3 PROJECT DESCRIPTION AND CONSTRUCTION METHODOLOGY

3.1 General Alignment and Key Elements

As discussed in **Sections 2.3 to 2.5**, a number of alignment options have been considered for the west, east and central portions. These options have been evaluated by considering a number of factors including engineering, public comments, environmental factors etc. The preferred alignment for each portion has been recommended and **Figure 1.1** shows the entire preferred alignment.

A brief summary of key elements of the Project is given below and more details are given in the following sections.

Key Elements	Description (Approximate dimension only)
Total Alignment	~ 4.7 km (dual 3-lane east-west trunk road)
Tunnel	~ 3.9 km (including a 370 m long underwater tunnel)
Ventilation Buildings (VB) and Administration Building	3 VBs and 1 Administration Building in total - Ventilation Building at Yau Ma Tei Interchange (approx. footprint: 5,000 m^2 with a building height of approximately 20m above ground) - Ventilation Building at Ho Man Tin (approx. footprint: 3,300 m^2 with a building height about 10m above ground) - Ventilation and Administration Building at Kai Tak (approx. footprint: 6,200 m^2 with building height less than 25m above ground)
Slip Roads / Connection Roads	In west and east ends of the tunnel for connecting to existing and future road networks
Landscaped Decks	3 nos. in total (one at the west portal in Yau Ma Tei, one at the Kowloon City Ferry Pier PTI at Ma Tau Kok and one above the depressed road at east portion in Kai Tak)
Demolition and / or Re-provisioning Works	- Yau Ma Tei Multi-Storey Car Park Building - Special Clinic Extension Building - Jade Hawker Bazaar - Hong Kong Automobile Association - Reprovisioning of Gascoigne Road Flyover (GRF) - Landing Step for Temporary Relocation of Ma Tau Kok

Public Pier

Enhancement Works	- Ma Tau Kok waterfront area and Kowloon City Ferry Pier Public Transport Interchange with cover
Full Enclosures	3 nos. in total - West Portal End (approx. 250 m) - Re-provisioning of Gascoigne Road Flyover (approx. 200 m) - Gascoigne Road Flyover (Ferry Street Section) (approx. 110 m)

3.2 Key Design Elements

3.2.1 Tunnel Sections from Yau Ma Tei to Ma Tau Kok

The total length of the tunnel section between Yau Ma Tei and Ma Tau Kok is about 3,325 m. The drill-and-blast rock tunnel in the central portion is approximately 2,760 m, which has been optimized to create land easement, minimizing building impact in urban area, geological condition, future private redevelopment constraints etc. Cut-and-cover tunnels will be proposed at both ends of the tunnel where rock cover is not sufficient. The cut-and-cover section in Yau Ma Tei will be approximately 400 m long while that in Ma Tau Kok will be 135 m.

The above figures are rounded up slightly to cover for the different lengths of the two bores. The actual lengths may vary depending on the eastbound / westbound bore and on the interpretation of the change in tunnel types (i.e. the seawall cope line has been taken as the end of the marine section).

Further elaboration on the construction methodologies of the proposed CKR are presented in **Section 3.5**.

3.2.2 Underwater Tunnel

The total length of the underwater tunnel between Ma Tau Kok and Kai Tak is about 370m long. As discussed in **Section 2.4**, a number of alignment options have been considered for the tunnel connecting Ma Tau Kok and Kai Tak, and the current option of underwater tunnel at Kowloon Bay is chosen based on various considerations including minimizing the disturbance to public/marine facilities, environmental impacts, extents of temporary reclamation and technical feasibility.

The tunnel is deepest at Ma Tau Kok and shallowest at Kai Tak. For most of its length the underwater tunnel has its ventilation ducts above the tunnel road portion and the tunnel width is approximately 43m. At the eastern end of the underwater tunnel, a side-duct ventilation arrangement is adopted to reduce the height of the underwater tunnel section so as to ensure the tunnel structure remains beneath the existing marine bed levels and the width is at approximately 53 m.

3.2.3 Yau Ma Tei Interchange of the West Kowloon Highway and associated road network in West Kowloon

CKR will have the following slip road connections in West Kowloon, as also illustrated in **Figure 3.1.1**:

- Slip Road A – CKR westbound to Lin Cheung Road southbound;
- Slip Road B – CKR westbound to Western Harbour Tunnel southbound;
- Slip Road C – CKR westbound to Lin Cheung Road northbound;
- Slip Road D – CKR westbound to West Kowloon Highway northbound;
- Slip Road E – West Kowloon Highway southbound to CKR eastbound;
- Slip Road F – Lin Cheung Road southbound to CKR eastbound; and
- Slip Road G – Hoi Po Road northbound to CKR eastbound.

3.2.4 Connection Roads to Trunk Road T2 and Associated Road Network in Kowloon Bay and Kai Tak Development

CKR will have a number of strategic connections to/from other main roads in eastern Kowloon as follows and as shown in **Figure 3.1.4:**

- Slip Road S1 – CKR eastbound to Kai Cheung Road eastbound;
- Slip Road S2 – Kai Cheung Road westbound to CKR westbound;
- Slip Road S3 – CKR eastbound to Kai Fuk Road eastbound;
- Slip Road S4 – Kai Fuk Road westbound to CKR westbound;
- Slip Road S5 – CKR eastbound to Kai Tak Development;
- Slip Road S6 – Kai Tak Development westbound to CKR;
- Slip Road S7 – CKR eastbound to Road D2;
- Slip Road S8 – Road D2 to CKR westbound; and
- Slip Road S9 – Kai Fuk Road westbound to Kai Cheung Road eastbound.

3.2.5 Landscaped Decks

A landscaped deck will be provided at the portal of west portion. The "Yau Tsim Mong District Aspirations Study Report" published by YTM District Council in April 2010 (http://www.ursreview.gov.hk/eng/doc/YTM_DAS_Report_final.pdf) referred to the area of YMT around Kansu Street being developed as an intersection area for north-south and east-west movement of pedestrian and vehicular traffic.

There is a need to provide a landscaped deck over a portion of CKR's depressed road at the Kai Tak Development area in between the east tunnel portal of CKR and Road D3 within the Kai Tak Development according to the Kai Tak Outline Zoning Plan No. S/K22/4. According to the latest design, open space would be provided at the top of the landscaped deck.

The existing Kowloon City Ferry Pier PTI requires re-provisioning for the duration of CKR east end construction activities to provide working and construction space. The re-provisioned permanent PTI will remain in the same vicinity as the existing PTI shifting slightly towards To Kwa Wan Road. A landscaped deck on top of the re-provisioned PTI has been proposed to mitigate noise impact of the PTI.

3.2.6 Demolition and / or Re-provisioning Works

The Project will include the following demolition and / or re-provisioning works which are not designated projects under Schedule 2 of EIAO.

Yau Ma Tei Multi-Storey Car Park Building

The CKR tunnel will pass beneath the existing YMT multi-storey car park building. As the tunnel tubes are too close to the foundation of the building, the stability of the building will be affected and need to be removed. Before the commencement of the demolition of the building, decantation of the Yau Ma Tei Public Library and the other government offices in the building is required.

Yau Ma Tei Public Library will be re-located to a temporary building at Shanghai Street/Market Street Playground during CKR construction stage. After CKR, the library will be moved to a new building at the location of the original position of multi-storey car park building.

The existing government offices in the building will be re-located to adjacent area during CKR construction stage. Co-ordination with relevant government departments e.g. Government Property Agency (GPA) for the temporary and permanent arrangements are on-going.

YMT Specialist Clinic Extension Building

The existing YMT Specialist Clinic Extension Building (SCEB) at Battery Street is also required to be demolished for the construction of CKR. A new building will be constructed in Queen Elizabeth Hospital to house the special clinic.

The existing Methadone Clinic at the ground floor of SCEB will be relocated to the adjacent Jockey Club Polyclinic Building.

Jade Hawker Bazaar

The existing single storey buildings for Jade Hawker Bazaar at Battery Street are located on the alignment of CKR. The buildings require removal for the construction of cut-and-cover tunnel. A temporary building will be built on the existing Kansu Street Rest Garden on the south side of multi-storey car park building to house the affected hawkers of the Jade Hawker Bazaar.

After completion of the cut-and-cover tunnel, the temporary building will be removed and the hawkers will be decanted to the new buildings located at the original Jade Hawker Bazaar position.

Hong Kong Automobile Association

The existing area (under short term tenancy) for Hong Kong Automobile Association is required for CKR construction site and therefore needs to be cleared before the commencement of CKR construction.

Section of Gascoigne Road Flyover

The section of GRF flyover between Temple Street and Ferry Street will be reprovided for the construction of CKR tunnel and removal of the existing multi-storey car park building. It is understood that the traffic on the flyover has to be maintained during construction stage and therefore a temporary flyover will be provided in its north side to divert the traffic before demolition of the affected section of the existing flyover.

Landing Step for Temporary Relocation of Ma Tau Kok Public Pier

In order to facilitate the construction of underwater tunnel, the existing Ma Tau Kok Public Pier is required to be demolished. A temporary Ma Tau Kok Public Pier needs to be provided to maintain the original ferry route and minimize the impact to the passengers and users in the district. A landing step is proposed at LCSD promenade (GLA-TK 618 TGLA) near King Wan Street for temporary boarding of the public between the bus drop-off area on King Wan Street and temporary Kowloon City Ferry Pier PTI during CKR construction stage. A small portion of the waiting area inside To Kwa Wan Vehicle Examination Centre is required to provide a minimum width of 2m between the temporary relocated Ma Tau Kok public pier and waiting area (GLA-TK 442 TGLA). Temporary covered walkway which directly connects the landing step and temporary PTI will be provided for the pedestrians as a safe, convenient and pleasant access. The public pier will be re-provisioned after the commissioning of CKR works and consistent with the theme of Kai Tak Development. According to the current construction methodology, dredging is not required for the temporary relocation of Ma Tau Kok Public Pier.

3.2.7 Conservation of the Yau Ma Tei Police Station

The cut-and-cover tunnel of CKR will be constructed partly beneath the building of YMT Police Station, therefore the police station needs to be decanted prior to the commencement of construction. After the commissioning of CKR, the existing police station building will be used for other, to be determined, purposes.

The CKR tunnel will run underneath the existing new wing building and provide around 2.3 m clearance with the old wing building. The existing new wing building is a four storey building supported by concrete friction piles. Construction of tunnel underneath the building will require to remove those affected piles. An underpinning scheme is proposed to transfer the existing column loadings to a deeper rock stratum. The supporting system includes cutting the existing ground floor slab to expose the existing pile caps and then constructs transfer beams at both sides of the pile caps. The transfer beams will tie up with the existing caps. Loadings of the transfer beams will be transferred to the rock socket piles installed at the two ends of the beams. For the old wing of the police station, Tube a Manchette (TAM) grouting will be carried out for the area before

the construction works of CKR. It is anticipated that effect on the building will be controlled below an acceptable level.

Apart from an investigation on the necessary measures to protect and preserve Yau Ma Tei Police Station during the construction of CKR, a study on the Yau Ma Tei Police Station revitalisation has been undertaken which aimed at investigating the best approach and the possible adaptive re-use options for the Compound after the Police Force has relocated. The findings discussed within the document "Report on Revitalisation of Yau Ma Tei Police Station" assessed the condition of the Compound, providing appraisals of the cultural significance of the Compound, a SWOT analysis, recommended conservation policy, suggested/ discussed possible options for adaptive re-use and summarize views collected from stakeholders and the public.

From the visual inspection carried out so far both the Old and New Blocks of the Compound appear to be in fair condition with only minor defects such as water leakage and cracks on renderings.

Yau Ma Tei Police Station gives an indication of the original coastal line and has been an inseparable part of the GIC cluster or the group of cultural assets in Yau Ma Tei, and thus it is opined that it carries high contextual value in the district level. On the other hand, it carries medium architectural value for it is an example of neo-classical building of fair architectural merits. It carries medium historic value for it is the oldest police station in an urban context that still survives in Hong Kong, and both the Old and New Wings add up to give a complete story of the evolution of the police station building and the Hong Kong Police Force over time. It is however observed that the community has built up deep bonding with the building, that they see it as one of the important cultural assets in the district that helps define the identity of the district. It is therefore opted that it carries fairly high social value.

In view of the above, conservation of the Compound in total, i.e. both the Old and New Wings, is the most desirable. The Compound has strength in terms of location and strong contextual bonding, weakness in terms of the ability to adapt new functions, opportunity to further enhance the strong contextual bonding within the area and to give interpretation to explain the future generation about the history and culture of the district, as well as threats by the construction of CKR and inappropriate adaptive re-use.

Other than the Old and New Wings, the Yau Ma Tei Police Station also includes a 1-storey kitchen and laundry block and car port. However, as stated in the report on the *Consultancy for Conservation Study of Yau Ma Tei Police Station at No. 627 Canton Road, Kowloon (July 2009)*, " The 1-storey kitchen and laundry block and the car port, are at low significance and lack of architectural interest. Hence, the 1-storey kitchen and laundry block and the car port would be demolished.

3.2.8 Enhancement Works

The Ma Tau Kok area is located in south-western part of Kai Tak Development (KTD). It comprises the existing waterfront area at Ma Tau Wai/To Kwa Wan bounded by To Kwa Wan Road and Yuk Yat Street to the west and Bailey Street to the south. Ma Tau Kok is an old urban district in Kowloon, which has been substantially developed for private residential, public housing and industrial uses. The Ma Tau Kok area currently consists of a mix of residential, industrial, open

space government, community and pier uses. Recent redevelopment projects include the Grand Waterfront residential development, which comprises 5 residential towers.

The Ma Tau Kok Area covers land on the waterfront of Victoria Harbour. For any development proposal affecting such land, due regard shall be given to the "Vision Statement for Victoria Harbour" published by the Town Planning Board (the Board), the requirements under the Protection of the Harbour Ordinance (Cap. 531) and the Harbour Planning Principles published by the Harbour-front Enhancement Committee. The principal objective within the planning area is to provide for the introduction of continuous public accessible open spaces at the waterfront, which is set as a strategic planning objective that seeks to secure the creation of continuous publicly accessible waterfront open space extending from Kowloon East to the Runway District.

The Ma Tau Kok waterfront areas therefore has been planned to develop as part of a continuous waterfront promenade connecting Kwun Tong, Kai Tak, Ma Tau Kok and To Kwa Wan waterfront as a long term planning proposal. The approved EIA for Kai Tak Development has also highlighted these open space developments along the waterfront. Besides providing pleasant public access to the harbourfront, the waterfront promenade will also act as key green connectors linking up individual open spaces, residential areas and surrounding areas.

Re-provisioning of the existing Kowloon City Ferry Pier Public Transport Interchange (PTI), including all bus, green light bus, drop-off area, taxi stand etc, is required to facilitate the construction of the cut-and-cover tunnel. According to Chapter 9, Section 4.2.14 of Hong Kong Planning Standards and Guidelines (HKPSG), it is recommended on the planning point-of-view to "*locate the facilities* (i.e. the PTI in this case) *so that there is no line-of-sight of the noise sources at the noise sensitive uses*". Potential noise source of the re-provisioned PTI has been assessed in Chapter 5 and landscape treatment will be considered as far as possible to enhance the urban environment.

3.2.9 Ventilation Buildings and Administration Building

The exhaust emissions of motor vehicles using the tunnel will require a tunnel ventilation system to ensure that the air quality within the tunnel meets the air quality objectives stipulated in the EPD "Practice Note on Control of Air Pollution in Road Tunnels". Air quality concerns at the tunnel portals have led to the intent to achieve limited portal emissions, requiring that the ventilation system extracts air constantly from the tunnel to capture the traffic generated airflow through the tunnel. An air purification system (APS) is needed to treat the air discharged by the tunnel ventilation system to reduce the air quality impacts at air sensitive receivers and achieve the air quality objectives (AQO). Separate from this need for an air purification system, cost benefit analysis using the acute and chronic health benefit if air purification system is adopted suggests that the provisions of air purification systems would be justified.

To enable the tunnel ventilation system and air purification system to be readily maintainable (without lane or tunnel closures), the majority of the tunnel ventilation and air purification system equipment will be located in ventilation buildings, connected to the tunnel through adits and shafts.

All the tunnel control and monitoring systems will be connected to the Administration Building. Tunnel operators shall 24-hourly station in the building to control the tunnel systems and monitor the tunnel operation.

Air Purification System

The proposed APS for CKR schematically comprise of 2 main processes.

The first part involves the use of Electro-static Precipitators (ESP) to remove portion of particulates including PM10 and PM2.5 from the air extracted from the tunnel.

ESP has been successfully used in the past 90 years for effective removal of particulates from airstreams, especially for processes requiring large and steady flow. For instance, typical applications include boilers, incinerators, coal-burning plants and many other industrial processes have employed this technology to remove particulates in the air, however their application for road tunnels (where pollution concentrations are notably lower) is a more recent development.

The basic operation of ESP is as follows:

- Incoming air first passes through an ionization chamber in which the particulates are ionized into both positive and negative ions under a very strong electric field (i.e. generated by a high voltage in the order of 10kV). This phenomenon is called "corona discharge".
- The air then passes through a precipitation chamber where the ionization particulates are collected by the alternately charged electrode.
- The collection efficiency of the ESP would however decrease when the electrode is accumulated with more particulates. Hence, the precipitation chamber would need to be cleaned periodically, or as required.

The effluent from the water jet system would be cleaned by a filtration system to remove the particulate matter, and the recycled water would be reused for electrode cleaning again. The particulate matters filtered (in the form of a cake or a sludge) would need to be separately disposed.

After passing through the ESP, the air would be fed into a NO_2 removal system to reduce the NO_2 concentration before it is eventually discharge to the atmosphere. There are generally two broad approaches adopted in typical NO_2 removal systems.

- The first approach consists of specially prepared activated carbon which is contained in box-shaped container with wire mesh on both sides and installed on a support structure downstream of the ESP. The activated carbon filter media would need to regularly replace (typically every three years).
- The second approach consists of decomposing modules which are periodically regenerated on site by "washing" with chemical solutions such as ammonia, potassium hydroxide or sodium sulphite etc., chemical solutions which depend on the proprietary design of the NO_2 removal system. The "washing" process would need to be conducted every few weeks.

The specific process to be adopted shall be determined at a later stage through the supplier pre-qualification process.

3.2.10 Enclosures and Barriers

Base on the findings of noise impact assessment, noise mitigation measures in the combination of noise enclosure, semi-enclosure, cantilever noise barrier and vertical barriers will be provided at the section of west portion along some slip roads connecting to CKR tunnel, re-provisioned Gascoigne Road Flyover (Ferry Street section), re-aligned Hoi Wang Road and widening of Lai Cheung Road.

3.3 Implementation Programme

The construction of CKR is to commence in 2015. The construction works would take about 5 years and the target commissioning date is around end 2020. The construction programme is presented in **Appendix 3.2**.

3.4 Material Changes to Exempted Designated Projects

Clause 1.4 of the EIA Study Brief ESB-156/ 2006 states that

> *"The Project may also include changes to associated roads that constitute material change(s) to exempted project(s) to be identified under Section 2 (xii) below."*

Also under Section 2 (xii), it states the need to

> *"To identify within the scope of the EIA study as defined in Section 3.2 below, any individual works that constitute material change(s) to exempted project(s) or other designated project(s) under the EIAO."*

Given these 2 provisions in the EIA Study Brief, it is considered that it has built-in flexibility to include the following exempted designated projects in the EIA without having the need to apply for revision of this EIA Study Brief ESB-156/2006 or to apply for a new one for this item in particular.

3.4.1 Re-provisioning of Gascoigne Road Flyover (GRF) (Kansu Street Section)

The section of existing GRF between Ferry Street and Temple Street will have to be demolished and re-provisioned due to the need to demolish the Yau Ma Tei Multi-storey Car Park Building for construction of CKR. To achieve this purpose, demolishing the section up to Temple Street is considered sufficient. Moreover, the structure crossing Nathan Road is a continuous concrete box girder balance cantilever bridge from the Temple Street section, further demolishing the section crossing Nathan Road is unnecessary. Furthermore, demolition of the structure will lead to substantial disruption to the traffic and the normal operation of the area.

The existing GRF is a primary distributor (PD), which falls within the meaning of Item A.1 of Schedule 2, Part 1 of EIAO, i.e. a designated project defined under the EIA Ordinance. Because of this change, the environmental impacts arising are

thus considered adverse with the factors listed in Annex 3 of the EIAO-TM likely to cause the criteria in Annexes 4 to 10 be violated, especially in traffic noise. The aforementioned re-provisioning of the GRF is therefore considered a material change defined under S.6.1 (a) of EIAO-TM.

The existing GRF will tentatively be widened after commissioning of CKR. The widening of GRF is a separate designated project and the EIA will be conducted according to the Study Brief ESB-155/2006. Ultimately, this re-provisioned section of the GRF will also be widened under the same package as the widening of GRF.

3.4.2 Re-alignment of Hoi Wang Road

The section of Hoi Wang Road between Lai Cheung Road and Yan Cheung Road is classified as district distributor (DD) and falls within the meaning of Item A.1 of Schedule 2, Part 1 of EIAO, i.e. a designated project defined under the EIA Ordinance. The existing Hoi Wang Road will need to be re-aligned because of the conflict with the proposed western tunnel portal of the CKR. The Hoi Wang Road will be re-aligned eastward with proposed slip roads connection with local roads.

Being an exempted designated project, this substantial change in the physical alignment constitutes a material change defined under S.6.1 (a) of EIAO-TM.

3.4.3 Widening of Lai Cheung Road

Lai Cheung Road needs to be widened to facilitate proper weaving arrangement and access to the CKR network. Similarly, the section of Lai Cheung Road is a district distributor (DD) and falls within the definition of Item A.1 of Schedule 2, Part 1 of EIAO, i.e. a designated project defined under the EIA Ordinance.

Being an exempted designated project, this substantial change in the physical alignment constitutes a material change defined under S.6.1 (a) of EIAO-TM.

3.4.4 Gascoigne Road Flyover (Ferry Street Section)

The current carriageway width of the GRF flyover is not in compliance with the design standard (Transport Planning and Design Manual - TPDM). The reprovisioned section of the GRF flyover under the CKR project will be designed in accordance with the requirements of the TPDM, with a standard lane width of 4m and with a 1m wide marginal strip on either side. In addition to the standard lane width, where the road is on a sharp curve the carriageway will be also widened in accordance with TPDM.

The resultant reprovided carriageways will be wider and aligned differently at the interface with the existing section of Gascoigne Road Flyover (Ferry Street Section), therefore the existing carriageway lines will need to be realigned accordingly. In addition the realigned carriageways have been checked for compliance with the sight distance requirements as specified in the TPDM and it is found that widening of the marginal strip adjacent to the central median and the edge parapets is required in order to provide a safe and compliant design.

The extent of the affected section which involves material change to the existing Gascoigne Road Flyover (Ferry Street Section) will extend up to approximately

185m north of the interface with the realigned section of Gascoigne Road Flyover (Kansu Street Section), approximately in line with Tung Kun Street. Similarly, this section of Gascoigne Road Flyover (Ferry Street Section) is an urban trunk road (UT) and falls within the definition of Item A.1 of Schedule 2, Part 1 of EIAO, i.e. a designated project defined under the EIA Ordinance.

Being an exempted designated project, this substantial change in the physical alignment constitutes a material change defined under S.6.1 (a) of EIAO-TM

3.4.5 Ferry Street at-graded South Bound Slip Road

The current Ferry Street at-graded south bound slip road is aligned around 1m offset from the structure of the adjacent up-ramp slip road. It can only meet the minimum of 1m horizontal clearance of TPDM's requirements for structure. However, due to the proposed noise enclosure for Gascoigne Road Flyover (Ferry Street Section), there is no space for the installation of the proposed noise enclosure under the current road layout. Hence, it is proposed to remove the existing Ferry Street Subway between Ching Ping Street and at-grade slip road so as to provide space to align the slip road. The scheme is to shift the slip road toward east and the columns and foundations of the noise enclosure will be put on the original position of the slip road. Similarly, this section of Ferry Street at-graded south bound slip road is a primary distributor (PD) and falls within the definition of Item A.1 of Schedule 2, Part 1 of EIAO, i.e. a designated project defined under the EIA Ordinance.

Being an exempted designated project, this substantial change in the physical alignment constitutes a material change defined under S.6.1 (a) of EIAO-TM.

3.5 Proposed Construction Methodology

3.5.1 Tunnel Alignment Sections

Site-specific construction methodologies have been developed comprising 4 different tunnelling methods, namely cut-and-cover tunnel, drill-and-break tunnel, drill-and-blast tunnel and underwater tunnels. **Figures 3.1.1 to 3.1.4** provides an overview of the CKR alignment.

With reference to the longitudinal and geological profile of CKR, the cut-and-cover tunnels sections at both ends of the tunnel will involve excavation of soil (fill) materials using non-percussive method while the central portion of tunnel will be accomplished by the traditional drill-and-blast (D&B) method within strata of the bedrock at more than 30 m below ground.

A summary of the tentative construction methods for the tunnel alignment is given in the table below. Detailed description of the tunnelling methods can be referred the following sections.

Table 3.1: Summary of Tentative Construction methods for the Tunnel Alignment

Section	Form	Tentative Construction Method	Selection Reason
Yau Ma Tei (from Hoi Wang Road	Tunnel	Cut-and-Cover	• To facilitate connection between drill-and-break tunnel

Section	Form	Tentative Construction Method	Selection Reason
to Shanghai Street)			and depressed road.
Yau Ma Tei (Shanghai Street to The Regalia)	Tunnel	Drill-and-Break / Drill-and-Blast Tunnel	• To facilitate the geotechnical condition of the adjacent underground areas • To minimize impact to adjacent public transport systems such as Tsuen Wan Line and the proposed Kwun Tong Line Extension
Ho Man Tin, To Kwa Wan & Ma Tau Wai (The Regalia to San Ma Tau Street)	Tunnel	Drill-and-Blast	• To facilitate the geotechnical condition of the adjacent underground areas.
Kowloon City Ferry Pier Public Transport Interchange	Tunnel	Cut-and-Cover	• To facilitate connection between drill-and- blast tunnel and underwater tunnel.
Kowloon Bay	Tunnel	Cut-and-Cover with temporary reclamation	• The only viable construction method for underwater tunnel.
Ex-Kai Tak Runway	Tunnel	Cut-and-Cover	• To facilitate connection between underwater tunnel and the east end tunnel portal before comes to the depressed road section.

Yau Ma Tei (from Hoi Wang Road to Shanghai Street)

'Top- Down' Cut-and-Cover method will be adopted for the shallow section of tunnel in order to reduce the impact upon the surrounding area, pedestrians and road traffic. The following paragraph explains the 'Top-Down' Cut-and-Cover method.

Following completion of the diaphragm walls, cross walls and the ground will be excavated to the tunnel roof level and the tunnel roof slab constructed. This first stage of excavation and roof slab works will be undertaken beneath temporary decking. This decking provides a platform for pedestrian and road traffic whilst also containing the noise and dust produced by the works being carried out beneath. (An attenuation of minimum 20 dB(A) is envisaged for works under the deck). Once the roof slab is complete, the area above the roof slab is to be back-filled with the footpaths and the roads reinstated. The remainder of the tunnel construction will then continue beneath the tunnel roof slab. This approach has the advantage of allowing early reinstatement of the roads and footpaths and therefore reducing the disturbance to the public. Additionally, the roof slab and back-fill will provide a barrier between the construction work of the lower part of the tunnel and roads and footpaths at ground level (thereby improving the noise and

dust barrier temporarily provided by the temporary decking). Conventional 'Bottom-Up' Cut-and-Cover construction would result in prolonged use of the temporary traffic decking (this would increase the risk of adverse effects of noise and dust at ground level) and would also delay the reinstatement of the ground above the tunnel.

The construction of the cut-and-cover tunnel will start from the west portion at the existing Highways Department's maintenance depot at Yau Cheung Road. A tunnel access shaft located between Shanghai Street and Battery Street will also be constructed at the early stage for the construction of the tunnel in the central portion. In order to maintain the traffic of the GRF and Kansu Street, diaphragm wall construction will be undertaken in two phases. When the northern diaphragm wall is constructed, the existing traffic at Kansu Street will be maintained. Whilst the southern side diaphragm wall is under construction, Kansu Street will be temporarily realigned north in order to provide sufficient working space.

The section of GRF be reconstructed is the existing pre-cast composite viaduct between the Gascoigne Road Flyover (Ferry Street Section) and the balanced cantilever bridge crossing Nathan Road. A new viaduct will be constructed along the north side of the existing GRF alignment. The existing section of GRF will then be demolished. At the western end, the new viaduct will connect to the existing carriageway of Gascoigne Road Flyover (Ferry Street Section) as well as utilising the existing end at YMT Police Station. The realignment of the existing Gascoigne Road Flyover at Kansu Street would be constructed in phase, the east-west traffic, i.e. dual-1 traffic lanes, will be maintained throughout the construction period. It is noted that, at this stage, the works at the demolished Yau Ma Tei Multi Storey Carpark will involve the provision of temporary bridge structure to maintain the east-west traffic. As for the constructions works between Kansu Street and Temple Street, the east-west traffic will remain at the existing Gascoigne Road Flyover until the works for the realignment works of Gascoigne Road Flyover is completed. Dual-1 traffic lanes will be maintained throughout the construction period.

Yau Ma Tei (Shanghai Street to The Regalia)

In the view of the topography and geology of the Yau Ma Tei areas, drill-and-blast method will be generally adopted for this section of the tunnel.

However, in certain locations such as public transport system, the drill-and-break method (i.e. a non-blasting technique) will be used. The drill-and-break method normally entails an alternative cyclic process of drilling the tunnel face with small drills to form a “Swiss cheese” structure in the rock, which can then be broken up using rock breakers. This method will only be used when passing close to sensitive structures, where blasting may be restricted.

As described in the previous section, the GRF will be reconstructed between Ferry Street and Nathan Road. During construction, a series of temporary viaducts will be constructed on and adjacent to the site of the existing Yau Ma Tei Multi Storey Carpark at junction between Kansu Street and Temple Street. The temporary viaducts will span over both Temple Street and Shanghai Street and will enable a

two way traffic to be maintained on the GRF whilst the multi storey car park and Temple Street sections of the existing GRF are demolished and subsequently replaced by the new GRF structure. The new GRF will connect with the existing GRF cantilever span at the site of the existing Hong Kong Automobile Association situated in between Temple Street and Nathan Road (NB the existing GRF span above the Hong Kong Automobile Association will be retained).

Ho Man Tin, To Kwa Wan & Ma Tau Wai (The Regalia to San Ma Tau Street)

In view of the topography and geology of the Ho Man Tin, To Kwa Wan and Ma Tau Wai areas, the central portion of CKR mainly comprises of a twin bored drill-and-blast tunnels in hard rock. The proposed tunnels of about 2.8 km long would run in underlying rock strata below ground to avoid affecting the buildings, roads and utilities at ground level.

The deep tunnels will be constructed by the drill-and-blast (D&B) method. It is an economical method and less restricted by site conditions and equipment set-up, where tunnelling by tunnel boring machine (TBM) is not possible given the large diameters involved and the extreme wear and tear expected due to the hard rock strata. The TBM method entails using a TBM to bore through the ground to form a circular tunnel, which is then lined with concrete, and is generally more suited to soft-ground tunnelling, whereas the drill-and-blast method is more suited to hard-ground tunnelling.

The main consideration in the choice is that the diameter of tunnel should be large enough to accommodate at least 3 lanes for each direction. This will require a minimum width of about 17m, which is considered large for a tunnel. Hence, an extremely large and powerful TBM would be required for CKR. Moreover, cutting through hard rock could lead to excessive wear and tear in the cutter and unnecessary over cut given the circular section produced by TBM.

For these reasons, tunnelling by TBM has been ruled out due to considerations of the practicality. The drill-and-blast method is considered most practicable and effective method for constructing the tunnel section of CKR in central portion. This method is the traditional method for boring through hard rocks, such as granite, and has been used successfully in many previous road projects in Hong Kong. It entails a cyclic process of drilling small holes into the tunnel face, filling the holes with explosives and blasting the rock into smaller fragments to ease removal. Given that CKR is located in an urban environment, the blasting will be strictly controlled to minimise vibrations at the various buildings and structures above the tunnel.

Considering that duration of blasting will be very short and be carried out underground and is infrequent in a day, as well as the damping effect provided by the thick soft/fill materials underlying building foundations, the airborne and ground-borne noise should unlikely be significant.

To minimise the impact/ nuisances, it is considered essential that blasting operations should not be carried out during sensitive hours at close proximity to noise sensitive uses. Nevertheless, the construction noise due to removal of debris of tunnelling will be part of the construction noise assessment.

In certain locations, the drill-and-break method (i.e. a non blasting technique) will be used. The drill-and-break method normally entails an alternative cyclic process of drilling the tunnel face with small drills to form a "Swiss cheese" structure in the rock, which can then be broken up using rock breakers. This method is however laborious, and will only be used when passing close to sensitive structures, where blasting may be restricted.

Kowloon City Ferry Pier Public Transport Interchange

Similar to the Yau Ma Tei side, cut-and-cover (C&C) method will be adopted for the tunnels located at the current Kowloon City Ferry Pier PTI at Ma Tau Kok where trench is excavated and roofed over. In order to reduce impacts on the environment and existing traffic, temporary decking will be constructed after construction diaphragm wall and initial shallow excavation. The excavation thereafter will be carried out under the temporary decking and removed at certain mucking out point. After the completion of tunnel construction, the ground level will be reinstated.

This method has the advantage of allowing early reinstatement of the roads for the rearrangement of PTI and disturbance to public can therefore be minimised. Further excavation are carried out under the temporary decking away from direct impact on the public and hence provide a shield to reduce the construction noise and fugitive dust.

The construction of the tunnel will be carried out in phases such that the Kowloon City Ferry Pier PTI can be rearranged and kept in function during the construction stage. A tunnel access shaft located at the western side of the PTI will be constructed at the early stage for the construction of the tunnel in central portion.

Kowloon Bay

A 370 m long section of the CKR tunnel between the Kowloon City Ferry Pier to the Kai Tak Development Area will pass through the seabed of Kowloon Bay. Due to various site constraints, it will have to be constructed using the temporary reclamation method.

We have considered whether the underwater tunnel can be constructed using the following methods that would not involve temporary reclamation –

(a) Immersed Tube Tunnel (IMT); and

(b) Tunnel Boring Machine (TBM).

(a) Immersed Tube Tunnel (IMT)

Under this method, a trench of about 220 m and 30 m deep will be excavated in the seabed along the tunnel alignment by dredging of marine mud. The tunnel units (about 47 m to 58 m wide, and 16.5 m high) will be cast off site and floated to the tunnel site for sinking into pre-determined locations on the trench. The tunnel units will be joined. Upon the completion of jointing, the trench will be backfilled to the original seabed level.

The dredging of the trench for placement of IMT box will involve the removal and disposal of approximately 0.75 million m^3 of marine mud. Furthermore, as the sea in Kowloon Bay is only about 6m to 8m deep, an approach channel of about

1,300 m long, 150 m wide and 12 m deep will have to be formed adjacent to the tunnel site to provide sufficient draft for floating the precast units thus resulting in the dredging and disposal of approximately 1.8 million m^3 of marine mud in total.

The trench will also affect the structural integrity of the existing Ma Tau Kok and Kai Tak seawalls, and foundation of the private buildings adjacent to the seawall. The jetty of Hong Kong China Gas Co for transporting raw materials and the Kowloon City Ferry Pier would also have to be relocated during the construction period.

Given the large volume of marine mud that will have to be dredged to form the trench for placing the immersed tube units; the equally large volume of marine mud to be dredged for forming the approach channel for floating these units; and the impacts on the seawall, the adjacent private buildings, the HKCG jetty and operation of passenger ferry, IMT is therefore not a reasonable alternative.

(b) Tunnel Boring Machine

This method involves boring of circular tunnel section using Tunnel Boring Machine (TBM) through the stratum along the tunnel alignment. The bored tunnel surface will then be protected with concrete lining.

Before the construction of the concrete lining, air pressure about 300 kPa to 500 kPa (or three to five times the atmospheric pressure) will have to be applied inside the tunnel to uphold the excavated face of the tunnel and to prevent the seepage of water into the tunnel. As such, sufficient soil cover will be required for containing the pressure inside the tunnel. The amount of cover required will depend on the ground conditions. Given the relatively low strength (undrained shear strength down to about 4kPa) of the soil in the seabed of Kowloon Bay the cover required will be about 1.5 times the diameter of the tunnel. The diameter of the eastbound tunnel (with three traffic lanes and one climbing lane) will be 20.5 m. The diameter of the westbound tunnel (with three traffic lanes) will be 17 m. The cover required will be about 30.75 m and 25.5 m respectively.

As the tunnel will have to gradually rise to ground level to connect to the road network in Kowloon Bay and KTD, the maximum soil cover will only be 17 m at the western end and the minimum soil cover will only be 2 m at the eastern end. This will be less than 1.5 times the diameter of the tunnel.

The available soil cover would be inadequate for containing the air pressure that would be required for upholding the excavated tunnel face and preventing the seepage of ground water thus leading to blow out failure.

On the other hand, if the air pressure were reduced, the pressure would be insufficient for upholding the excavated sections and for preventing the seepage of ground water. As such, the tunnel could also fail because of the collapse of the excavated face and excessive seepage of ground water.

For the foregoing reasons, the use of TBM for constructing the underwater tunnel would be unsafe both for construction personnel and the public. TBM is therefore not a reasonable alternative.

Construction Method Involving Reclamation

Since both the IMT and TBM methods are not reasonable alternatives, we have considered whether the underwater tunnel can be constructed on temporary reclamation using the cut-and-cover method.

This method would require constructing pipe pile or similar wall system along either side of the underwater tunnel as temporary seawall and backfilling between them to create a dry working platform such that the cut-and-cover tunnel may be constructed using the diaphragm wall technique. This would be the safest construction method with respect to both construction workers and local public. It would also enable high-quality construction of the underwater tunnel.

The temporary seawall structure is envisaged to consist of double-layer pipe pile wall, or a combined wall type make up of pipe pile wall and sheetpile wall or similar to be installed to predetermined level. The double layer walls are interconnected by diaphragm pipe pile wall or tie rod. The space between the double layer walls will then be backfilled by suitable filling materials for the completion of the temporary seawall structure. Prior to the construction of the temporary seawall structure, ground treatment, such as stone columns, will be carried out at the marine deposit layer to be left in-situ in front or under the proposed temporary seawall structure to enhance the stability of the seawall structure. As discussed in **Section 6.7.3**, the stone columns will be installed under seabed levels and a geotextile layers will be installed to cover the seabed to prevent re-suspension and seabed disturbance. A silt curtain will be deployed to the stone column working vessels during penetrations.

After the completion of the temporary seawall structure, reclamation will be carried out within the temporary seawall to +4.0mPD to form a temporary working platform. A diaphragm wall will then be constructed within the temporary working platform and the subsequent excavation and underwater tunnel construction works will be carried out within the area enclosed by the temporary seawall by cut-and-cover method with corresponding temporary lateral support system

After completion of the underwater tunnel, the space above the tunnel box within the temporary reclamation will be backfilled to the original seabed level while the temporary lateral support system are being removed in phase. Demolition of the temporary seawall will then take place. The proposed construction method adopts an approach where the double-layer seawall will not be removed until completion of all excavation works within the temporary reclamation area enclosed by the double-layer seawall. The fill forming the temporary reclamation will be removed and the diaphragm walls will be cut down to the original seabed level. The double-layer seawall will then be demolished by first removing the soil infill within the double-layer steel pipepile/sheetpile, followed by the removal of the steel pipepile/sheetpile. The steel pipepile/sheetpile are removed by full extraction from ground where possible, or otherwise trimmed to just at the seabed level by underwater cutting with no dredging of marine deposit involved.
In order to reduce the amount of sediment to be dredged and the extent of seabed to be disturbed, the temporary reclamation would be constructed by using the pipepile seawall method (**Appendix 3.3**). As compared to the conventional fully dredged approach for seawall, this scheme could reduce the amount of sediment to be dredged significantly. Dredging would be limited to the area

outside the temporary reclamation footprint to maintain navigation to northern part of Kowloon Bay during the construction stage.

In order to reduce the amount of sediment to be dredged and the extent of seabed to be disturbed, the temporary reclamation would be constructed by using the pipepile seawall method (**Appendix 3.3**). As compared to the conventional fully dredged approach for seawall, this scheme could reduce the amount of sediment to be dredged significantly. Dredging would be limited to the area within the tunnel footprint and surface dredging to maintain navigation to northern part of Kowloon Bay during the construction stage.

The use of a 2-stage temporary reclamation rather than having more stages is primarily due to the consideration of a tight construction program as more stages need more interfacing works and will take more time overall.

Additional merits of two stages of reclamation include maintaining at all times a connection with the shore to enable timely and easy access of plant, equipment and delivery of construction materials as well as allowing direct removal of excavated materials. Having 3 or more stages will simply create islands and is hence undesirable.

In brief, underwater tunnel by temporary reclamation is considered technically feasible, safer and produce less contaminated or uncontaminated sediment by dredging requiring open sea disposal.

Temporary Reclamation and Relation to Protection of the Harbour Ordinance

The Protection of Harbour Ordinance (PHO) is not an environmental legislation. However, it has the implications in relation to reclamation in the Victoria Harbour. As discussed above, temporary reclamation is required to facilitate construction of the underwater tunnel in Kowloon Bay.

The PHO originally resulted from a private member's bill proposed in 1996 by the Society for Protection of the Harbour. The bill was first enacted as the original Ordinance in June 1997 and was then modified in the course of the legislative process. The PHO provides protection and preservation of the harbour by establishing a presumption against reclamation. In December 1999, the Ordinance was further amended to its present form by expanding its scope to cover the whole of Victoria Harbour.

Section 3 of the Ordinance states:

(1) The harbour is to be protected and preserved as a special public asset and a natural heritage of Hong Kong people and for that purpose there shall be a presumption against reclamation in the harbour. [Section 3(1)]

(2) All public officers and public bodies shall have regard to the principle stated in subsection (1) for guidance in the exercise of any powers vested in them. [Section 3(2)]

On 27 February 2003 the Society for Protection of the Harbour commenced legal proceedings and applied for judicial review of the decisions of the Town Planning Board made in connection with the draft Wan Chai North Outline Zoning Plan. Madam Justice Chu of the High Court delivered the judgment on 8 July 2003 in respect of the judicial review. In the judgment, with regard to the presumption

against reclamation under section 3 of the Protection of the Harbour Ordinance, the following three tests were laid down:

> *"...the purpose and extent of each proposed reclamation ought to be individually assessed by reference to the three tests of –*
>
> - *Compelling, overriding and present need;*
> - *No viable alternative; and*
> - *Minimum impairment.*"

The interpretation of the PHO ordinance deems that reclamation works may only be considered justifiable if it satisfies the above three tests. In view of this, a "Cogent and Convincing Materials Report for Temporary Reclamation in Kowloon Bay" has been prepared to demonstrate compliance with the overriding public need for CKR, setting out the findings of the investigations and the conclusions regarding the need for reclamation and the minimum extent of reclamation (see http://www.ckr-hyd.hk/pdf/044-02_English(Combined).pdf). To summarise, the need for CKR has been clearly established through a series of traffic and transport studies which have taken account of traffic growth and future development. The need for temporary reclamation to construct the underwater tunnel portion of CKR is compelling as none of the potential alternative alignment or construction ideas for the underwater tunnel have been found to be feasible. The total area of temporary reclamation does not exceed 3.8 ha, with a maximum of 2.0 ha at any given time.

Ex-Kai Tak Runway

Similar to the Kowloon City Ferry Pier PTI, cut-and-cover (C&C) method will be adopted for the tunnel box section located at the ex-Kai Tak Runway. It is a typical method of construction frequently adopted for shallow tunnels where a trench is possible to be excavated. The trench is excavated with lateral support system as necessary, and the tunnel box is constructed inside. After the completion of tunnel construction, the trench will be back-filled and the ground level will be reinstated.

3.5.2 Yau Ma Tei Interchange of the West Kowloon Highway and associated road network in West Kowloon

The bridge form is designed as continuous prestressed concrete box girder bridges which are matched with the existing highway structures. As the lengths of the bridge are relatively short, conventional span-by-span method could provide more feasibility to suit different alignment change of the bridges.

Typical span length for intermediate span and end span is 50m and 40m respectively. 5.1m vertical clearance will be provided between the bridge soffit and the underneath road surface. The width of the bridge for single traffic lane (Bridge B2, B, C2, C and G) is 8.8m including edge planters. For the two traffic lane bridge (Bridge D), the width will be increased to 12.1m.

Bored piles are designed to transfer the loading from the bridge to the rock stratum. G.I. information indicates that the rock head is located at around 55m below existing ground.

Retaining walls will be provided at the locations where man-made slope is not feasible at the area in close proximity with XRL vent building, new police station and the private development site. L shape reinforced concrete retaining wall type is designed for the retaining walls.

3.5.3 Connection Roads to Trunk Road T2 and Associated Road Network in Kowloon Bay and Kai Tak Development

As the structural form of the elevated sections of the connection roads in the Kai Tak Development and Kowloon Bay area is to be designed as continuous prestressed concrete box girder bridges with relatively short span length for flexibility to suit different alignment change and various interface constraints, conventional cast in-situ span-by-span method is to be implemented for construction of these bridges.

The construction methodology of the associated underpass and at-grade sections of the connection roads will be in the form of an open trench, with excavation (for below ground sections) and fill (for above ground sections) in the Kowloon Bay area. All these features will be constructed by cast in-situ method.

3.5.4 Landscaped Decks

A landscaped deck is designed to beautify the west end portal of CKR which is generally following the vertical profile of CKR. The landscaped deck is a structure on the cut-and-cover tunnel with green treatment for visual improvement. The primary function of the landscaped deck is to serve as a noise enclosure to mitigate the potential noise nuisance on the adjacent sensitive receivers.

The construction methodology of the landscaped deck and the depressed road in the east portion will be in the form of an open trench, with excavation in the Kai Tak area. Temporary shoring system with water-proofing function will be used as external lateral support / cofferdam. The depressed road and landscaped deck structures will be constructed by cast-insitu method. To resist uplift forces generated by the maximum possible ground water level, tension piles will be adopted along the depressed road section including the landscaped deck box structure.

For the landscaped deck on Kowloon City Ferry Pier PTI, the structure is proposed to be in the form of reinforced concrete structure supported by beams and columns. The reinforced concrete slabs and walls of the PTI cover structure is designed for designed for no direct line-of-sight of the noise sources at the noise sensitive uses in accordance to the HKPSG.

3.5.5 Demolition and / or Re-provisioning Works

A number of government buildings and facilities may require decanting and demolishing. A tentative list is give below. However, these decanting / reprovisioning proposals are subject to review / change in the detailed design stage.

Affected Building / Facility / User	Decanting / Reprovisioning Requirement / Proposal	Demolition Requirement
YMT Police Station Old Wing: ➢ Police	Move to new police station	Retain
YMT Police Station New Wing: ➢ Police	Move to new police station	Retain
YMT Police Station Covered Car Port: ➢ Police	Move to new police station	Demolish
YMT Police Station Kitchen and Laundry Block: ➢ Police	-	Demolish
YMT Jockey Club Specialist Clinic Extension Building: ➢ Methadone Clinic ➢ Maternal and Child Health Centre ➢ Dermatological Clinic ➢ Other specialist clinics	 Move to Polyclinic Building site Further investigate the feasibility of permanently reprovide within the proposed Community Health Centre at the ex-Mon Kok Market site by Food and Health Bureau and Department of Health Move to Polyclinic Building Move to new wing at Queen Elizabeth Hospital	Demolish
YMT Multi-storey Car Park Building (YMTCPB): ➢ Car park ➢ Government departments ➢ YMT Public Library	 Demand taken up by other car parks in the vicinity Temporarily moved to other buildings and move to proposed West Kowloon Government Offices in long term Relocate to the rest area at the south of Henry G. Leong Yau Ma Tei Community Centre in construction phase and relocate inside a new building to be constructed on the original site of the YMTCPB	Demolish
YMT Jade Market: ➢ Jade market stall holders	Move to temporary Jade Market and then to new Jade Market permanently	Demolish
Shanghai Street Playground and Basketball Court ➢ Recreational users	Closed down temporarily and re-opened after construction	Temporarily closed

Affected Building / Facility / User	Decanting / Reprovisioning Requirement / Proposal	Demolition Requirement
Ma Tau Kok Public Pier ➢ Passengers	Move to temporary landing step and then to new pier permanently	Demolish

Section of Gascoigne Road Flyover

The tunnel portion of CKR will be constructed underneath the foundation of Kansu Street section of GRF. The affected portion of the flyover will be underpinned or re-constructed. In addition, the GRF (Ferry Street Section) extending from Tung Kun Street to Kansu Street will be modified due to the construction of CKR. Noise enclosures and noise barriers will be installed at these to sections of flyover. Transparent materials and streamlined structure will be adopted to enhance the appearance of the noise enclosures and noise barriers. Greening will also be provided at appropriate locations so that the noise enclosures and noise barriers can better blend in with the surrounding environment.

A new bridge will be constructed on the north side along the same GRF alignment and then demolished the existing section of the flyover. At the west end, it will connect to the existing carriageway of Gascoigne Road Flyover (Ferry Street Section) as well as utilizing the existing stub end at police station. On the east side, the new flyover will connect at Temple Street with the balanced cantilever bridge crossing Nathan Road. With the obstruction of the Alhambra Building, it has to be built on the north side only.

To suit the nature of vary width of the new flyover, cast in-situ pre-stressed concrete box girder bridge is considered as the most appropriated structural form for the new flyover. As the alignment of CKR and GRF at that section are overlapped, the new flyover will be stand on the top slab of the CKR cut-and-cover tunnel.

Provisions for future widening to dual-two carriageway will be allowed in the design of the deck as well as the piers and foundations. The deck can be widened by extending the cantilever slabs from the top slab. Noise enclosure will be provided at most of the sections along the new flyover except the area facing Kansu Street CLP substation building. At that section, the noise barrier will be in the form of semi enclosure.

3.5.6 Conservation of the Yau Ma Tei Police Station

Construction of CKR cut-and-cover tunnel underneath the YMT Police Station New Wing Building will require to remove those affected piles. An underpinning scheme is required to transfer the existing column loadings to a deeper rock stratum. The supporting system includes cutting the existing ground floor slab to expose the existing pile caps and then constructs transfer beams at both sides of the pile caps. The transfer beams will tie up with the existing caps. Loadings of the transfer beams will be transferred to the rock socket piles installed at the two ends of the beams. As the existing building is founded on pile, appropriate design of the underpinning work e.g. provide sufficient clearance between the excavation

trench and the existing piles, it is anticipated that the structure of the building will not be jeopardised.

The existing old wing building is a Grade II historic building built in 1920's. The building is found on spread footing foundation. CKR will allow 2.3m clearance between CKR structure and the historic building. As a contingency measure, TAM grouting will be carried out for the area around the building to control the settlement.

3.5.7 Ventilation Buildings and Administration Building

The West Ventilation Building is proposed to be located adjacent to the existing FSD Rescue Training Centre and will comprise one single integrated building. The building is proposed to have several levels of basement with 3 storeys above ground level. At present it is perceived that the structure will be in form of reinforced concrete and will be constructed by using conventional cast-insitu method.

The proposed Ho Man Tin Ventilation Building is proposed to be located adjacent to the existing Ho Man Tin service reservoir and will comprise one single integrated building. The building is proposed to have several levels of basement with a some (to be determined) storeys above ground level. At present it is perceived that the structure will be in form of reinforced concrete and will be constructed by using conventional cast-insitu method.

East Ventilation Building and Administration Building are located near the existing Kai Tak Tunnel. These 2 buildings can be considered as one integrated building. The building has several levels of basement with a few storeys exposed above ground level. As there is not much site and environmental constraints, the structure will be in form of reinforced concrete and will be constructed by using conventional cast-insitu method.

3.5.8 Enclosures and Barriers

Acoustic panels will be fixed on the frame to provide sufficient sound insulation.

3.5.9 Temporary Works Sites / Areas

There will be temporary works sites / areas in the vicinity of the interchange structures, tunnel, landscaped decks, depressed roads, ventilation buildings and administration building to facilitate the construction process.

It is recommended that C&D material should be transported off-site by barge wherever possible to reduce impacts from road transport. There is a potential barging point (being used by XRL project) at Kwai Chung underneath Cheung Tsing Bridge. DLO/TW&KT has allocated the site until August 2015 to RDO/HyD. **Figures 3.2.1 to 3.2.12** show the locations of these temporary works sites.