Environmental Impact Assessment of the Central Kowloon Route Project

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ABSTRACT

The Government of the Hong Kong Special Administrative Region of the People's Republic of China (The Government of the Hong Kong SAR) is committed to sustainable development. The Central Kowloon Route (CKR) is a 4.7 km long dual 3-lane trunk road linking the Yau Ma Tei Interchange in West Kowloon with the road network in the Kai Tak Development and Kowloon Bay in East Kowloon. The CKR will relieve traffic congestion on existing major east-west corridors, enhance linkage amongst districts and support various developments in Kowloon. The CKR will reduce the number of vehicles using the existing major east-west corridors and alleviate the noise and air pollution arising from the existing traffic thus bringing significant overall environmental benefits. In this paper, the authors will present the environmental impact assessment (EIA) process of the CKR Project and focus on the approaches to protect the environment through early considerations of environmentally friendly designs, advanced air purification systems, and prevention of adverse environmental consequences in order to achieve key decision makings throughout the entire life cycle of a designated project. This paper also highlights the further sustainable development of the Project after the EIA approval including re-use of land-based marine sediments and green building design.

Keywords: *design process, green rating tool, high-performance building*

1. INTRODUCTION

1.1. The need of the CKR

The traffic on existing major east-west corridors in Kowloon, including Lung Cheung Road, Boundary Street, Prince Edward Road West, Argyle Street, Waterloo Road, Gascoigne Road Flyover and Chatham Road North of central Kowloon is nearing saturation and traffic congestion frequently occurs. The Government of the Hong Kong SAR has implemented local traffic management and improvement measures. However, since the areas on both sides of the existing east-west corridors are highly developed, the options for such measures are limited and therefore can only alleviate localised traffic problems in the short term. A large scale scheme to comprehensively improve the situation and cater for the long term need is thus essential.

CKR is a proposed dual 3-lane trunk road across central Kowloon linking the West Kowloon in the west and the proposed Kai Tak Development (KTD) in the east. Its western end at West Kowloon would connect to the Yau Ma Tei Interchange, via which to connect to strategic road links of the Western Harbour Crossing, West Kowloon Highway, Route 8, and Route 3 and key urban areas of Tsim Sha Tsui and the future West Kowloon Cultural District. Its eastern end at KTD would connect to trunk roads of Kwun Tong Bypass, Tseung Kwan O Tunnel, the future Road T2 and Tseung Kwan O-Lam Tin Tunnel, and urban development areas of Kowloon Bay, Kowloon East and Kai Tak Development. CKR together with Trunk Road T2 and Tseung Kwan O-Lam Tin Tunnel would form the strategic Route 6 highway link connecting West Kowloon and Tseung Kwan O. Figure 1 shows the layout plan and longitudinal section of CKR.

Figure 1: Layout plan and longitudinal section of CKR

CKR will provide an alternative route for the traffic to bypass the congested existing road network thus significantly reducing the journey time. For example, it is estimated that during the peak hours after completion of CKR, the journey time between west and east Kowloon via CKR will take around 5 minutes, compared to 30-35 minutes without CKR. CKR will also substantially reduce the traffic volumes around major east-west corridors in central Kowloon thus relieving their traffic congestion. The improved traffic conditions will also benefit the adjacent areas including Wong Tai Sin, Ho Man Tin and Kowloon City.

1.2. Benefits of the project

- Economic returns

Savings resulted in travel distance and travel time are the primary source of economic benefits from CKR. It is estimated that by 2030, the daily travel time savings will reach 120 thousands passenger hours bringing an economic value of $2.6 billion per annum.

Benefits will also arise from fewer accidents as travellers are diverted to use tunnel from local roads. According to the accident statistics provided by the Transport Department, the accident rate per veh-km for tunnels is 85% lower than local road during 2006 – 2010.

- Environmental benefits

As the traffic on the existing east-west corridors in Kowloon could be diverted by CKR, the traffic volume on these at-grade corridors could be reduced. Pollution resulted from traffic congestion could therefore be reduced to improve the environment in the surrounding areas.

With CKR in place, the traffic conditions (in terms of average travelling speed) along these east-west corridors would be improved and this would lead to a reduction in the substances such as CO2, NOx and Respirable Suspended Particulates (RSP) released from vehicles.

Through the adoption of advanced technology like Air Purification System (APS), vehicle exhaust discharged from the 3 ventilation buildings along CKR are largely decreased by the Electro-Static Precipitator and NO2 removal system.

The following Table 1 summarises the estimated environmental benefits for east-west corridors of Kowloon:

Substances from Vehicular Emission	Reduction by CKR at 2026, Ton / year
CO_2	Approx 20,000
NOx	Approx 18
RSP	Approx 2

Note: Considering key East-West Corridors of Kowloon ONLY

Table 1: Reduction of annual emission for key East-West corridors

- Social benefits

In the future when CKR is completed, there will be a reduction in journey time, which will enhance the connection amongst districts thus supporting social developments.

2. EIA PROCESS OF THE CKR PROJECT

2.1. General approaches

The principle of avoidance and minimization of environmental impacts is the key driving force from the outset of the project planning and development.

Avoidance is the most effective way of preventing environmental impacts and this is primarily achieved through the careful selection of the best options among alternative routes and designs. Environmental considerations are an integral part of the route selection process at the early planning stage of a project, through which adverse impacts on important environmental sensitive receivers could be avoided as far as practicable.

Where adverse impacts on the environment are unavoidable, extensive efforts would be deployed in the planning and design of the project with an aim to achieving minimization of the impacts.

Once the preferred route has been chosen, control of the environmental impacts is mainly achieved by mitigation measures. Mitigation measures involve putting in place measures to reduce the effect of the impacts on the surrounding environment.

2.2. Selection of preferred alignment options

The proposed alignment of CKR evolved through various stages of studies, aimed at minimizing the land resumption/clearance, disruption to the public and impact on the environment. More than 40 alignment options had been considered and screened at each stage of studies, including tunnel and flyover options covering most of the Kowloon Peninsula from the northern Boundary Street to Tsim Sha Tsui. All these studies had concluded that a tunnel (as opposed to flyover) option across central Kowloon would be preferable.

A summary of the configuration of the key road sections of CKR is given in Table 2 below:

Location	Design	Approximate Length (m)
West Portion	Elevated/At-Grade Road	200
	Depress Road	200
	Cut-and-Cover Tunnel	400
Central Portion	Drill-and-Blast Tunnel	2760
East Portion	Cut-and-Cover Tunnel	210
	Underwater Tunnel	370
	Underpass/Depressed Road	320
	Elevated/At-Grade Road	320

Note: Along the mainline of CKR.

Table 2: Overview of key elements of the proposed alignment of CKR

CKR will mainly pass underneath an urban environment. As such, it is important to select an alignment, which can both follow the most favourable geological conditions for adopting mainly the drill-and-blast/break tunnelling method and maximise the rock cover above the tunnel. The selected alignment passes underneath the hills of Kings Park and Ho Man Tin. These areas not only have the advantage of greater rock cover but also have a relatively lower building density than the surrounding low-lying areas. The preferred alignment of the drill-and-

blast/break tunnel section also maximises the actual length of drill-and-blast/break and minimises the length of cut-and-cover tunnel. In that way, the adopted alignment will have the least adverse environmental impacts.

2.3. Approach adopted to minimize environmental impacts

Whilst the alignment selection process had avoided many environmental constraints from the outset, extensive efforts were also made to examine every opportunity to minimize environmental impacts.

Minimizing the Size of Reclamation at Kowloon Bay

In order to preserve the precious Victoria Harbour, the method of constructing the underwater tunnel by temporary reclamation using the cut-and-cover method was adopted. The alignment of the underwater tunnel was chosen for it would not involve resumption and/or demolition of private buildings and the extent of temporary reclamation was the minimum for practical construction. Figure 2 shows the layout plan and longitudinal section of the underwater tunnel.

The width of the temporary reclamation is dictated by the highway alignment design of the dual 3-lane trunk road and the minimum working space of 20 m working platform on both sides of the cut-and-cover tunnel. According to the experience of construction of underwater tunnel by similar method in the Central-Wan Chai Bypass project, this 20 m width is just adequate for construction activities. As such, the width of the proposed temporary reclamation is the minimum which requires less filling materials and hence fewer vehicles/barge trips during construction.

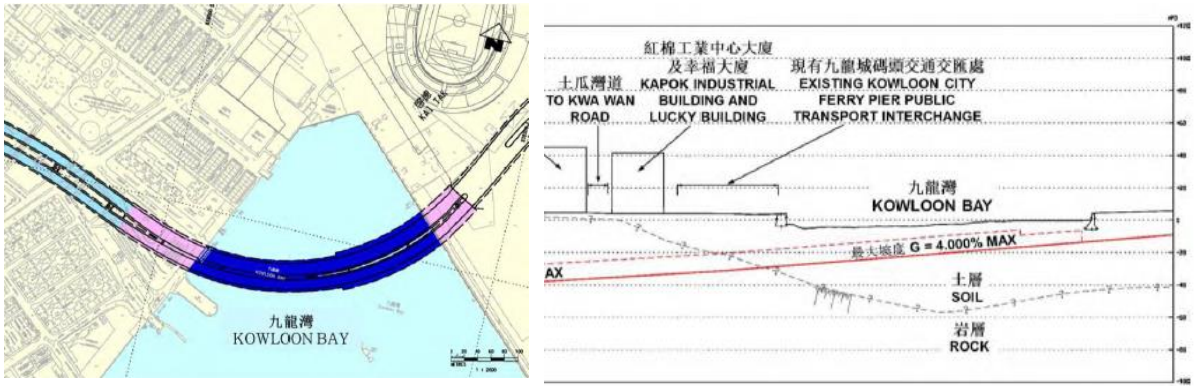

Figure 2: Layout plan and longitudinal section of underwater tunnel minimizing the extent of seawall

Conventionally, seawalls are constructed on firm foundations by replacing the soft marine mud in the seabed by sand fill. This process requires dredging and dumping of a large amount of soft marine mud. In order to minimize the extent of seawall for temporary reclamation, the current design is to use pipepile seawall as shown on Figure 3. The adoption of the pipepile seawall approach would significantly reduce the amount of marine-based dredged / excavated sediment from about 357,500 m^3 to 176,600 m^3.

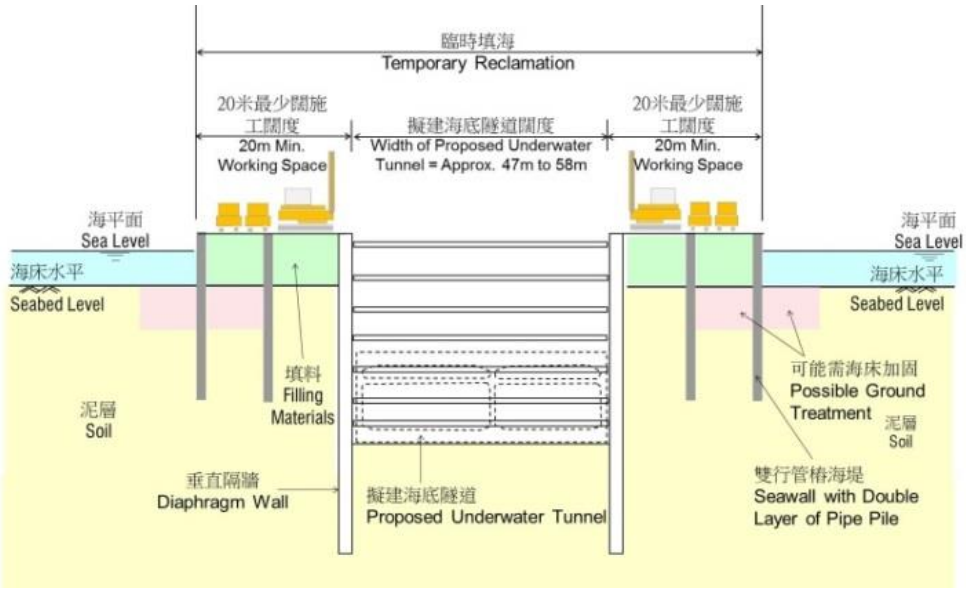

Figure 3: Typical cross section of temporary reclamation

2.4. Approaches adopted to mitigate environmental impacts

- Noise impact mitigation measures

To mitigate operational noise impact, noise mitigation measures including noise barrier / semi-enclosure / full noise enclosure and low noise surfacing are proposed for the project roads. With the provision of the noise enclosures / barriers recommended in the EIA report, there will be significant benefit on reduction in noise level at the noise sensitive receivers at Yau Ma Tei of up to 10dB(A) with an average 3dB(A) reduction. Approximately 1,600 existing dwellings and 85 existing classrooms could be benefited from the Project.

- Air quality impact mitigation measures

Vehicular emission inside the CKR tunnel will be discharged to atmosphere via the three proposed ventilation buildings, i.e. West Ventilation Building located in Yau Ma Tei, Central Ventilation Building in Ho Man Tin and East Ventilation Building in Kai Tak, which are sited away from residential buildings as far as possible. Limited emission from the CKR tunnel portals would be achieved in order to reduce potential air quality impact in these areas. To further reduce the air quality impact, an APS will be adopted to remove the pollutant concentrations before releasing the exhaust to the atmosphere. The APS design aims to achieve a removal efficiency of 80% for both RSP and NO2. Figure 4 shows the schematic layout of the APS.

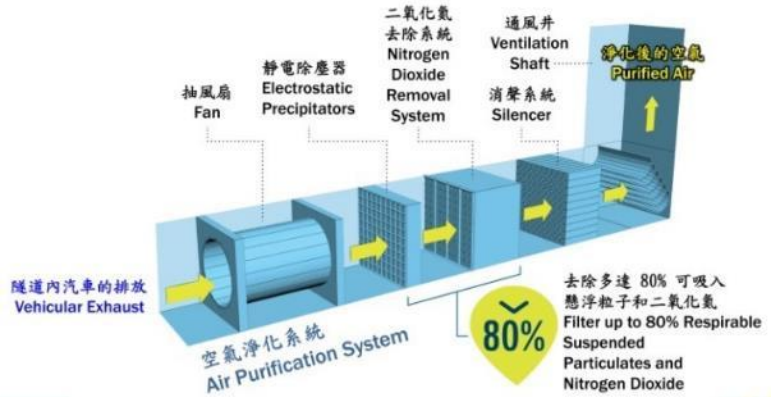

Figure 4: Schematic layout of air purification system enhancement of greening and landscaping

Highways Department (HyD) will make use of the opportunity of constructing CKR to improve the environment through greening and landscaping. A landscape deck with an area of about 20,000 m2 will be constructed at the western tunnel portal of CKR tunnel. A 160 m long and 40m wide waterfront promenade will also be constructed along the waterfront area fronting the Kowloon City Ferry Pier Public Transport Interchange (PTI). The

reprovisioned PTI will be covered by a landscape deck with an area of about 9,000 m2. CKR Project will also include the planting of about 1,800 heavy standard trees and 685,000 shrubs, covering a planting area of about 54,600 m^2. Figures 5.1 to 5.2 show the proposed landscape decks and waterfront promenade, which will be provided with multi-function recreational facilities such as jogging trails and pavilions, to be constructed under CKR Project.

Figure 5.1: Landscape deck above yau ma tei interchange

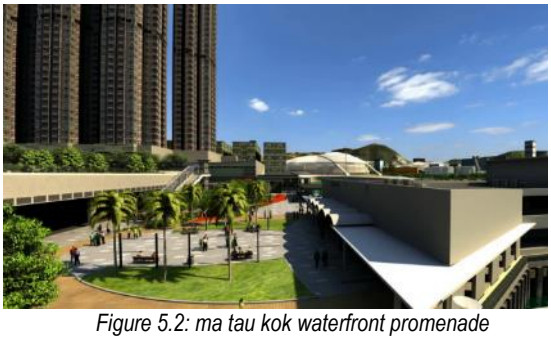

Figure 5.2: ma tau kok waterfront promenade

- Preservation of built heritage

The Yau Ma Tei Police Station at West Portion of CKR is a Grade 2 Historic Building. The proposed side-by-side cut-and-cover tunnel avoids the old wing of the Police Station and the residential buildings at the south side of Kansu Street. For the affected New Wing of the Yau Ma Tei Police Station, we will carry out underpinning to preserve the structure.

- Mitigation measures to be adopted during construction phase

For the construction phase, good site practices would be adopted to reduce various environmental impacts. For example, the implementation of watering in all works areas would substantially suppress the generation of fugitive dust. The use of quiet plant and site hoarding, use of movable noise barriers, etc. will reduce the construction noise. The use of silt curtains and cage curtains will control the release of suspended solids during the reclamation phase.

2.5. Environmental Monitoring and Audit (EM&A) programme

A comprehensive EM&A programme will be implemented to oversee the environmental performance of the Project on various aspects including air quality, noise, water quality, and waste management, etc. on the neighbouring sensitive receivers. It provides a framework to identify and contain potential impacts, and apply appropriate measures to ameliorate them.

In accordance with the requirements of the Environmental Permit (EP) of CKR, an Environmental Team (ET) shall be established and an Independent Environmental Checker (IEC) shall be employed by HyD no later than one month before commencement of construction of the Project. The ET, ET Leader and IEC will ensure full compliance of environmental requirements during construction and operation of the CKR Project according to the EP.

HyD will also set up community liaison groups comprising representatives of affected parties, including local committees, residents and schools in the affected areas along the route alignment, to facilitate communications, enquiries and complaint handlings on environmental issues related to the Project. Respective community liaison teams and designated complaint hotlines shall be set up for the Project to address related concerns and enquiries in an efficient manner. HyD shall also follow up with the respective community liaison groups on the implementation of mitigation measures as necessary.

3. CONTINUING DEVELOPMENT IN SUSTAINABLITY

The Government of the Hong Kong SAR has always been an advocate of sustainable development and has capitalised on the opportunity to steer forward with various green approaches on public works projects. After the approval of the EIA of the CKR Project, HyD continue to incorporate environmental protection and sustainable elements into the Project.

A tree compensation proposal was developed to justify the need for any tree felling required to facilitate the CKR construction works.

To reduce the volume of disposal of marine sediment generated from the construction of cut-and-cover tunnels, it is proposed to reuse about 30,000 m3 land-based uncontaminated marine sediment with treatment by cement solidification such that the treated sediment is suitable for backfilling of excavated trenches.

The administration building of CKR will be designed as a sustainable building capable of meeting the relevant requirements under the latest "Building Environmental Assessment Method for New Building" (BEAM Plus) of the Hong Kong Green Building Council.

It is confident that through continuing efforts, the CKR Project could be further enhanced in a sustainable way.

4. CONCLUSION

The EIA process is a proactive planning tool to avoid and mitigate adverse environmental impacts that might be caused or experienced by the proposed development. This article highlights the importance of alignment selection of the CKR Project at the beginning of the project planning stage with an aim to avoiding adverse environmental consequences of the proposed Project. Approaches to minimize environmental impacts have also been integrated into the design as much as practicable. For those adverse environmental impacts that could not be fully avoided, measures have been proposed to reduce and control the possible adverse environmental impacts to within established limits or criteria. The environmental performance of the Project during its implementation will then be overseen in accordance with the EM&A programme. Through the EIA process, the Project was planned and designed by striking a balance between development and environmental conservation.

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