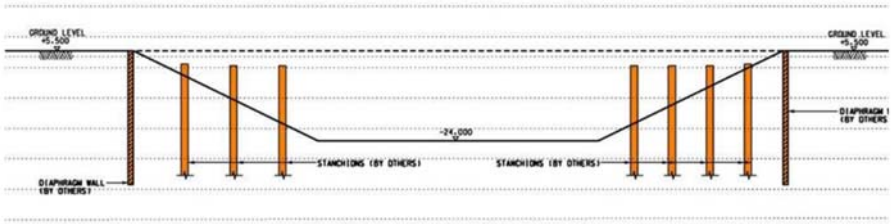
Overview of site as in November 2013

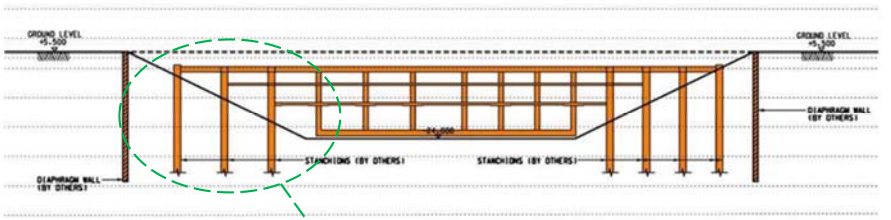


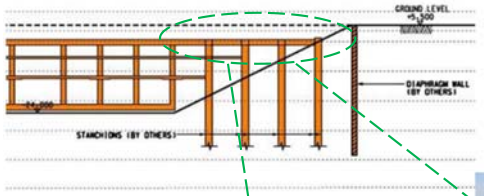


Section showing the underground space of the Terminus

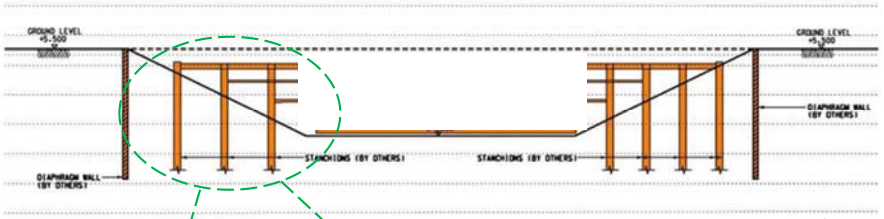
Excavation proposal and the actual work set-up
for the south portion of Terminus







Casting of the first slab before top-down

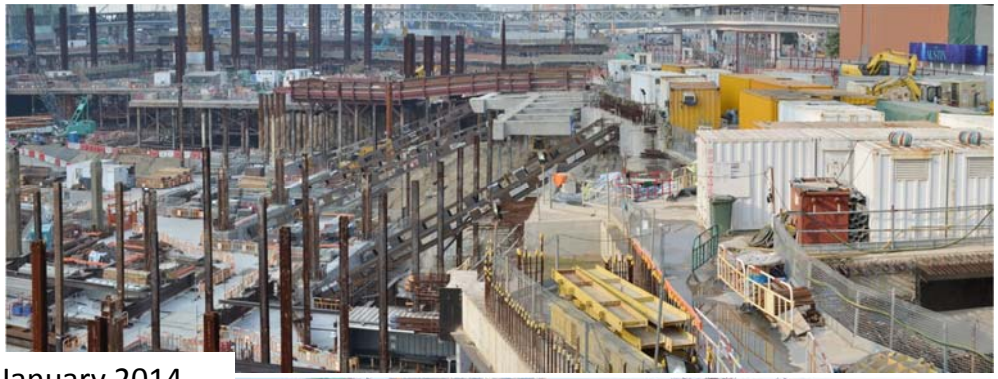


December 2012

Steel stanchion supporting the upper slabs

August 2013

December 2013

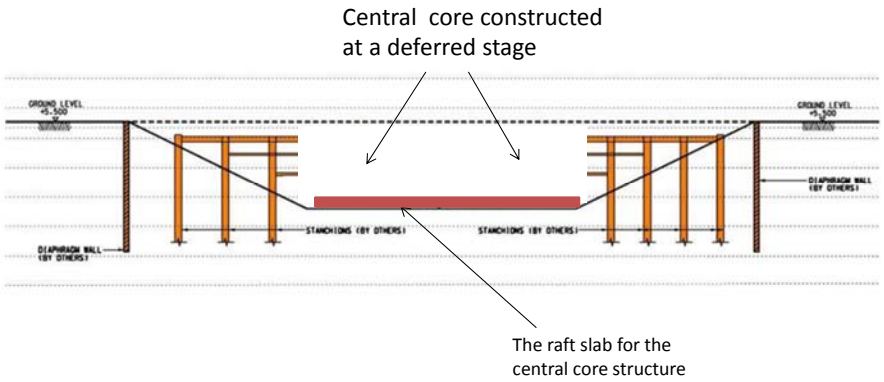


January 2014

Commencing the erection of the falsework in the form of a gigantic structural steel frame to supporting the construction of the terminus canopy truss roof

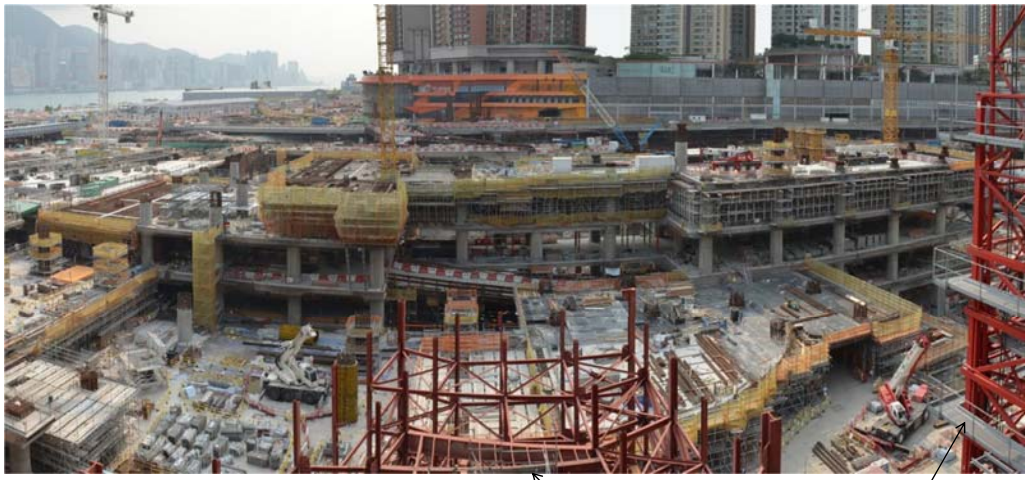
Terminus underground structure along the Wui Man Road (匯民路) constructed in top-down approach

November 2013



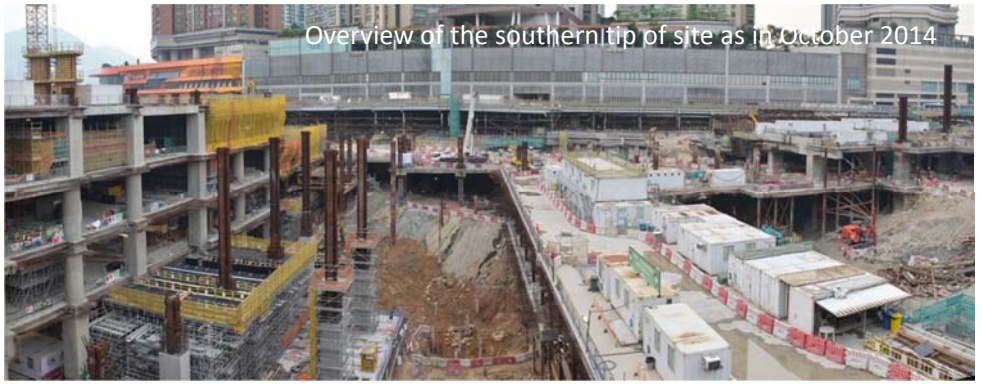
Construction of the central portion of the terminus structure

Overview of the southern tip of site as in April 2014



Falsework to support the erection of steel truss for the future canopy structure

Overview of the southern tip of site as in April 2014



Overview of the southern tip of site as in October 2014

Overview of the terminus structure as in March 2015

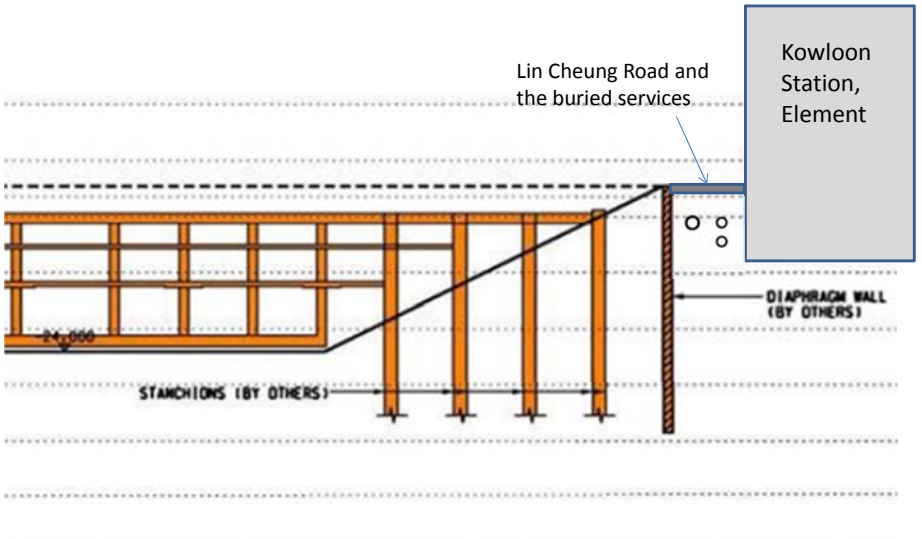
Overview of the terminus structure as in March 2015

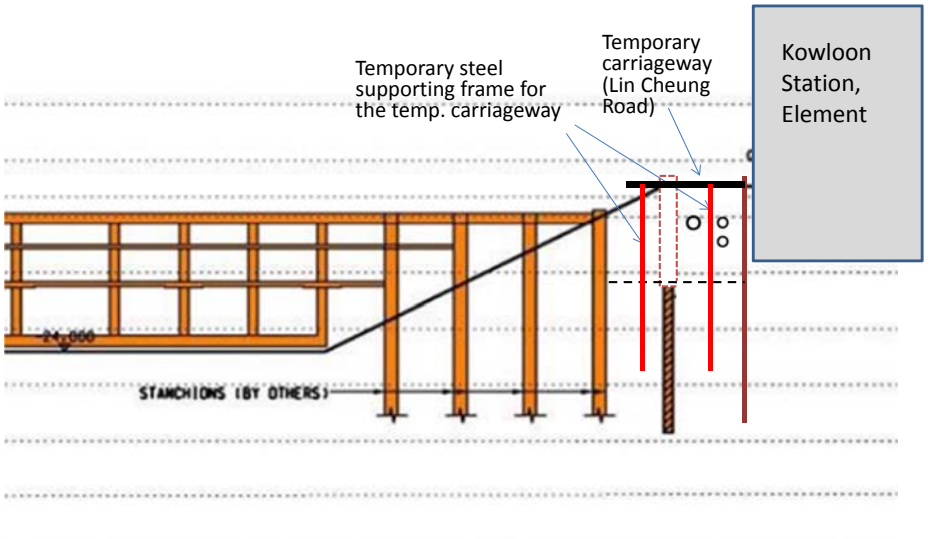
Complicated construction layout as seen in mid 2015

Construction of the terminus structure along Kowloon Station (previous Lin Cheung Road)

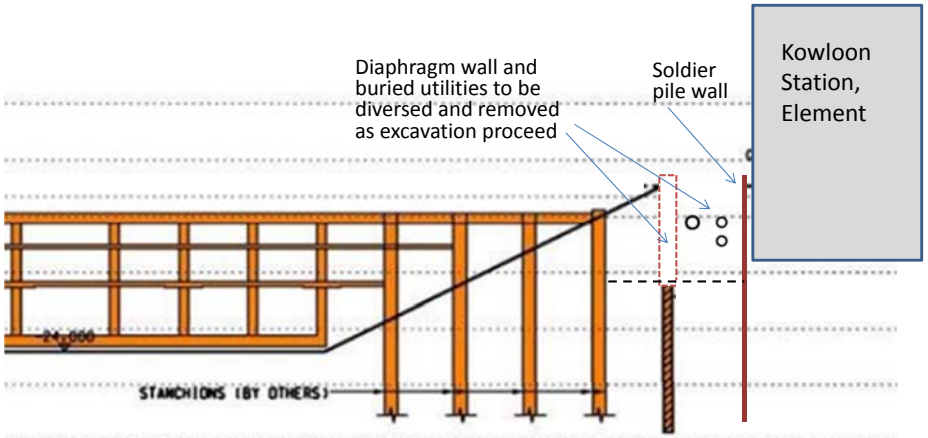
Work along this area is very difficult due to several reasons, including:

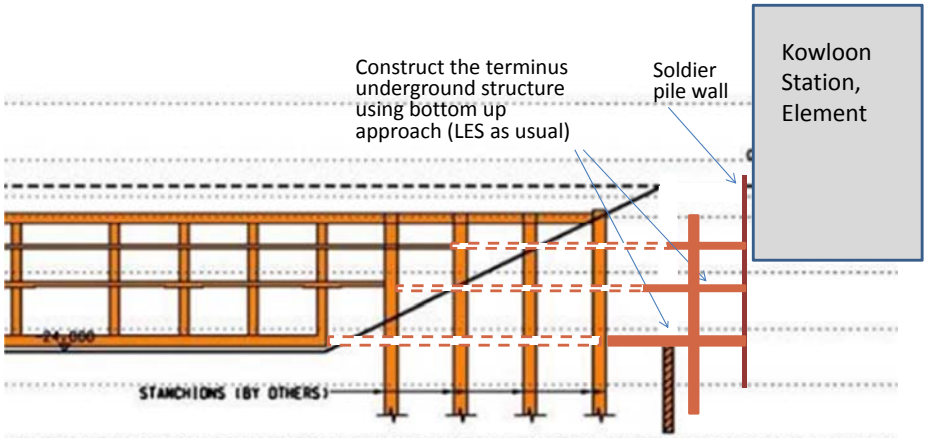
1. Some major utilities were located underground along previous Lin Cheung Road.
2. Construction using top-down manner along this area adjacent to the underground structure of the Kowloon Station needs extra stabilization during the excavation process





Drawing not to scale





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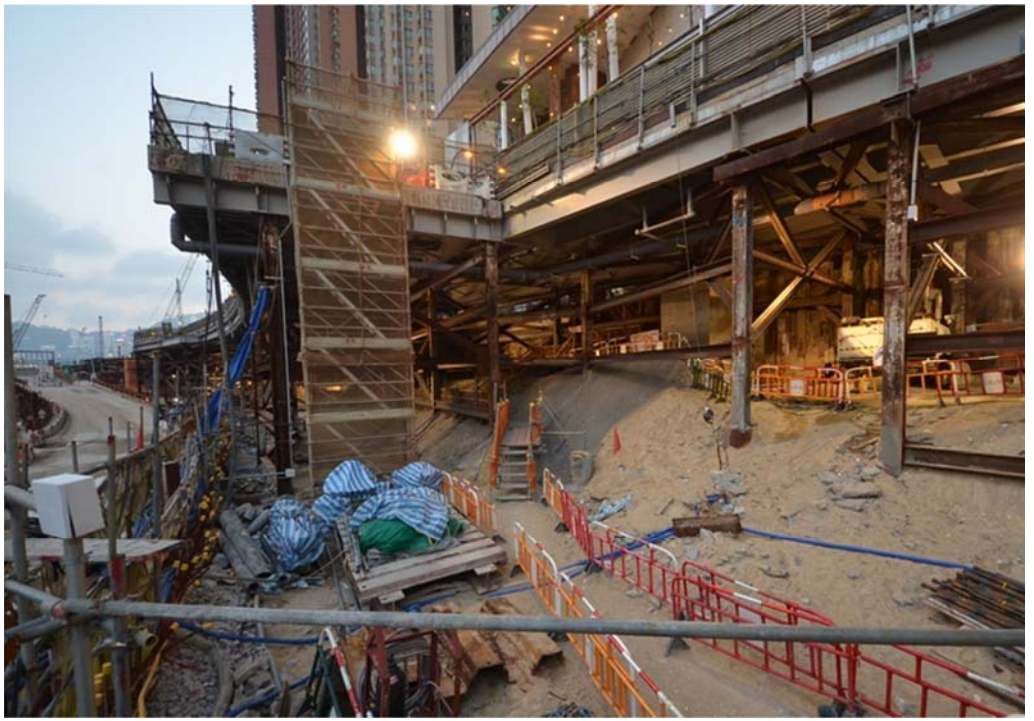


Working situation underneath the temporary carriageway

Highlight of Express Rail Link on the West Kowloon Terminus Station North

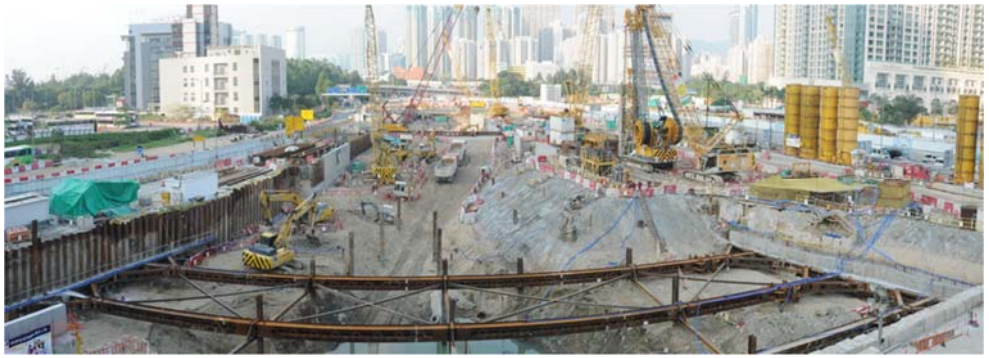
(Mainly for Contract 810B)


Alignment of the
Kowloon Southern Link


storm water
nullah
Difficulties encountered
- Crossing storm water nullah
- Crossing a series slip roads of the W Kowloon interchange
- Working close to two railway tunnel


The construction of the cut-and-cover tunnel as seen in early 2015

The approaching tunnel heading north as seen in mid 2012

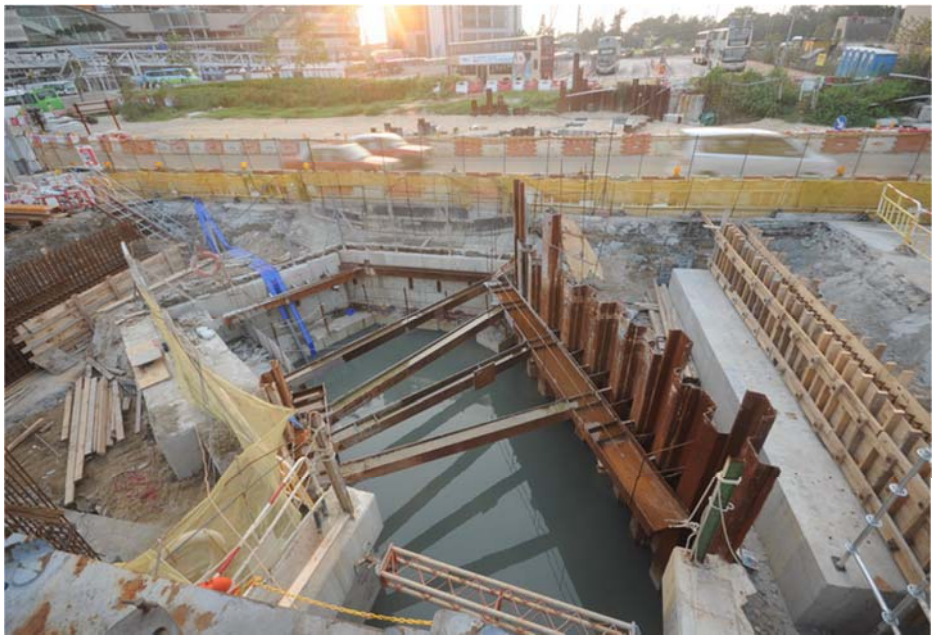


The approaching tunnel constructed using cut-and-cover method as seen in mid 2014

The approaching tunnel constructed connecting to the terminus structure as seen in mid 2014

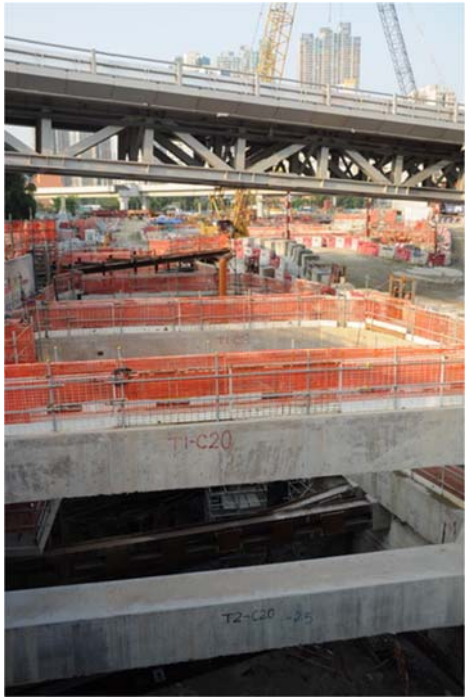
Views inside the cut-and-cover tunnel (Mid 2014)

Diversion of existing storm water nullah

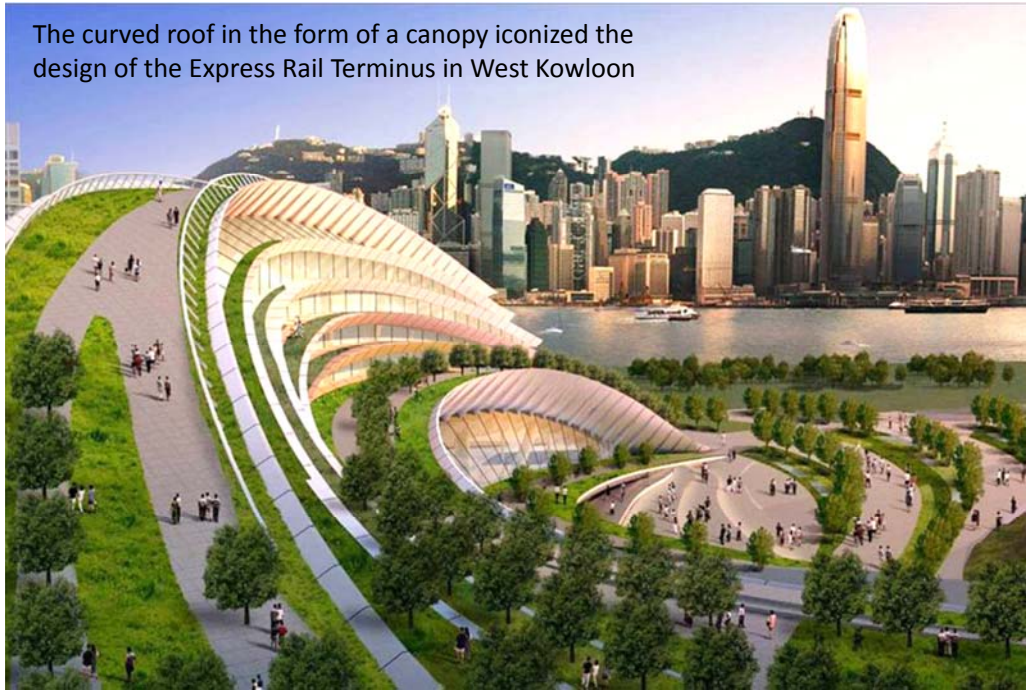


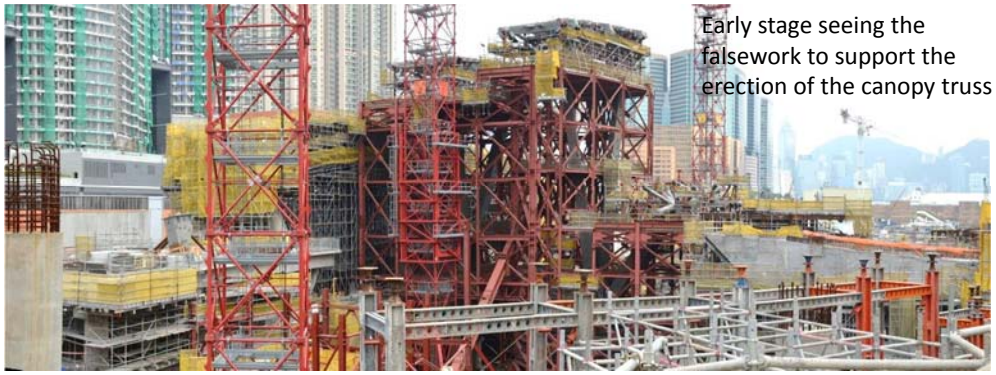
Temporary diversion of a slip road
(West Kowloon Interchange)

Tunnel end heading to the
Tai Kok Tsui TBM section


T1-C20
T2-C20

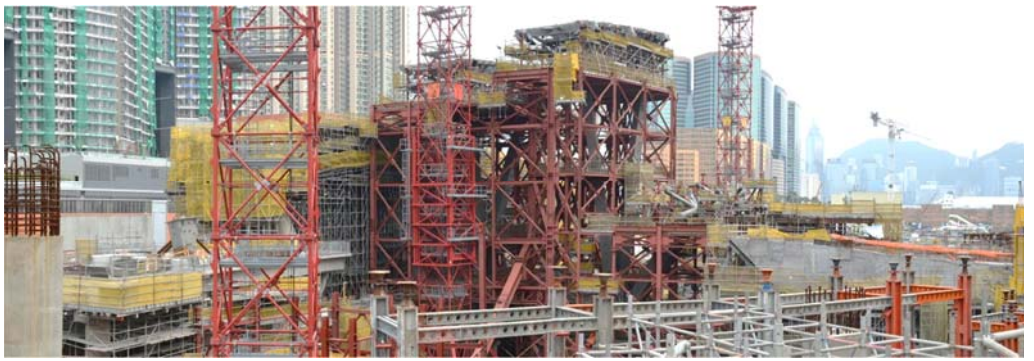

T1-C18


The curved roof in the form of a canopy iconized the design of the Express Rail Terminus in West Kowloon



Early stage seeing the falsework to support the erection of the canopy truss

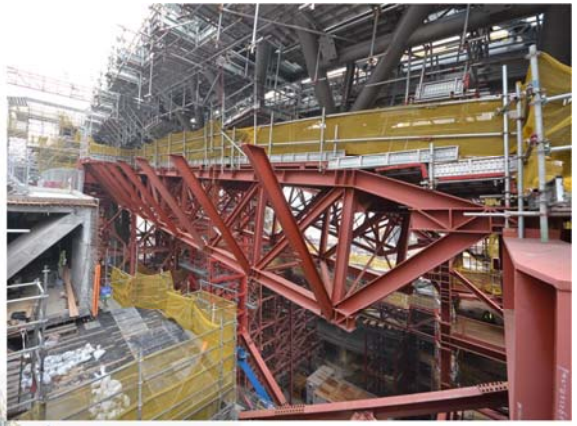
Erection of the main canopy truss as in Feb 2016

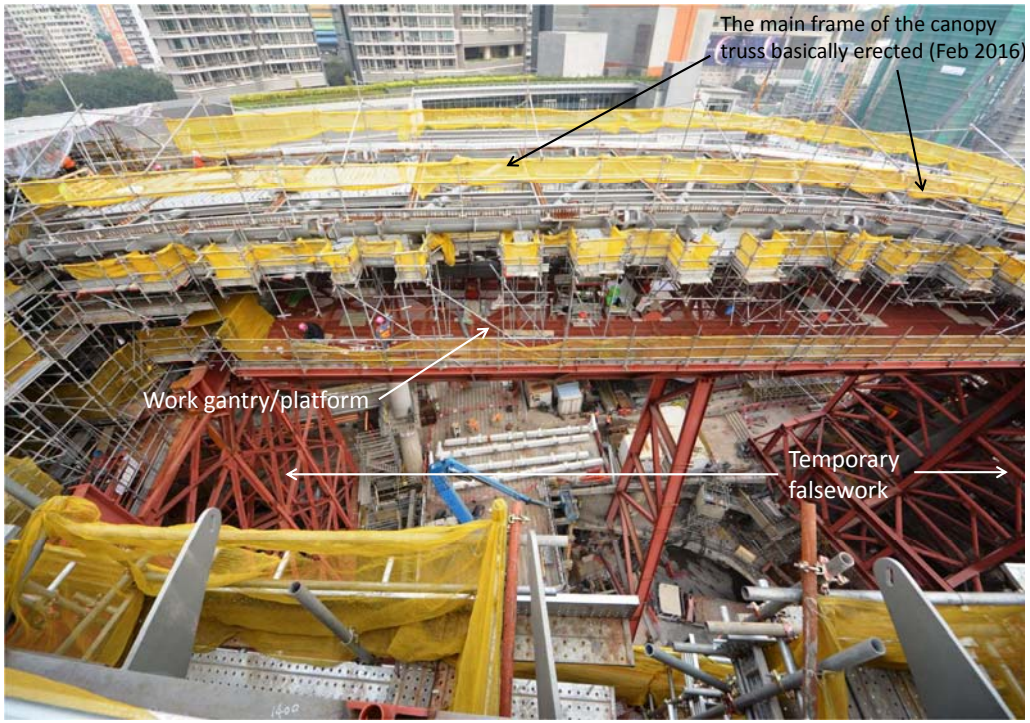


Side views of the canopy truss as seen in February 2016 (eastward/Westward views)

View on the top of the 3rd roof truss

Gigantic false and gantry supporting the erection of the main trusses of the curved canopy





Means to control the dimension due to deflection using hydraulic or screw jack

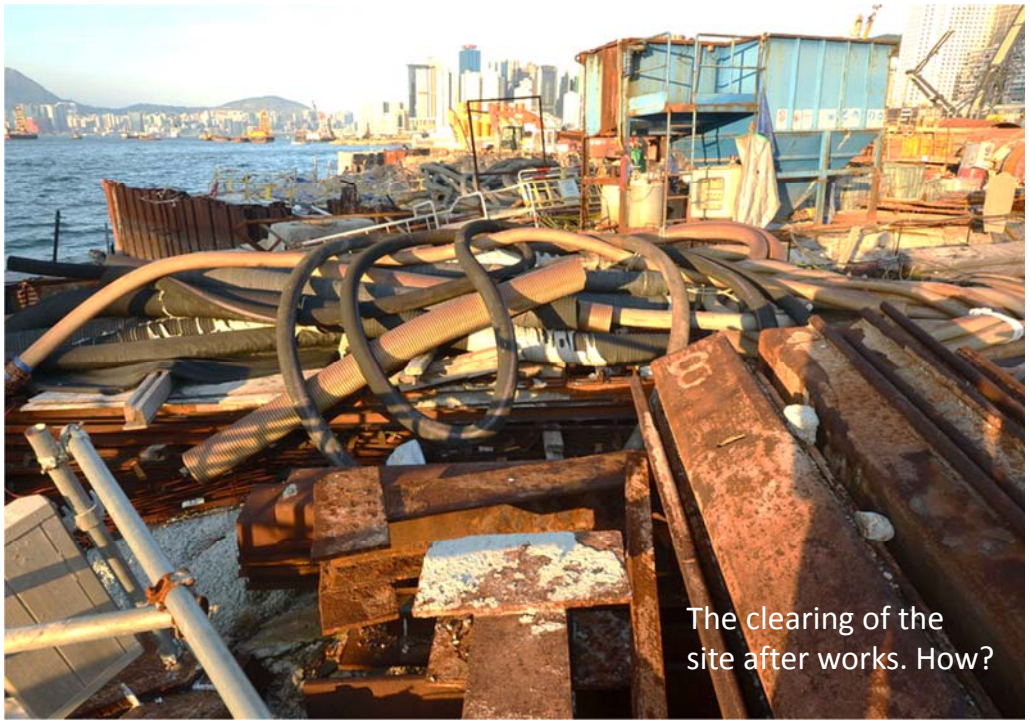
Using hydraulic or screw jacks to control dimensions

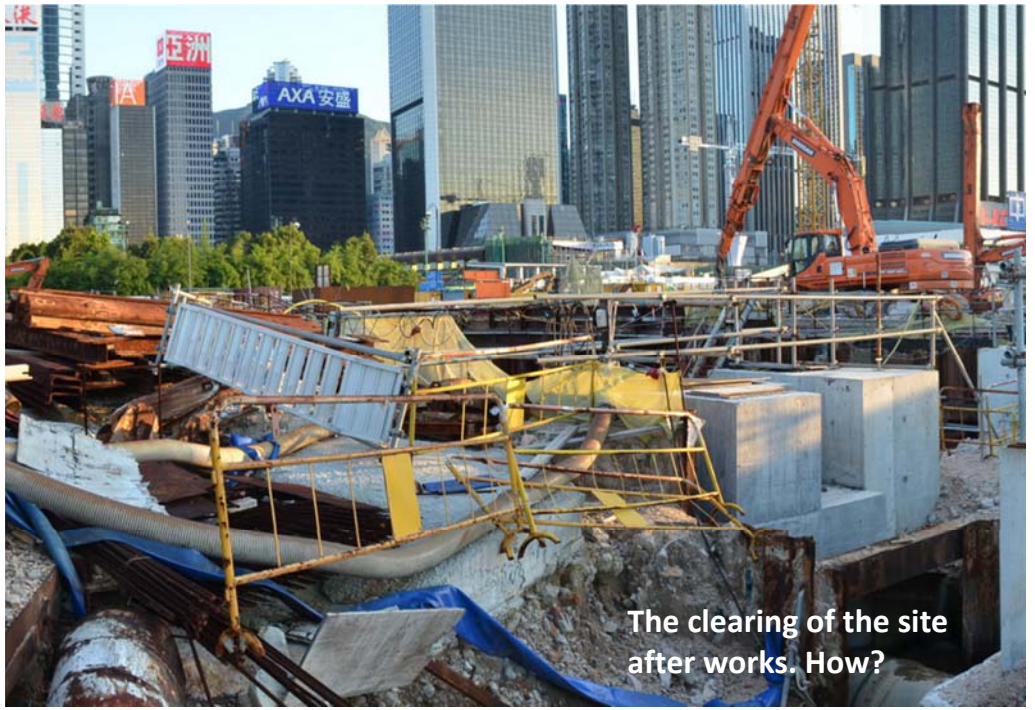
Aftermath

The clearing of the site after works

The clearing of the site after works

Formwork collapsed during concreting





Any cases for discussion about the provision of temporary works?

1. Construction of rock cavern
2. Mega stadium (Bird's Nest in Beijing)
3. Long-span bridge (Ting Kau, Tsing Ma)

The end of Part 2 Presentation