Highways Department

Agreement No. CE 43/2010 (HY) Central Kowloon Route – Design and Construction

Environmental Impact Assessment Executive Summary

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1 INTRODUCTION

1.1 Background

The main objective of the proposed Central Kowloon Route (CKR) is to relieve traffic congestion at peak hours on the existing east-west corridors, including Lung Cheung Road, Boundary Street, Prince Edward Road West, Argyle Street, Waterloo Road, Gascoigne Road Flyover and Chatham Road North.

The proposed CKR will connect the West Kowloon Highway at Yau Ma Tei Interchange to the existing road network at Kowloon Bay as well as the future Trunk Road T2 at Kai Tak Development (KTD) and the Tseung Kwan O – Lam Tin Tunnel, thus forming a strategic highway link to serve the existing and planned developments in West Kowloon, East Kowloon and Tseung Kwan O. **Figure 1.1** shows the CKR alignment.

The proposed CKR will largely be in the form of a tunnel to minimize its impact on the environment and existing buildings. The length of CKR is approximately 4.7 km long and the tunnel section would be approximately 3.9 km long, in particular, there will be an underwater tunnel of about 370m long in Kowloon Bay to the north of the To Kwa Wan Typhoon Shelter.

CKR comprises the following elements which are classified as Designated Projects (DPs) as per Schedule 2, Part I of the Environmental Impact Assessment Ordinance (EIAO):

- A.1: A road which is an expressway, trunk road, primary distributor road or district distributor road including new roads, and major extensions or improvements to existing roads;
- A.7: A road or railway tunnel more than 800 m in length between portals;
- A.8: A road or railway bridge more than 100 m in length between abutments;
- A.9: A road fully enclosed by decking above and by structure on the sides for more than 100 m;
- C.2: Reclamation works (including associated dredging works) more than 1 ha in size and a boundary of which

  (c) is less than 100 m from an existing residential area.
- G.5: A facility for the treatment of construction waste

  (a) With a designed capacity of not less than 500 tonnes per day; and

  (b) A boundary of which is less than 200m from an existing or planned

  (i) Residential area;

  (ii) Place of worship;

  (iii) Educational institution; or

  (iv) Health care institution.

The Project also involves material changes to exempted designated projects (existing roads), viz.

- Re-provisioning of Gascoigne Road Flyover

- Re-alignment of Kai Fuk Road and Hoi Wang Road
- Widening of Lai Cheung Road
- Re-arrange the carriageway lines on Gascoigne Road Flyover (Ferry Street Section) and Ferry Street

1.2 Project Scope & Implementation Program

The scope for CKR includes:

- A dual 3-lane east-west trunk road about 4.7km long with about 3.9km in tunnel connecting West Kowloon with the proposed Kai Tak Development (KTD);
- Connection with Yau Ma Tei Interchange of the West Kowloon Highway and associated road network in West Kowloon;
- Connection to future Trunk Road T2 and associated road network in Kowloon Bay and KTD;
- A landscaped deck at the west portal and the structure of landscaped decks above the depressed road at east end;
- Demolition and/or re-provisioning of Government and other facilities affected by CKR;
- Re-provisioning of the section of Gascoigne Road Flyover affected by CKR;
- Conservation of the Yau Ma Tei Police Station;
- Enhancement works at Yau Ma Tei and Ma Tau Kok;
- Tunnel ventilation system and air purification system, and associated ventilation buildings, adits and shafts;
- Administration building, tunnel management system and operator facilities for the management and operation of the tunnel;
- Traffic Control and Surveillance System;
- Associated environmental, geotechnical, marine, landscape, utility, drainage, traffic engineering, fire services, electrical and mechanical works, and road works and modification works; and
- All other works associated with the construction or future operation of CKR.

The current implementation programme for CKR is to commence construction in 2015 for commissioning in around end 2020.

1.3 Need for the Project

The need for an alternative east-west traffic route across Kowloon, particularly to cope with new developments on its western and eastern sides, has been recognised for a number of years. Traffic congestion is now common on many of the existing east-west surface routes, including Boundary Street, Prince Edward Road, Argyle Street, Waterloo Road and East Kowloon Corridor etc. A new trunk road is required urgently to bypass traffic from these congested routes and connect directly West Kowloon with Kowloon Bay and KTD, and thereby help relieving the traffic congestion on these roads. If CKR does not proceed, traffic congestion would continue to worsen on the existing east-west surface routes. Indeed, many

of the existing major road links in Kowloon are already operating close to or above capacity.

In fact, the benefits of the reduction in journey time in the above key east-west traffic corridors could also be represented in terms of the increase in average traffic speeds. For example, in 2021, the introduction of CKR would allow the average traffic speed on some of these key east-west traffic corridors to increase by up to 15kph during the peak hour. Since some of these key east-west corridors are experiencing serious traffic congestion during peak hour already and would probably be even more severe by 2021. The introduction of CKR would allow the increase in average traffic speed of up to 70%, which represent a rather high percentage of increase. Since vehicular emission would decrease as the average traffic speed increases, the introduction of CKR would cause a decrease of emission from vehicles travelling on these key east-west corridors. This decrease in vehicular emission would definitely provide positive impacts on the large number of residential buildings along these key east-west corridors, and also provide a contribution in achieving a better air quality in the region. An estimation has been made on the generation of nitrogen oxides, respirable suspended particulates, carbon dioxide along these key east-west traffic corridors (see http://www.ckr-hyd.hk/pdf/044-02_English(Combined).pdf).

The proposed CKR, Trunk Road T2 and Tseung Kwan O – Lam Tin Tunnel will form part of Route 6, which will connect West Kowloon and Tseung Kwan O. If CKR does not proceed, it would not be possible to complete this important strategic highway link.

1.4 Concurrent Projects

The sections of the CKR that would interface with other major projects and has the potential to lead to cumulative impacts. Expected concurrent/ interfacing projects include

- Shatin to Central Link (Tai Wai to Hung Hom)
- Kai Tak Development (KTD)
- Trunk Road T2
- Cross Bay Link
- Tseung Kwan O – Lam Tin Tunnel
- Town gas submarine pipeline.

1.5 Alignment Selection

A number of alignment options have been exhaustively considered during the design developments. The general preferred criteria of the alignment options are that, firstly they should connect to West Kowloon Highway at the already constructed connecting points at the Yau Ma Tei Interchange, secondly they should be mainly in the form of a tunnel and thirdly they should avoid affecting private properties or public facilities, such as Yau Ma Tei Police Station, Yau Ma Tei Jockey Club Polyclinic, to the maximum extent, if possible. A number of factors has been considered in the alignment evaluation process, including environmental impacts, engineering considerations and public views etc.

For the western portion of the alignment, the selection of the preferred alignment is adopted since 1) The alignment will avoid the old wing of the Yau Ma Tei Police Station on the north side of Kansu Street and also avoids the old residential buildings on the south side of Kansu Street; 2) The alignment avoids any impact on private land in this area. In addition the vertical alignment is developed so as to pass under the MTRC Tsuen Wan Line and Kwun Tong Line Extension tunnels; 3) The side-by-side cut-and-cover tunnel construction is found to be the most engineering feasible of the options considered with a relatively low depth and reasonable construction area. For the eastern portion of the alignment, the preferred alignment would have the shortest marine tunnel section and therefore generate the least amount of excavated sediment to be disposed of and would have the least water quality impact to the surrounding waters.

1.6 Construction Methodology

Site-specific construction methodologies have been developed comprising different tunnelling methods, including cut-and-cover tunnel, drill-and-break tunnel, drill-and-blast tunnel and underwater tunnels. With reference to the longitudinal and geological profile of CKR, the cut-and-cover tunnels sections at both portions 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 construction methods for the tunnel alignment is given in the table below. Other than the tunnel sections, other approach roads, ventilation buildings, landscaped decks etc would be constructed using conventional approach.

Table 1.1: Summary of Tentative Construction methods for the Tunnel Alignment

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

Section	Form	Tentative Construction Method	Selection Reason
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.

2 SUMMARY OF KEY FINDINGS IN EIA STUDY

2.1 Air Quality Impact

2.1.1 Construction Phase

Potential dust impact would be generated from the soil excavation activities, backfilling, site erosion, storage of spoil on site, transportation of soil, etc. during the construction of CKR.

Quantitative fugitive dust assessments have been conducted, taking into account the cumulative impact caused by nearby concurrent project. Effective dust control following the requirements given in the Air Pollution Control (Construction Dust) Regulation and in accordance with the EM&A programme during construction are recommended. Assessment results suggested that watering at site once per hour would be required to control the fugitive dust impact to acceptable levels.

2.1.2 Operational Phase

A quantitative air quality assessment has been conducted to assess the cumulative impacts from all neighbouring pollution sources. The assessment has been determined according to the EIA Study Brief and concluded to be 2021 which is the first operational year. The PATH model has been adopted to simulate the regional air quality effects, which has included various pollution sources in Hong Kong and the Pearl River Delta Economic Zone (PRDEZ). For the emission inventory in Hong Kong, various sources have also been included in the PATH model, including the including the power stations, Chek Lap Kok International Airport, marine emission, roads.

For the road networks associated with the CKR, the vehicular emission has been estimated by using a finer model EmFAC – HK (ver. 2.1), whilst CALINE4 and ISCST3 models have been used to simulate the local dispersion. The output of PATH, CALINE and ISCST have been combined and compared against the Hong Kong Air Quality Objectives (HKAQO). The combined results indicate that the cumulative air quality impacts at the identified receivers would comply with the HKAQO and hence there would not be any adverse residual impacts.

2.2 Noise Impact

2.2.1 Construction Phase

Potential construction airborne noise impacts would be caused by various construction activities including excavation, backfilling and construction of approach road and associated ventilation buildings, etc.

Construction noise assessment has concluded that the unmitigated construction noise impacts would be high at some NSRs. Suitable noise mitigation measures have therefore been identified which could reduce the noise impacts at most of the

NSRs. In view of works that will be carried out close to sensitive uses, especially in the West Portion, a number of alternative construction methodologies have been considered to alleviate the noise impact. These include the use of top-down approach to enable earlier decking of the cut-and-cover tunnel sites. The top slab thus constructed would contain noisy works activities to continue underneath.

Careful selection of construction equipment and working methods including the use of quiet plant is adopted, where practicable has also been considered. Moreover, good site practice, the use of site hoarding, installation of movable barriers and sequential operation of construction plant have also been recommended. The predicted noise levels at most of the NSRs would comply with the corresponding noise criteria, except for a few NSRs near the works areas e.g. Kansu Street at West Portion, Chung Hau Street at Central Portion and San Ma Tau Street at East Portion. According to the current construction methodology, mucking-out points will be located in west, central and east portion. Since the mucking out activities will be located in the vicinity of residential premises, large full noise enclosures would be adopted for these three mucking out points to minimize the potential construction noise generated by the construction activities. All practicable mitigation measures are exhausted and the impacts are minimised.

Potential construction groundborne construction noise impacts may arise from tunnel boring activities. Groundborne noise assessment has therefore been conducted for tunnel areas in West Portion, Central Portion and East Portion. Predicted results suggested that construction groundborne noise levels will be within the statutory requirements and mitigation measures are not required.

2.2.2 Operational Phase

Noise impact during the operational phase of the project include those from existing and planned road networks in the vicinity, and the fixed plant such as ventilation system.

Without mitigation measures, the predicted road noise levels at most representative NSRs would exceed the criteria. With the implementation of the proposed direct noise mitigation measures, including low noise road surfacing, combination of vertical noise barrier, cantilevered section noise barrier, semi-enclosure and full enclosure, compliance of EIAO criteria is achieved. However, given the noise environment, some of the NSRs are dominated by the traffic on existing roads instead of the planned roads, exceedance is still predicted at some NSRs. These NSRs include those along Nathan Road, Ferry Street and West Kowloon Highway in West Portion and Kai Fuk Road and other planned roads (D2, D3 and T2) in East Portion. Indirect noise mitigation measure in term of building orientation of planned schools in West and East Portions to avoid direct facing the CKR is recommended. With all the practicable mitigation measures within the context of this study, the noise contribution at these NSRs due to this project would be controlled to within 1.0dB(A).

Fixed noise sources during the operational phase would be the ventilation buildings. Operational noise impacts can be effectively mitigated by

implementing noise control treatment (e.g. acoustic silencers) at source during the design stage to ensure compliance of the stipulated noise criterion.

2.3 Water Quality Impact

The potential water quality impacts arising from the construction and operation of the CKR have been assessed. The key focus is on the construction of the proposed underwater tunnel in Kowloon Bay.

During construction phase, a pipepile seawall method will be applied for the temporary reclamation. Excavation and filling activities will be carried out within pipepile seawall. Dredging activities will only be carried out during the re-location of navigation channels. The assessment has also included the potential water quality impacts due to other concurrent dredging activities.

Delft3D model was used in the quantitative assessment to study the potential water quality impacts on different types of WSRs including cooling water intakes and WSD flushing water intakes, as well as meeting the water quality objectives (WQOs). Pollutants of concern include suspended solids (SS), dissolved oxygen (DO) depletion, ammonia nitrogen, and SS elevation. It has also included selected metals, total Polyaromatic Hydrocarbons (PAH), unionized ammonia (UIA), and total inorganic nitrogen (TIN) with potential release during dredging.

Mitigation measures such as use of silt curtains, reduction of dredging rates, additional silt screen at seawater intakes, good site practices, etc, were proposed. Modeling results indicate that most of the parameters would be well within the respective criteria after implementation of mitigation measures, except the Cu and total PAH levels at WSR 3 (To Kwa Wan Typhoon Shelter) will exceed the criteria proposed by the Australian Water Quality Guidelines for Fresh and Marine Waters. However, these criteria are for protection of irrigation/aquaculture and fresh water aquatic ecosystem respectively which is under a conservative side. While WSR 3 is a typhoon shelter only and its function are neither ecological importance nor for portable use, such exceedances will not deteriorate the existing functions of WSR 3. In addition, the impact will be reversible since the dredging period will be only last for 2 months. To ensure the effectiveness of the mitigation measures, regular water quality monitoring in the Kowloon Bay and its vicinity are recommended during the dredging periods.

During operational phase, adverse water quality impact is not anticipated with the implementation of proper mitigation measures for road runoff and wastewater from APS.

2.4 Waste Management Implications

The potential impacts of wastes arising from the construction and operation of the Project have been assessed. The construction activities will generate a variety of wastes including vegetation from site clearance, excavated materials including soil and rocks, construction and demolition (C&D) wastes, chemical and municipal wastes, etc.

There will be about 0.88 Mm^3 of Grade I/II rocks generated from bored tunnelling. They are expected to be of good quality and hence can be sent to quarry for re-use. The remaining surplus C&D materials requiring disposal will amount to about 2.57 Mm^3. This comprises 0.014Mm^3 of non-inert C&D materials to be landfilled

and the remaining 2.56 Mm^3 as public fill. The quantity of inert C&D materials to be reused within the project is subject to the availability of temporary stockpile area (TSA) and the project proponent will continue to explore the feasibility to setting up TSA so as to maximize the reuse of inert C&D materials.

The total volume of dredged/ excavated materials arising from the Project is estimated at 218,894 m^3, in which 500 m^3 of land-based sediment is proposed to be reused for backfilling of pile caps of viaduct piers with low headroom under the same project. The amount of dredged sediment requiring disposal will be 218,394 m^3. Out of the total 218,894 m^3 of dredged/ excavated materials, 42,254 m^3 of which will arise from construction of the cut-and-cover tunnels at Yau Ma Tei, and Ma Tau Kok where deep excavations can disturb part of the sediment in the previously reclaimed areas as well as sediment that could be disturbed by foundation works for piers of the connecting flyover/ elevated slip roads in the West Portion.

The amount of sediment expected from excavation in the temporary reclamation has been estimated at 176,640 m^3. In terms of sediment quality, the marine investigation results have indicated that the footprint for the underwater tunnel and the fairway is heavily contaminated with organic PAHs. The contamination by heavy metals is also a key concern since exceedance of UCEL was commonly found. All 4 types of disposal options have been recommended in line with ETWB TCW No. 34/2002. Given the amount of C&D materials that will be generated, it should be managed properly so that timely disposal arrangement can be made. The C&D Materials Management Plan ("C&DMMP") and the Waste Management Plan ("WMP") should be enforced by incorporating them as part of the contract requirements.

Provided that the recommended waste management practices are implemented, potential impacts on the environment associated with waste generated during the construction phases of the Project should be surmountable.

2.5 Land Contamination

A land contamination assessment has been conducted in order to investigate the land contamination impact arising from works of the CKR especially at sites coincide with the cut-and-cover tunnel alignments at both portions. The middle section of the CKR tunnel is entirely created in rock by drill-and-blast method and will not involve excavations through the ground surface and hence is not going to be affected by any contaminated soil.

Based on the testing results collected from the site investigation works conducted in 2009, exceedances of the relevant Risk-Based Remediation Goals (RBRGs) limits have been detected at 3 boreholes including PBH4 and PBH5 in Yau Ma Tei and PBH7 in Ma Tau Kok. Based on the confirmatory investigation conducted in 2011 and 2012, the contamination extent at PBH4 has been determined and the quantity of contaminated soil to be generated from PBH4 was estimated at 157m^3.

Considering the small quantity of contaminated soil to be generated from PBH4 and that the level of contamination detected did not exceed the RBRGs for "Public Park" which is a more representative land use for CKR, on-site reuse of the contaminated soil within the boundary of CKR, such as using to backfill in non-pedestrian use area under new flyover, would be recommended as the remediation option for the contaminated soil.

Investigation of contamination extents at PBH5 is not required as this borehole is located outside the CKR alignment and does not fall within the excavation extent. For PBH7, since the SI works could not be completed for 2 boreholes (EBH1 and EBH2) which are intended to confirm the extent of the contamination detected at PBH7, the contamination extent of PBH7 could not be determined at this stage.

The remaining SI works will be conducted at a later stage e.g. after site possession and utility diversion by the construction contractor. Following the completion of the remaining SI works, the Project Proponent would prepare and submit a Second Supplementary CAR/RAP to EPD to present the findings of the SI works and to recommend specific remediation measures, if required. Upon completion of the remediation works, if any, a Remediation Report (RR) would be prepared and submitted to EPD for agreement prior to commencement of the construction works.

Nevertheless, the contamination issue is anticipated to be surmountable with the supportive view that the contamination identified are relatively localised, likely contaminants are generic and easily remediated as remediation methods available in the market are well established and nature of the possible contaminants can be dealt with by sufficient local remediation experience.

2.6 Hazard

Considering that CKR will pass through very hard granite that could cause extreme wear and tear to a Tunnel Boring Machine (TBM) and cause excessive downtime, drill-and-blast method is considered most practicable and effective method for constructing the bored tunnel section of CKR. A Quantitative Risk Assessment (QRA) for transport and use of explosives during construction of the CKR has been carried out as per the EIA Study Brief No. ESB-156/2006 (EIA Study Brief) in terms of individual risk and societal risk criteria stipulated in Annex 4 of the Environmental Impact Assessment Ordinance Technical Memorandum (TM-EIAO).

Explosives have been identified as the major hazardous source in the Project. The use of explosives and its delivery by approved trucks are the two main issues addressed in the assessment.

For delivery of explosives, feasible routes have been identified. By taking into account blasting schedule and consumption of explosives at different period of time, frequency of accidental detonation of explosives and consequence of detonation have been assessed using reasonably conservative data. Impact of accidental detonation on indoor and outdoor population has been considered.

For use of explosives, simultaneous accidental detonation of up to 6 maximum instant charge (MIC) due to human errors has been considered. Frequencies for human errors leading to higher ground vibrations have been derived using Human Error Assessment & Reduction Technique (HEART) and Fault Tree Analysis. Sensitive receivers such as buildings and structures potentially affected by excessive ground vibrations have been identified. Impact of accidental detonation during transport in the underground tunnel has also been assessed. It is found that none of the sensitive receivers is anticipated to be subject to serious structural damage in case of accidents. Failure of slopes is found to be highly unlikely.

During the design development of the Project, the originally proposed fresh air supply ventilation building at the junction of To Kwa Wan Road and San Ma Tau Street has been removed to eliminate the potential draw in of accidental towngas release into the CKR tunnel during operation of CKR.

The assessment results indicate the risk is acceptable in terms of individual risk and societal risk. It is concluded that the risk associated with the transport and use of explosives for the CKR project satisfies the Hong Kong Government Risk Criteria set out in Annex 4 of the TM-EIAO. Hence, the hazard to life impact due to the construction and operation of the CKR project is considered acceptable.

2.7 Landscape & Visual Impact

As the majority of the CKR is located underground, landscape and visual impacts would be restricted to above ground construction works and operational facilities only. It is considered there will be no substantial adverse landscape and visual impacts to the surround sensitive receivers during the operation phase.

Based on the 2010 Tree Survey, about 1304 trees will be affected by the works and need to be removed by felling or transplanting, while approximately 2812 will be retained. The 2010 Tree Survey estimated approximately 163 trees would be suitable for transplanting and approximately 1141 trees will not be suitable for transplanting and would therefore require felling. Due to the Project re-alignment and other projects development (e.g. XRL), the number of trees affected by the CKR Project has reduced since the 2010 Tree Survey. An updated Tree Survey will be carried out (due to commence mid 2013) and tree treatments will only be finalised during the Tree Removal Application.

For trees unavoidably affected by the Project that have to be removed, where practical, transplantation will be chosen as the top priority method of removal but if this is not possible or practical (e.g. the tree is too large or has a low survival rate), compensatory planting will be provided for trees unavoidably felled. The felled trees will be compensated for mainly within the Project Boundary including on the future landscape deck near the western tunnel portal but it is likely that it will be necessary to agree additional receptor sites for some compensatory trees (and possibly transplanted trees). Using worst case scenario numbers, current estimates predict additional receptor sites will be required for approximately 550 trees but given the reduced numbers of trees now affected by the Project, particularly in the West Portion, this number is likely to be reduced.

No Registered Old and Valuable Trees are located within the Works Area and none of these affected trees are LCSD champion Trees or Registered Old and Valuable Trees, neither are they rare or endangered species, but mainly common exotic trees. All the trees with high amenity values that are unavoidably affected by the works would be transplanted where possible. Detailed tree preservation, transplanting and felling including compensatory planting proposals will be submitted to the relevant Government Department for approval in due course in accordance with ETWB TC no. 3/2006.

Part of the public open spaces within the works area will be permanently taken by connection road, tunnel portal, ventilation building or re-provisioned community facilities, particularly in the West Portion. All areas of public open space affected

by the Project will be re-provisioned either at the same location following the completion of temporary works, or at a separate site, as agreed with relevant Government departments and under the proposed development. Overall more public open space will be re-provisioned/ reinstated than is taken during construction providing a net benefit to the regional environment.

A number of Landscape Resources (LRs) in the East Portion are also considered to benefit from the Project once mitigation measures have been implemented. These include Roadside Planting along San Ma Tau Street and Bus Terminus (LR3.3a), Disturbed Area within former Kai Tak Airport (LR3.5a), Man-made Shoreline around former Kai Tak Airport (LR3.8b) as well as the Man-made Shoreline of West Kowloon Bay (LR3.8a).

Impact on Landscape Character Areas (LCAs) during construction would be primarily due to construction activities including associated temporary works for the construction of cut-and-cover tunnel, ventilation and administration buildings and connecting roads. After implementation of mitigation measures, there would be moderate adverse residual impacts on the Transport Corridor Landscape (LCA1.1) in the West Portion the Typhoon Shelter (LCA3.4) and and Transportation Corridor Landscape (LCA3.5) in the East Portion during construction. The rest of the LCAs would experience slight or insignificant adverse residual impacts at this stage. With the implementation of mitigation measures, at the design year (operation year 10), impacts from the Project on all the LCAs would be insignificant.

Visual impact during the construction phase would be primarily due to construction activities such as excavation for cut and fill, piling and demolition of existing buildings as well as actual construction of new structures such as the ventilation and administration buildings, depressed and connecting roads and tunnel portals including landscape deck. With implementation of mitigation measures during construction, there would still be some substantial impacts on VSRs adjacent or close to the CKR especially residential and GIC Visual Sensitive Receivers (VSRs) while adverse residual impacts on VSRs further away from the works would be moderate to slight except for those who will be shielded from the view by future development in the former Kai Tak Airport area and not be affected by the Project. After the implementation of mitigation measures in operation year 10, visual impacts on all VSRs will be insignificant with the exception of some slight adverse visual impacts on residential and GIC VSRs that are close to the tunnel portal in the West Portion.

Considerable effort has been made to integrate the CKR with KTD and overall the former Kai Tak Airport area will be enhanced. A number of CKR VSRs close to the Ma Tau Kok waterfront, which will be converted into a landscaped promenade, will also slightly benefit from the CKR Project, while viewers along the current and future waterfront here will benefit moderately.

Overall, it is considered that the adverse residual landscape and visual impacts of the proposed Project are considered as acceptable with mitigation measures during construction and operation phase.

2.8 Cultural Heritage Impact (Terrestrial & Marine Archaeology)

Terrestrial Archaeology

A baseline study on terrestrial archaeology has been conducted comprising desk-top research and site visits. The findings of the study have indicated that the impacted areas are of no or very low archaeological potential. As no adverse impacts are expected to arise from the Project, mitigation measures are not considered necessary. As a precautionary measure, the Antiquities and Monuments Office should be informed immediately in case of discovery of antiquities or supposed antiquities during the construction.

Marine Archaeology

A Marine Archaeological Investigation (MAI) of the seabed has been carried out to identify any potential impacts that may be caused by the construction of the underwater tunnel between Kowloon City Ferry Pier and the Kai Tak runway. The purpose of the MAI was to locate and assess underwater archaeological resources, which may be damaged by the Project. In accordance with AMO Guidelines, the MAI has included a Marine Archaeological Review, Baseline Review, Geophysical Survey and Underwater Diver Survey. The Baseline Review also included examination of earlier MAI reports covering the study area.

The first phase of the MAI was completed in 2008. The MAI Baseline Review established high marine archaeological potential for Kowloon Bay. The 2008 geophysical survey located 8 unknown seabed objects. Diver inspection of them identified them as modern dumped debris.

As the design has developed in 2012, additional dredging is required and hence additional geophysical survey was conducted. The two MAI surveys together combine to provide 100% coverage of the study area.

The 2012 geophysical survey located 36 unknown seabed objects. Diver inspection of 28 of them identified them as modern debris with no archaeological value. The eight objects that were not practicable to inspect were deemed to have low archaeological potential due to their location underneath the disused fuel dolphin which is a current work site creating debris.

A watching brief is therefore not required during dredging. However, contractor should be alerted during the construction on the possibility of locating archaeological remains, such as cannon and AMO shall be informed immediately in case of discovery of antiquities or supposed antiquities in the subject sites.

2.9 Cultural Heritage Impact (Built Heritage)

A baseline study comprising a desk-top study and a built heritage field survey has been conducted to identify if there is any built heritage resources within the Study Area that could be affected by the Project. The study has identified 9 graded or proposed graded historical buildings and 9 structures with heritage value. There are no government historic (GH) sites or declared monuments identified within the Study Area. The construction and operation of the CKR tunnel and road network will not cause any insurmountable adverse impacts if proper protection

measures and ground-borne vibration monitoring are implemented. These measures include:

Yau Ma Tei Police Station

New Wing

The proposed works will directly impact on the Yau Ma Tei Police Station Compound. The 1-storey kitchen and laundry block and the car port are recommended to be demolished and an underpinning scheme will be implemented for the new wing. There are no direct impacts to the old wing, however, as the old wing and new wing are extremely close to the works, an engineering study has been conducted and considered that the most effective means of ensuring no damages to the structures during the construction period of the CKR is by underpinning the new wing prior to commencement of construction works. Once implemented, the underpinning will become a permanent part of the structure. The old wing however does not required to be underpinned.

As the construction works will be expected to be close to the new wing, the following mitigation measures are recommended to be undertaken:

- A protective covering should be provided for the buildings in the form of plastic sheeting;
- Buffer zones should be provided between the construction works and the external walls of the buildings. The buffer zones should be as large as site restrictions allow and shall be marked out by temporary fencing or hoarding.
- The Alert, Alarm and Action (AAA) settlement and tilting limit should be 6/8/10 mm and 1/2000, 1/1500 and 1/1000.
- Monitoring of vibration levels will be undertaken during the construction phase and the AAA vibration limit will be set at 5/6/7.5 mm/s.
- A monitoring proposal will be prepared and submitted to AMO.

Regular site inspections and monitoring works will be carried out by the contractor and the monitoring results will be submitted to the resident site staff of HyD to ensure compliance.

Old Wing

The mitigation measures will include the use of a diaphragm wall construction method and providing a grout curtain in front of the building.

- The Alert, Alarm and Action (AAA) settlement and tilting limit should be 6/8/10 mm and 1/2000, 1/1500 and 1/1000.
- Monitoring of vibration levels will be undertaken during the construction phase and the AAA vibration limit will be set at 5/6/7.5 mm/s.
- A monitoring proposal will be prepared and submitted to AMO.

With the above measures, it is anticipated that effect on the building will be controlled to an acceptable level.

Regular site inspections and monitoring works will be carried out by the contractor and the monitoring results will be submitted to the resident site staff of HyD to ensure compliance.

1-storey kitchen and laundry block and the car port

The 1-storey kitchen and laundry block and the car port are of low heritage and architectural value, demolition is an acceptable impact and no mitigation is required.

Boundary Wall and Vehicular Entrance of the New Wing

The existing boundary wall and vehicular entrance gate of the New Wing are of low heritage and architectural value, demolition is an acceptable impact and no mitigation is required.

The Tin Hau Temple at Yau Ma Tei

Monitoring of vibration levels will be undertaken during the construction phase and the AAA vibration limit will be set at 3/4/5 mm/s.

A condition survey shall be carried out by the Project Proponent prior to the construction phase.

With the above measures, it is anticipated that effect on the buildings will be controlled to an acceptable level.

Kowloon Methodist Church & Ma Tau Kok Animal Quarantine Depot

Monitoring of vibration levels will be undertaken during the construction phase and the AAA vibration limit will be set at 5/6/7.5 mm/s.

The vibration monitoring proposal will be submitted to AMO for comment.

With the above measures, it is anticipated that effect on the buildings will be controlled to an acceptable level.

Kowloon City Ferry Pier and Kowloon City Vehicular Ferry Pier

A monitoring system for settlement, vibration and tilting will be determined and implemented pending determination of the future grading.

Ma Tau Kok Public Pier

No mitigation is required at present. If the public pier is granted Grade 1, Grade 2 or Grade 3 status, the mitigation will be revised to adhere to the requirements for protective measures for Graded Historic Buildings.

Kowloon Permanent Pier No. 70

The pier contains active gas pipelines and will be strictly monitored for safety precautions during the works based on guidelines from the HK China Gas Company. It is concluded that these guidelines will provide sufficient protection for the pier structure and no additional precautions from a heritage perspective would be required. However, if the pier is granted Grade 1, Grade 2 or Grade 3 status, the mitigation will be revised if necessary, to adhere to the requirements for protective measures for Graded Historic Buildings.

Air Raid Precaution Tunnels of the K1 Network

A condition survey for the tunnel network should be undertaken by the Project Proponent to determine the present condition of the air raid tunnels and to recommend protective measures to ensure that the tunnels are not damaged by the construction works and as such appropriate vibration monitoring on the tunnel should be complied with as appropriate.

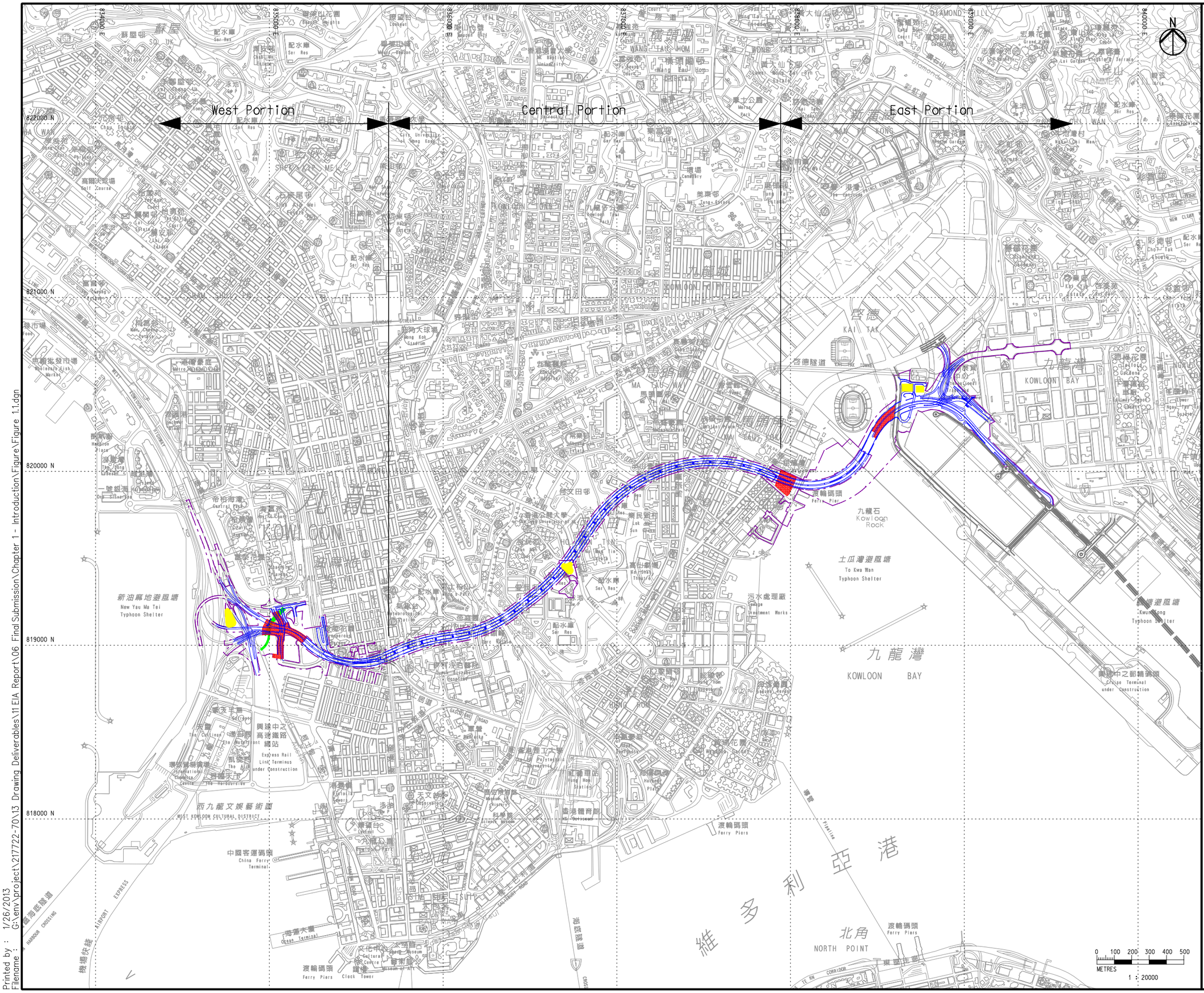
3 OVERALL CONCLUSION

An EIA Report has been prepared to fulfil the requirements as specified in the EIA Study Brief No ESB-156/2006 and the TM-EIAO. All the latest design information has been incorporated into the EIA process. The aspects that have been considered in this EIA Report include:

- Alignment evaluation;
- Description of construction and operational activities;
- Air Quality impact;
- Airborne noise impact;
- Groundborne noise impact;
- Water quality impact;
- Waste management implications;
- Land contamination impact;
- Impact on hazard to life;
- Landscape and visual impact;
- Impact on cultural heritage; and
- EM&A requirements

Overall, the EIA Report has predicted that the Project would be environmentally acceptable and individual impacts are minimized with the implementation of the proposed mitigation measures for construction and operational phases. An environmental monitoring and audit programme has been recommended to check the effectiveness of recommended mitigation measures.

Figure



Rev	Description	By	Date
F	SIXTH ISSUE	GL	01/13
E	FIFTH ISSUE	GL	12/12
D	FOURTH ISSUE	GL	09/12
C	THIRD ISSUE	GL	06/12
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Consultant

ARUP

Mott MacDonald

Project title

Agreement No. CE 43/2010 (HY)

Central Kowloon Route - Design and Construction

Drawing title

General Layout Plan of CKR

Drawing no.			Rev.
Figure 1.1			F
Drawn GL	Date 01/13	Checked FC	Approved ST
Scale 1:20000 ON A3		Status PRELIMINARY	

路政署
HIGHWAYS DEPARTMENT
主要工程管理處
MAJOR WORKS PROJECT MANAGEMENT OFFICE

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