Consultancy Agreement No. NEX/2301  
South Island Line (East)  
Environmental Impact Assessment

2. Project Description

2.1 Project Background

The South Island Line (SIL) was originally proposed as part of the Second Railway Development Study (RDS-2) completed in May 2000 as an extension to the existing railway network to serve the Southern District of Hong Kong. In June 2002, MTRCL submitted a preliminary proposal for a medium-capacity SIL, which involved a monorail system looping from University Station of the planned West Island Line (WIL) to the southern part of Hong Kong Island and back to Wanchai Station of the existing Island Line (ISL). The study identified that SIL would not be commercially viable without Government's funding support.

Subsequently, MTRCL further developed the proposed SIL as part of a Feasibility Study (FS) entitled “West Island Line and South Island Line Feasibility Study” which was completed in March 2004. After an evaluation of various alternative options, the FS recommended the implementation of the proposed SIL(E) from South Horizons to Admiralty, via intermediate stations at Lei Tung, Wong Chuk Hang and Ocean Park, for serving the Southern District and provision of a necessary depot at Wong Chuk Hang to support the operation of SIL, amongst other recommendations related to WIL. The FS also evaluated the feasibility of providing additional intermediate stations at Happy Valley and Wanchai. In February 2005, MTRCL submitted a project proposal to the Government for phased implementation of the SIL and WIL.

In December 2007, the Executive Council gave the green light for MTRCL to proceed with preliminary planning and design of the SIL(E), which will be a medium capacity railway line running from Admiralty to South Horizons, with three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung. In response to the Government's decision, MTRCL recruited an Engineering Design Consultant to undertake preliminary design for the SIL(E) in February 2008 and appointed separate Engineering Design Consultants to undertake scheme and detailed design in mid 2009. The SIL(E) scheme was gazetted under the Railways Ordinance in July 2009.

2.2 Project Alignment

The proposed SIL(E) comprises a new medium-capacity railway system with an approximate total route length of 7km from Admiralty to South Horizons, via three intermediate stations at Ocean Park, Wong Chuk Hang and Lei Tung. Figures 2.1.1 to 2.1.5 shows the proposed alignment of the Project.

The new railway line will run in tunnel for a route length of about 3.5km from Admiralty to Nam Fung Road, then on viaduct (for about 2km) past Ocean Park and through Wong Chuk Hang and over the Aberdeen Channel. On Ap Lei Chau, the route is also in tunnel for a route length of about 1.6km from the southern side of the bridge crossing Aberdeen Channel to South Horizons according to the local topography.

The proposed Admiralty station, which is situated to the east of the existing Admiralty station as illustrated in Figure 2.1.5, will be underground. The two new stations at Lei Tung and South Horizons on Ap Lei Chau (as illustrated in Figures 2.1.2) will also be located underground, while the two stations at Ocean Park and Wong Chuk Hang will be above-ground (Figures 2.1.3 refer).

2.3 Project Benefits

Southern District has a long desire to have a railway connected, in particular for the population in Ap Lei Chau. The proposed SIL(E) will provide a fast, convenient, environmentally friendly and reliable mode of public transport between South Horizons and the central business district of Hong Kong, as well as for...
cross harbour trips via the interchange with the existing railway network at Admiralty Station. The new railway line serves not only the resident population in the Southern District but also tourists heading to or returning from the major existing and future tourist attractions located in the District. Upon completion of SIL as well as the Shatin to Central Link, the railway network on Hong Kong Island will be enhanced.

Operation of the new railway line will help relieve existing traffic congestion experienced at critical bottlenecks, including the Aberdeen Tunnel and as a result journey times on the Hong Kong Island will be significantly reduced. All the travelling public, whether using the railway or other mode of transportation, will benefit either from the speedy service provided by the railway, or from the less congested road network and living quality at large.

There will be no direct emission of air pollutants from operation of the trains as they are electric powered. Reduced road traffic and congestion will also lead to improvements in local air quality.

Development of the Southern District has long been constrained by the lack of a reliable mass transportation system. Operation of the SIL(E) will remove this constraint and serve as a catalyst to trigger renewal of older districts in the Southern District in the long term. The Wong Chuk Hang area in particular would be rejuvenated. Significant new employment opportunities will also be created as new businesses will be benefited from the improved transport.

2.4 Scope of the Project

The Project comprises:

a. approximately 7km of partly underground and partly viaduct railway alignment from South Horizons via Lei Tung, Wong Chuk Hang and Ocean Park to Admiralty. This alignment will connect the exiting Island Line (ISL) and future Shatin Central Link (SCL) alignments;

b. construction of South Horizons (SOH), Lei Tung (LET), Wong Chuk Hang (WCH) and Ocean Park (OCP) stations as well as Admiralty (ADM) interchange station for SIL(E) and SCL which includes station structures and protection works for interchange with SCL. WCH and OCP Stations are designed to be elevated along the viaduct alignment, while SOH, LET and ADM Stations are designed to be underground associated with above-ground entrances and exits, ventilation shafts and plant buildings, and will be constructed by either drill-and-blast or cut-and-cover tunnelling method;

c. construction of tunnels by drill-and-blast, mining and cut-and-cover method. Based on the current design, tunnel sections from Admiralty to Nam Fung Portal and from Lee Nam Road to Ap Lei Chau Drive will be constructed by drill-and-blast tunnelling method, whilst tunnel sections from Ap Lei Chau Drive to the portal at the southern side of Aberdeen Channel Bridge will be constructed by mining and cut and cover tunnelling method;

d. construction of tunnel portals at southern side of Aberdeen Channel Bridge and Nam Fung Road at the ex-Canadian Hospital site;

e. construction of ventilation shafts along the alignment associated with the proposed stations, at Hong Kong Park, Lee Wing Street and Nam Fung Road;

f. construction of a railway depot at the ex-Wong Chuk Hang Estate site;
g. construction of a viaduct section from Aberdeen Channel Bridge via Wong Chuk Hang and Ocean Park to the tunnel entrance adjacent to Nam Fung Portal including a proposed emergency access next to Ap Lei Chau Bridge Road;

h. construction of a railway bridge alongside the existing Ap Lei Chau Bridge across the Aberdeen Channel;

i. provision of site offices, areas for construction material storage, construction shafts, temporary barging points and temporary magazine site during construction; and

j. operation of the railway system and the depot.

2.5 Do-nothing Scenario

At present, traffic pile-up at the Cross Harbour Tunnel and Causeway Bay in Hong Kong Island North in the peak hours has contributed to the congestion problem experienced at the Aberdeen Tunnel during the rush hours. As a result, intermittent closures of the northbound traffic towards the tunnel have been found necessary during the peak hours. Although the existing traffic congestion problem could be solved by construction of new roads and implementation of additional traffic management measures, these may not give the optimal solution to the problem and indeed contribute to additional air quality and traffic congestion issues.

The proposed SIL(E) will help reduce traffic on the road and help relieve the existing traffic congestion problem. Without the project, people travelling to or from the Southern District will have to continue relying on the existing congested road system in travelling between the region and the central business district. Planned new developments such as new residential developments, offices and schools in the Southern District may aggravate the traffic congestion problem.

2.6 Public Consultation

2.6.1 Introduction

MTRCL values the views of stakeholders and considers that the support of the community is important in the development of railway extensions. The Corporation together with the Southern District Council launched a public consultation programme in conjunction with the preliminary design for the SIL(E). The public consultation programme consists of 2 rounds of activities which commenced in March 2008 and September 2008, respectively. Public forums, meetings with residents and a series of roving exhibitions were organised as part of the public consultation programme. The Central & Western District Council and the Wanchai Council were also consulted about the proposed arrangement of Admiralty Station and the feasibility of the provision of the Happy Valley Station. A list of these activities is given in Appendix 2.1.

Most of the feedback received during the public consultation were requested for early completion of SIL(E) to solve the traffic problems. Suggestions received during the public consultation process in relation to the further planning of the SIL(E) project, ranging from issues on station locations and design, through locations of station entrances, to alignment of the railway line have been taken into account as far as practicable in the design of the Project. The 2-round of public consultation has also allowed the Corporation to give the community a better understanding of the planning of the Project and site-specific factors and constraints that have to be taken account of in selecting the preferred alignment and design of the Project.
2.6.2 Key Comments Received

Key comments received from the various rounds of public consultations were described below.

During the first round of public consultation, some residents suggested a conceptual plan that involved lowering gradually the level of the proposed viaduct from Ocean Park, to at grade level in Wong Chuk Hang, then went underground to deeper level until reaching Ap Lei Chau when the railway would be in deep rock tunnel, and climbed up again to the proposed underground station at LET. Further evaluation of this proposal revealed that given the gradient requirements, the section changing from viaduct to tunnel would cut across Police School Road and Nam Long Shan Road. Besides, the alignment could not cross the Aberdeen Channel. Therefore, this option was discarded from further consideration. The full tunnel option had also been reviewed but was not pursued due to operational concern, programme implication and impact to the community and the environment.

For the location of SOH Station, apart from two possible locations including (i) to the immediate north of Ap Lei Chau Bridge Road near Lei Yee House of Ap Lei Chau Estate and (ii) under Yi Nam Road, the following suggestions were received during the public consultation programme on the location of SOH station:

- Lower SOH Station at Ap Lei Chau Bridge Road to avoid the need for diversion of the 275kV cables;
- Move the station back under Yuk Kwai Shan to avoid the utilities problem and avoid disruption of the South Horizons area;
- Locate the station in the area of the playground on Lee Nam Road, close to its junction with Ap Lei Chau Bridge Road.

However, these schemes were not considered further in view of problems associated with constructability and passenger convenience:

- Lowering of the SOH Station at Ap Lei Chau Bridge Road is not feasible from the engineering perspective;
- Moving the station back under Yuk Kwai Shan and locating the station in the playground on Lee Nam Road is also not feasible from the engineering perspective and would result in passenger inconvenience as the station would be outside of the associated walk-in catchment covering the residential blocks of Ap Lei Chau Estate and South Horizons.

Considerations given to address comments from the public consultation on railway design alternatives and other public comments were detailed in Sections 2.7 and 2.8 below.

2.7 Consideration of Railway Design Alternatives

2.7.1 Design Process

The SIL(E) is planned for serving the Southern District of Hong Kong. The purpose of the project dictates to a certain extent the appropriate location of the stations and hence the alignment of the new railway line. The congested urban areas presented many site constraints on the location of the stations and alignment.

2.7.1.1 Consideration of Design Alternatives at FS Stage

The planning of the new railway line for serving the community began with the identification of those areas in the Southern part of Hong Kong Island that might benefit from the provision of a railway station. At the
FS stage of the project, a large number of alternative options and sub-options of network options were considered in a holistic manner for the SIL taking into account the planned WIL project before the preferred network option was recommended. Environmental factors were given due consideration in the evaluation process, with the undertaking of a preliminary environmental assessment as part of the FS. For instance, it was identified that various options required the construction of an additional and longer bridge (referred to as the West Bridge) between Hong Kong Island and Ap Lei Chau on the western side of the islands in addition to the proposed bridge across Aberdeen Channel. In order to minimise the environmental impact from the Project, including visual impact on nearby sensitive receivers (e.g. South Horizons), these options that required the construction of the West Bridge were discarded in the evaluation process.

The maximum flow capacity required to serve the Southern District suggested that a medium capacity system would be appropriate for SIL(E). After a detailed evaluation of various alternative options, the preferred network option recommended in the FS involves a medium capacity system for SIL(E) that will run from Admiralty to South Horizons, with three intermediate stations at OCP, WCH and LET. The station locations were chosen to optimise the station catchments, while taking into account relevant site factors including environmental considerations before selecting the preferred network option and railway alignment. The station locations and associated alignment were identified taking into account the existing land uses such that any encroachment into private land and hence necessary land resumption for the construction of the project can be avoided as far as practicable.

2.7.1.2 Further Consideration of Design Alternatives at Preliminary Design Stage

The Preliminary Design exercise has allowed the further planning and design of the proposed SIL(E) and where possible the evaluation of design alternatives. The alignment design, including key horizontal and vertical alignment criteria, have largely followed the railway engineering design requirements while taking into account the shorter train length of the proposed medium capacity system as compared with the traditional urban line stock of MTRCL. The Preliminary Design exercise commenced with a review of the recommendations of the FS as the base scheme. Design alternatives, where available, were identified and analyzed before determining the preferred or refined design. Amongst other site-specific factors and engineering constraints, environmental benefits and dis-benefits during both the operational and construction phases have been given due consideration in the evaluation of alternatives.

2.7.1.3 Key Considerations and Findings

The key considerations and findings in relation to consideration of alternative options in terms of alignment, station locations, location of the depot, as well as train system design are summarised in the sub-sections below. Taking into account the prevailing site conditions and constraints, an alignment option review undertaken as part of the Preliminary Design has confirmed that a viaduct section will be required in the Wong Chuk Hang and Ocean Park area.

Discussions focusing the different sections of the project are presented below under the following headings:

- Section between South Horizons and Lei Tung;
- Section between Lei Tung and Aberdeen Channel Crossing;
- Section between Aberdeen Channel Crossing and Nam Fung Portal;
- Section between Nam Fung Portal and Admiralty;
- Station Entrances;
2.7.2 Section between South Horizons and Lei Tung

2.7.2.1 Location of SOH Station

As shown in Figure 2.2, two possible locations were evaluated for the SOH Station, including:

- SOH Station Option 1 (base scheme) – to the immediate north of Ap Lei Chau Bridge Road near Lei Yee House of Ap Lei Chau Estate;
- SOH Station Option 2 (alternative scheme) – under Yi Nam Road.

SOH Station Option 1

At the FS stage, the SOH Station was recommended to be located to the immediate north of Ap Lei Chau Bridge Road near Lei Yee House of Ap Lei Chau Estate. Under this base scheme, the proposed SOH Station would be constructed as a semi-underground station within a long rectangular shaped box on a narrow strip of land. The station would be bounded by residential block of Lei Yee House to the north and Ap Lei Chau Bridge Road to the south. Noise and visual mitigation measures will have to be provided in the design of ventilation shafts and other fixed plant placed on the landscaped deck to minimise any potential noise impact on the nearby residents during the operational phase.

During the construction phase, a major disadvantage of this station option is the direct conflict with the existing major 275kV electricity transmission cables. These cables originate from the existing buildings of Hong Kong Electric Company Limited (HEC) opposite the proposed station location. As a result, the cables will have to be diverted for construction of the proposed station and it is envisaged that the diversion work will delay the completion of SOH by about 3 years to 2018.

Besides, to arrive at this proposed station location, the approach tunnel will have to run along the section of Ap Lei Chau Bridge Road between the ingress of the public transport interchange (PTI) at Ap Lei Chau Estate and the junction of Ap Lei Chau Bridge Road and Lee Nam Road. The proposed level of this semi-underground station suggests that a significant length (approximately 300m) of the approach tunnel will have to be constructed by cut-and-cover method. Excavation works required for construction of the station box, approach tunnel and for cable diversion would inevitably lead to noise, dust and visual impacts on the nearby residents, given their proximity to the work site. The construction works would also require temporary closure of a section of eastbound Ap Lei Chau Bridge Road, requiring traffic diversion and this would affect the operation of the existing public transport interchange.

SOH Station Option 2

Further evaluation as part of the preliminary design has identified a practicable alternative location for construction of the SOH Station. The alternative station location is under Yi Nam Road. The overall length of the station, including a proposed station plant building alongside Yi Nam Road, is approximately 165m.
The north-west part of the station is bounded by the basements of the adjacent South Horizons Phases 3 and 4 Development, while Marina East Shopping Centre is located to the further north-west of the proposed station. The south-east end of the station will be under a slope to the south of Lee Nam Road. On top of which will be the proposed station plant building.

Compared with Option 1, Option 2 is considered better from the perspective of avoiding potential noise and visual impact from ventilation shafts and other fixed plants, which can be integrated into the design of the plant building alongside Lee Nam Road away from sensitive receivers. It is also envisaged that some of the station and tunnel plant can be accommodated at a separate plant building proposed at Lee Wing Street. In addition to addressing the potential noise problem, this arrangement will also keep the top of the station building alongside Lee Nam Road at about the level of the lowest storey of the residential towers on the opposite side of Lee Nam Road, thereby alleviating any potential visual impact to the nearby residents. Option 2 is also supported by the residents of South Horizons and Ap Lei Chau Estate as revealed from the survey conducted by the Southern District Council together with local District Councillors in April 2009.

During the construction phase, although required excavation for the cut-and-cover box at Yi Nam Road and Lee Nam Road will also lead to environmental impact in terms of noise, dust and visual impacts on the residents in the proximity, the length of the cut-and-cover section is significantly reduced for Option 2 compared with Option 1, as the south-east end of the station and the associated approach tunnel will be construction inside the hill away from the sensitive receivers. Compared with Option 1, the number of sensitive receivers situated in the vicinity of the work site is also lower for Option 2. Deep station arrangement for Option 2 is technically infeasible due to unacceptable gradient between LET and SOH stations. Station at shallower depth will be in soft ground and thus cut-and-cover method cannot be avoided.

**Selection of Preferred SOH Station Location**

Taking into account the factors described above, the SOH Station Option 2 – under Yi Nam Road was identified to be the preferred option. The key engineering factors, as well as environmental benefits and dis-benefits considered in the evaluation of SOH Station Options 1 and 2 are summarised in Table 2.1.

<table>
<thead>
<tr>
<th>Option</th>
<th>Engineering Factors, including constraints</th>
<th>Environmental Benefits and/or Dis-benefits (on relative terms)</th>
</tr>
</thead>
</table>
| SOH Station Option 1 – to the immediate north of Ap Lei Chau Bridge Road near Lei Yee House of Ap Lei Chau Estate | - Direct conflict with existing major 275kV electricity transmission cables; required diversion will have significant impact on the completion date of the SOH Station;  
- Require closure of a section of eastbound Ap Lei Chau Bridge Road and traffic diversion; operation of existing PTI would be affected | Dis-benefits:  
- Noise and visual impacts from ventilation shaft and fixed plant on residential block of Lei Yee House and other nearby sensitive receivers (given their close proximity to the station box), requiring mitigation;  
- Cut-and-cover construction of station box and approach tunnel and additional excavation required for cable diversion will lead to noise, dust and visual impacts on the sensitive receivers situated in close proximity;  
- Number of sensitive receivers in the proximity is relatively high |
| SOH Station Option 2 – South-east end of station will | Benefits: |
2.7.2.2 Alignment Options

Two alternative tunnel alignments (see Figure 2.2) that cater for the two different location options for SOH Station were evaluated accordingly. Taking into account the location of SOH Station selected (i.e., SOH Station Option 2 described above), the preferred alignment of the tunnel between SOH Station and LET Station in which beyond SOH the alignment turns through about 90 degrees and runs under Yuk Kwai Shan to approach LET was selected accordingly. From an environmental perspective, the tunnel alignment associated with SOH Station Option 2 is preferred in terms of minimising potential environmental impact from cut-and-cover construction during the construction phase as described above.

2.7.3 Section between Lei Tung and Aberdeen Channel Crossing

2.7.3.1 Alternative Alignments and Station Locations evaluated at the FS Stage

At the early stage of the FS, alternative locations and configuration of LET Station and the associated approach tunnel were considered.

It was identified that the alignment to the south would require a high viaduct across Aberdeen Channel, running south along the line of Ap Lei Chau Praya Road before turning to the west. Taking into account the site constraints, the alignment would need to go into tunnel within the grounds of Hong Kong True Light College and then along the narrow gap between Hor On House of Yue On Court and Lei Tung Estate of Tung Ping House. The tunnels would pass under the perimeter of both buildings. In view of the significant impact on the existing school, this option was not considered technically viable. Besides, under this option, a longer span bridge would be required to cross the Aberdeen Channel and the non-parallel alignment to the existing Ap Lei Chau Bridge would create adverse visual impact. The bridge would also need a central pier away from the location of the existing pier, which would adversely affect marine traffic through the channel and is not preferable in terms of potential adverse effect on flushing capacity and water quality within the Aberdeen Channel (Typhoon Shelter). Two alternative alignments to the north were also considered, both running parallel to the Ap Lei Chau Bridge, with one elevated to the immediate north of Ap Lei Chau Bridge Road and the other underneath Ap Lei Chau Bridge Road. However, both alignment alternatives were identified to be too far north to be able to continue to SOH Station without adopting...
unacceptably low radius curves. In terms of optimising the catchment area, the station location was neither considered to be the most preferred option.

The FS therefore concluded that the alignment which passes under Yue On Court and Lei Tung Estate were adopted as the base scheme for further consideration.

2.7.3.2 Further evaluation as part of the Preliminary Design

LET Station Options 1 and 2

The main considerations given to positioning the LET station include issues with topography, the variation in levels and connectivity between exits. Other design constraint is the potential impact on foundations of existing buildings. This severity limited the available options for siting LET station.

Based on locating the LET Station under Lei Tung Estate as the base scheme, two alternative options for the stations were further evaluated as part of the preliminary design:

- LET Station Option 1 (base scheme) – shallow alignment option;
- LET Station Option 2 (alternative scheme) – deeper alignment option.

Alignment Options

It was identified that the open cut section of the approach tunnel at Yue On Court as proposed in both Options 1 and 2 would impose impacts on the residents, including potential groundborne noise impact during the operation phase and environmental impact from the excavation works on residential buildings in the proximity during the construction phase.

Further evaluation of alternatives as part of the Preliminary Design process revealed that these impacts can be minimised by adopting a deeper alignment (i.e., Option 2). Option 2 will not require the cut-and-cover section within Yue On Court lot. This will minimise the overall environmental impact on the sensitive receivers in the proximity.

Besides, as shown in Figure 2.3, a shallow alignment scheme for LET Station would require a section over Ap Lei Chau Drive to be placed on viaduct and given the proximity of sensitive receivers, noise and visual impact mitigation measures will have to be incorporated into the design of the viaduct. For the deeper alignment scheme, the corresponding section will be in cut-and-cover tunnel.

Aberdeen Channel Bridge

As identified through the FS and established in the Preliminary Design exercise, the alignment of the railway bridge across Aberdeen Channel adopted is as such that it will be lying parallel to the two existing highway bridges to minimise any potential visual impact. A similar alignment will also permit similar location of the north pier within the Aberdeen Channel such that any potential adverse effects on flushing capacity and water quality within the Aberdeen Channel (Typhoon Shelter) can be avoided.

Selection of Preferred Station Location and Alignment

Table 2.2 summarises the environmental benefits and dis-benefits considered in the evaluation of the two options of LET Station and associated alignment. The deeper alignment option (i.e., Option 2) was
identified to be the preferred option. The tunnel would pass deep underneath the open space of the blocks of Yue On Court. The foundations of existing buildings would not be impacted.

Table 2.2: Selection of Preferred LET Station Location and Associated Alignment

<table>
<thead>
<tr>
<th>Option</th>
<th>Environmental Benefits and/or Dis-benefits (on relative terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LET Station Option 1 – shallow alignment option</td>
<td>Dis-benefits:</td>
</tr>
<tr>
<td></td>
<td>• Potential ground-borne noise impact during the operation phase</td>
</tr>
<tr>
<td></td>
<td>• Potential environmental impact from the excavation works on residential buildings in the proximity during the construction phase</td>
</tr>
<tr>
<td></td>
<td>• Noise and visual impacts mitigation measures have to be incorporated into the design of a viaduct section over Ap Lei Chau Drive given the proximity of sensitive receivers</td>
</tr>
<tr>
<td>LET Station Option 2 – deeper alignment option</td>
<td>Benefits:</td>
</tr>
<tr>
<td></td>
<td>• Ground-borne noise impact minimised with deeper tunnel alignment;</td>
</tr>
<tr>
<td></td>
<td>• Section crossing Ap Lei Chau Drive will be in cut-and-cover tunnel, hence additional noise and visual impact mitigation measures are not required</td>
</tr>
</tbody>
</table>

2.7.4 Section between Aberdeen Channel Crossing and Nam Fung Portal

2.7.4.1 Locations of WCH and OCP Stations

As detailed below, a number of vertical alignment options were considered as part of the Preliminary Design exercise. After a detailed evaluation of the technical difficulties, construction risk, impact on existing land uses and existing extra high voltage cables behind wall of Staunton Creek Nullah, operation of Aberdeen Channel, impact on the construction programme as well as design, operational requirements, the underground alignment options were not identified to be practicable. Accordingly, the WCH and OCP Stations have to be designed at elevated level along the proposed viaduct. Considerations had been given to locate the WCH Station to the south of the Staunton Creek Nullah or as far north as possible of the proposed road layout for Heung Yip Road would permit to reduce the impact to Police Training School and Tai Wong Ye Temple. The horizontal alignment constraints posed by existing land uses and the need to avoid impact on private land are as such that there are limited feasible alternative options for locations of WCH and OCP Stations.

Compared with an underground station, it is envisaged that urban regeneration of Wong Chuk Hang would be better served by an above-ground WCH station. Specifically, it is noted that at Wong Chuk Hang, the presence of the Staunton Creek Nullah dictates that any grade-separated passage across the various roads in the area must be by footbridges rather than by subways. With an above-ground WCH Station, opportunity exists for pedestrian walkways of future developments to link straight into the station concourse, thus enhancing passenger accessibility to the station.

Similarly, an above-ground station at Ocean Park designed with convenient pedestrian links and a proposed footbridge will facilitate access to the station from nearby areas, including the planned Ocean Park entry plaza after its expansion.

An above-ground location of the stations will also permit the incorporation of more sustainable and environmentally friendly features into the design, including reduced use of electricity in lighting and air-conditioning systems through permitting natural light and/or wind to enter the stations.
2.7.4.2 Alignment Options

A number of alignment options were considered for the railway section between Aberdeen Channel Crossing and Nam Fung Portal, including:

- Option 1 – in deep rock tunnel;
- Option 2 – in shallow tunnel; and
- Option 3 – on viaduct

**Option 1 – in deep rock tunnel**

Under this option, the railway would be running in deep rock tunnels below ground (at some 40m below ground at Ocean Park area) as shown in Figure 2.4. An advantage of this option is that during the operational phase, noise and visual impacts would be restricted to those associated with operation of above-ground facilities such as ventilation shafts. During the construction phase, potential environmental impact will also be confined to those sensitive receivers situated near the mucking out points. Handling of excavated materials (e.g. by dump trucks) will also generate secondary environmental impacts in terms of dust from loading and unloading activities as well as noise and gaseous emissions from trucks. However, taking into account requirements on track gradients, adopting this option would mean that the WCH and OCP Stations as well as WCH depot would also need to be placed deep underground. These would not fulfil the operational requirements such as means of escape in the event of a major incident, which are fundamental in the design of a new railway alignment. Moreover, the construction of a deep alignment under the Aberdeen Channel is not practicable.

In addition to the operational dis-benefit is the environmental dis-benefit resulting from significant amounts of excavated materials produced and the longer construction period due to the extra excavation requirement. Other considerations include issues relating to connectivity and accessibility from a passenger’s point of view, whereby a deep subway would take up more of the passenger’s time to get from A to B, and would be less convenient for the passenger. Therefore, this option was not considered practicable.

**Option 2 – in shallow tunnel**

Under this option, the tunnels will be excavated through the mixed ground above the rock layer. Compared with the deep rock tunnel Option 1 described above, both the depth of tunnels and stations are reduced. The depot will also be underground. The crossing at Aberdeen Channel will have to be constructed by cofferdam and/or immersed tunnel method.

During the construction phase, those sections that are required to be constructed by cut-and-cover method would result in environmental impacts on the nearby sensitive receivers. These include noise, dust and visual impact associated with construction activities including site clearance, pipe pile wall or diaphragm wall installation, excavation and spoil removal and tunnel and station construction. Cut-and-cover construction at major road carriageways would also result in traffic disruption, increased traffic congestion and associated noise and gaseous emissions.

During the operational phase, potential environmental concerns including airborne noise and visual impact can be minimised, and similar to the deep rock tunnel option will be confined to areas in the vicinity of above-ground facilities such as ventilation shafts. Ground-borne noise could be an issue but can be mitigated by adopting appropriate trackform design.
However, further consideration of the in-shallow tunnel option revealed its construction are subjected to a number of technical difficulties and construction risk and will have direct impact on existing land uses, operation of Aberdeen Channel and will delay the completion date of SIL(E). These constraints are summarised below:

(i) **Impact on existing land uses**

Construction of a floodgate and a ventilation building is required for operation of the tunnel section crossing Aberdeen Channel. The provision of these facilities will require the clearance of a significant portion of existing shipyard area on the north shore of the Channel. Land will also be required for a permanent road for access to the facilities. The land requirement will affect the existing shipyards which have been operating at the location since 1985.

In Wong Chuk Hang, for construction of a cut-and-cover tunnel section required to accommodate complex track geometry for entry to the Wong Chuk Hang Depot, a major part of the existing Hong Kong Police College Tactical Training Complex along Heung Yip Road will have to be demolished, affecting the operation of the Police College.

(ii) **Impact on operation of Aberdeen Channel**

In order to construct the tunnel section across the Aberdeen Channel, part of the Channel will need to be closed to facilitate the construction of cofferdams, followed by dewatering of the works site, and subsequent construction of the tunnel units. It was estimated that a significant portion (about two-thirds) of the Aberdeen Channel along the tunnel alignment will have to be closed during the construction of the alignment section. The narrowed fairway will affect the operation of the nearby Aberdeen Typhoon Shelter.

(iii) **Impact on the Construction Programme of the Project**

The new depot planned in Wong Chuk Hang will need to be put in service on day one of the commissioning of the SIL(E). The completion date of the depot will therefore affect the commissioning programme of the new railway line.

The level of the depot tracks is constrained by the level of the WCH Station tracks in the proximity, as they are linked by connecting tracks. For the tunnel alignment option, the level of the proposed WCH depot will have to be lowered by about 14 m accordingly to achieve an acceptable gradient for the connecting tracks. Construction of the underground depot will require erection of substantial retaining structures along the boundaries of the depot site at Police School Road and Nam Long Shan Road, and the excavation of 1 million m$^3$ of hard rock inside the whole of the depot site. These works are time consuming and will delay the completion of the depot and commissioning of the SIL(E) by three to four years.

**Option 3 – on viaduct**

During the construction phase, adopting a viaduct option would allow the possible use of precast elements such that the railway alignment can be completed within a relatively short period, and without major excavation activities that would be required for construction of a corresponding tunnel section. The viaduct option will also effectively reduce the quantity of excavated materials generated from the Project. The direct waste management implications and secondary environmental impacts from handling and disposal of the excavated materials are thus effectively minimised.
During the operational phase, with incorporation of sufficient mitigation measures into the design to address potential noise and visual impacts, the viaduct can be designed and operated to meet established environmental criteria. Measures have been demonstrated to be practicable through similar projects completed locally and overseas.

From the passengers perspective, an elevated section for the SIL(E) in Wong Chuk Hang and Ocean Park area and over the Aberdeen Channel will significantly enhance the riding experience, which could be found particularly enjoyable for tourists and children.

The possible horizontal alignment of the aboveground viaduct is very constrained by the existing land uses in Wong Chuk Hang and Ocean Park which is a relatively built-up area. In addition to existing buildings such as Tai Wong Ye Temple and the Nam Long Shan Road Cooked Food Market, the piers of the viaducts have to avoid existing road carriageways and foundations. Taking into account the prevailing site conditions and constraints with the aim to minimise the construction stage and long term impacts, it was identified that the only possible alignment for the viaduct in Wong Chuk Hang is along the existing Staunton Creek Nullah (SCN). Concerns from Tung Wah Group of Hospitals Jockey Club Rehabilitation Complex in Wong Chuk Hang have also been addressed. To locate the viaduct structure further away from the centre, it is now proposed to combine the two single track viaducts into a twin track viaduct. Furthermore, a section of full noise enclosure for the viaduct section adjacent to Block A of the Rehabilitation Complex has been proposed in view of the special circumstances. The design of the full noise enclosure is subject to wind loading, structural form and safety concern to be addressed in the detailed design stage. Communication between the Corporation and the Rehabilitation Complex will be continued.

Environmental factors have been taken into account in selecting the horizontal alignment of the viaduct section. Thus, to the west of WCH Station the viaducts will be lying to the south of the Staunton Creek nullah while to the east of WCH Station the viaducts will be lying alongside and across Ocean Park Road. The downstream section of the nullah is under tidal influence and has been serving as a feeding ground for waterbirds such as egrets. This arrangement would require re-construction of about 600m of the existing SCN from the roundabout at Ocean Park Road to near the junction of Nam Long Shan Road and Heung Yip Road only, thus could minimise the encroachment to the foraging opportunities for the wetland birds. However, an area of degraded woodland that is being used by little egrets as a night roost mainly during winter would inevitably be affected, requiring mitigation. To the north of the OCP Station, a registered Old and Valuable Tree (OVT) *Ficus elastica* (LCSD S/8) was identified within the proposed works site along Nam Fung Portal to Ocean Park. The alignment has also been refined to provide sufficient clearance for protecting the tree.

**Selection of Preferred Option**

Taking into account the technical, environmental and social constraints as described above, Options 1 and 2 have not been identified to be practicable options for further consideration. The viaduct option (i.e., Option 3) is therefore selected as the preferred option for the railway section between Aberdeen Channel Crossing and Nam Fung Portal. Table 2.3 summarises the key engineering factors and environmental considerations considered in determining the preferred option.

<p>| Table 2.3: Selection of Preferred WCH and OCP Station Locations and Associated Alignment |
| Option | Engineering Factors, including constraints | Environmental Benefits and/or Dis-benefits (on relative terms) |
| Alignment Option 1 – in deep rock tunnel | WCH and OCP Stations and WCH depot would need to be placed deep underground; | Dis-benefits: Greater amount of excavation |</p>
<table>
<thead>
<tr>
<th>Option</th>
<th>Engineering Factors, including constraints</th>
<th>Environmental Benefits and/or Dis-benefits (on relative terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>operational requirements cannot be met;</td>
<td>materials requiring disposal will lead to secondary dust and noise impacts on the sensitive receivers along the disposal route</td>
</tr>
<tr>
<td></td>
<td>• Not identified to be a practicable option for further consideration</td>
<td>Benefits:</td>
</tr>
<tr>
<td></td>
<td>Dis-benefits:</td>
<td>• Construction phase environmental impact largely confined to those sensitive receivers situated near the mucking out points. Handling of excavated materials by dump trucks will generate secondary environmental impact (in form of dust, noise and gaseous emissions);</td>
</tr>
<tr>
<td></td>
<td>• Operational phase noise and visual impacts are largely avoided and confined to those associated with operation of above-ground facilities such as ventilation shafts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction subjected to major technical difficulties and construction risk and will have direct impact on existing land uses (existing shipyard area and Hong Kong Police College Tactical Training Complex), operation of Aberdeen Channel (part of the Channel will need to be closed) and will delay the completion date of SIL(E):</td>
<td>Benefits:</td>
</tr>
<tr>
<td></td>
<td>• Crossing at Aberdeen Channel will have to be constructed by cofferdam and/or immersed tunnel method;</td>
<td>• During the construction phase, cut-and-cover construction would result in environmental impacts (in terms of noise, dust and visual impact) on nearby sensitive receivers;</td>
</tr>
<tr>
<td></td>
<td>• Substantial site formation works and rock excavation required for construction of WCH Depot causing program delay of about 3 years;</td>
<td>• Cut-and-cover construction at major roads would result in traffic disruption, increased traffic congestion and associated noise and gaseous emissions;</td>
</tr>
<tr>
<td></td>
<td>• Not identified to be a practicable option for further consideration</td>
<td>• Enormous amount of excavated materials (about 1Mm$^3$) requiring disposal</td>
</tr>
<tr>
<td></td>
<td>Dis-benefits:</td>
<td>Benefits:</td>
</tr>
<tr>
<td></td>
<td>• Operational phase noise and visual impacts are largely avoided and confined to those associated with operation of above-ground facilities such as ventilation shafts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Compared with a corresponding tunnel section, construction of a viaduct section can be completed within a relatively short period of time</td>
<td>Benefits:</td>
</tr>
<tr>
<td></td>
<td>• Possible horizontal alignment is very constrained by existing land uses in the built-up area of Wong Chuk Hang and Ocean Park; piers of viaducts have to avoid existing roads and foundations;</td>
<td>• During the construction phase, quantity of excavated material generated from the Project will be reduced. Direct waste management implications and secondary environmental impact (dust, noise and visual impacts) of the Project are effectively minimised;</td>
</tr>
<tr>
<td></td>
<td>• Only possible alignment for the viaduct in Wong Chuk Hang is</td>
<td>• Given shorter period of construction associated with viaduct and possible use of precast elements in construction, duration of exposing sensitive receivers to potential environmental impact will be</td>
</tr>
</tbody>
</table>
### Option

<table>
<thead>
<tr>
<th>Engineering Factors, including constraints</th>
<th>Environmental Benefits and/or Dis-benefits (on relative terms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>significantly reduced; Dis-benefits:</td>
</tr>
<tr>
<td></td>
<td>▪ Sufficient mitigation measures have to be incorporated into the design of the viaduct section to address potential noise and visual impact, though these measures has been demonstrated to be practicable through similar projects completed locally and overseas.</td>
</tr>
</tbody>
</table>

### 2.7.5 Section between Nam Fung Portal and Admiralty

#### 2.7.5.1 Location of ADM Station

At the FS stage of the study, it was identified that a proposed station at Admiralty is preferred over Wanchai as the interchange station and terminus of the SIL(E) based on both engineering and passenger-handling consideration. The proposed ADM SIL Station is located under Harcourt Garden and Queensway. The station location was chosen to provide a convenient connection to the existing Admiralty Station and the future SCL Admiralty Station, avoid any land resumption and maintain the station box and approach tunnels within rock as well as minimise any adverse effects on the operation of the existing Island Line and Tsuen Wan Line during construction.

Alternative options were considered for the design of the ADM station itself, including the options for a standalone SIL station versus a parallel SIL/SCL scheme and a stacked SIL/SCL scheme. The stacked SIL/SCL scheme has been chosen as the preferred scheme with the main environmental benefit being a reduced overall duration of major construction at Harcourt Garden, hence minimising the disruption to the area.

#### 2.7.5.2 Possible HAV Station

As highlighted in Section 2.1, MTRCL has explored in conjunction with the Hong Kong Jockey Club the feasibility of providing an additional intermediate station at Happy Valley as part of the proposed SIL(E) scheme. Upon completion of an option review, the Government and the MTRCL consulted the District Councils concerned and the Legislative Council Panel on Transport. The main considerations noted are summarised below:

- The projected patronage upon commencement of operation of SIL(E) is not high;

- Significant technical difficulties are anticipated in construction and there would be serious traffic disruption in the vicinity of the tram terminus in Happy Valley;

- In order to provide the HAV Station, the alignment of the SIL(E) would have to deviate from the original alignment that efficiently connects Admiralty with Ocean Park and Wong Chuk Hang. The longer tunnel will lead to a much longer journey time and have significant impact on the transport and economic benefits of the project;

- The much longer tunnel mean longer construction period, which go against the public expectations for early completion of the SIL(E).
During the construction phase, a longer tunnel also means that more construction and demolition materials (C&D materials) will be generated from the construction works. Construction works at Happy Valley will also lead to environmental impact on nearby sensitive receivers, though these can be mitigated to acceptable levels. During the operational phase, the operation of a shorter tunnel that more efficiently connects Admiralty with the Southern District would lead to reduced energy consumption.

2.7.5.3 Nam Fung Portal Location

Alignment of the railway line near the proposed tunnel portal at Nam Fung Road has been considered in detail to ensure that it is located away from the Nam Fung Road Woodland Site of Special Scientific Interest (SSI) to avoid any impact or disturbance during both the construction and operational phases on the SSSI. Besides, the tunnel from Nam Fung Portal will be on an approximately 2% downgrade such that it will be deeply embedded in massive volcanic rock when the railway is inside the boundary of Aberdeen Country Park. Potential adverse effect on existing ground water regime above bedrock is minimised.

Further evaluation as part of the Preliminary Design exercise suggested that two options exist with respect to the location of the tunnel portal at Nam Fung Road:

- Nam Fung Portal Location Option 1 – at slope between Aberdeen Tunnel toll plaza and Wong Chuk Hang Old village;
- Nam Fung Portal Location Option 2 – at a vacant site that was previously earmarked for Canadian Hospital development

The Option 1 site is steeply sloping in parts with level differences across the site. Most of the site is heavily wooded while the remaining area is covered by a mixture of permanent and temporary village structures. The Option 2 site is a large approximately rectangular site bounded by Nam Fung Road, Nam Fung Path (on two sides) and the St. Paul’s School co-ed.

It was noted that the ex-Canadian Hospital site (i.e., Option 2) has a number of significant advantages over the Wong Chuk Hang Old village site (i.e., Option 1), including environmental merits, as summarised below:

- Maximise separation distance of the portal from Nam Fung Road Woodland SSSI;
- The length of the viaduct section of the railway is reduced by 250m. Distance between the railway line and nearby sensitive receivers (e.g. at Shouson Hill) is also increased, thus reducing any potential visual and noise impact during both the construction and operational phases;
- The ex-Canadian Hospital site will not be sterilised by the railway line. The tracks will be carried by an elevated box structure supported by columns and piled foundation to allow future development on top to encompass the tracks without affecting the railway operation;
- No land resumption or clearance is required. Old village will be undisturbed by the works;
- Access to the site can be from Nam Fung Road and Nam Fung Path; therefore works traffic will have minimal impact on access to the nearby village and school during the construction phase; and
- Emergency vehicle access to the tunnel portal, as well as maintenance access to the ventilation building will be directed, off Nam Fung Road.
2.7.5.4 Selection of Preferred Alignment

As the decision made was not to provide an additional intermediate station at Happy Valley as part of the SIL(E) in view of lengthen the construction period and cost of the entire SIL(E) project, the alignment that involved a shorter tunnel between ADM and OCP Stations by adopting a 300m radius curve at each end and then connecting with a straight line as shown in Figure 2.1.1 was selected as the preferred option. Besides, the ex-Canadian Hospital site was identified to be a better location for the proposed Nam Fung Portal than the Wong Chuk Hang Old village site.

2.7.6 Station Entrances

After identifying the preferred location of the stations, the areas surrounding the stations which would benefit from the provision of station entrances were identified, taking into account the views received from local residents through the public consultation programme. However, available options of entrance locations were identified to be very limited as impact on private land has to be avoided.

For LET station in particular, due to the hilly terrain of the area, the catchment is located at different levels which poses significant constraints to locate the station entrance. In response to the demands of the local community, the station entrance of LET station has been relocated from the playground of Tung Sing House to the vicinity of the Lei Tung Commercial Centre away from the residential blocks. Potential environmental concern during construction and operational phase such as noise could be minimised. This arrangement also offers better coverage for the residents in the neighbouring estates, however, the average walking distance is lengthened.

Environmental impacts such as dust and noise associated with construction of station entrances and associated adits would be transient and limited to the construction phase, and can be effectively mitigated through implementation of standard mitigation measures.

2.7.7 Ventilation Shafts

Ventilation facilities are integral parts of a railway providing the necessary air exchange for the stations and tunnels. After determining the preferred locations of the stations and the preferred alignment of the tunnel sections, careful consideration has been given to the locations and design of required ventilation shafts, cooling systems and other fixed plants to ensure that they are situated away from sensitive receivers as far as practicable and sufficient mitigation measures have been incorporated into the design. It is identified that alternative locations for these facilities are subjected to significant constraints such as technical considerations and construction impact to the local community, given that land resumption should be avoided and the ventilation facilities could not be situated too far away from the stations and tunnel alignment. Locating the ventilation facilities further away will significantly affect the efficiency of ventilation and render additional plants and conduits and thus larger footprint.

To minimise the impact from fixed plant on nearby residential receivers, most of the SOH and LET stations and tunnel plant will be accommodated at Lee Wing Street plant building, which is further away from the main residential estates. Potential environmental concerns during construction and operational phase such as noise could be minimised. The ventilation shaft associated with the LET station has been located to the vicinity of the Lei Tung Commercial Centre to reduce operational impacts to nearby residences. Locations of the ventilation buildings are indicated in Figures 2.6.1 to 2.6.9.
2.7.8  Depot Location

A new depot is required to house rolling stock and for regular inspections, maintenance and cleaning to support the daily operation of SIL(E) and the possible extension of the SIL(W). The depot provides stabling tracks, facilities for off-loading rolling stock at the day-end using maintenance tracks, lifting tracks, Engineer’s Train sidings, wash plant and areas for accommodation for stores, workshops and plant rooms. Because SIL(E) is a medium capacity system with shorter trains, the depot required is much more compact than the traditional railway system operated by MTRCL on the Hong Kong Island. At the early stage of the FS, as an alternative to the proposed depot site in Wong Chuk Hang, a potential alternative site near Ocean Park was considered:

- Depot Location Option 1 – the former Hong Kong School of Motoring site and the area in its vicinity;
- Depot Location Option 2 – Wong Chuk Hang Estate site

2.7.8.1  Depot Location Option 1

The area required under Option 1 comprises the former Hong Kong School of Monitoring site, the existing football field of Wong Chuk Hang Sports Centre, the existing bus depot and the ArchSD’s District Agreement Office. The total site area is around 4.75 hectares and the site level varies from 6 to 9.5mPD. The site has an irregular shape (measures 270m at its longest side) and it was noted that the majority of the stabling berths can only accommodate the length of one train. It was estimated that the allowable stabling capacity cannot meet the ultimate train requirements of SIL.

Under this option, the main service entrance for the depot would be located opposite to the Ocean Park main entrance which is the only place where a small buffer area in front of the entrance gatehouse could be provided. This is not preferable taking into account the potential visual impact and other interfacing issues. Besides, constrained by the existing flyover at the eastern end of the site, the provision of an alternative entry/exit for the depot was not identified to be feasible.

To allow the tracks to ramp down from the main line level to the depot level, an extensive ramp structure will be required under this option. Besides, for avoiding encroachment of the ramp structure into the Aberdeen Sports Ground, it was also identified necessary to shift Ocean Park Road to the south. This major modification works would affect traffic to Ocean Park and create environmental impacts during the construction phase of the work.

2.7.8.2  Depot Location Option 2

Under this option, the depot will occupy the Wong Chuk Hang Estate site that is already vacated for demolition. Compared with Option 1, the site has a much regular shape and a larger area of about 6.5 hectares bounded by Police School Road and Nam Long Shan Road on three sides with the fourth northern edge occupied by WCH Station and Staunton Creek Nullah. The site is mainly at a level of about +20.5mPD, with the northern part reduced to about +7.5mPD, with the two parts separated by a formed cut slope. In view of the existing site levels, unlike Option 1, construction of an extensive ramp structure between the running track and the depot and associated environmental impact during both the construction and operational phases can be avoided.

For the operational phase, there are practicable measures that could be incorporated into the design of the depot to ensure that its operation will not pose any unacceptable noise and visual impact on the nearby
sensitive receivers. The effectiveness of these measures has been demonstrated through similar projects of MTRCL.

2.7.8.3 Selection of Preferred Depot Location

Taking into account the factors described above, including environmental considerations, Option 2 was identified to be the preferred option for accommodating the proposed depot, i.e. at ex-Wong Chuk Hang Estate. Effort would be made to reduce the footprint of the depot at the detailed design stage. Potential environmental concerns during construction phase such as dust and airborne noise impact could be further reduced.

2.7.9 Train System

With consideration of the service level required, it was identified that a medium capacity railway is appropriate for SIL(E). The rolling stock for SIL(E) is similar to those used in the existing Kwun Tong Line. With the shorter train length (3-cars) of the medium capacity system, length of platforms and stations can be reduced accordingly. In general, this will reduce the potential environmental impact (in terms of extent and/or duration) that would be generated from the project during both the construction and operational phases.

2.8 Consideration of Construction Methodologies

This section describes the planning of the construction of the project, covering the key aspects including the envisaged methods of construction, work site requirements and locations, requirements on barging points for handling excavated materials, and temporary magazines for the tunnelling works.

2.8.1 Construction Methods

Two major tunnels are to be constructed under the project, including a 3.5km long tunnel from Admiralty to Nam Fung Portal and 1.6km long tunnel from SOH Station to Aberdeen Channel Bridge. In addition, a viaduct section will be constructed from Aberdeen Channel Bridge via Wong Chuk Hang and Ocean Park to Nam Fung Portal.

2.8.1.1 Tunnel Sections

The tunnelling techniques reviewed for possible use in the Project include drill-and-blast, mechanical boring (i.e., with the use of a tunnel-boring machine), mining and cut-and-cover method. A description of these tunnel construction methods is given in Appendix 2.2, including summary of the environmental merits and dis-merits of these construction methods.

The techniques to be adopted for construction of the tunnel sections depend very much upon the levels of the proposed tunnels and the nature of the substrata and have been selected with the objectives of achieving the safest while most efficient construction approach such that disturbance to existing land uses, including periods of exposing nearby sensitive receivers to environmental impacts can be minimised. The sub-sections below describe the construction methods recommended for the tunnel sections of the Project. The adopted construction methods for the different sections are as illustrated in Figure 2.5.
Consultancy Agreement No. NEX/2301  
South Island Line (East)  
Environmental Impact Assessment

Nam Fung Tunnel

The proposed Nam Fung Tunnel traverses Hong Kong Island between ADM and OCP Stations. The tunnel is predominantly in very hard volcanic rock, with major faults encountered at Magazine Gap and Wanchai Gap.

Possible construction methods identified for this section are drill-and-blast, cut-and-cover, mining and the tunnel boring machine (TBM) method. In view of the geological conditions, it is likely that construction by drill-and-blast would be more efficient and economical and with less programme risk. Drill and blast tunnelling is well proven technology for tunnel construction in hard rock. With careful control of the quantity of explosives, the generated vibration levels on existing structures (buildings, roads, utilities etc) can be well controlled.

As pointed out earlier, the tunnel alignment has been selected such that any impact or disturbance to Nam Fung Road Woodland SSSI during the construction phase would be unlikely. Besides, the tunnel will be on an approximately 2% downgrade from Nam Fung Portal and will be lying within massive volcanic rock inside the boundary of Aberdeen Country Park such that any adverse effect on the existing ground water levels can be minimised. Besides, groundwater ingress into the tunnel will be properly engineered to avoid groundwater draw down within the rock mass.

Lei Tung Tunnel

The proposed Lei Tung Tunnel connects Aberdeen Channel Bridge with SOH Station via the LET Station. The tunnel is predominantly in volcanic tuff without major faults. Except for the construction of a shallow cut-and-cover tunnel between the Aberdeen Channel Bridge and Ap Lei Chau Drive and the cut-and-cover box of SOH Station at Yi Nam Road, it is envisaged that drill-and-blast tunnelling method would be adopted for construction of Lei Tung Tunnel as the use of explosive for the bulk excavation of hard rock is the most efficient tunnelling method available in the market. Drill and blast tunnelling will involve less construction plant items and reduce the duration of overall long term noise from the works, thus reduce impacts on sensitive receivers above the tunnel when compared with cut-and-cover tunnelling method.

Sequence of Works

For construction of both Nam Fung Tunnel and Lei Tung Tunnel, it is envisaged that the construction sequence will involve drilling probe holes and carrying out pre-excavation grouting or support as necessary before initiating blasts and mucking out the excavation. Supports will then be installed before the process is repeated. This construction sequence could ensure that environmental effects such as dust could be effectively controlled.

It is envisaged that in view of access and programme difficulties at the Admiralty end, the Nam Fung Tunnel will mainly be constructed from the Nam Fung Portal. However, given the significant length of the tunnel, construction from the Admiralty end may become necessary when construction difficulties at the Nam Fung Portal end are encountered, which may otherwise create a high risk of programme over-run.

Construction of the Lei Tung Tunnel, including LET Station, will be accessed from the construction adit to be launched at Lee Wing Street, close to Lee Nam Road. This arrangement will allow the excavated spoil to be effectively disposed of via the construction adit to a proposed barging point at Lee Nam Road (see subsection on Barging Points below for further details). Volume of dump trucks required for handling of
excavated materials and secondary environmental impact in terms of noise, dust and gaseous emissions associated with handling of excavated materials can thus be effectively minimised.

2.8.1.2 Viaduct Section and Aberdeen Channel Bridge

The viaduct section was designed to allow the use of precast segmental method for the standardised viaducts. Where practicable, the deck will be formed from precast segments which will be manufactured at a casting yard offsite and joined together at their final positions onsite. This approach will minimise the extent and duration of construction activities required onsite and hence potential environmental impact (e.g. in terms of noise from use of powered mechanical equipment) on nearby sensitive receivers.

Construction of the viaducts will generally involve use of in situ bored piled foundations founded on bedrock or seabed. For constructing the viaduct section between the Staunton Creek and the existing slope where a degraded woodland was identified, single bore piles are proposed to be used to reduce impacts to degraded woodlands and slopes as this would affect a smaller area. The viaduct pile caps will be constructed by traditional means. The pier segments will be constructed using precast units as much as possible with some segments constructed in situ due to the complexity of the reinforcement. The pile in Aberdeen Channel for supporting the bridge sections would be constructed in the form of bored piles. The piles construction would be through the placing of steel pile casing and construction of a cofferdam at the pier site in which the seawater trapped inside the casing and cofferdam would be pumped out to generate a dry working environment. This construction method of creating a confined and dry environment for sediment dredging/ excavation could minimise the release of contaminant into the water column.

2.8.1.3 WCH Depot

The proposed WCH Depot is located at the former Wong Chuk Hang Estate. Two platforms with different formation levels had to be formed by open excavation followed by construction of temporary perimeter walls, slope formation works and subsequently foundation and superstructure works.

Two possible construction methods identified for excavation are by breaking and surface blasting. In view of the large volume of spoil required to be removed to create the two formed platforms, it is likely that surface blasting would be more efficient and with less programme risk. With excavation by breaking, noise criteria will limit the number of breakers on-site, slowing the progress to the point where breaking will be inefficient and will take longer time than by surface blasting. Prolonged noise and dust nuisance to surrounding noise and air sensitive receivers was also not preferred from the environmental perspective.

2.8.2 Work Area Requirements

Given the scale of the Project, works areas would be required for supporting the construction and have been identified for site office, storage of materials and nurseries. For construction of a new railway system within a built-up urban environment, identification of available work areas and work sites represents a significant challenge. Through the design exercise, a number of work areas and work sites have been identified and these are shown in Figures 2.6.1 to 2.6.12. The locations of works areas have been selected with consideration of their accessibility and suitability for construction works and future permanent facilities. The above-ground works areas have been minimised to reduce the land take as far as possible and avoid the potential environmental sensitive areas including Aberdeen Country Park and Nam Fung Road Woodland SSSI.
For the works at Admiralty, nearly the whole Harcourt Garden of approximately 10,000m$^2$ will be required during the construction phase of the Project. Approximately half of the site will be occupied by the large cut-and-cover box required for construction of the ADM Station. The other half for works areas will be taken up by the public access to be maintained to the existing car-park as well as the access road through the site, leaving only a quarter of the total area for site storage and works. Works have been planned as far as possible to complete the major excavation before concreting start to avoid the site congestion. Other smaller site will be required in the Admiralty area for the construction of ventilations shaft at Hong Kong Park while two other small sites will be required to the north of Harcourt Road for site offices and temporary materials storage.

The use of the large ex-Canadian Hospital site of approximately 17,700m$^2$ is critical to the implementation of the Project, as it will be required for the construction of the Nam Fung Tunnel to ADM Station and for construction of the viaducts towards Ocean Park. It may also be used as a storage area for precast viaduct segments. Later the site may be used for access and support for track and railway systems installation. The Nam Fung Road Woodland SSSI would be undisturbed as a separation of about 200m between the SSSI and the works sites can be provided.

The Citybus Depot site adjacent to OCP Station of approximately 9,000m$^2$ provides an available site for construction of the station and viaducts towards WCH Station. Land contamination in this site is not anticipated based on desktop review and site investigation results. The majority of the Wong Chuk Hang Estate site needs to be excavated for the depot and for construction of the station. Rock crushing facilities are proposed at the ex-Canadian Hospital site and the WCH depot site due to the large amount of rock generated. The rock crushers will be enclosed with appropriate dust extraction and collection system subject to the design of the Contractor to minimize the environmental nuisance. A typical layout of the rock crushing facilities is given in Figure 2.7.

Construction of the viaduct section lying between the Staunton Creek Nullah and the existing slope to the west of WCH Station requires careful planning. Appropriate construction techniques and special equipment will be required to minimise the area of degraded woodland that would be affected and noise impact on nearby sensitive receivers.

Construction of the Aberdeen Channel Bridge shall take into account the fact that the north pier of the crossing is located within Aberdeen Channel with limited marine access. The south pier and abutment of the Aberdeen Channel Bridge and the cut-and-cover to the south will be built from the available work site adjacent to Aberdeen Channel. Appropriate mitigation measures such as control of sediment release will be required to minimise water quality impact.

It is planned that LET Station and the tunnel to its west leading to SOH Station will be constructed via an adit from the portal proposed at Lee Wing Street. The construction adit will intercept the running tunnel at about 300m from the SOH station at Yi Nam Road. As discussed earlier, this arrangement will allow the effective handling and disposal of excavated spoil via the construction adit to a proposed barging point at Lee Nam Road and control the associated environmental impacts.

Soh Station and entrances to the station will be constructed by cut and cover. As no off-road work sites are available in its vicinity, the works will inevitably need to be carried out in stages under a series of temporary traffic diversions. Bulk excavation activities will be carried out under road decks provided by maintenance of road traffic. The decks will also help minimise potential environmental dis-benefits associated with the use of cut-and-cover technique in terms of dust, airborne noise emission and visual impact.
2.8.3 Barging Points

The tunnelling and earth works will inevitably generate a large quantity of excavated materials. A comprehensive strategy for handling and where practicable reuse of the materials is essential from an environmental perspective and to avoid impact on the programme of the construction works. Unfortunately, the majority of the rock to be excavated is expected to be of volcanic origin which is unsuitable for recycling or reuse other than as fill material. With a view to minimizing road-based traffic and stress on road surfaces, barging points have to be set up nearer the work sites on coast of Hong Kong Island to remove these excavated materials by sea. This will significantly reduce the impact on road traffic in particular the burden on strategic routes in the Southern District and in Central and Wan Chai as well as the impact on the environment.

2.8.3.1 Proposed Barging Points at Island North

The temporary barging point at Western District Public Cargo Working Area, proposed shared use with WIL project, is envisaged to handle the excavated materials generated from the works site at Harcourt Garden. The capacity of the barging point would be able to cater for the spoil disposal from SIL(E) as the disposal arrangement has been carefully considered such that the peak period would not overlap with that of WIL. Chai Wan Public Filling Barging Point (CWPFBP) was also considered but further consultation with CEDD indicated that the CWPFBP is operating at its capacity and would be unable to handle the excavated materials generated by the works of SIL(E). Further evaluation of the construction traffic impact suggested that, if spoil generated from work sites at Island South was to be disposed of at Western District Public Cargo Working Area, the construction traffic could overload a number of critical junctions and major links along the envisaged haul route in peak hours. The traffic congestion created would also generate additional traffic noise and gaseous emissions.

2.8.3.2 Proposed Barging Points at Island South

In view of the geographic locations of the major mucking out points, it is recommended that separate barging points should be provided near the mucking out points at Island South for more efficient handling and disposal of the excavated materials, and in order to reduce impacts on traffic and the associated environmental impacts.

The overall traffic impact/congestion and associated environmental impacts would be considerably greater if no suitable locations for the proposed barging points could be identified within the Southern District, as the excavated materials would have to be transported by trucks to dumping facilities outside the district via Pokfulam Road or Aberdeen Tunnel and even the Cross Harbour Tunnel, thus putting additional traffic to the major roads in / outside the Southern District. The progress of the construction works would also be affected.

Various alternative sites including either side of the Aberdeen Channel, the demolished barging point of Ocean Park project and seafront locations of Aberdeen and Ap Lei Chau, Kellett Bay and Telegraph Bay – existing Drainage Services Department's Hong Kong West Drainage Tunnel and Harbour Area Treatment Scheme Stage 2A works areas were identified as possible barging point site at Island South. Seafront locations of Aberdeen Praya Road, Kwun Hoi Path, Ap Lei Chau Main Street and other areas within the Aberdeen Typhoon Shelter would, however, result in serious safety issues with large vessels maneuvering alongside existing smaller local boats. In addition, the typhoon shelter lacks an appropriate off-loading area. There would also be an impact on the fishing industry. Reinstating the demolished barging point at Tai Shue Wan within Ocean Park would occupy Ocean Park’s own expansion project area. Moreover,
delivery of excavated materials by trucks would occupy the narrow and winding Shum Wan Road and Nam Long Shan Road and adversely affect the operation of Ocean Park while delivery of excavated materials by conveyor belt would require building of a conveyor belt along the steep slope of Nam Long Shan which would endanger the emergency evacuation of park visitors at Nam Long Shan Road. Kellett Bay is also considered not practicable as its adjacent concrete batching plant and other nearby facilities would result in too much traffic impact/congestion and associated environmental impacts.

Taking into account land availability, extent and accessibility to sea front, road and marine traffic constraints, incompatible facilities and local residents’ concerns, two sites were considered as viable for locating the barging points on the south side of Hong Kong Island:

- Site A – near Lee Nam Road;
- Site B – near Telegraph Bay.

It is proposed that Site A will be used mainly for disposal of excavated materials generated at works sites in Ap Lei Chau and WCH depot, while Site B will mainly serve construction works for Nam Fung Tunnel. Setting up two barging points at Island South is required to share the delivery volume and therefore minimize the environmental and traffic impact on the local community.

**Site A – near Lee Nam Road**

The site is located at the south western portion of Ap Lei Chau. It comprises Lee Nam Road sitting out area (Lot No. GLA-HK 759 GLA) and the DSD Works Area (Lot No. GLA-THK 1721 TGLA). The layout and arrangement of the barging point is as shown on Figures 2.6.8.

As discussed earlier, an access adit is proposed to be constructed at Lee Wing Street. The access adit intercepts the tunnel between SOH and LET Stations at a point about 300m from SOH Station. It is planned that either a temporary bridge or a conveyor belt could be erected between the construction adit and the barging point site for removal of excavated materials generated from construction of LET Station and the tunnel. As such, excavated materials generated from the tunnelling works can be effectively disposed of via the barging point, without creating additional construction related traffic and associated environmental impact on nearby sensitive receivers, although conventional method by trucks is also a viable alternative for spoil removal from the adit to the barging point. Excavated materials generated elsewhere would need to be delivered to the barging point by road traffic.

**Site B – near Telegraph Bay**

The layout and arrangement of the barging point is shown on Figures 2.6.11. The site is located at waterfront area of Telegraph Bay next to DSD’s Hong Kong West Drainage Tunnel and Harbour Area Treatment Scheme Stage 2A site offices. It is reasonably distant from nearby community and is well served by public roads that are still under capacity. It is currently proposed to co-use the existing barging facilities of DSD’s Hong Kong West Drainage Tunnel project as an alternative of constructing a temporary pier at Telegraph Bay to minimize the environmental and traffic impacts on the Southern District as a whole.

Taking into account the concerns of the local community, the trucks travelling to the barging point would primarily take the route via Victoria Road (from Pokfulam Road) and Sha Wan Drive and would depart via Cyberport Road. Trucks would not pass by schools near Telegraph Bay. The capacity of the existing road network in the vicinity of the proposed barging points has been reviewed. The road capacity of the proposed truck delivery routes can handle the additional trucks and the existing traffic condition and
associated environmental impacts would not be worsened due to the construction of SIL(E). The average number of trucks going to the Telegraph Bay barging point would be less than 200 a day which is far less than the capacity of the road network. The truck movement would be within acceptable speed limit and safety procedures would be strictly adhered to. Potential environmental impact as a result of the aforesaid arrangement would unlikely to be significant. The proposed operation hours of the barging facility have also been reduced to avoid causing traffic impact/congestion and associated environmental impacts during peak hours. The facility would be closed on public holidays. The delivery programme for offsite disposal would be well planned such that potential environmental impact from transporting the C&D material would be minimised.

To minimize environmental nuisance, the tipping area at the barging point would be enclosed and covered trucks and wheel-washing bay would be used. The operation of the barging point and the environmental conditions would be closely monitored. The Corporation will continue to maintain communication with the local community.

2.8.4 Temporary Magazines

Refer to the Section 7 Hazard to Life on the selection of temporary magazine sites.

2.9 Tentative Construction Programme

Construction of the SIL(E) is expected to commence in 2011 for completion in 2015. The tentative construction programme is given in Appendix 2.3.

2.10 Concurrent Projects

There are several major concurrent designated projects in the vicinity of the Project’s works areas, as summarised in Table 2.4. Consideration of concurrent projects for cumulative environmental impacts would only take into account those with available implementation programmes as shown in Appendix 2.4. Cumulative impacts from the planned and existing major concurrent projects, if any, have been assessed in the individual sections of this EIA study.

Another project, Shatin to Central Link (SCL), is also proposed by the Project Proponent. The enabling works of SCL at Admiralty will be carried out under SIL(E) at the time of the ADM construction and thus it is considered that the cumulative impact from the SCL project had been assessed in this EIA study.

Construction works for expansion and redevelopment of Ocean Park under the project entitled “Repositioning and Long Term Operation Plan of Ocean Park” is taking place concurrently and the work sites involved are in the vicinity of the proposed OCP Station. Based on available information on the current programme, it is envisaged that all major civil engineering works required for expansion and redevelopment of the Park would have been completed by the time when there would be construction activities in the vicinity of the expanded Ocean Park under the Project. Potential cumulative environmental impact on the nearby sensitive receivers is therefore not expected and thus have not been assessed in this EIA study.
Table 2.4: Major Concurrent Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Planned Construction Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Reclamation Phase III</td>
<td>2003 to 2012</td>
</tr>
<tr>
<td>Wanchai Development Phase II and Central- Wan Chai Bypass</td>
<td>2010 to 2016</td>
</tr>
<tr>
<td>Harbour Area Treatment Scheme Stage 2A</td>
<td>2009 to 2014</td>
</tr>
<tr>
<td>Hong Kong West Drainage Tunnel</td>
<td>2007 to 2012</td>
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