Title of Talk :

An overview of various types of construction operations as an introduction to operatives involved in the construction related industries

The talk aims to allow audience to understand more about the following targets related:

- What kind of infrastructure projects are undergoing in HK during the recent years.
- What are the engineering or technical features of these kinds of projects.
- The complexity of these projects in terms of the procurement process, scale of work, construction planning, resources handling and other multi-disciplinary concerns.
- The use of technology in the construction process.
- The concerns of safety in the work process.

Presented by
Raymond Wong
29 October 2016

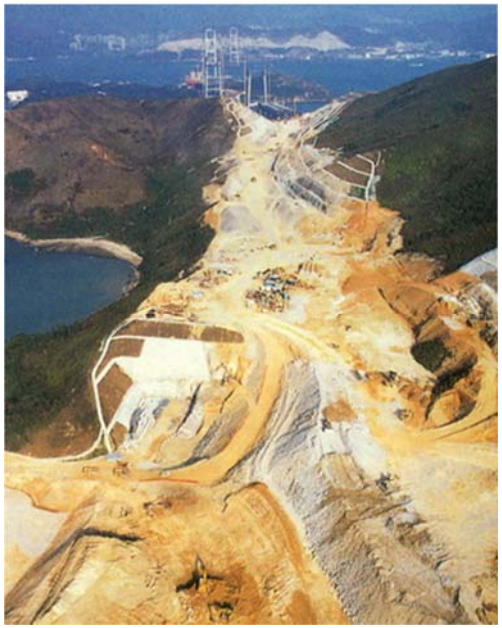
Engineering/Technical features of Construction Projects

Classification of Construction works in general

1. Excavation/rock cutting works
2. Slope works
3. Foundation works
4. Falsework (including work platform, scaffolding and other temporary work erection)
5. Formwork
6. In-situ and precast construction
7. Structural steel works
8. super-highrsie construction
9. Long-span construction
10. Heavy lifting and fixing/erection works
11. Landfilling and reclamation
12. Tunneling works
13. Construction of Bridged
14. Demolition and dismantling works
15. Building services/E & M installations

1. Excavation/rock cutting works
2. Slope works

Large scale cutting in the 1790s – Tuen Mun Highway at Ting Kau



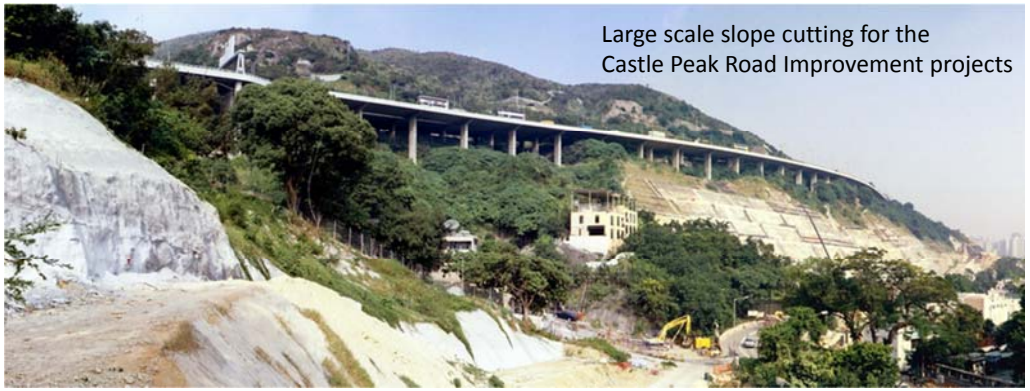
Major slope cutting for the forming of the North Lautau Expressway as viewed in 1995

Land formation for the connection between Ting Kau Bridge and Tai Lam Tunnel (Route 3)

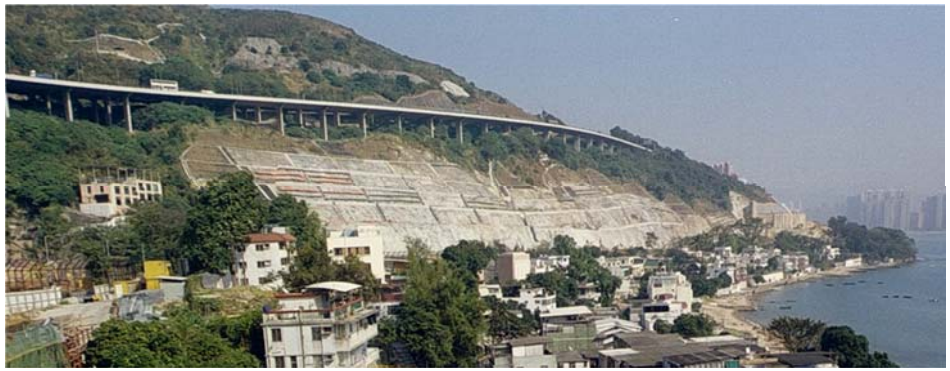
Some of the mechanical equipment used in the Route 3 project for slope cutting/land formation

Forming of the new town of Tseung Kwan O (Tiu Keng Leng)

The use of blasting and splitting method to cut the rock



Large scale slope cutting for the Castle Peak Road Improvement projects



Forming the tunnel portal for Nam Wan Tunnel at Tsing Yi (from Stonecutters Bridge)

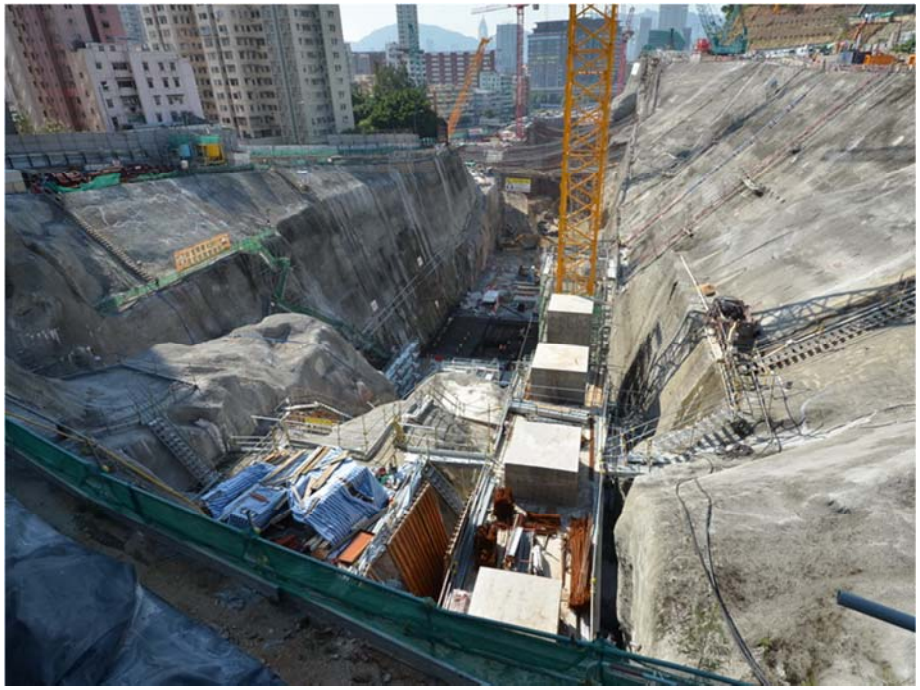
Aerial view of the Express Rail Terminal at West Kowloon in 2011

The terminus site (south) as seen in mid 2012

Express Rail Terminal Site at West Kowloon (November 2011)

Overview of site as in August 2012

Forming the Ho Man Tin Station by rock cutting (August 2012)

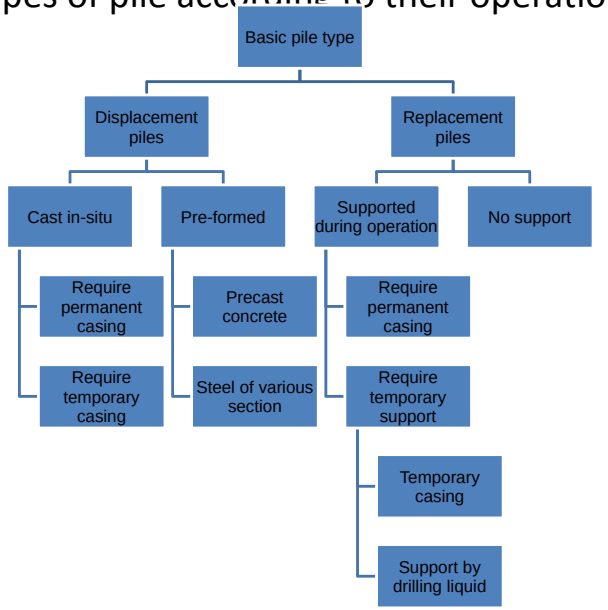


November 2013

Slope work for highway projects, the Tuen Mun Highway Improvement Works

Foundation Works

Types of pile according to their operation



Steel H-pile as foundation

Piles formed by percussion methods

H-pile driven using gravity drop hammer

Precast circular-section pile driven by diesel hammer

Forming of bore-pile as foundation

Piles formed by mechanical methods (e.g. bored piles of various kinds)

Small dia. pile formed using boring rig and drill

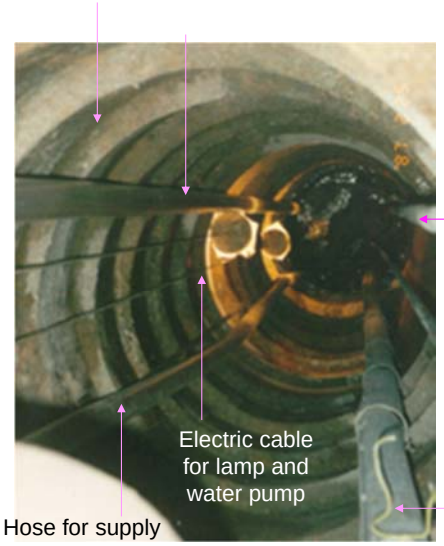
Medium dia. pile formed using bucket barrel

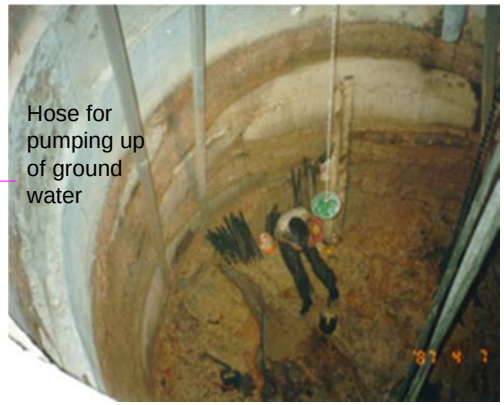
Large dia. Pile formed by reverse circulation drill

Foundation using bored piles

(Manual-dug method – Caisson)

Hand-dug caisson working in sloped site





Working inside a caisson

Foundation using bored piles

(formed by chisel and grab and support with casing)

Various forms of grab

Foundation using bored piles

(formed by chisel and grab and support with casing)

Various forms of chisel (for rock breaking)

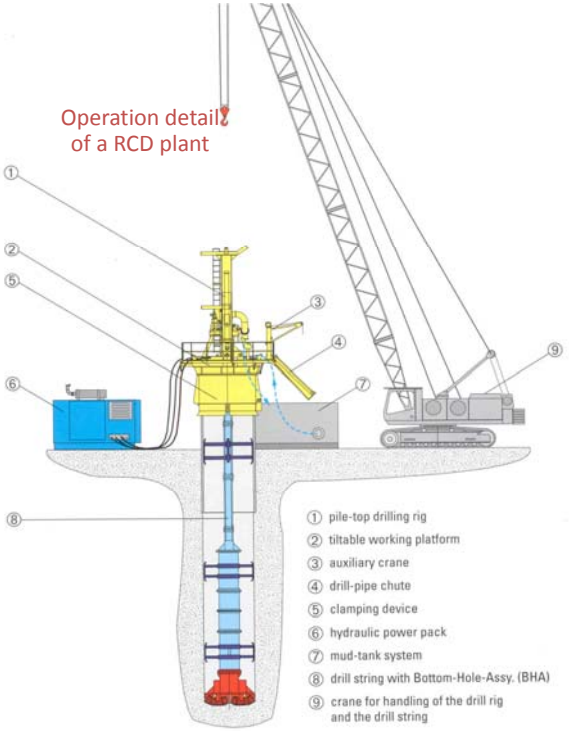
The set-up – RCD rig, serving crane and spoil separating tank

Placing the drill rod into the bore hole with the RCD rig tilted to give way

The drilling process

Drilling rod and the auger head

Bored pile formed by Reverse Circulation Drilling (RCD) method



Besides foundation, the sub-structure part of a building is also an important part of the building structure supporting a building.

Other example for sub-structure works – City University new Administration Building

Other example for sub-structure works – City University new Administration Building

Ground beam details

Falsework and Temporary Works

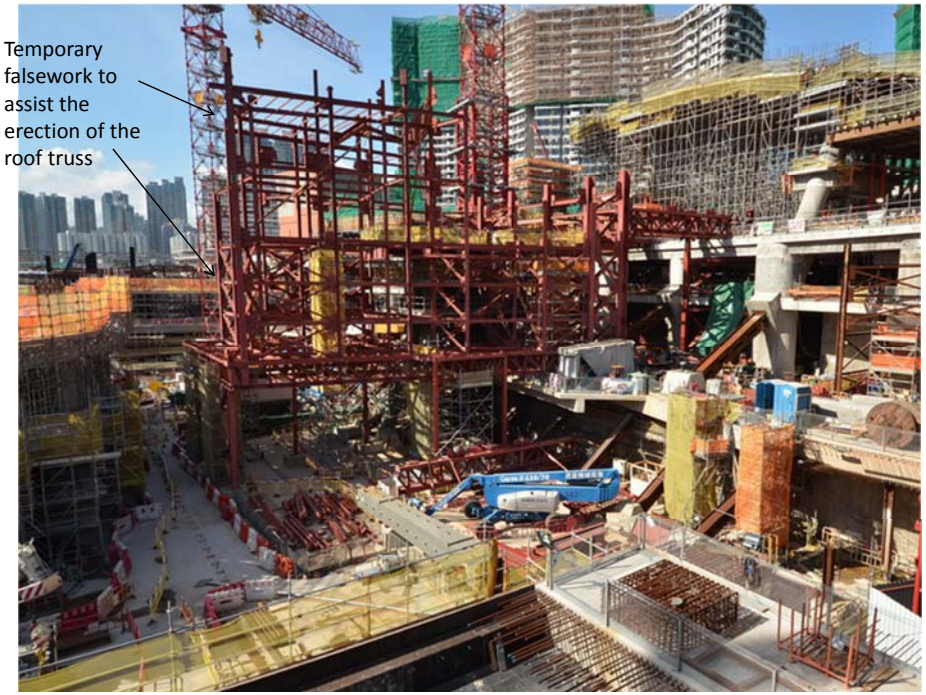
External scaffold as work platform/safety screen for general building renovation work

Falsework to support the construction of a portal beam
for the Route 8 Truck Road at Butterfly Valley

The falsework set-up as seen from the from the storm water discharge nulah

Temporary driveway-work platform for the Tuen Mun Highway Widening project

Work platform for sloped/confined sites



Falsework to support the large span roof truss of the Express Rail Terminus at West Kowloon

Temporary access way over water

Work platform in very congested site

Work platform in very congested site

Large area of falsework forming part of the floor formwork

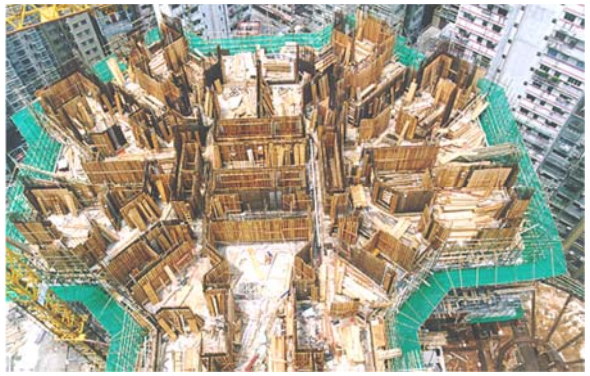
Formwork

Typical set for a large-scale project using traditional timber formwork

Overview of the tower blocks seated on the transfer plate above the gigantic podium structure. Note the complicated spatial environment especially the working height in this job.

Superstructure

- irregularity in layout
- complicated architectural features in external envelops
- large amount of short-span slabs
- large amount of shear walls in the structure
- use of manually operated timber panel forms



Formwork in reality - in typical site environment

Examples of steel form in the form of large panel shutters

Using table form for slab

Table form for the flat slab structure

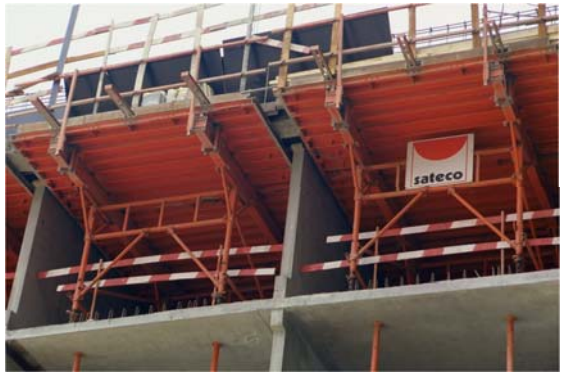


Table Form

Floor formwork using manual system (propped small panels)

General detail of the aluminium form – stair

Detail of a typical aluminum formwork system for apartment-type building

Climb form operated by the use of a series of synchronized hydraulic jack systems

Formwork at its opened mold

Arrangement for the core wall and floor formwork

Traveling form for the forming of the passenger access linking the Airport Terminal Building and the Ground Transportation Center

The roof portion above column head that formed using normal soffit panel supported by props

Gantry form/tunnel form system for the construction of station facilities

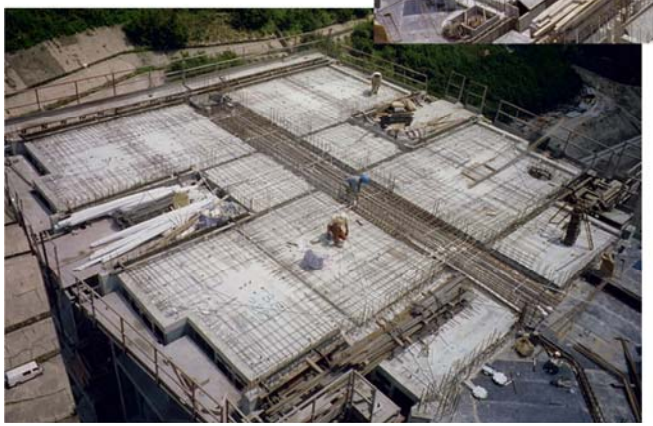
Formwork Collapse Cases – The Festival Walk

Formwork Collapse Cases - Industrial Building in Kwai Fook Rord, Kwai Chung, 1995

Precast Construction

First generation of Harmony Block using after-fix façade

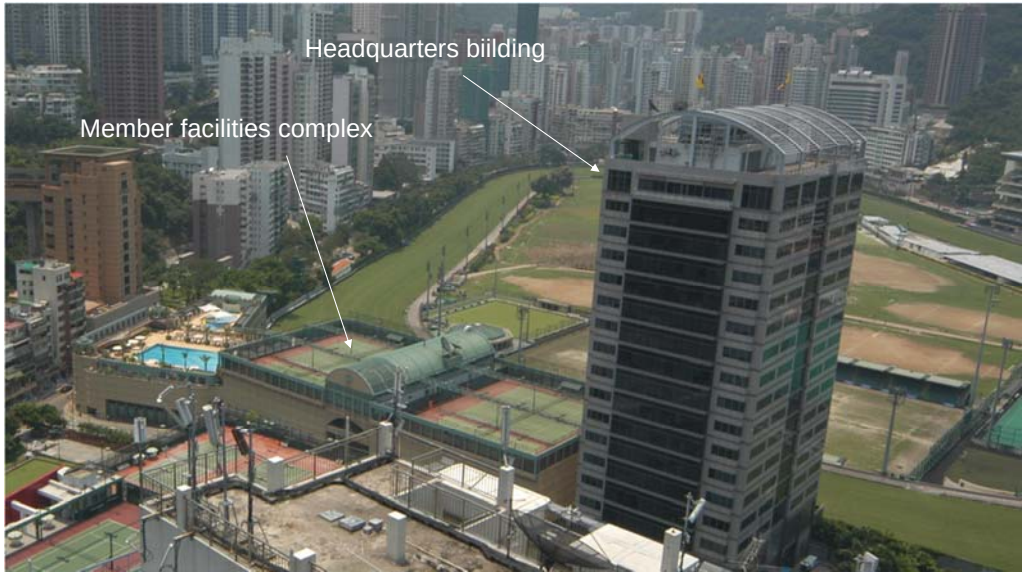
Later version of Harmony Block using inisitu façade cast at the same time with structural walls



Mechanical formwork systems incorporating the standard precast elements in the construction of latest version of public houses in the late 1990 (the Concord design)

Formwork in the casting yard for the casting of the precast units

Other examples of using large amount of precast elements
– Headquarters Building of the HK Jocky Club



Other examples of using large amount of precast elements – Government staff quarters in West Kowloon near Nam Chong Station

Residential Development at Taikoo Valley (2003)

Residential development
at Cyber Port (2003)

Hotel/Apartment Building project in Hung Hom Bay (2004-06)

Another hotel project owned by Cheung Kong in Hung Hom Bay just next to the other one

Private residential development at Tuen Mun (2006)

Private residential development at Tuen Mun (2006)







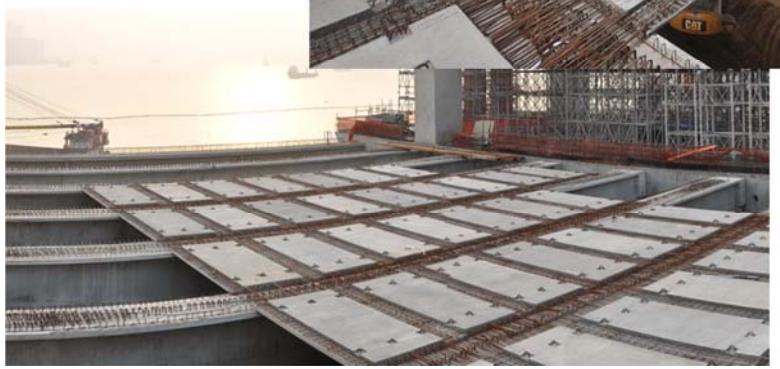


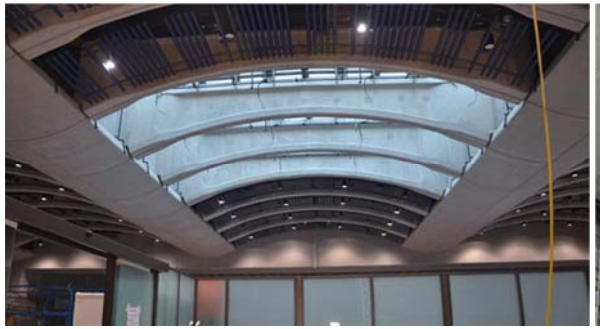

Residential redevelopment
in Kowloon City

Precast façade with finished tile work

Kowloon Motor Bus Maintenance Depot (2002)

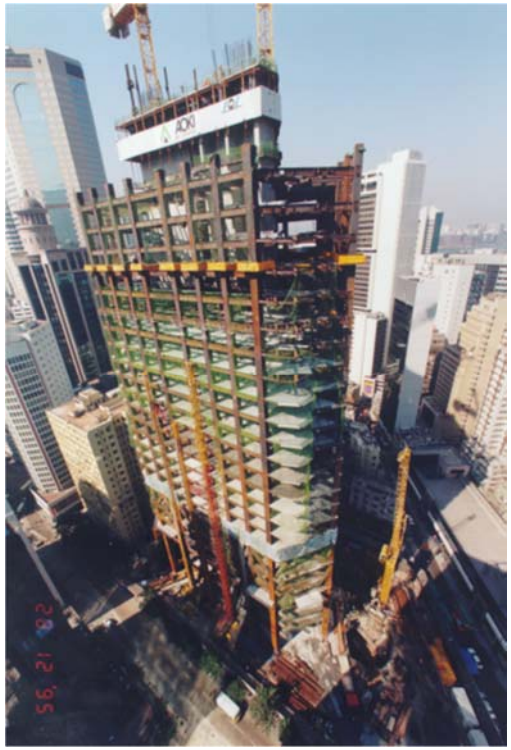
Cruise Terminal at Kai Tak





Structural Steel Works
and
High-rise Construction

The Center



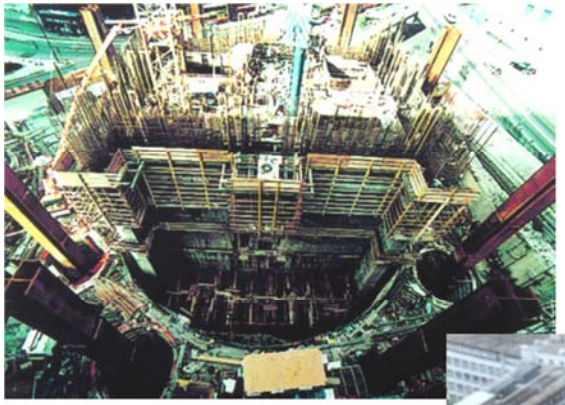
Redevelopment of the Lee Gardens Hotel – The Manulife Tower

Redevelopment of the Hilton Hotel – Cheung Kong Center

International Finance Center Tower 2

International Finance Center Tower 1 – RC core + RC perimeter columns configuration up to 23/F, 23/F to 38/F becomes a composite structure with columns & slabs in steel

IFC 2 – structural configuration of the tower with the first set of Transfer/Belt Truss on 6/F, mega-columns, edge beams, floor deck. and the RC core

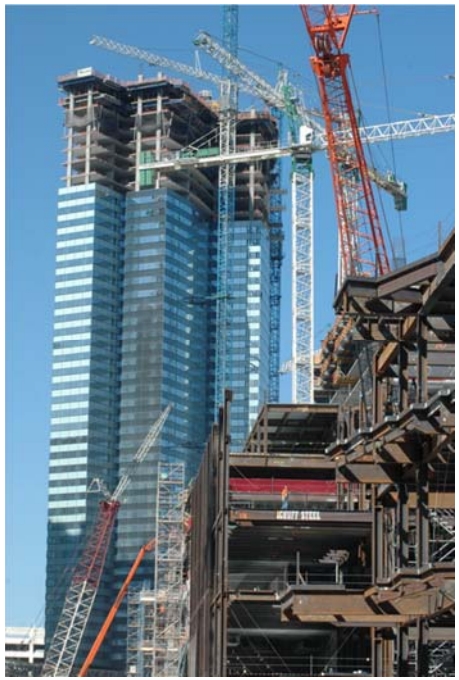


Cheung Kong Center

The Jump form being used in the construction of the core wall for the Cheung Kong Center

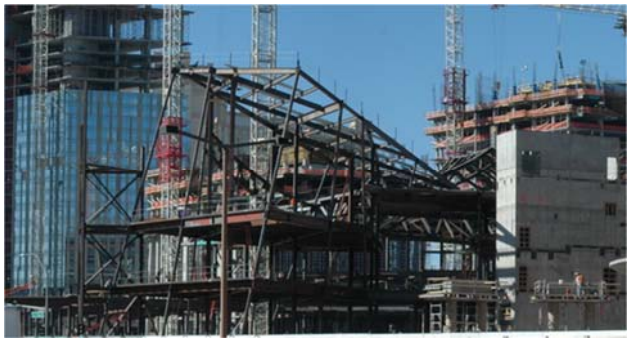
Climb form system for the construction of the core wall for the Manulift Tower's superstructure

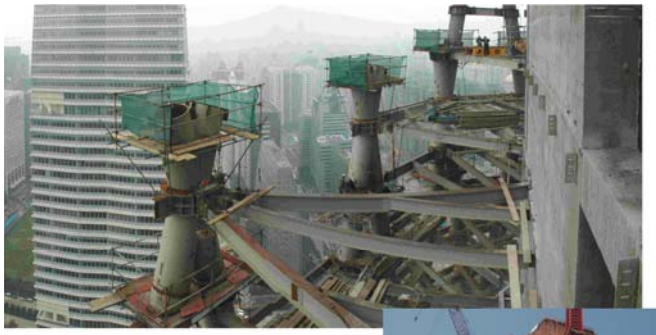
External steel column being erected & tied back onto core wall by steel beams



The popular use of structural steel in construction other than in HK

– the case in Las Vegas, USA, 2008

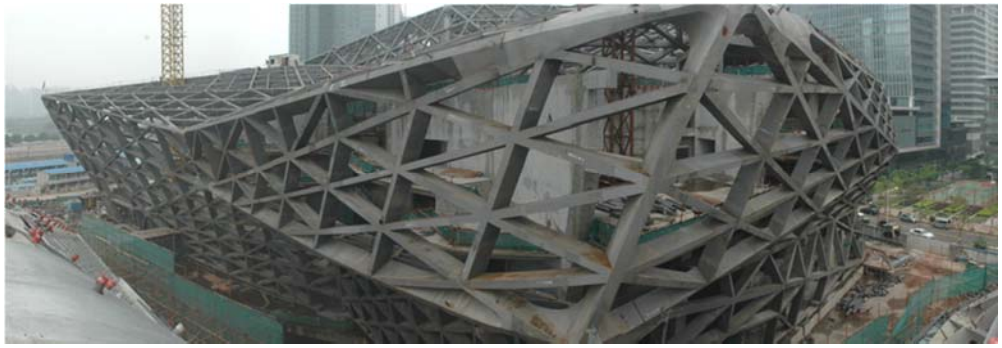




The popular use of structural steel in construction – the case in Guangzhou International Finance Centre

The popular use of structural steel in construction – the case in Guangzhou Museum, (2009)

The popular use of structural steel in construction – the case in Guangzhou Opera House, 2009

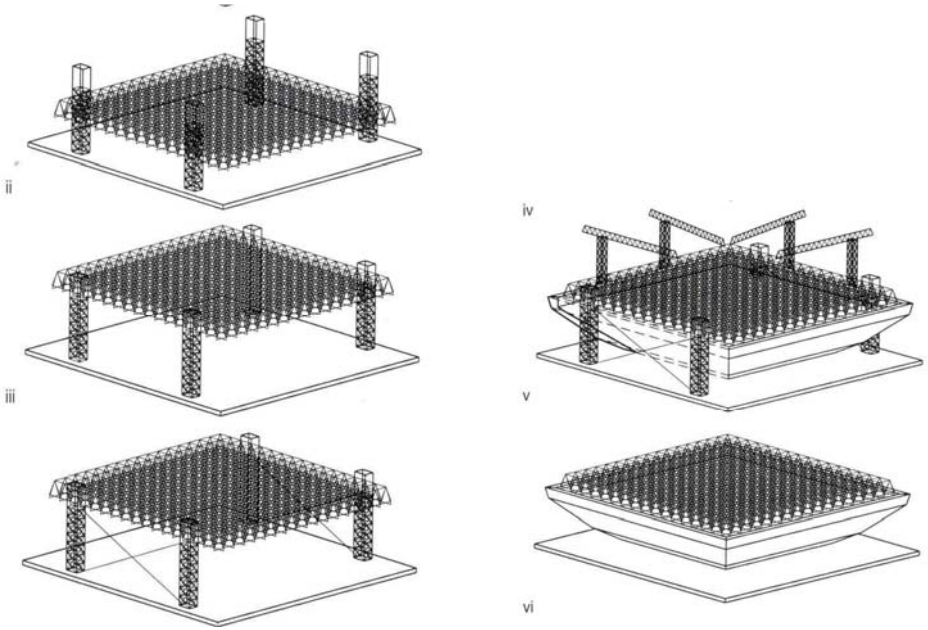


The steel external envelope
of Guangzhou Opera House

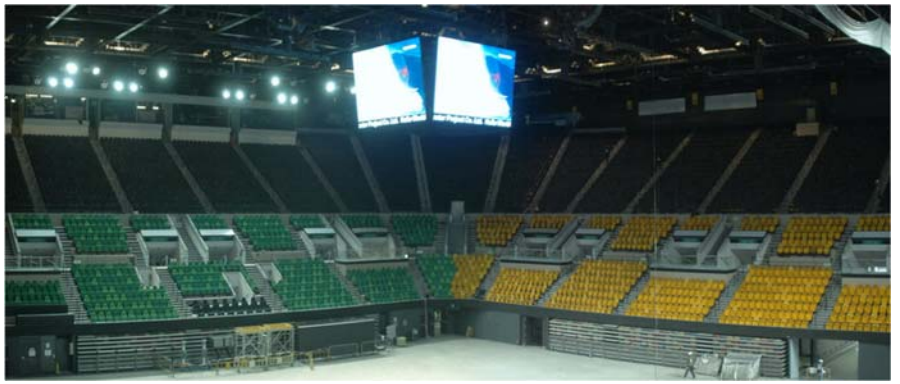
New Guangzhou
TV Tower

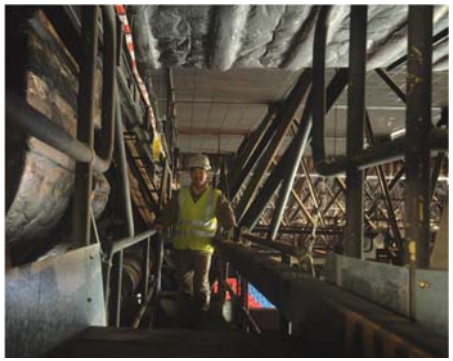
Long-span Construction, Heavy Lifting
and
Heavy Fixing/Erection Works

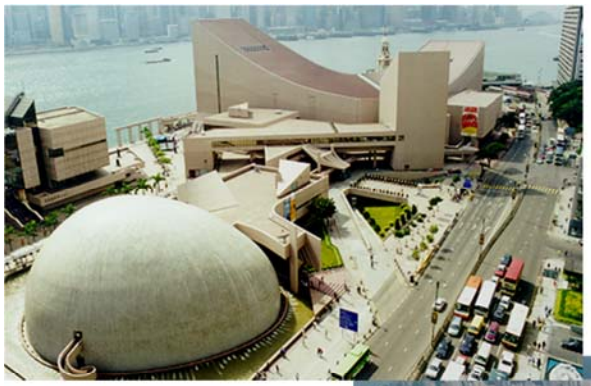
Hong Kong
coliseum



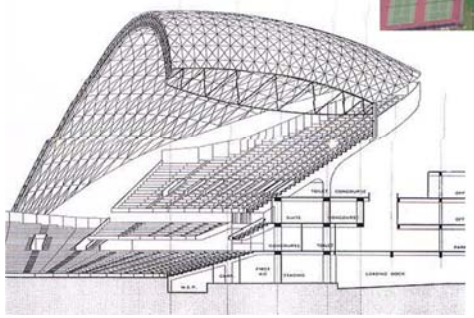
The Hong Kong coliseum



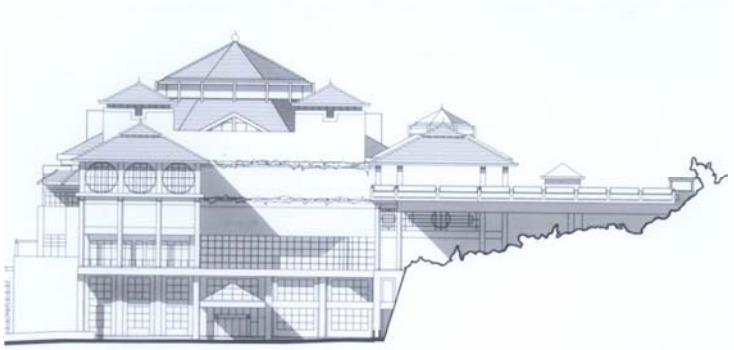




Cultural Center and Space Museum



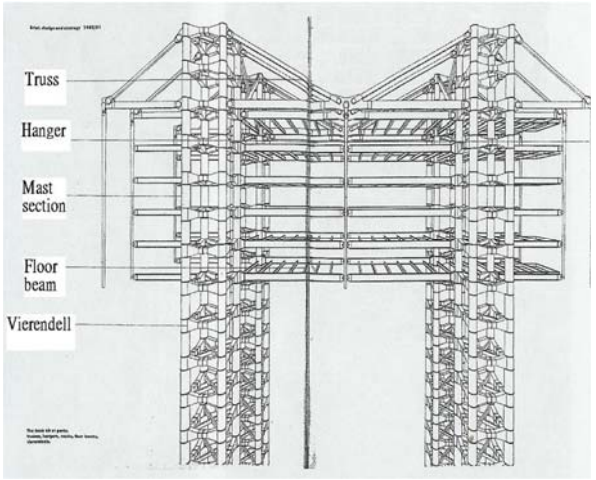
The Hong Kong Stadium



Member Centre of the Hong Kong Jockey Club

Member Centre of the Hong Kong Jockey Club

Span about 25m

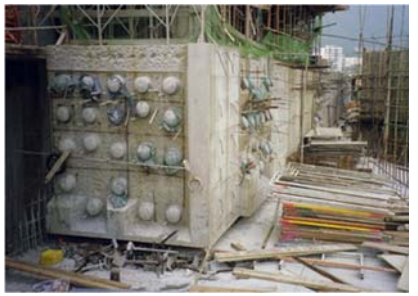


Actual Example –

Headquarter Building, Hong Kong $ Shanghai Bank

Actual Example –

The Skylight structure of Festival Walk



Other long-span spaces within Festival Walk constructed using in-situ method

Other long-span spaces within Festival Walk – the public bus terminus

The New Hong Kong International Airport at Chek Lap Kok

The New Hong Kong International Airport at Chek Lap Kok

Hanger structure for HK Aircraft Engineering Company Ltd. (HAECO) at Chek Lap Kok Airport

Hanger structure for HK Aircraft Engineering Company Ltd. (HAECO) at Chek Lap Kok Airport

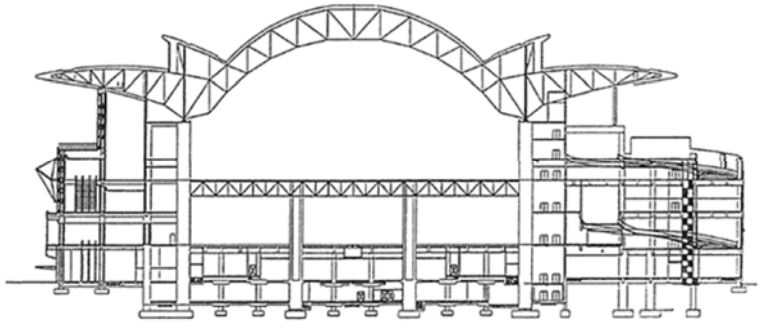
Linking structure between the International Finance Center Phase I and II

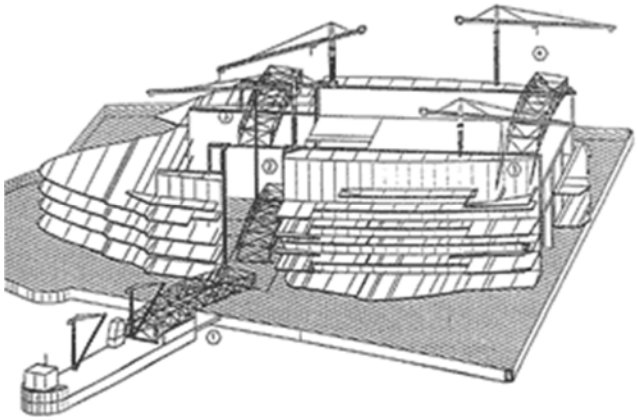
Hong Kong Convention and Exhibition Centre

The deck and roof structure of the HK Convention and Exhibition Centre

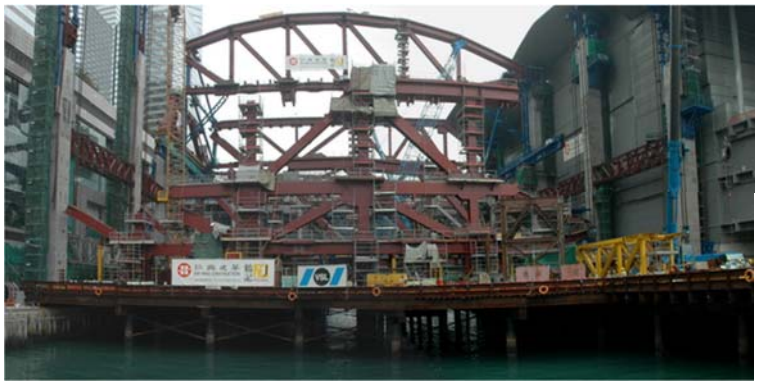
Hoisting of the 80m-span roof truss

Placing of the roof truss at the top of the core wall





Linking structure between Phase I and II of the HK Convention and Exhibition Centre



Extension to Hong Kong Convention and Exhibition Centre

Extension to HK Convention and Exhibition Centre

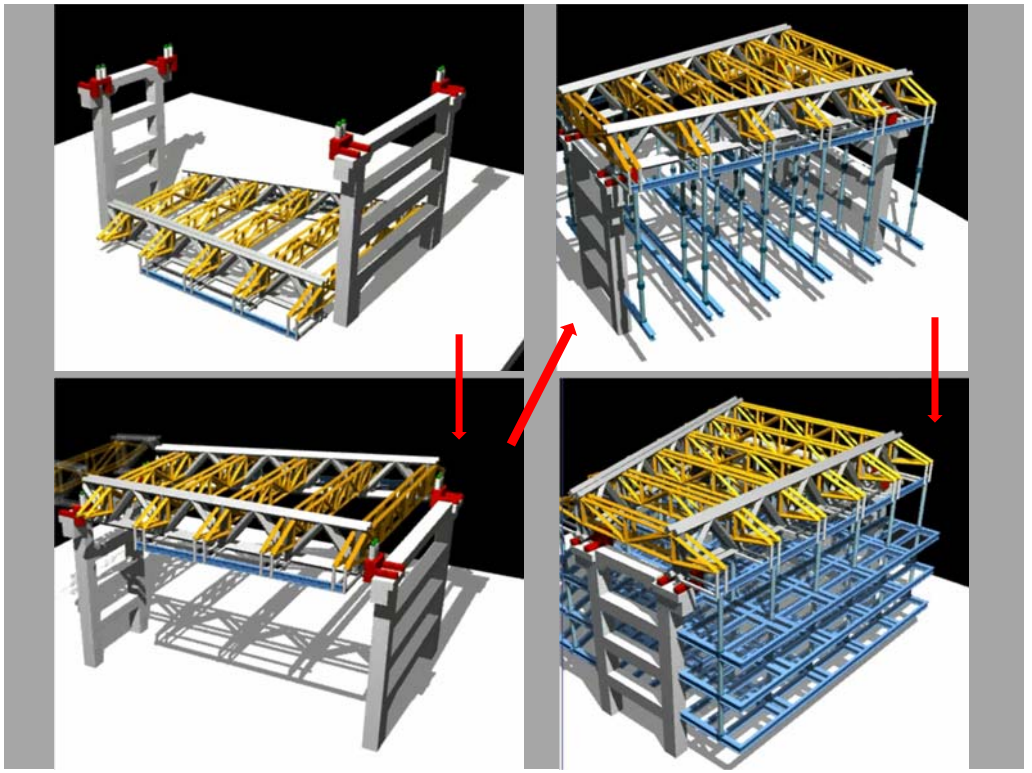
Bird View

Design Overview

Design Overview

Lifting and erecting of the link bridge between IFC 1 & 2

Lifting and erecting of the
link bridge between IFC 1 & 2



The link bridge as seen in 2014

The Sky Dome, Cyber Port

The Sky Dome, Cyber Port

Canopy for the New Stand/Race-practicing Court for the HK Jockey Club

The roof structure of Langham Place – Shopping Mall

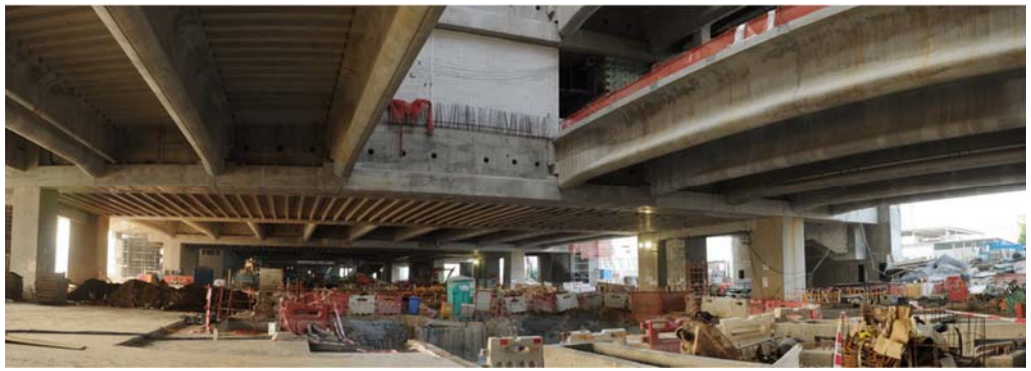
The Grand Atrium in Langham Mall

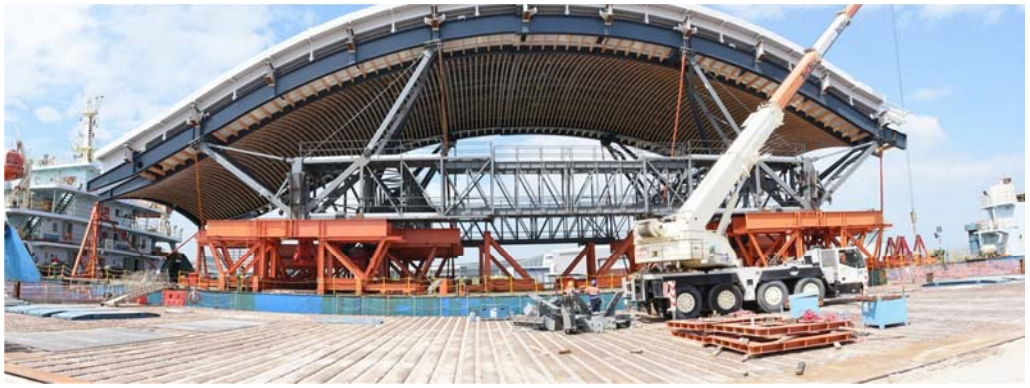
New Lisbon Casino.
Macau

New Lisbon, the hotel tower

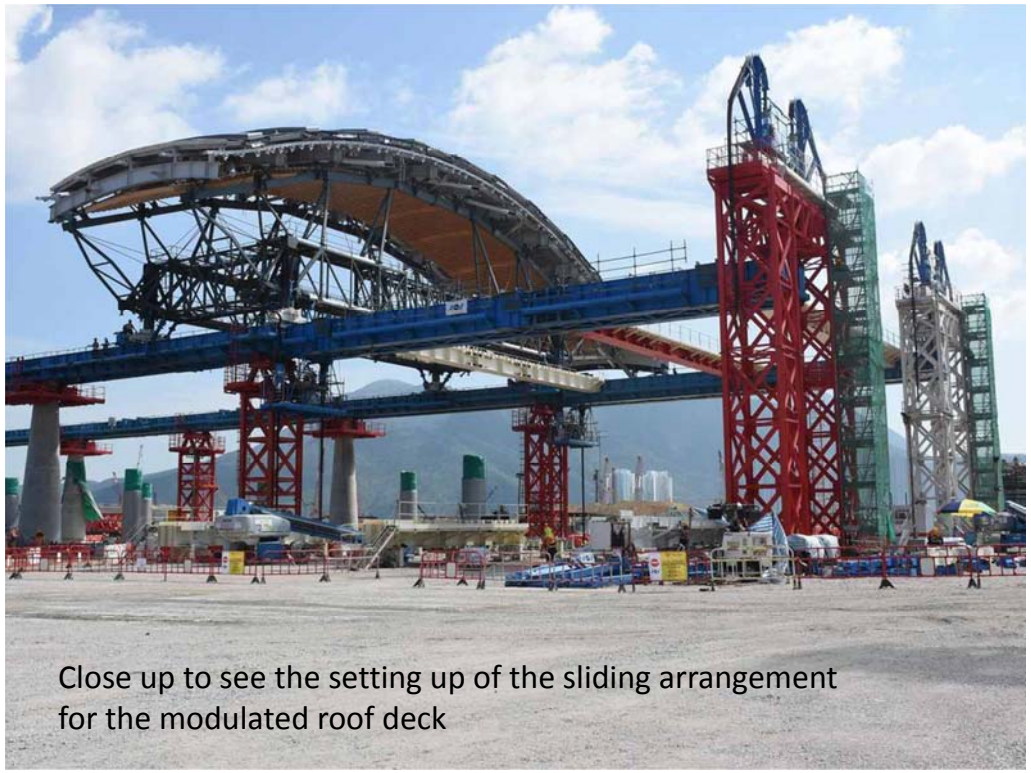
Sport ground in Tseung Kwan O

Lifting of the 45m precast beam
for the Cruise Terminal project





Lifting and erection of the modulated roof deck for the Border Check-point for the HK-Zhuhai-Macao Bridge



Close up to see the setting up of the sliding arrangement for the modulated roof deck

Landfilling and Reclamation

Formation of the Shatin New Town in the late 1970s

Formation of Tuen Mun New Town in the early 1980s

Hung Hom Bay
Reclamation in late 1980

Formation of the Airport Platform from the original Chek Lap Kok Island

Tai Ho Section and the Depot Facilities of the Tung Chung Line

West Kowloon at Yaumatei/Shamshuipo at the early stage of reclamation

Reclamation at Stonecutter Island to form land for Container Terminal No. 5 to 8

Construction of new ferry piers to replace the old that were still servicing central to Jordon Road and outlying islands

Servicing ferry piers

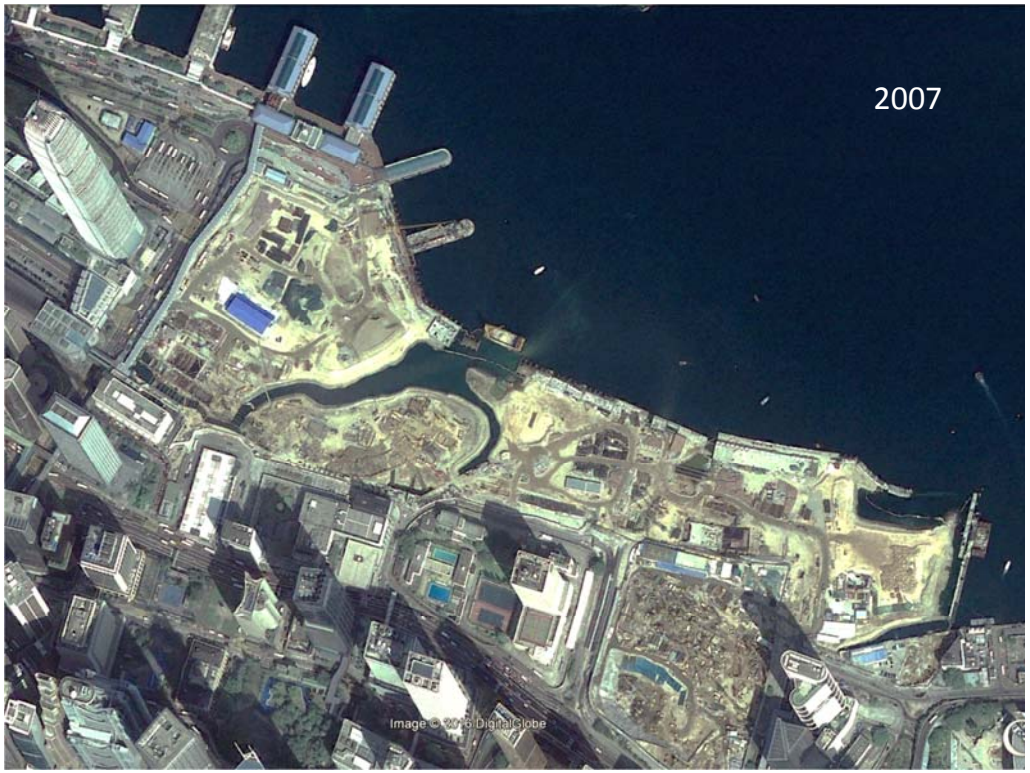
Reclamation carried out in a looped manner to allow servicing facilities to be replaced at the latest stage

Tsuen Wan West reclamation in late 1990

Reclamation for the Container Terminal No. 9

從昂船洲大橋下望所見的葵涌6、7及8號貨櫃碼頭

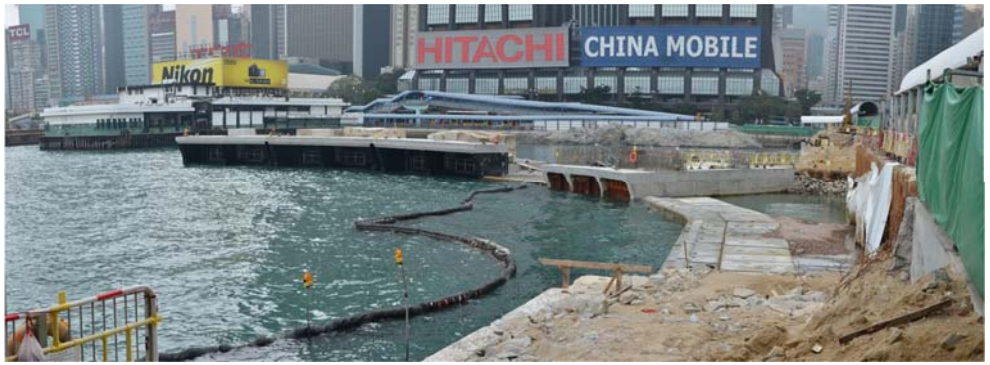
Reclamation involved in the Central-Wanchai Bypass Project


2007
Image © 2016 DigitalGlobe


2007

2011


Image © 2016 DigitalGlobe


HITACHI
CHINA MOBILE
Nikon


HITACHI
CHINA MOBILE
Nikon


2013
Image © 2016 CNES / Astrium


2014
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2015
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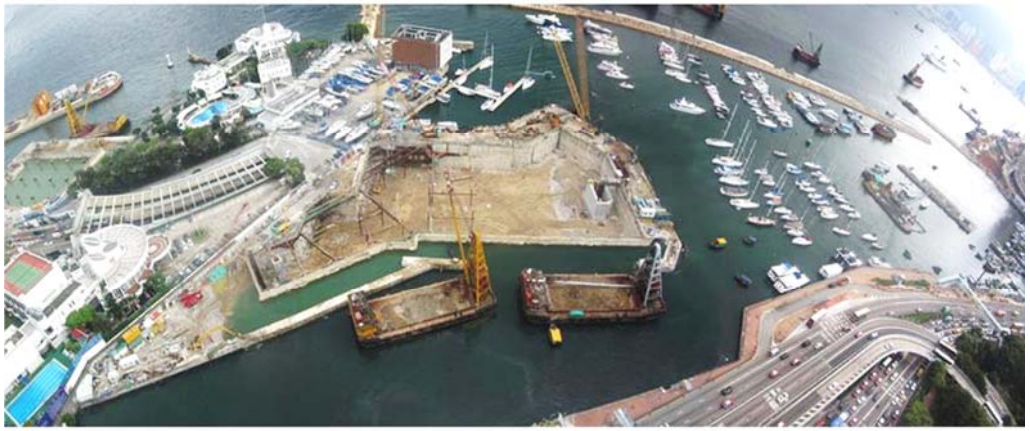
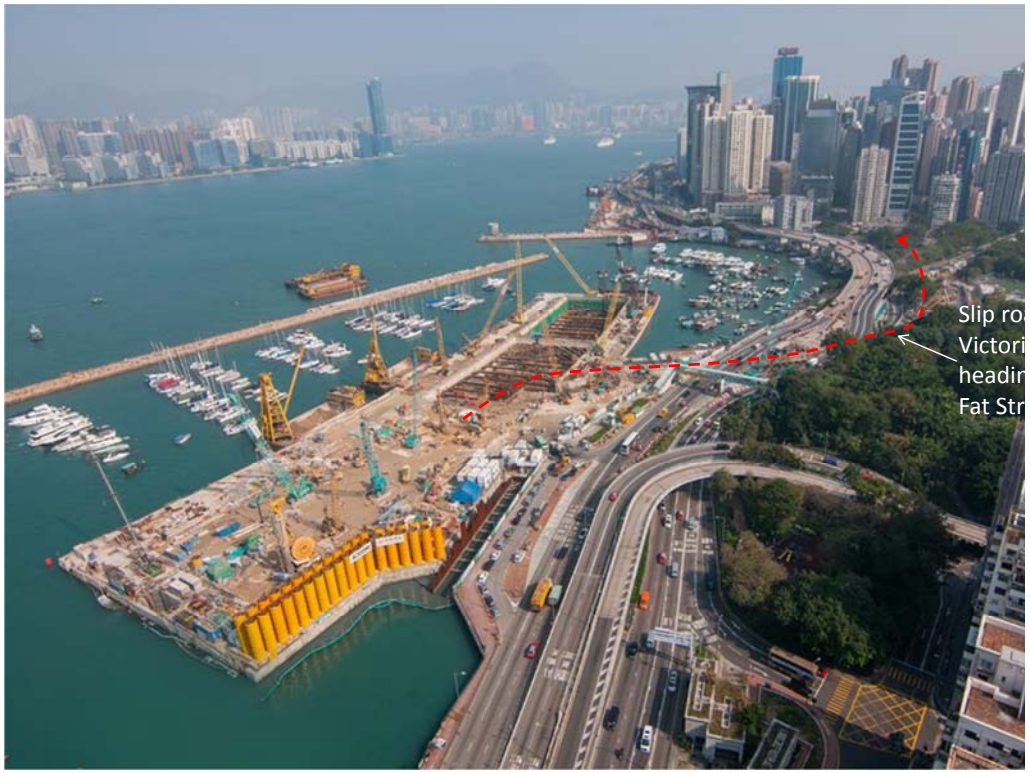


July 2014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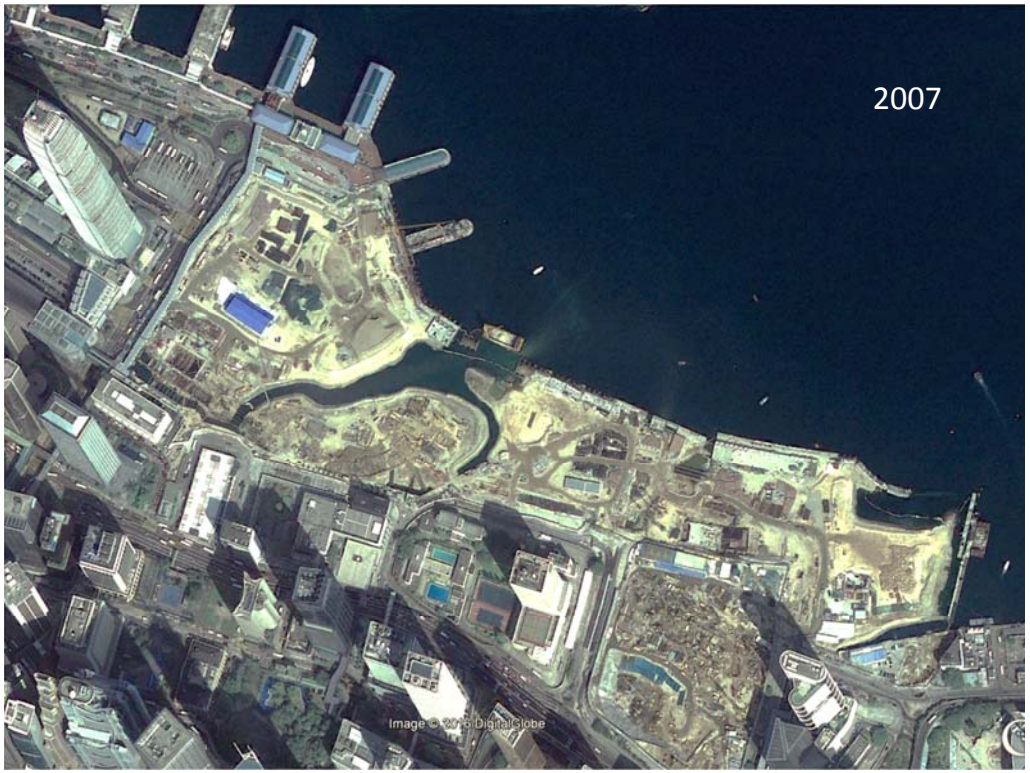
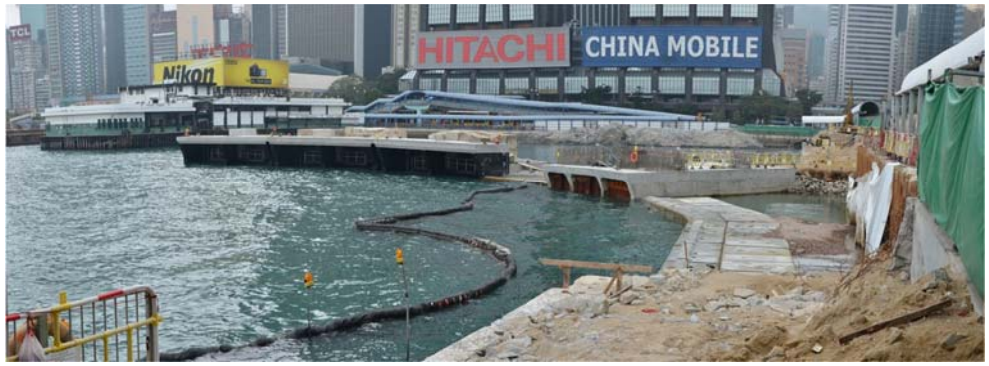

2007
Image © 2016 DigitalGlobe


2007


2011


Image © 2016 DigitalGlobe


HITACHI
CHINA MOBILE
Nikon


HITACHI
CHINA MOBILE


2013
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2014
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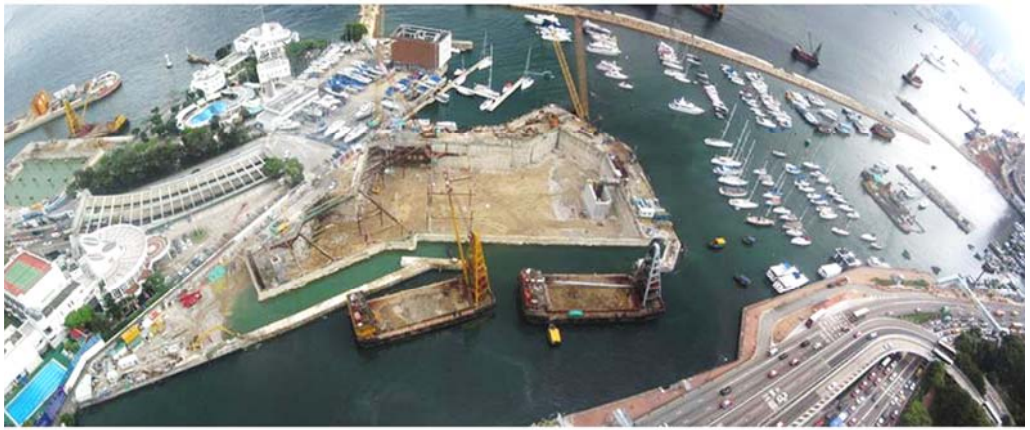
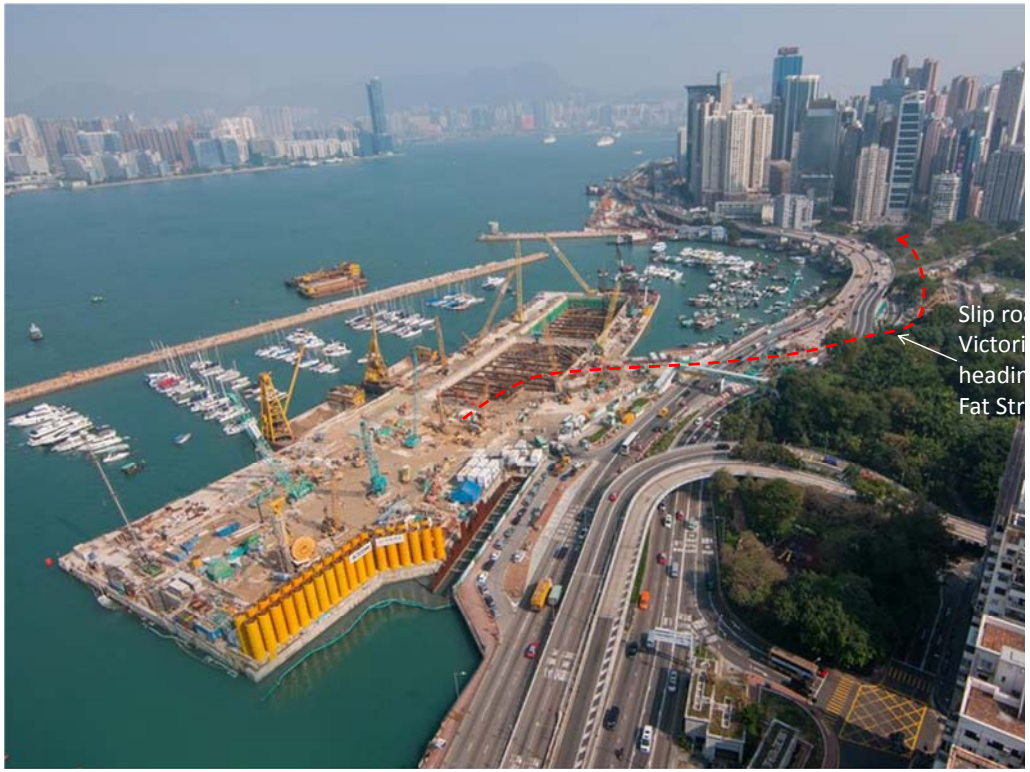


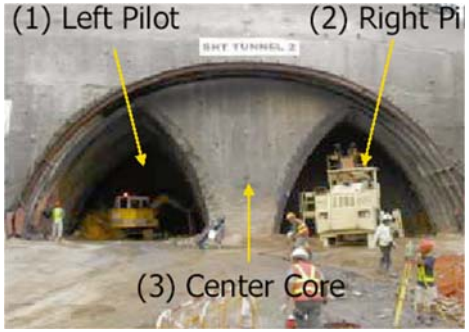
July 2014

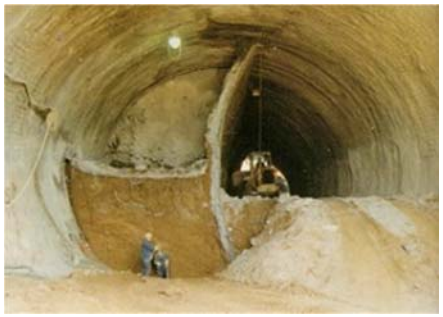
May 2015



Tunneling Works

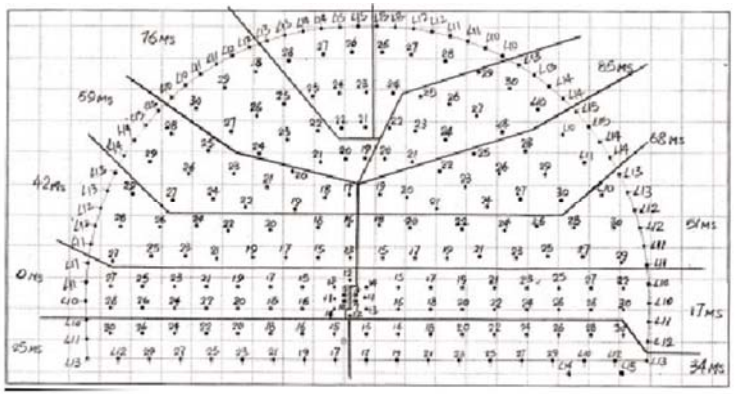
Entrance arrangement to the tunnel portal for the 3.7km long Tai Lam Tunnel of Route 3 at Kam Tin as seen in early 1996. Tai Lam Tunnel consists two main tunnels, each measures 15.5m wide and 10.5m high, and a 950m long servicing duct for ventilation and other supply purposes in between the main tunnels.

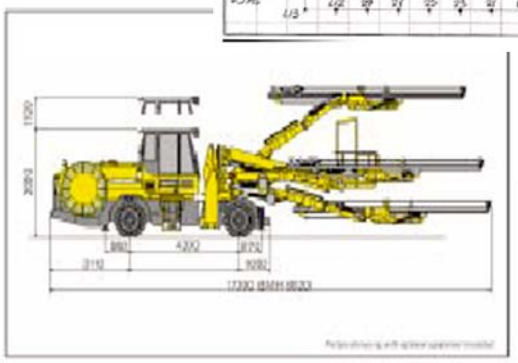




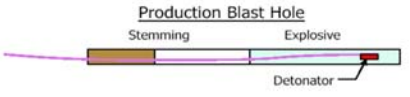
A section of tunnel excavation using New Austrian Tunnel Method (NATM).

Blast hole layout pattern



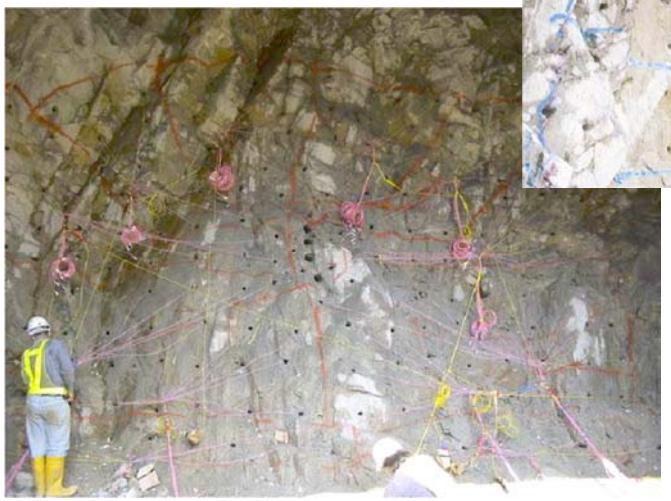


Machine use for the drilling of the blast hole



The machine, known as Jumbo tunneling machine, is used to drill and form holes inside the tunnel for the placing of explosive to activate the blasting. This machine is computer controlled and can drill 3 holes at the same time with direction or angle precisely set.

Placing explosive into the blast hole



Excavating, Scaling and removing of the blasted section at tunnel end

The erection of the gantry-type formwork for the forming of tunnel lining at entrance of the tunnel portal on Ting Kau side.

Detail look of the gantry-type formwork for the forming of tunnel lining

Fixing of the reinforcement before the forming the tunnel lining

After the tunnel formed by drill and blast process, the newly formed tunnel surface is to be lined with an in-situ concrete lining to stabilize the exposed soil or rock faces. The photo shows the gantry-type formwork used to form the in-situ concrete lining.

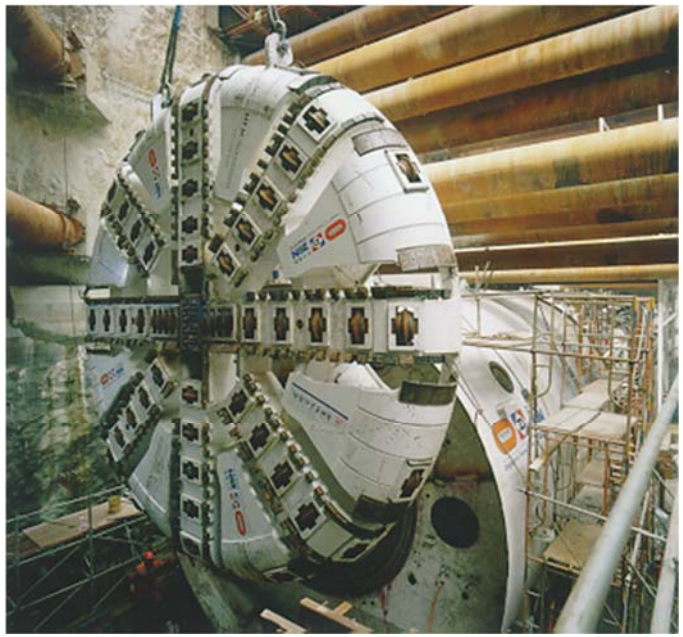
The tunnel boring machine for the forming of the 3.8m diameter tunnel tube on Butterfly Valley side.

Viewing inside the tunnel portal

Tunnel Boring Machine (TBM)

Another set of tunnel boring machine at the fabricating factory at Guangzhou in 2005 preparing for the tunnel work for the KCR Kowloon Southern Link project.

The trial assembly of the tunnel boring machine in 1998 at the fabricating factory at Shanghai before shipping to Hong Kong for final operation.



The cutter head is being connected to the shield of the EPBM by the help of a track-mounted gantry crane positioned on the ground level. The rows of steel tubes on the background are lateral support used to stabilize the 25m deep tunnel shaft.

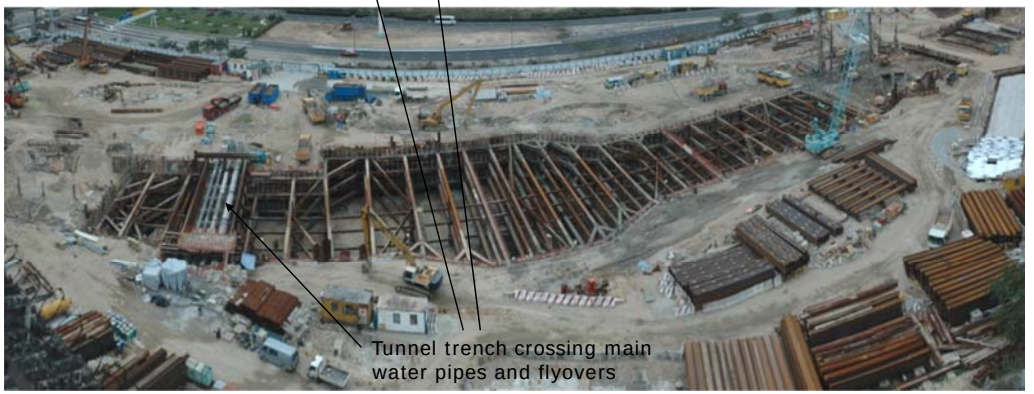
The tunnel interior with the in-situ concrete lining already been placed.

Section of the tunnel pit formed by soldier pile wall and laterally supported by anchors. The structure of the approach tunnel have basically been completed pending for backfilling at a later stage.

Large amount of cut-and-cover tunnels were constructed in the MTR Tseung Kwan O Line in the reclaimed land of TKO New Town

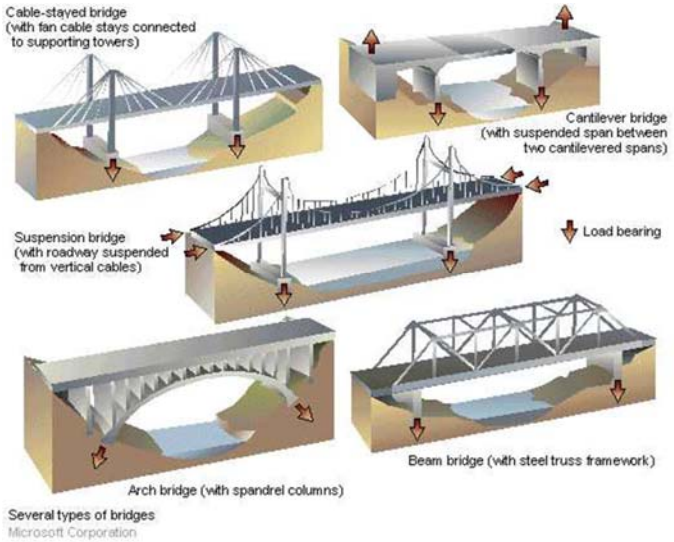
Alignment of tunnel

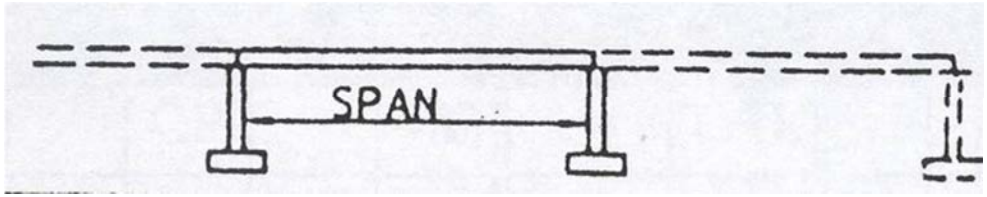
Tunnel section along Jordon/Tai Kok Tsui (excavation up to about half of formation level)



Construction of Bridges

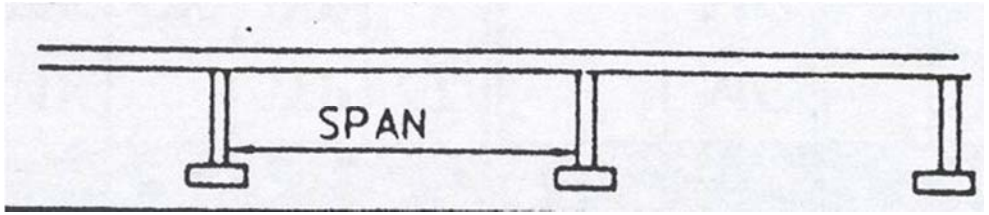
Common Bridge Forms





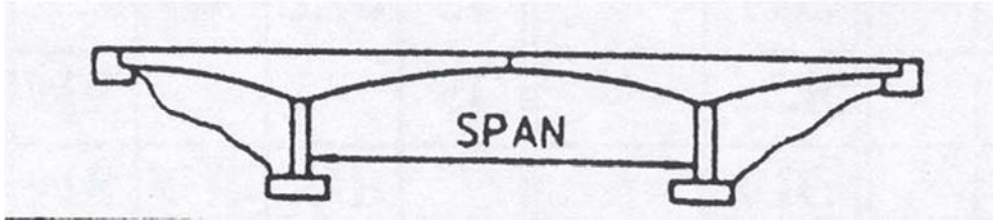
Simple Supported – span effective from 10m to 60m

Actual example – Route 3
Interchange at Au Tau, Yuen Long



Continuous Span – from 10m to 100m

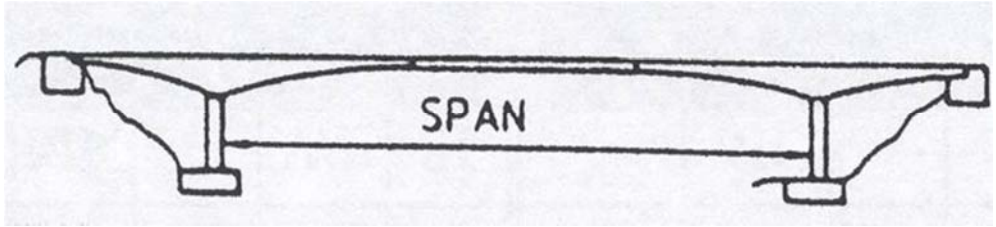
Actual example – construction of a span of continual section
of elevated highway bridge at Route 3, Kwai Chung



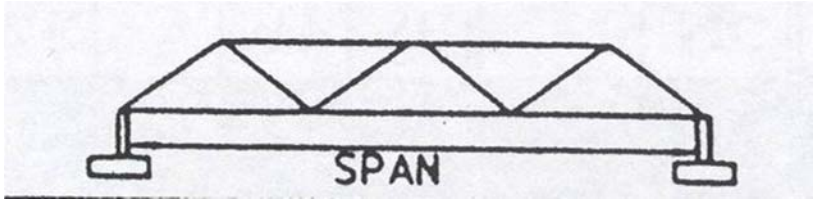
Balanced Cantilever – span from 25m to 200m

Actual example – balanced cantilever bridge series forming the approach to the Ting Kau Bridge

Balanced cantilever bridge for viaduct of West Rail at Au Tau Interchange

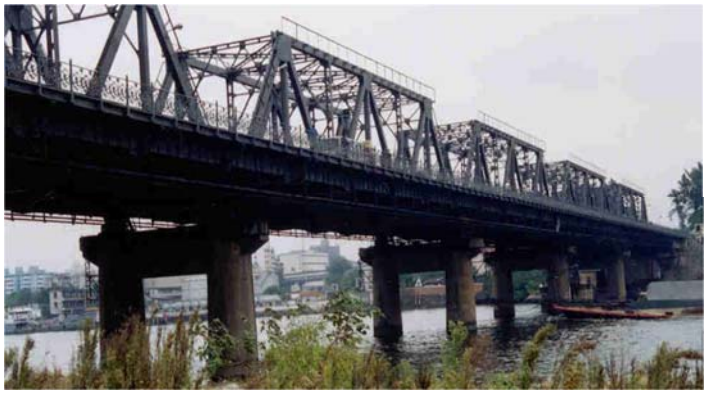


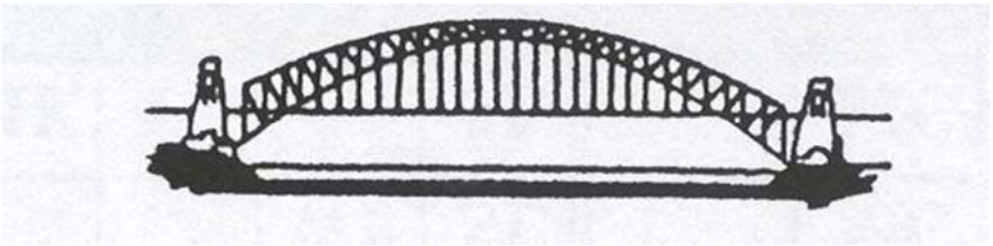
Balanced Cantilever Suspended Span – span from 50m to 300m



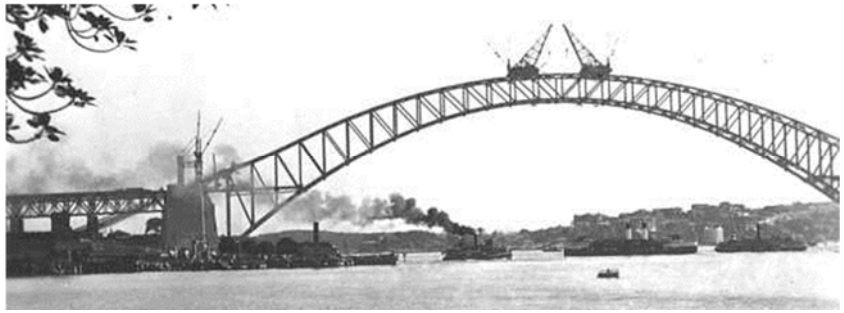
Steel Truss – 50m to 100m

Actual example – 5-span steel truss bridge in western part of Pearl River, Guangzhou



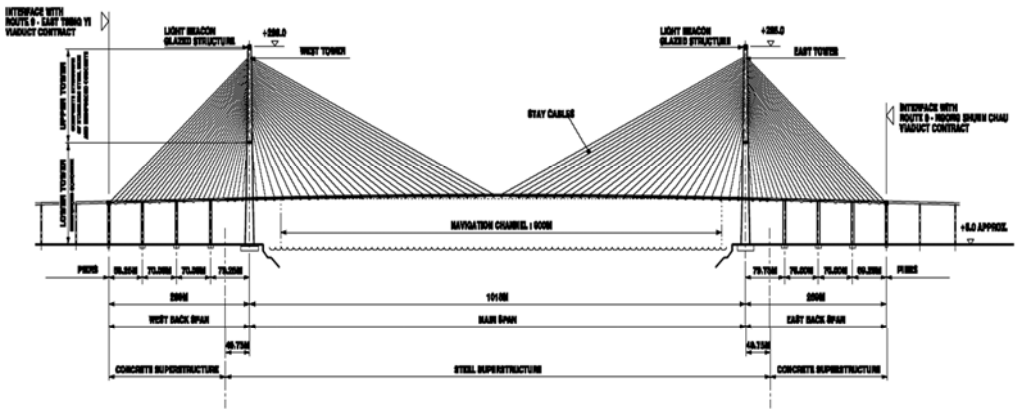


Steel Arch (framed or trussed) – from 150m to 500m



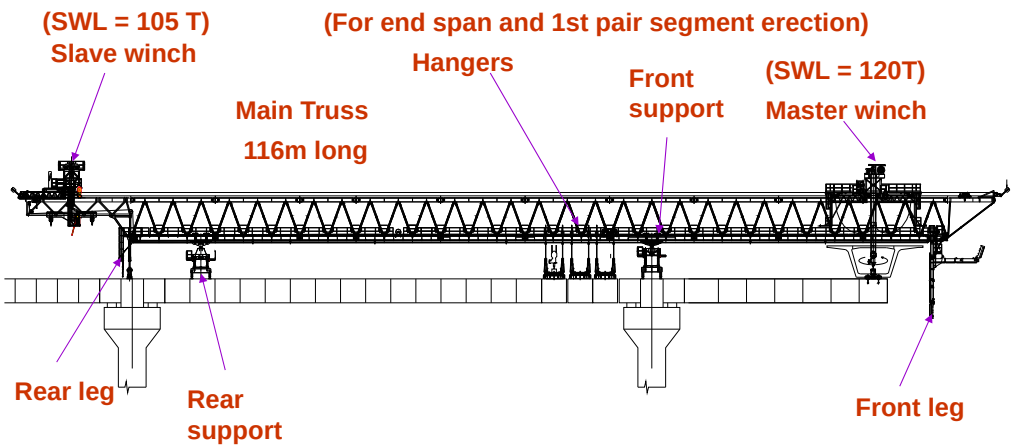
Close up view of the bridge trusses

In-situ Concrete arch bridge

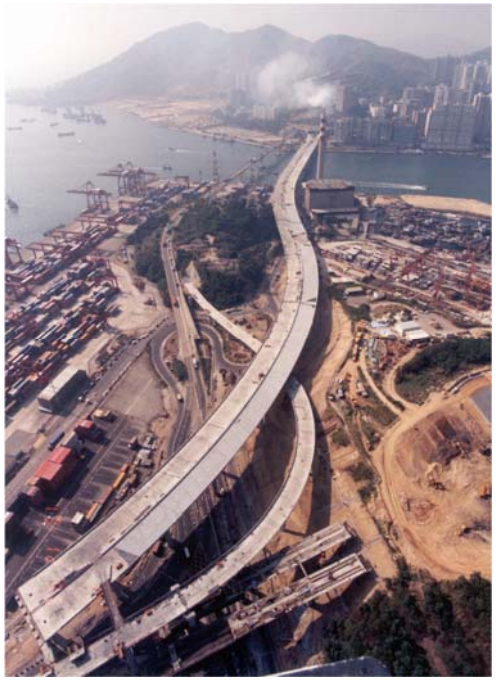


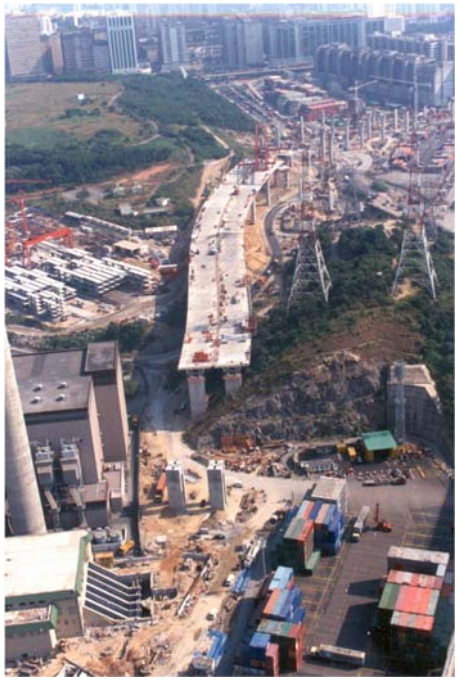
STONECUTTERS BRIDGE

http://www.youtube.com/watch?v=GqpZamvvJnU



Elevation of the Launching Machine





Route 3 – Kwai Chung Section

Launching gantry used in the Hung Hom Bypass

Launching gantry used in
Route 3 at Au Tau Interchange

Demolition and Dismantling Works

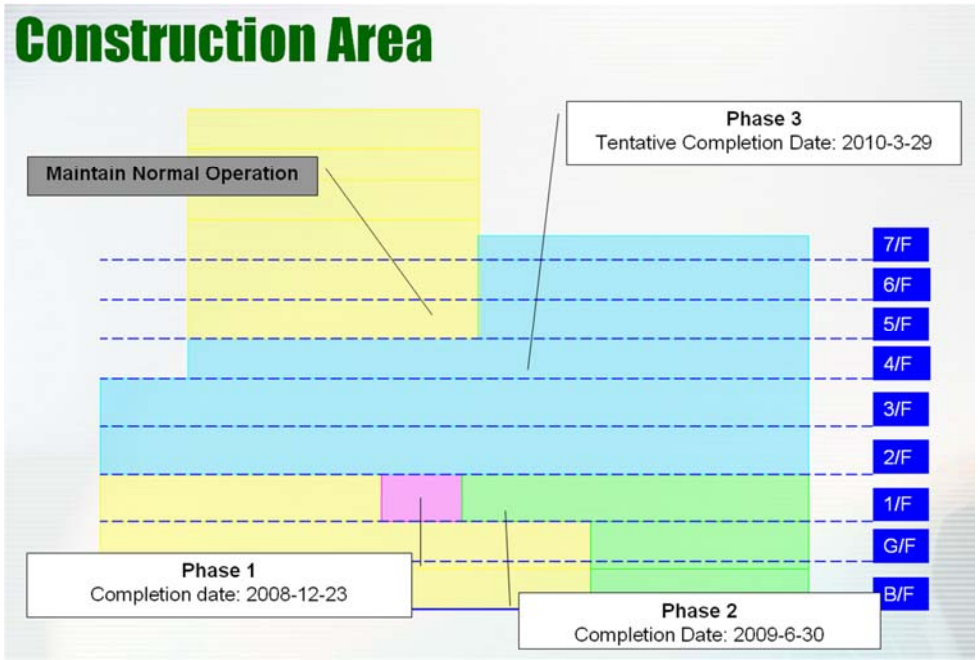
Difficult access for workers entering into a building under demolition

Further examples of difficult access in demolition jobs

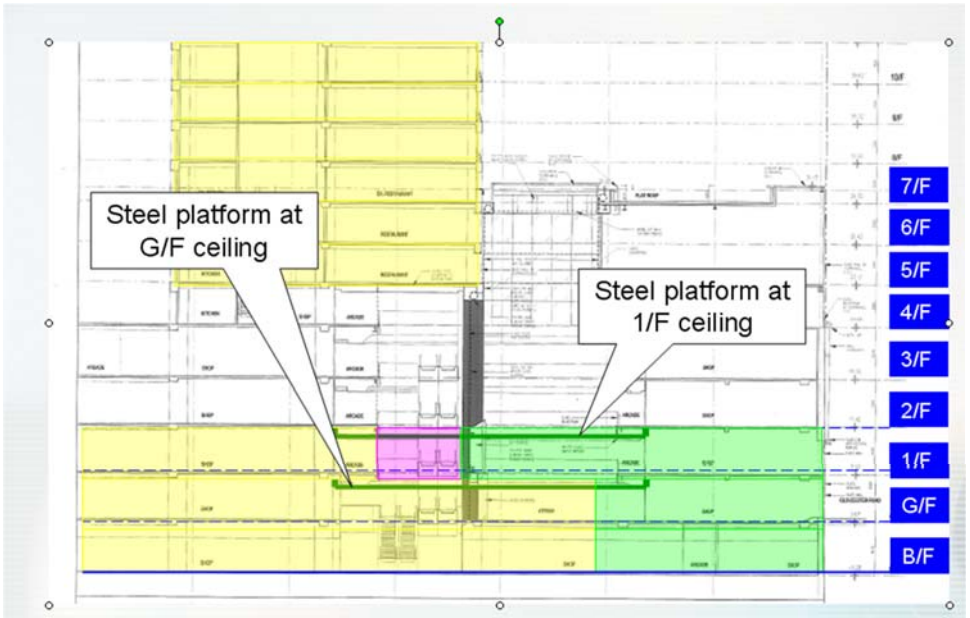
Heavy machinery used in demolition may have risk of collapse due to insufficient support.

Accommodation of too much debris during demolition can impose intolerable loading to the disturbed structure

Typical congesting neighbour-hood condition for demolishing small buildings within urban environment



Example for large scale building alteration project inside servicing facilities (the Windsor House A & A project)



Special safety and user provisions during demolition and other A & A works

The actual condition during the demolition

Other demolition cases working in congested urban environment

Typical layout arrangement in small and medium sized building under demolition.

Set-up and mounting of the saw dis on wall

Demolition using disc/saw cutting

Demolition using saw-cut and drill method for the diversion of a storm water discharge culvert

Using core and drill method to demolish a pedestrian subway

Partial demolition for historic building
– Shanghai Street Pre-war buildings revitalization project

Appearance of the pre-war buildings before conversion

Continual stages of the basement demolition with the incorporation of other substructure of the future building

The redevelopment of the Lee Gardens Hotel

(building with an existing basement)

The demolition of the basement structure working at the same time with the construction of the future building

The redevelopment of the Hilton Hotel

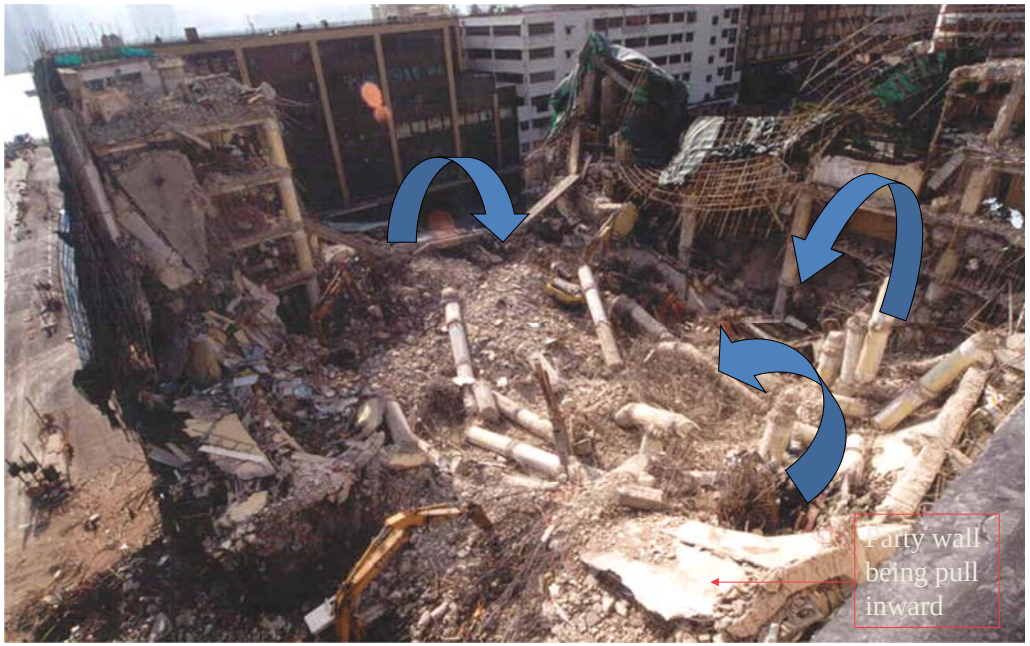
Demolition of the basement structure of the previous Hilton Hotel – the lower basement was backfilled to maintain stability of the disrupted basement structure before the commencement of the new basement

The Millennium City in Kwun Tong

Demolition of the basement working at the same time with the building foundation

Major demolition accident, the collapse of the Yau Tong Industrial Building in 2001

The site as seen on 30.11.01



Observation – all the fallen columns centered inward indicates that the collapse orientated somewhat from the building center

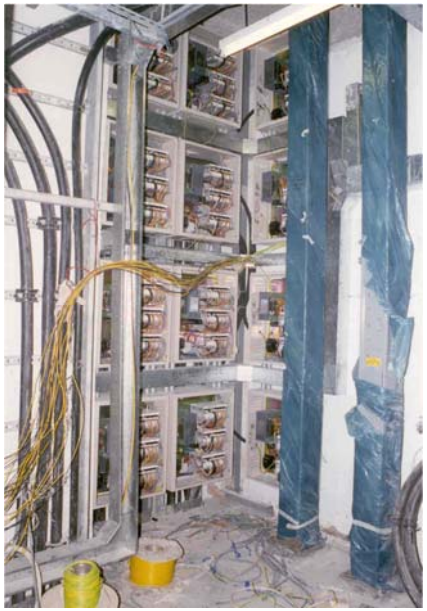
Building Services/E & M Installation

Essential building services in building include:

HVAC, Electrical, Fire Services, Plumbing & Drainage, Lift Services, Security, telecommunication, and Building Automation Systems, or other systems that provide human's environment comfort (e.g. acoustic installation).

Service-runs inside
floor slab

Service-runs within
sub-structure of building



Electrical and cable
installation as seen in a
major switch room

Switch broad and control
panel for electrical
distribution systems

Installation of raised floor

Final finish to an office interior with raised floor and dry wall partition system

Ceiling services before the laying of false ceiling

Complicated ceiling services works within a club facility where curtain interior design elements are required

Running and accommodation of pipes within building

Chiller plant/evaporator units located on roof of a commercial complex

The completed air-conditioning plant located on roof top

Plant Room before equipment fully installed

Inside a plumbing plant room

Installing Escalator into building structure

Installation of window cleansing equipment

Window cleaning system as a form of mechanical building maintenance system in building

Provision and installation of other environmental systems – Solar panel

End of presentation

Please note that this set of presentation is making use of a large amount of real-situation photo record to elaborate the topics. Explanation using written description is not the main design focus for this seminar.