The Port Rail Terminal

7.4.49 At this stage of the project's development, there are limited details available regarding the proposed Port Rail Terminal (PRT). However, it is envisaged that the PRT will be a state of the art intermodal terminal located at the Kwai Chung port area of Kowloon. The PRT is likely to be triangular in shape with the site bordered on the west by the container Port Road, on the north by Route 3, on the south by CP3 and to the east by the proposed road CP2. The envisaged site is currently occupied by the Lai Chi Kok North Container Back-up Area.

7.4.50 The following points provide a brief summary of the potential strategic environmental impacts that are likely to be related to its development.

- Noise from the operation of the PRT has the potential to give rise to impacts, especially as it is likely to require night-time working. However, as the area in which the PRT is proposed is already used for similar uses (i.e. the container terminal), and there are limited sensitive receivers in the locality, the introduction of the PRT into the area would not be envisaged to result in any insurmountable noise impacts.
- The PRT is proposed to be located on an area of reclamation. If there is a need to excavate beneath the existing sea bed during the construction phase, there is the potential to encounter contaminated marine sediments. This matter will require further consideration during the development of the PRT, however, it is predicted that such concerns can be effectively mitigated and therefore, no insurmountable problems are envisaged.

7.5 Comparison of the Air Quality Implications of Freight Movements on the Port Rail Line

7.5.1 The vast majority of freight movements with the Mainland are associated with Guangdong province, and are principally road-hauled, increasingly in containers. However, as river-trade offers some cost advantages, this has grown steadily in recent years.

7.5.2 The RDS-2 study has given specific consideration to freight as part of the freight rail study. The PRL has been proposed as one of the Stand Alone schemes.

7.5.3 Due to economic factors, it is considered that the market potential for rail lies in distant inland markets where the economies of scale of rail transport can compete with other multi-modal transhipment routings. At present these markets are not substantially developed.

7.5.4 The PRL/PRT concept aims at offering inter-modal freight transport with rail as the line haul (long distance) mode supported by feeder rail, road and river modes at key transfer centres (e.g. Wuhan). A freight distribution centre would be developed at Pinghu north of Shenzhen to receive trains from the Mainland, consolidate cargo into containers as necessary, and despatch to Hong Kong (via PRL/PRT) or the Shenzhen ports. Conversely freight will be received from Hong Kong and Shenzhen ports at Pinghu for despatch to destinations in the Mainland.

7.5.5 The key market objective of the proposed PRL/PRT is not the existing road and river-based Cross Boundary freight movements of today, rather, the objective is to enter new geographic markets deeper into the Mainland and extend Hong Kong Ports' effective hinterland. This is of increasing importance as the Shenzhen ports and other Mainland ports compete with Hong Kong for its traditional Guangdong Province/South China market.

7.5.6 As a consequence, if open market competition continues, the PRL/PRT may not result in a substantial reduction in the existing road-based Cross Boundary freight traffic movements. Furthermore the target market deeper into China may be foregone totally (and use other Mainland ports) if the PRL/PRT is not implemented.

Emissions from Road Traffic

7.5.7 The following assessment attempts to estimate the potential road traffic related environmental (air quality) implications that may be associated with the implementation of the PRL/PRT.

7.5.8 The main RDS-2 Study has forecasted the volumes of freight going through the PRT. These are presented for different years as outlined in Table 7.1, for the high, central and low scenarios.

Table 7.1 Forecasts of PRT Container Traffic (thousand TEUs)

	2001	2006	2011	2016
High	18	60	261	1211
Central	15	45	184	799
Low	12	32	111	420

7.5.9 For the year 2016, it has been predicated that the PRT will have two opposite impacts for road traffic:

1. a reduction in container truck traffic between the boundary and the container terminals at the Kwai Chung Container Port (KCCP) resulting from a diversion from road to rail; and
2. the addition of container traffic within the KCCP between the PRT and the container terminals.

7.5.10 The main RDS-2 Study has concluded that, by 2016, the forecasted volume of freight that will have its origin or destination in South China is likely to be 31% or 244,000 TEUs. This compares with a forecast of 24.4 million TEUs in 2016 of all cargo (road, rail and river) through Hong Kong with an origin/destination in South China. Thus, in 2016, rail is expected to represent only 1% of Hong Kong's cargo volume with origin/destination in South China.

7.5.11 The other 69% of the forecast baseline 2016 rail container traffic will have its origin or destination in what the main RDS-2 Study has referred to as 'Other China'. In 2016, rail is expected to have a 32% market share of Hong Kong's cargo volume with origin/destination in Other China.

7.5.12 The predicted volume of freight, with its destination/origin in South China, that would be carried by the PRL/PRT combination could be generated from a spectrum of alternatives. In order to determine the possible shift from road to rail two possible extreme options have been considered:

- 'New traffic option' - in this option it is assumed that all 2016 forecast PRL/PRT rail traffic would represent cargo that otherwise would not have been routed through Hong Kong.
- 'Old traffic option' - in this option it is assumed that all the 2016 forecast PRL/PRT traffic would have routed through Hong Kong anyway.

'New Traffic Option'

7.5.13 Under this option there would be no diversion of Cross Boundary road traffic to Cross Boundary rail traffic. All rail freight with its origin/destination in South China would be 'new' to Hong Kong.

'Old Traffic Option'

7.5.14 Under this option, all the forecasted 2016 rail traffic routing through Hong Kong with origin/destination in South China would divert either from road to rail or from river to rail. In 2016 the distribution of South China based cargo routing through Hong Kong over road and river is predicted to be approximately 70%/30% respectively.

7.5.15 For the purposes of this assessment, it has been assumed that all diversion to rail will come from road. River trade is expected to come mainly of the west-bank of the PRD, for which rail is no alternative.

Other China

7.5.16 In relation to freight with origin/destination in 'Other China', it is assumed that this would result from a shift from ship to rail rather than road to rail, and as such, there would be no reduction in truck movements within the HKSAR.

Reductions in Truck Movements

7.5.17 Assessing the potential for diversion from road to rail as a result of implementation of the PRL/PRT proposals has resulted in ranges of results as presented in Table 7.2. The maximum reduction is based on the rail traffic forecast of 244,000 TEUs with origin/destination in South China and an average of 1.5 TEUs per truck load. It should be noted that the results presented are impacts on diversion of truck loads from road to rail. Associated truck movements (for empties, port back up, etc.) have not been included in the estimations.

Table 7.2 Diversion from Road to Rail, 2016 Central Forecasts

	Reduction in Road Freight from Boundary to KCCP	
	Maximum	Minimum
South China	163,000 truck loads	0
Other China	0	

7.5.18 Assuming an annualisation factor of 333, if the maximum diversion to rail took place the PRL/PRT would relieve the SAR roads of some 488 loaded truck loads per day in 2016; say 635 assuming about 30% empties. This is equivalent to less than 1% of forecast 2016 Cross Boundary traffic.

7.5.19 Applying similar assumptions to the Low and High forecasts gives a range of 398 to 960 truck loads per day as shown in Table 7.3.

Table 7.3 Reduction in Truck Movements Resulting from Maximum Diversion from Road to Rail

Scenario	TEUs Annual	Truck Loads Annual	Truck Loads Daily	Trucks incl. empties Daily
High	369,000	246,000	739	960
Central	244,000	162,667	488	635
Low	153,000	102,000	306	398

7.5.20 Conversely as noted above there is the potential that a large proportion of this traffic may not use Hong Kong port and/or road haulage if the PRL/PRT were not implemented. In this case there would be no benefit on the strategic roads in the SAR.

Movements from PRT to KCCP Terminals

7.5.21 The decrease in Cross Boundary traffic will be, in part, offset by the additional domestic truck loads from the PRT to the container port berths. All rail cargo passing through the PRT - whether South China or Other China, 'New Traffic or Old Traffic Options' - will be transported by truck from the PRT to the container port berths.

7.5.22 Under the RDS-2 Central forecasts, the total volume passing through the PRT is 799,000 TEUs in 2016. Assuming that cargo is moved between the PRT and the container port berths by trucks carrying 1.5 TEU on average, this implies that the PRL/PRT proposals will lead to an increased use of Hong Kong's domestic road network between the PRT and the container port berths of approximately 533,000 truck loads per annum. Assuming an annualisation factor of 333, the annual figures for 2016 give a daily traffic flow of 1,600 with no empty running, and 1,920 assuming 20% empty running. As this traffic will be confined to the Port area, there is the potential for other more environmentally acceptable forms of container transport to be considered at the later design stages (e.g. electric trolley /conveyance system) to move containers between the PRT and KCCP.

7.5.23 Applying similar assumptions to the Low and High forecasts gives a range of 1,009 to 2,909 truck loads per day as shown in Table 7.4. These estimates apply to both the Maximum and Minimum estimates of diversion from road to rail.

Table 7.4 Additional Truck Movements in Kwai Chung Port between PRT and Container Terminals

Scenario	TEUs Annual	Truck Loads Annual	Truck Loads Daily	Trucks incl. empties Daily
High	1,211,000	807,333	2,424	2,909
Central	799,000	532,667	1,600	1,920
Low	420,000	280,000	841	1,009

7.5.24 The environmental impacts of the PRL/PRT will a trade-off between the reduction in truck travelling between the Boundary and the Port (resulting from the diversion from road to rail), and those additional truck movements created between the PRT and container terminals in Kwai Chung.

7.5.25 Based on the truck movements from Tables 7.3 and 7.4 and the estimated distances travelled, the changes truck kilometres shown in Table 7.5 below.

Table 7.5 Reductions in Daily Truck Travel, 2016

	Reduction Diversion from Road to Rail		Additional Travel between PRT and CTS		Saving Truck-km	
Scenario	Truck Movements	Truck-km	Truck Movements	Truck-km	Maximum	Minimum
High	960	38,400	2,909	7,273	31,128	(7,273)
Central	635	25,400	1,920	4,800	20,600	(4,800)
Low	398	15,920	1,009	2,523	13,398	(2,523)

Note: (1) Under Minimum saving, figures in brackets represent increases in truck travel.

7.5.26 Using the data presented in Table 7.5, together with known emission factors, it has been possible to quantify the potential air quality "benefits" or "impacts" that are associated with either the increase or decrease in annual truck kilometres brought about as a result of the different scenarios.

7.5.27 NO_X and RSP were chosen as the reference air quality pollutants because they are presently the principal air pollutants affecting roadside air quality, and of greatest concern in Hong Kong. In order to give an indication of the potential greenhouse gas effects, the changes in CO2 were also estimated and compared.

Emission Factors

7.5.28 The data on quantities of air pollutant emissions produced per kilometre travelled by heavy goods vehicle are presented in Table 7.6. The data for NOx and RSP (which relates to the year 2011 and assumes, for example, that taxis are using LPG) was obtained from the EPD's vehicle emission group, whereas the data for CO_2 emissions was derived from the PATH Vehicle Emission Study.

Table 7.6 Quantities of Air Pollutants Generated per Kilometre Travelled by Heavy Goods vehicles (grams)

Pollutant	Emission Factors
NOx	3.84
RSP	0.53
CO_2	1,033

7.5.29 Using the data on changes in truck kilometres presented in Table 7.5 above together with the data on amounts of air pollutant emissions produced per kilometre travelled by heavy goods vehicles, the quantities of air pollutants that could be potentially 'saved' or 'generated' from the change in lorry movements associated with the implementation of the PRL were calculated.

7.5.30 The potential air quality implications are presented in Table 7.7 below.

Table 7.7 Potential Daily Emissions 'Savings' (tonnes)

Scenario	Maximum			Minimum		
	NOx	RSP	CO_2	NOx	RSP	CO_2
High	0.120	0.016	32.2	(0.028)	(0.004)	(7.5)
Central	0.079	0.011	21.3	(0.018)	(0.003)	(4.9)
Low	0.051	0.007	13.8	(0.010)	(0.001)	(2.6)

Note: (1) Under the ' Minimum' column, figures in brackets represent increases in emissions.

7.5.31 Using an annualisation factor of 333 the potential annual savings in emissions can be calculated. These are presented in Table 7.8.

Table 7.8 Potential Annual Emissions 'Savings' (tonnes per year)

Scenario	Maximum			Minimum		
	NOx	RSP	CO_2	NOx	RSP	CO_2
High	39.9	5.3	10,722.6	(9.3)	(1.3)	(2,497.5)
Central	26.3	3.7	7,092.9	(6.0)	(1.0)	(1,631.7)
Low	17.0	2.3	4,595.4	(3.3)	(0.3)	(865.8)

Note: (1) Under the ' Minimum' column, figures in brackets represent increases in emissions.

Discussion

7.5.32 It can be seen from the above that there are potential air quality savings (i.e. benefits) that could be accrued from the reduction in lorries associated with scenario whereby there is a maximum shift to transporting Cross Boundary freight from road to rail. Conversely, in the scenario whereby there is a net increase in lorries to transport freight from the PRT to and from the container port berths, there is a consequential potential increase in emissions, and thus a potential adverse impact.

7.5.33 With regard to the annual emissions, Table 7.8 indicates that the potential savings for NO_x that could be accrued from a reduction in lorries range from 17 tonnes per year for the low scenario to 39.9 tonnes per year for the high scenario. Similarly for RSP, the range for the low to high scenarios varies from 2.3 tonnes per year to 5.3 tonnes per year. Potential CO_2 savings range from 4,595 to 10,722 tonnes per year for the low and high scenarios respectively.

7.5.34 For the scenario where there is a net increase in lorry movements, the potential increases in emissions of NO_x range from 3.3 tonnes per year for the low scenario to 9.3 tonnes per year for the high scenario. For RSP the range for the low to high scenarios varies from 0.3 tonnes per year to 1.3 tonnes per year, whilst for CO_2 the range of potential emissions varies from 865 to 2,497 tonnes per year for the low and high scenarios respectively.

7.5.35 Whilst the above assessment has indicated that there could be both potential air quality benefits or air quality impacts associated with the different scenarios, in strategic terms the potential changes are relatively small.

CO_2 Emissions from the Operation of the Railways

7.5.36 Changes in NOx and RSP brought about by the reduction in road vehicles kilometres could have a significant influence on road side air quality at street level. However, as CO_2 is a "greenhouse gas", its effects are more "global". With the assumption that the PRL will operate electrically driven trains, the energy sector supplying electricity to power the locomotives will also emit CO_2 (assuming it is not generated by 100% nuclear or renewable power).

7.5.37 The inventory compiled for EPD as part of their Greenhouse Gas Study can be used to indicate the relative amounts of CO_2 that would be generated from different types of power stations. For a coal fired powered station, the inventory details that a 1kg of CO_2 will be produced for each kWh of electricity that is produced, whereas for combined-cycle gas turbines running on natural gas (NG CCGT) 0.4kg of CO_2 will be produced for each kWh of electricity produced. The generation of electricity by means of nuclear or renewable power would not result in any CO_2 emissions. Although the figures do not necessarily reflect the situation in 2016, they indicate that choices of fuel source and plant type made by the energy sector will have a significant influence on the magnitude of the rail related CO_2 emissions.

7.5.38 In the absence of detailed data for the energy usage of the new rail schemes, an estimate of the energy requirements for operating the new railways in the year 2016 has been undertaken based on the energy used by the rail corporations in 1997. This data was related to the proposed number of new above and below ground stations, and the projected increase in train kilometres that will be brought about as a result of the operation of the new rail schemes. Using this approach, the annual energy requirement for the operation of the PRL was predicted to be in the range of 6,000 to 28,000 MWh depending on different scenarios and alignments that could be adopted. However, combining these figures with those in paragraph 7.5.37 above to arrive at an estimation of the CO_2 emissions that will associated with electricity generated to operate the PRL in 2016 is an over-simplification of the issue. Please refer to paragraphs 8.2.20 to 8.2.24 on the discussion of CO_2 emissions associated with electricity generation for the operation of the expanded railway network.

7.5.39 It should also be noted that for the majority of containers carried, the PRL represents a very minor part of a much longer journey from the deep hinterland of China to another country or continent. The alternative to the PRL could likely involve a rail journey to another port in China and would also have air quality impacts. Clearly it is outside the scope of RDS-2 to assess the "global" impacts of these alternatives against comparable journeys via the PRL.

7.6 Mass Transportation Centre

7.6.1 The preceding sections have presented the key environmental impacts that may result from the implementation of the Component and Stand Alone schemes that comprise the proposed rail development options. Where appropriate, reference has also been made to the impacts that may be associated with other key related infrastructure, such as depots and/or the PRT. However, at the current level of engineering detail, and given that this is a strategic study, assessments have not been undertaken regarding the impacts that may result from individual stations or traction sub-stations etc. This is because the details and precise locations of these components are not yet finalised. Assessments of the impacts related to the construction and operation of these facilities will need to be undertaken at a later stage of the development process, and during the EIA stage.

7.6.2 However, the main RDS-2 study did undertake a Topical Study into the need for, and most appropriate location of, a Mass transportation Centre (MTC). After considering a number of other potential sites, the topical study resolved that the most appropriate location for the MTC would be at Hung Hom (HUH).

7.6.3 As with the preceding sections for the Component and Stand Alone schemes, this section presents a discussion on the MTC and the predicted key environmental impacts that are likely to be associated with its construction and operation.

Description and Assumed Construction Methodology

7.6.4 The concept of the Mass Transportation Centre is that it would serve as a terminus and interchange for Cross Boundary Inter-City services, providing customs and immigration facilities and acting as a centralised venue for a major KCR/MTR rail interchange and a bus/taxi PTI. The main functions of the MTC are as follows:

- to operate as a terminus for Cross Boundary Inter-City trains which require customs and immigration facilities. These are split into Through Train Services (TTS) (e.g. to Guangzhou) and Long Distance Services (LDS) (e.g. to Beijing and Shanghai);
- to serve as a regional railway station, including Boundary Train Services (BTS) to Lo Wu/Lok Ma Chau; and
- to provide good connections to KCR and MTR systems and road-based public transport (e.g. Buses and Taxis).