A Review on the Recent Large Scale Infrastructure Projects in Hong Kong

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Part I

A general understand and Review of the scope and nature of Infrastructure Developments in Hong Kong
General Classification of Infrastructure Development/Projects

1. Transportation facilities including highway and railway projects
2. Port and Airport development projects
3. Land formation projects
4. New Town development projects
5. Environmental and Sewage projects
6. General urban facilities including water and power supply
Chronological milestones of HK’s Infrastructure Development after WWII

1945 – 60

- Basically completion of a paved single lane 2-way roadway network encircling the area of New Territories with limited linkage into the Metro-area

- Development of the first Satellite Town of Tsuen Wan
Chronological milestones (continue)

1960 - 70

- Opening of the 1st Lion Rock Tunnel (1967)
- Opening of a West-east run Highway system on the northern part of Kowloon Peninsula (Lung Cheung Rd)
- Completion of the Western Yaumatei/Mong Kok and Admiralty/Wanchai Reclamation
- Opening of other linking roadway to newly developed areas such as Kwun Tong, Chai Wan and Kwai Chung
Chronological milestones (continue)

1970 - 80

- Opening of the Cross Harbor Tunnel linking HK Island and Kowloon (1972)
- Completion of Container Terminals No. 1 – 4 (throughout the 70s)
- Opening of the 1st Tsing Yi Bridge and gradual development of the Island (74)
- Development of the New Town of Tuen Mun and Shatin, the opening of the Tuen Mun Highway (78)
- Opening of the 2nd Lion Road Tunnel (78)
- Opening of the MTR Island, Kwun Tong and Tsuen Wan Lines (late 70s)
Formation of the Shatin New Town in the late 1970s
Shatin in 2000
Chronological milestones (continue)

1980 – 90

• Opening of the East Kowloon Highway (1981)

• Electrification of the dual-track KCR East Rail (83)

• Opening of the Tolo Harbor Highway (85)

• Opening of the Light Rail System in the Tuen Mun/Yuen Long Corridor (88)

• Development of the Tuen Mun/Yuen Long and Tai Po/Fanling/sheung Shui Corridor, and the Tseung Kwan O New Town (throughout 80s)
Formation of Tuen Mun New Town in the early 1980s
Development along Tuen Mun-Yuen Long Corridor
Formation of Tai Po New Town in the early 1980s and an aerial view of the district as seen in 2000
Tolo Harbour Highways in late 1990s
Chronological milestones (continue)

1980 – 90

- Opening of the East Kowloon Highway (1981)
- Electrification of the dual-track KCR East Rail (83)
- Opening of the Tolo Harbor Highway (85)
- Opening of the Light Rail System in the Tuen Mun/Yuen Long Corridor (88)
- Development of the Tuen Mun/Yuen Long and Fanling/sheung Shui Corridor, and the Tseung Kwan O New Town (throughout 80s)
Chronological milestones (continue)

1980 – 90

• Opening of the Eastern Harbor Crossing (1989)

• Opening of the 1st section of West Kowloon Corridor between Lai Chi Kok and Mong Kok (88)

• Opening of the Island Eastern Corridor (89)

• Opening of the latter phase of MTR Lines (Island Line in 1982, Island Line linking to Kwun Tong Line through Eastern Harbor Crossing in 1989)
Chronological milestones (continue)

1990 – 95

- Opening of a series of road tunnels including Tseung Kwan O (90), Shing Mun (90) & Tate’s Cairn (91) tunnels
- Opening of the Kwun Tong Bypass (92)
- Opening of the final phase of the New Territories Circular Road (94)
- Reclamation for the Hung Hom Bay, Central/Wanchai, and West Kowloon Reclamation (mid 90)
- Commencement of the New Airport and the related core projects
Chronological milestones (continue)

1995 – 2000

- Opening of the Lantau Link (Tsing ma /Kap Shui Mun Bridge) and the North Lantau Expressway (1997)
- Opening of the Western Harbor Crossing & West Kowloon Expressway (97)
- Completion of Container Terminal 5 – 8 (98)
- Development of Tung Chung New Town (98)
- Opening of Chek Lap Kok Airport (98)
- Opening of the MTR Tung Chung Line and Airport Railway (98)
- Opening of the Route 3 including the Ting Kau Bridge and Tai Lam Tunnel (98)
Chronological milestones (continue)

2000 onward

• Opening of the MTR Tseung Kwan O Extension (2002)

• Opening of the KCR West Rail (03)

• Opening of the KCR East Rail Extension – Ma On Shan Line (04)

• Opening of the KCR East Rail Extension – Hung Hom to Tsim Sha Tsui (04)

• Completion of Container Terminal No. 9 (04)
Infrastructure Development in general aims to achieve the following basic objectives

1. Provide new lands for the required developments.

2. Provide a land structure with the basic physical constituents able to support or accommodate the provision of the required facilities, quality living of the inhabitants and the sustainability/development of all essential social or economical functions.

3. Provide the transportation linkage within or outside the territory for the efficient operation of various functions.

4. Provide the hardcore facilities to achieve the objectives.
Specific objectives for Hong Kong’s development (as stipulated by the Planning Department in the Territorial Development Strategies and its revision visioned toward 2030)

1. Enhance HK as an international city and a region centre for business, finance, information, tourism and manufacturing.

2. Ensure provision to satisfy land use and infrastructure needs arising from various strategized sectors.

3. Conserve and enhance significant landscape, ecological attributes and heritage features.

4. Enhance and protect quality of overall environment
Specific objectives for Hong Kong’s development

5. Provide framework to develop a multi-choice, high capacity, environmentally acceptable transport system for efficient and safe movement of passengers & goods.

6. Able to be implemented by public and private sectors to cater for resources and market demand. In addition to the revised objects for 2030, it further reiterates

7. Provide a good quality living environment through
   - conserving natural landscape,
   - preserving cultural heritage,
   - enhancing townscape
   - regenerating old urban areas
   - meeting various housing and community needs

8. Strengthen link with Mainland to cope with growth.
Major Infrastructure Development projects since 1990

1. Airport Core Projects
2. Strategic/General highway projects
3. Strategic railway projects
4. Strategic Sewage Disposal Scheme (SSDS)/Harbour Area Treatment Scheme (HATS)
Constituents of the Airport Core Projects

1. New Airport at Chek Lap Kok
2. Tung Chung New Town
3. North Lantau Expressway
4. Airport Railway
5. Lantau Fixed Crossing
6. Route 3 (Kwai Tsing Section)
7. West Kowloon Reclamation
8. West Kowloon Expressway
9. Western Harbour Crossing
10. Central Reclamation
Major Highway projects completed since 90s

1. Tsuen Wan/Shatin Connection (Route 5, including Shing Mun Tunnel, 1990)
2. Kwun Tong Bypass (1991)
4. Improvement/Widening of Tuen Mun Highway (1996)
7. Route 3 (Country Park Section, including Tai Lam Tunnel (1998)
8. Tsing Yi North Coastal Road (2001)
Major Highway Systems (Highway Strategic Network)
Major New Highway projects (to be completed before 2008)

1. Deep Bay Link and Shenzhen Western Corridor (early 2006)

2. Route 9, Tsing Yi to Shatin, including the Stonecutter Bridge, 2007)

3. Route 10, North Lantau to Yuen Long, including the Tsing Lung Bridge, 2008)
Major Recent Railway Projects

1. MTR Quarry Bay Congestion Relief project (1997 – 2001)
6. KCR Lok Ma Chau Spur Line (2002 - 2006)
7. KCR Shatin to Central Link ($32B, 2004 - 2009)
Alignment and Stations of the KRC West Rail
Soon to be completed
KRC Railway projects
Future Railway Networks according to the Railway Development Strategy 2000

Five major Lines are proposed as a strategic development to enhance the existing railway systems

1. **Shatin to Central Link** – linking Tai Wai Diamond Hill, Kowloon City, Hung Hom, Wanchai to Central

2. **Kowloon Southern Link** – linking East Rail and West Rail at south between TST Station & Nam Chong Station (West Rail)

3. **Northern Link** – linking the East Rail and West Rail of KCR at the north between Sheung Shui to Pat Sheung

4. **Regional Express Link** – provide a non-stop railway link between the city and the border at Lo Wu

5. **Island Line Extension** – an extension at the north shore of the existing Island Line to relief the existing line traffic

6. **Port Rail Line** – an extension from the East Rail to enhance cross boundary freight services
Alignment of the
1. Island Line
2. Shatin to Central Link
3. Kowloon Southern Link
Alignment of the Northern Link and Regional Express Line
Infrastructure Projects of other natures

1. HK Convention & Exhibition Centre (1994 – 1997)
2. Large-scale sewage works such as Strategic Sewage Disposal Scheme (SSDS)/Harbour Area Treatment Scheme (HATS) (1998 – 2003)
3. Water Supply project (e.g. construction of a 13km aquaduct from Lai Chi Kok to Tai Po for the laying of a series of water mains (1997 – 2000)
4. Storm water and flood control
Procuring Agents for Infrastructure Projects

1. Highway Department – highway, bridges and large-scale roadwork

2. Civil Engineering Department – land formation, reclamation, port and marine works, environment improvement works

3. Territory Development Department – Airport Core Projects, New Town Development, other assignment projects similar to CE Dept.

4. Drainage Services Department – Flood control, large-scale drainage and SSDS/HATS projects

5. Water Supplies Department – large-scale water supply/distribution works (e.g. aquaduct)
Procuring Agents for Infrastructure Projects

6. Mass Transit Railway Corporation – all railway works managed/operated by the MTRC

7. Kowloon Canton Railway Corporation – all railway works managed/operated by the KCRC

8. Airport Authority – projects related to the construction of the new airport in Chek Lap Kok

9. Other Franchised Organizations (in BOT projects), for example:
   • Tate’s Cairn Tunnel
   • Eastern Harbour Crossing
   • Western Harbour Crossing
   • Tai Lam Tunnel
Part II a

Detail understand of some major Infrastructure Developments – Airport Core Projects
Airport Core Projects include:

1. New Airport at Chek Lap Kok
2. Tung Chung New Town
3. North Lantau Expressway
4. Airport Railway
5. Lantau Fixed Crossing
6. Route 3 (Kwai Tsing Section)
7. West Kowloon Reclamation
8. West Kowloon Expressway
9. Western Harbour Crossing
10. Central Reclamation
Location of Airport Core Projects

- **NEW AIRPORT AT CHEK LAP KOK**
- **TUNG CHUNG NEW TOWN (PHASE I)**
- **NORTH LANTAU EXPRESSWAY**
- **AIRPORT RAILWAY**
- **MA WAN**
- **TSING YI**
- **ROUTE 3 (PART)**
- **WEST KOWLOON EXPRESSWAY**
- **CENTRAL RECLAMATION (PHASE I)**
- **LANTAU FIXED CROSSING**
- **WEST KOWLOON RECLAMATION**
- **WESTERN HARBOUR CROSSING**
- **HONG KONG ISLAND**

**Locations:**
- LANTAU ISLAND
- KOWLOON
- HONG KONG ISLAND
- MA WAN
- TSING YI
- WEST KOWLOON EXPRESSWAY
- CENTRAL RECLAMATION (PHASE I)
Airport Core Projects – approx. costs

1. Airport – $65B, including formation of the airport island ($22B) and the construction of the Terminal Building ($15B)

2. Tung Chung New Town – $6B

3. North Lantau Expressway – $10B

4. Airport Railway – $28B

5. Lantau Fixed Crossing – $12B, including the construction of the Tsing Ma Bridge ($7.2B), Ma Wan Viaduct and Kap Shui Mun Bridge ($1.6B).
Airport Core Projects – approx. costs

6. Route 3 (Kwai Tsing Section) – $10B, including the construction of the Cheung Tsing Tunnel ($0.8B) and a 6.5km elevated expressway ($2.2B)

7. West Kowloon Reclamation – $6B

8. West Kowloon Expressway – $8B

9. Western Harbour Crossing – $6B

10. Central Reclamation – $4B

Total costs for the Airport Core Project around $155B as in 1997 price
New Airport at Chek Lap Kok
Formation of the Airport Platform from the original Chek Lap Kok Island
Early stage of the Airport Terminal Building construction – foundation and sub-structure
Construction of the Terminal superstructure
Modulated roof for the Terminal Building
Position the modulated roof onto the Terminal structure
Installation of the Glass Wall
Construction of the Air Bridge
Finishing up the Terminal Interior
The new Airport close to its completion
Other facilities in the New Airport
Ground Transportation Centre
Post Office
Air Mail Centre
Other facilities owned by the Government
Air Cargo Facilities – Asian Air Terminal (left) and Super-Terminal No. 1
HKAEO Aircraft Maintenance Depot
Tung Chung New Town
Formation of the Tung Chung New Town
Tung Chung taking shape as in 1997
North Lantau Expressway
Original Coastline of North Lantau (section between Yam O and Tai Ho)
North Lantau Expressway – formation of the Yam O Section
Slip Road to Penny Bay (Disney Land) at Yam O
Tai Ho Section and the Depot Facilities of the Tung Chung Line
Toll Plaza of the Expressway at Kap Shui Mun entrance
Lantau Fixed Crossing
The 1377m span
Tsing Ma Bridge
The Tsing Ma Bridge

Ma Wan side

Tsing Yi side

Cable anchor

Main span

Side span and approach bridge
Formation on Tsing Yi side – construction of the bridge tower and the anchor for the suspension cable
The approach concourse on the Tsing Yi side
Approach section leading to the main span
Construction of the bridge tower
Formation work on the Ma Wan side as seen in 1995
Forming the cable anchor on the Ma Wan formed land
The approach section on the Ma Wan side
Forming the suspension cable
Suspension cable supported onto the tower head by the saddle
Hoisting and erecting the modulated bridge deck onto the suspension cable
Location of
Exterior and interior view inside the bridge deck
The Ma Wan Viaduct – the linking section between the Tsing Ma and Kap Shui Mun Bridge
Kap Shui Mun Bridge – a 430m cable-stayed bridge
Hoisting and erecting of the modulated bridge deck
Forming the approach section of the KSM Bridge on the Lantau side
Route 3 – Kwai Tsing Section
Route 3, Tsing Kwai Section at Kwai Chung
Approach section of Route 3 heading to the Rambler Channel
This section of Route 3 is mainly composing of 4-lane 2-way elevated roadway, averaged 35m span and 15m above ground.
Forming the deck of elevated bridge using precast beam by launching machine (section along Kwai Chung & Kwai Tai Road)
Elevated track of the Airport Railway running along Route 3 at Kwai Chung Road

Launching machine for installing the precast girder section of the elevated track
West Kowloon Reclamation
West Kowloon at Yaumatei/Shamshuipo at the early stage of reclamation
Gradual progress of Reclamation at Yaumatei
Reclamation at Cheung Sha Wan – relocation of the Fish Markets
Government docks and private-owned shipyards being relocated during the reclamation process
Commencement of roadwork and other infrastructure facilities after reclamation completed in 1996
South-most tip of West Kowloon Reclamation – connection to the harbour crossing tunnels
Reclamation at Stonecutter Island to form land for Container Terminal No. 5 to 8
Container Terminal No. 5 to 8 put into operation in early 1997
West Kowloon in 2002
West Kowloon Expressway
West Kowloon Expressway comprising:
1. North Section – Elevated, 2.7 km
2. South Section – On-grade, 1.5 km
West Kowloon Expressway –
construction of Mei Foo Interchange
West Kowloon Expressway at Tai Kok Tsui near Olympus Station
Construction of the elevated expressway using precast box-girder by portal gantry
Western Harbour Crossing
Casting yard for the forming of the submerge tunnel tubes at Shek O Quarry
Delivery of the Submerge-tube by floating-out from the casting yard (dry dock)
Transport the submerge-tube by barges and place them onto pre-arranged position
Connecting the submerge-tube to the tunnel approach
Forming the tunnel approach using cut-and-cover arrangement
The tunnel approach and connection arrangement at Sai Ying Poon side
Associated roadwork forming the entrance concourse to the Western Harbour Crossing at Sai Ying Poon side
Western Harbour Crossing at the West Kowloon entrance
Central Reclamation
Early stage of the reclamation work in 1994
Construction of new ferry piers to replace the old that were still servicing central to Jordon Road and outlying islands.
Reclamation carried out in a looped manner to allow servicing facilities to be replaced at the latest stage
Gradual completion of the reclamation for handing over for commencement of other facilities
Associated works – sewage diversion and the construction of a slip road (future Centra/Wanchai By-pass)
Viewing the area in 2002 from the IFC Tower 2
Airport Railway
The 32km Airport Railway and Tung Chung Line owned by MTR
Hong Kong Station of the Airport Railway
Cut-and-Cover Tunnel for the Airport Railway in the newly Reclaimed Land in Central
Aerial view of the Central Reclamation seeing the Railway Alignment going into the Harbour Crossing Tunnel
Financial sources for the Airport Railway projects – the International Financial Centre
Construction of the Kowloon Station and the cut-and-cover tunnel of the Airport Railway at its early stage in 1995
Kowloon Station as seen in 1998, the station provide vast land resources to fund the Airport Railway projects as well as for the future development of the West Kowloon
Airport Railway crossing the Rambler Channel heading to the Tsing Yi Station
Part II b

Detail understand of some major Infrastructure Developments –

Highway projects
Route 3, Country Park Section
Ting Kau Bridge
Elevation of the Ting Kau Bridge and the Approach Section on Ting Kau side
Location plan of the Ting Kau Bridge and the Approach Section
Ting Kau Bridge is a cable-stay bridge in 3 spans.

Overall view of the Ting Kau Bridge at her opening in 1998.
Construction of the bridge towers

Channel Tower

Tsing Yi Tower

Ting Kau Tower
Tower head for the anchoring of the stay cables
Detail of the tower head with the stay cables in position
Forming of the bridge deck, placing of precast elements.
Forming the bridge deck using balanced cantilever method with the span stretching out on 2 sides from the tower.
Final joining of the bridge deck

Bridge approach on Ting Kau side
Route 3, Country Park Section
Works at Ting Kau area
The bridge approach on Ting Kau side

Tuen Mun Highway
Construction of the approach bridge (650m in the form of viaduct)
Aerial view of the approach and the slip road heading TK Bridge
Construction of the approach viaduct using balanced cantilever method (traveling form)
Crossing over of the approach viaduct onto Tuen Mun Highway

Alignment of the approach viaduct
Section between Ting Kau and Tai Lam Tunnel – 600m roadway cutting through a 70m-high rocky hill

Original rock profile
Rock cutting process

Conveyor system for rock disposal
Route 3, Country Park Section
Tai Lam Tunnel
Connection of the Tai Lam Tunnel - Tunnel portal on Ting Kau side (South)
Tunnel constructed using drill-and-blast method
Forming the tunnel lining and interior fitting out at the final stage
Route 3, Country Park Section
Works at Kam Tin area
Forming the interchange using precast launching system
Location of Hung Hom By-pass
Layout of the Hung Hom Bypass routing
Erection of the elevated roadway using precast box-girder by a launching gantry
Standard box-girder segment for forming the bridge deck
Placing the segment onto the column head for onward erection
Holding down and tensioning of the segment
A section of viaduct passing over sea water near the Mail Centre
Viaduct near the Mail Centre
Work at servicing traffic – slip junction to Gascoigne Road
Working very close to servicing railway track – forming the junction to Prince Margaret Road
Work over very busy servicing roadway at junction of Hong Chong Road and Chatham Road
Work over very busy servicing roadway at junction of Hong Chong Road and Chatham Road
Location of

Tsing Yi North Coastal Road
Location map of the Tsing Yi North Coastal Road
Overview of the construction at the early stage in 2000
The road system at its completion in early 2002
Formation to cut into the slope for the construction of the piers for the elevation road deck
Forming the elevated road deck using box girders and install by launching machine
Detail of the launching machine and the operation system
Improvements to Island Eastern Corridor section between North Point Interchange and Sai Wan Ho
Forming of bored pile on sea along existing elevated roadway of the Eastern Corridor
Formation of bored piles (1.5m) using reverse circulation drill (RCD)
Associated work – relocation of an existing pier and replacing it by a new one.
Construction of the pier column
Using precast beam to form the deck
Deck detail before placing the concrete topping
Part II c

Detail understand of some major Infrastructure Developments – Railway Projects
MTR Tseung Kwai O Line (TKE)
Layout of the MTR Tseung Kwan O Line
Tseung Kwai O Line –
Formation of the Yau Tong Station
Aerial view showing the overall layout of the Yau Tong Station and its vicinity
Yau Tong Station as seen in the construction stage
Approach tunnel merging into the slip section of the Eastern Harbour Crossing
Cutting through a rock slope to form the approach tunnel between the Yau Tong Station and Eastern Harbour Crossing
Tseung Kwai O Line –
Formation of the Tiu Keng Leng Station
Formation of Tiu Keng Leng Village to provide land for the Development of the Tiu Keng Leng Station Complex
Cutting a 450m x 60m x 30m deep trough into solid rock to form the buried structure of Tiu Keng Leng Station
The Station and its vicinity as seen in early 2002
Tseung Kwai O Line –
Formation of the Tseung Kwai O Station
Tseung Kwan O Station located on new land formed by reclamation
Construction of the Tseung Kwan O Station
Tseung Kwai O Line –
Formation of the Hang Hau Station
Layout of the Hang Hau Station as seen in early 1999
The buried station structure was formed using a top-down and bottom-up mixed construction approach.
Tseung Kwai O Line –
Formation of the Po Lam Station
Po Lam Station is the only station that built at-grade. The photo shown the early stage of station work.
Gradual completion of the station’s superstructure
Tseung Kwai O Line – Maintenance Depot of the TKE Line
MTR Tseung Kwan O Depot – residential development will be provided on top of the depot podium at a later stage.
Close up of the depot podium and the train maintenance depot underneath.
Tunnels in the Tseung Kwai O Line

There are 2 forms of tunnels being built:

1. Drill-and-blast tunnel
   - tunnel between Lam Tin and Yau Tong Station (1.2 km)
   - Black Hill Tunnel between Yau Tong and Tiu Keng Leng Station (2.2 km)
   - Pak shing Kok Tunnel between Tseung Kwan O Station and the Depot (2.0 km)

2. Cut-and-cover tunnel
Tseung Kwai O Line –
Cut-and-Cover Tunnels
Cut-and-cover tunnel between Tseung Kwan O and Hang Hau Station
Typical formwork arrangement (tunnel form) for the construction of the tunnel tubes
Some difficult situations in constructing the cut-and-cover tunnel – working in the reclaimed land very close to culvert and seawall
Some difficult situations in constructing the cut-and-cover tunnel – double decked tunnel and tunnel junctions
Some difficult situations in constructing the cut-and-cover tunnel – tunnel crossing servicing roadway
Tseung Kwai O Line –
Drill-and-Blast Tunnels
Tunnel portal provision at the Yau Tong Tunnel
Traveling formwork for the forming of the tunnel lining
Laying of membrane sheeting to waterproofing the tunnel interior before placing the lining
KCR West Rail

(please refer to separate Powerpoint for West Rail Construction)
KCR East Rail Extensions – Tsim Sha Tsui Extension
Tsim Sha Tsui Extension alignment running basically alongside the Salisbury Road at the coast of TST East
Track within covered tunnel coming from the KCR Kowloon Station at Hung Hom
Tunnel work outside Mail Centre of the Post Office
Cut-and-cover tunnel between Kowloon and Tsim Sha Tsui Station
Tsim Sha Tsui Station
KCR East Rail Extensions –
Ma On Shan Line
Alignment of the KCR Ma On Shan Line
Ma On Shan Line joining East Rail at Tai Wai Station
Service Depot of the MOS Line located in Tai Wai
The first section of viaduct running from Tai Wai northbound along Shing Mun River
Construction of viaduct at Tai Shui Hang crossing a busy highway
Installing the box-girder viaduct using a gantry type launching machine
Forming the pieres and portal beams for the supporting of the viaduct
Laying of track
Important Internet Reference

1. Homepage of Raymond Wong
   http://personal.cityu.edu.hk/~bswmwong/

2. Homepage of Highway Department
   http://www.hyd.gov.hk/major/index.htm

3. Homepage of KCRC

4. Homepage of Civil Engg. Department

5. Homepage of Territory Development Dept.
   http://www.info.gov.hk/tdd/