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1. INTRODUCTION

Background

1.1 The first Railway Development Study (RDS-1) defined the current phase of rail development, and the implementation of the schemes proposed under RDS-1 is due to be completed by 2005. To plan for the next phase of Hong Kong railway development, the Second Railway Development Study (RDS-2) was initiated by the Railway Development Office of the Highways Department of the Hong Kong SAR Government in March 1998.

1.2 The Consultant team, led by a joint venture between MVA Asia and Maunsell Consultants Asia Limited, was appointed to undertake the main RDS-2 study. ERM-Hong Kong Ltd was included in the sub-consultants team to undertake the Strategic Environmental Assessment (SEA).

Strategic Environmental Assessment (SEA)

1.3 One of the objectives of the RDS-2 study was to develop a preferred rail network that is nvironmentally acceptable'. To achieve this objective, environmental considerations were included as an important element throughout all the stages of the RDS-2 study.

1.4 A SEA was therefore undertaken to ensure that environmental considerations were fully integrated into the overall study, thereby maximising the environmental benefits and, as far as practicable, avoiding adverse environmental impacts.

1.5 In addition to assisting with the development of the preferred rail network, the SEA Study Team also undertook a review of the environmental benefits that may be gained from choosing rail transport over road.

2. JUSTIFICATION OF RAIL

Road Versus Rail

2.1 The SEA Team undertook a review to determine the scope of environmental benefits that could be accrued from implementing rail in preference to road schemes. The review considered the implications related to air quality, noise, ecological, landscape and heritage impacts and the risks faced by the travelling public. The findings of the review are summarised below.

Air Pollution Implications

2.2 The predominant types of air pollutant generated by road and rail were reviewed and the different means by which the emissions from the two transport modes are regulated and controlled were also assessed.

2.3 The two transport modes differ in relation to the source of emission and the extent to which such emissions are diluted by dispersion. Electric rail systems derive their electricity from power stations where (predominantly) fossil fuel combustion emissions are dispersed from relatively high stacks. Such emissions are typically regarded as influencing regional air quality. By contrast, road vehicle emissions have a direct impact on local air quality conditions given their discharge at street level, although they also effect regional air quality.

2.4 A comparison was undertaken of the total emissions from road and rail sources based on emissions per passenger-per kilometre travelled. Based on 1997 data, rail transport was found to be more efficient than road transport in terms of nitrogen oxides (NO_x), carbon dioxide (CO_2) and Respirable Suspended Solids (RSP). On average NO_x emissions from road transport were found to be approximately 2.5 times greater than rail, while road emissions of CO_2 and RSP emissions were found to be about 2 and 10 times greater than rail respectively.

Noise Control Implications

2.5 The review demonstrated that, in Hong Kong, there are differences in the residential noise criteria for road and rail traffic, and that, internationally, people generally find rail noise to be less intrusive than road noise. It was also found that only rail noise is statutorily controlled, requiring compliance with the absolute noise criteria to be achieved through direct (at-source) mitigation without any recourse for using in-direct methods (such as acoustic glazing) that could be permitted to control road noise.

2.6 Whilst the costs of providing mitigation measures for railways must be borne by the rail operator (and therefore have a direct implication for the financial feasibility of projects and the cost to passengers), the costs of providing attenuation for road noise is borne by the wider Hong Kong community due to Government funding of the road programme and maintenance programme. It can therefore be concluded that there are differences that can be regarded as being restrictive to the development of rail.

Landtake Implications

2.7 Rail infrastructure was shown to be less land consuming than equivalent capacity roads, and this was found to result in a lower potential to affect environmental resources.

2.8 The greater landtake requirements of highways have commensurately greater impacts upon ecological, landscape and heritage resources and on the ability of project proponents to effectively mitigate predicted impacts.

2.9 It was concluded that the landtake requirements of railway developments provide greater opportunities to manage the allocation of land in a sustainable manner, particularly in the context of Hong Kong's limited available land area.

Risks Faced by the Travelling Public

2.10 The risk evaluation concluded that rail travel offers significantly reduced levels of risk for the travelling public compared with road transport. This conclusion was based on historical accident data for Hong Kong. Currently, rail operators are demanding even lower levels of risk to be achieved, and quantitative risk assessments have shown that this is possible.

2.11 With regard to the risk posed to the travelling public by Potentially Hazardous Installations (PHIs), rail was found to be preferred to road because the travelling public is generally better protected from external hazards when within a rail car than within a road vehicle.

The Appraisal of Transport Projects

2.12 The reviews supported the perception that railways can provide substantial environmental benefits over road based forms of transportation.

2.13 In Hong Kong the appraisal techniques used for proposed highway and railway projects differ; a review was therefore undertaken to ascertain whether these differences influence the implementation of new railway projects.

2.14 At a strategic transport planning level, such as that undertaken for the Third Comprehensive Transport Study (CTS-3) and RDS-2, the economic benefits of road and railway schemes are assessed. In addition, RDS-2 undertook a financial appraisal of the railway schemes. While bus operators enjoy financial benefits such as paying no taxes for road usage, fuel, or first registration, Government facilitate the implementation of railways by way of equity injection, granting property development rights and paying for the associated public works. As bus companies do not have to pay for the construction or maintenance of roads, bus operators are effectively provided with free infrastructure which enables them to hold down fares and thereby capture a large market share.

2.15 The economic appraisal systems that are currently being used to assess road and rail projects do not currently include environmental factors. Railways are hence being ndersold" in the project evaluation. In order to accrue the actual environmental benefits of railway schemes, it is recommended that more emphasis is placed on environmental factors in the assessment procedures.

3. PREFERRED RAIL NETWORK

3.1 The core work of the SEA component of the RDS-2 Study was to assist in the selection of the preferred rail network. The following sections summarise the SEA input into the selection process.

Absolute Environmental Constraints

3.2 Strategic environmental resources were identified at the earliest possible stage of the development process in order to ensure that conflicts with such resources were avoided.

3.3 Current Hong Kong environmental legislation was reviewed to determine the range of requirements with which new railways must comply. Each of the key Environmental Impact Assessment Ordinance (EIAO) impact categories were reviewed to determine those resources having strategic importance.

3.4 For consistency, strategic resources were considered as being those which were statutorily protected. These resources were considered as being bsolute environmental constraints' which must be avoided at the earliest stage of the rail development process. The absolute environmental constraints comprised the following:

- existing and potential Country Parks and Special Areas;
- existing and potential Marine Parks and Marine Reserves;
- Fish Culture Zones;
- Ramsar sites;
- Sites of Special Scientific Interest (SSSIs); and
- Sites of Cultural Heritage (Declared Monuments).

3.5 Other environmental issues, such as green belts, which have are not statutorily protected, were identified for consideration during subsequent stages of the strategic development process.

3.6 Following the identification of the absolute environmental constraints, they were compared against the broad corridors of the maximum conceptual network (which comprised all the possible rail routes that were being considered within RDS-2) in order to identify any schemes that conflicted with these resources and that therefore had atal flaws'.

3.7 This "sieving" process identified a number of schemes (comprising those in the North East New territories across Tolo Harbour and Plover Cove, and the Sha Tau Kok corridor) which conflicted with the absolute environmental constraints; each of these schemes was rejected. The remaining schemes were retained for further development and environmental evaluation.

Assessment of Schemes

3.8 During the final phase of the RDS-2 Study, a number of rail development options were developed. The elements of the various railway expansion schemes were divided into Component Schemes and Stand Alone Schemes.

3.9 The Component Schemes were assembled into six network options depending on the configuration, operator and routeing of the Fourth Harbour Crossing (FHC). The Component Schemes (i.e. the North Island Line, the East Kowloon Line, the FHC, the Tai Wai to Diamond Hill link and the Kowloon Southern Loop), are common to each of the network options.

3.10 The network options for the Component Schemes can be divided into two main groups:

- Regional - in which the FHC is formed by extending East Rail (ER); and
- Urban - in which the FHC is formed by extending the proposed East Kowloon Line (EKL).

3.11 The Urban options were then further sub-divided into options operated either by the MTRC or KCRC.

3.12 Finally, there were two options for the routeing of the FHC on Hong Kong Island; either via Exhibition/Admiralty or via Victoria Park/Hong Kong Park.

3.13 In addition, a number of Stand Alone Schemes have been identified. These comprise the Northern links, the West Island Line, the Regional Express Line and the Port Rail Line. These schemes could be implemented independently and at any time during the implementation of the Component Schemes.

3.14 Environmental assessment were undertaken for each of the Component Schemes and Stand Alone Schemes. These environmental assessments identified the key strategic construction and operational phase impacts for each scheme. At this strategic stage, the purpose of the assessment was not to quantify or evaluate the magnitude of these impacts, but to identify whether there were any potential strategic environmental implications that would make the scheme under consideration unattractive from an environmental perspective or would require particular attention if the scheme progressed.

3.15 Generic discussion was also provided, as guidance, on possible means of mitigation that could be utilised to control the potential environmental impacts; the detailed evaluation of impacts and the precise specification of the mitigation measures will be undertaken during future Environmental Impact Assessments (EIA) studies under the EIA Ordinance.

3.16 The Component Schemes within each of the rail development options will be constructed and operated almost entirely underground, which very greatly reduced the potential environmental impact of each of the Component Schemes. The predicted impacts from the Component Schemes were therefore reduced substantially from equivalent above ground alternatives.

3.17 Of the Stand Alone Schemes, only the Northern Links (NOL), is proposed to be predominantly above ground. It therefore has a relatively high potential for impacts. A possible passenger and freight connection is proposed that would link the NOL with Lo Wu (LOW). During the course of the SEA it was identified that this freight connection would conflict with part of Long Valley, an area of high ecological importance. Whilst this ecological resource had no statutory designation at the time of undertaking the Stage 1 ieving' process, it has recently been recommended that it be protected and the Recommended Outline Development Plan (RODP) revised to rezone the area to a classification of ther Specified Uses (Nature Park)'.

3.18 To avoid this important area, the work of the SEA resulted in the alteration of the freight line alignment such that it does not encroach upon the protected area.

3.19 Overall, each of the Component Schemes and Stand Alone Schemes is likely to give rise to a degree of environmental impacts during either the construction or operational phases. However, in strategic terms, none of the schemes considered are likely to give rise to insurmountable environmental impacts since established means of environmental mitigation are available which can be developed during the design stages of the project.

4. CUMULATIVE IMPACTS

4.1 In addition to the assessment of the Component and Stand Alone Schemes, the SEA also considered the predicted cumulative environmental impacts that would result from implementing the rail network expansion plans. These are discussed below.

Cumulative Air Quality Implications

4.2 The implementation of the rail network expansion plans is predicted to result in a reduction in road based vehicle journeys. Using transport forecasts for the year 2016 (generated with reference to the major network assumptions used in the CTS-3 medium scenario) and agreed emission factors, the potential associated air quality "benefits" from the reductions in vehicle kilometres were calculated in terms of reductions in NOx, RSP and CO_2.

4.3 The assessment concluded that the expanded networks (i.e. the Component Schemes plus the NOL and West Island Line) could result in potential emissions savings ranging from 565 to 669 tonnes/annum for NOx, 50 and 61 tonnes/annum for RSP, and 152,000 and 181,000 tonnes/annum for CO_2.

4.4 Whilst reductions in NOx and RSP can be considered as having a ocal" beneficial impact at street level, CO_2 is a greenhouse gas and its emission due to the generation of electricity to power the new railways should be considered as having a more lobal" perspective. The amount of rail related CO_2 emissions will be dependant upon the future energy requirements of the railway sector. However, there are difficulties accurately determining the potential electricity requirements that may be needed to power the new railways in 2016, and there are also many uncertainties related to the potential future combinations of power stations that may be used. Consequently, an accurate prediction of the future rail related CO_2 emissions could not be undertaken.

4.5 However, it was concluded that any CO_2 benefits resulting from implementing the railways developments could be maximised through the introduction, by the energy sector, of more nvironmentally friendly' fuel sources and plant types, and by advances in power generation technology. Similarly, developments in the rail industry (such as more energy efficient rolling stock and stations, and the use of platform edge doors) could also help reduce the future electricity requirements of the new railways thereby leading to lower emissions of CO_2.

Cumulative Ecology Impacts

4.6 As the great majority of the rail development options are to be constructed underground within an urban environment, the potential for ecological impacts is generally low. However, losses to sensitive ecological habitats or resources, may occur from the implementation of above ground schemes such as the NOL.

4.7 Assuming a landtake corridor of 40 m width along the alignment (and 100 m at stations) will be required by the above ground schemes, the alignments were assessed to identify the extent of any ecological impacts.

4.8 Following the re-alignment of the NOL freight connection to avoid Long Valley, the assessment determined that, of most significance, the currently proposed above ground alignments would affect 4.42 ha of natural woodland (equating to 0.042% of Hong Kong overall resource), 2.7 ha of other wetlands (including marsh areas) (or 0.81%) and 21.3 ha of inland water (including fishponds) (or 0.42%)

4.9 In line with best practice, steps should be taken during the rail development process to avoid or minimise the impacts to the identified ecological resources However, if ecological impacts to certain important habitats (including natural woodland, wetlands, and fishponds) cannot be avoided, the affected habitats will need to be compensated in line with the established mitigation practice in Hong Kong; with the extent and location of such compensatory areas being commensurate with the significance and exact area of the affected habitats.

Cumulative Cultural and Heritage Impacts

4.10 As the majority of the alignments are proposed to be constructed underground, the potential for cultural and heritage impacts is generally considered to be low.

4.11 Each of the assumed schemes were assessed to determine their proximity to cultural and heritage resources. It was found that 10 deemed and declared monuments are within 50 m of the currently assumed alignments. Concerns have been expressed by the Antiquities and Monuments Office (AMO) regarding the proximity of the alignments to heritage resources including the tunnel networks located below the Former Marine Police Headquarters.

4.12 Because of the importance and fragility of the identified resources, detailed consideration should be given to historic and cultural issues during the further developing the proposed rail alignments and construction methodologies so that potential impacts can be avoided.

Cumulative Landtake Impacts

4.13 To provide an indication of the potential cumulative landtake implications, reference was made to the total lengths of track that are proposed to be constructed above ground.

4.14 Five schemes were found to include potential sections of above ground track. Taking a orst-case' approach it was determined that the maximum length of new above ground railways track would be 19.8 km; whereas the total length of new (above ground and below ground) track that is proposed under the rail network expansion plan would be 75.9 km.

Cumulative Hazard Impacts

4.15 To provide an indication of the potential cumulative hazard implications, an assessment was undertaken to determine the length of track, and number of stations, within the Consultation Zones (CZs) of Potentially Hazardous Installations (PHIs).

4.16 With the currently assumed alignments, it was found that five of the proposed schemes may enter the CZs of PHIs. The cumulative hazard implications were determined by assessing the sum total of above ground rail track that runs within the CZs. Assuming a worst case approach, the total length of above ground track within the CZs was found to comprise 5,420 m . In addition one above ground station was also found to be within a CZ.

4.17 In comparison to the total length of proposed new railway (i.e. 75.9 km) the potential length of above ground track within the CZs is relatively small. It is also noted that 3,000 m of the track is within the CZs of two PHIs which currently have approximately 2,900 m of above ground railway within their CZs.

4.18 Whilst the estimated lengths of proposed new track within the CZs are not anticipated to present any insurmountable impacts, as is standard practice, hazard assessments will be required to assess the actual hazard implications, and, where applicable, to develop and specify suitable mitigation measures.

Cumulative Noise Impacts

4.19 With the majority of the proposed schemes proposed to be located underground, the potential for operational noise impacts is low.

4.20 The Noise Control Ordinance (NCO) defines absolute performance limits for controlling operational railway noise. Therefore, for any above ground schemes where impacts are envisaged, direct (at source) mitigation measures must be developed to meet the required noise standard.

4.21 As a consequence of the statutory requirements and the underground construction of the majority of the schemes, the implementation of the proposed rail network expansion plans should not result in any properties being exposed to railway noise in excess of the require noise criteria.

Summary

4.22 The assessments of the cumulative impacts provides a strategic bench-mark for the sum of potential impacts from the rail expansion schemes; the information contained within the SEA should be used in the further development of the rail proposals and the actual impacts from each scheme assessed in more detail at the EIA stage once the alignments are finalised, with the aim of meeting, and preferably falling below this benchmark.

5. STRATEGIC ENVIRONMENTAL IMPACTS AND STRATEGIC EM&A

5.1 The strategic level environmental assessments of the rail expansion schemes identified that each scheme was likely to give rise to potential environmental impacts, but that these impacts could be reduced, if not wholly avoided, during the development and design of the schemes, and/or suitable mitigation could be developed to successfully reduce them to acceptable levels.

5.2 To ensure that the key potential impacts that have been identified are addressed at the correct stage of the scheme development, a mechanism has been developed for arrying forward' such issues, called Strategic Environmental Monitoring and Audit (SEM&A). The SEA has outlined a SEM&A procedure for achieving this follow-up process for the proposed schemes.

5.3 For each of the Component and Stand Alone Schemes, the SEM&A has identified:

- the potential impacts that require further evaluation and consideration;
- the development stage at which the issue should be further considered; and,
- who is expected to be responsible for the further work.

5.4 Recommendations were also made regarding strategic, SAR-wide measures that could be implemented during the planning and development of future rail projects to avoid or minimise potential impacts at the earliest stage in the planning process.

5.5 It was recommended that consideration be given to:

- Improving co-ordination and exchange of information between government departments; particularly regarding the integration of land use requirements and planned housing developments into the railway planning and development process.
- Undertaking technical studies or investigations into the means of improving the operational environmental performance of railways.
- Implementing measures to promote the use of rail, (and possibly discourage the use of road based means of transportation) to maximise the environmental benefits.