7 CONSTRUCTION IMPACTS

7.1 Introduction

7.1.1 The construction phase of the development has the potential to produce the most intrusive impacts, be they from noise, dust, or atmospheric emissions. Although transient in nature, these can cause disturbance to work, leisure and sleep. However, because of the nature of the sources there is usually considerable scope for mitigating the impacts.

7.2 Construction Programme

Preliminary Programme

7.2.1 The construction phase of Route 9 will occur over a period of 5 years and will have impacts with respect to air pollution, noise, visual aspects, water pollution, and vibration from construction operations. The areas affected and the impact on these areas have been identified in Section 7.4 and Section 10.

7.2.2 The overall construction programme for Route 9 will be phased over a period of four and a half years. A preliminary construction programme has been developed. Completion is currently anticipated for 2006/2007.

7.2.3 A bridge will be constructed over the Rambler Channel from CT8 to CT9. Viaducts will be constructed and will total 2.5km in length.

7.2.4 The overall construction period for the viaducts is anticipated to be from 2002 to 2006/2007.

7.3 Construction Methods for Viaducts

Viaducts - Land Piles

7.3.1 Machine bored piles are required and it is anticipated that these will be constructed using either an auger or a reverse circulation drilling rig.

Pile Cap and Pier Construction

7.3.2 Standard methods will be used for pile cap and pier construction with the concrete delivered by agitator/mixer trucks and placed by chute, skip, trunking or pump. The concrete will be compacted by vibrators. Backhoes will be used for excavation of the pile caps.

Deck Construction

7.3.3 It is anticipated that decks will be erected by precast segmental construction, for the decks over the piers.

7.3.4 For the purpose of the exercise it has been assumed that a launching girder will be used and the time to construct the 2.5km of viaduct will take 36 months. On this basis the deck construction (i.e. concreting works) should commence in 2003 and be completed in 2006/2007.

7.3.5 Precast segmental balanced cantilever erection methods will be used. A launching girder of approximately 130m long will be assembled and supported onto two temporary piers

for segment erection. This launching girder will be equipped with one front leg, one rear leg, one front pylon, one rear pylon and two lifting gantries. By means of re-positioning of the legs and pylons, the girder can travel forward, backward and transversely.

7.3.6 Segments will either be lifted in pairs or individually in accordance with the erection procedures. Segments will be tied onto the previous segments by using temporary prestressing bars. These bars will be removed when permanent cantilever cables have been stressed.

7.4 Construction Methods for Stonecutters Bridge

Substructure

7.4.1 Land piles and pile caps for the approach structure and Main Tower will be constructed in the same way as the viaducts.

Construction

7.4.2 It is expected that the main towers and possibly the approach span piers would also be constructed using slip form techniques. However the selected contractor will decide on the precise construction methods at a later stage.

7.4.3 For the main towers it is assumed that 1m/day would be achievable, giving 8 months slip forming construction time, with a month either side allowed for assembling/dismantling the rig. Assuming that the contractor chooses to slip form the approach piers, 1.5m/day should be achieved, owing to the simpler construction, and therefore with 2 rigs this should take fifteen months in total.

7.4.4 It is assumed that concrete would be supplied from a haul road.

Anchor Block Construction

7.4.5 On the assumption that the bridge will be a suspension bridge (the more conservative case), two anchor blocks will be required, each one located approximately 220m behind the bridge towers, one will locate at CT8 and one at CT9. Construction will involve the excavation of a foundation 70m in diameter and 50m deep. The foundations and anchor block will then be formed. This is essentially a concreting operation.

Deck Construction

7.4.6 Deck construction for the main span will be deck units transported by barge and then craned into position.

7.4.7 The decks for the approach spans will be constructed using precast units. It is anticipated that the deck units for both sections will be manufactured at yards remote from the Bridge, (possibly outside Hong Kong) and transported to storage yards on Tsing Yi. However concrete casting near the Project is not ruled out at this stage. Due to environmental considerations suitable sites should allow sufficient buffer distances to SRs. The most suitable locations on these grounds would be at the industrial areas outside the western portal of the Nam Wan Tunnel and the reclamation to the east of Stonecutters Bridge (CT8, Figures 1.2 and 1.4).

Bridge Construction Equipment

7.4.8 Details of the estimated construction equipment required for the various construction phases will be presented in construction impact calculation tables in the final EIA and EM&A manual. The information will be used to estimate construction noise and air quality impacts.

7.5 Sensitive Receivers

7.5.1 The proximity of the SRs discussed in the preceding sections is critical to the extent and intensity of construction impacts. Areas of adverse impacts and potential non-compliance with the noise and air quality objectives, arising from the noise, air, water and waste impacts, according to the current development program are assessed and discussed below.

7.6 Noise

7.6.1 Precise predictions of construction noise require a detailed knowledge of the type and numbers of plant to be used, detailed methods of working, and inventories of plant. These are required to enable a detailed assessment to be carried out. Indicative figures regarding anticipated noise levels could be generated from generic plant inventories. At this stage the uncertainties regarding construction phasing and methods in the various sections of the Project still remain but these have been determined in sufficient detail to allow useful estimates to be provided.

7.6.2 Under the NCO, construction noise permits will be required for activities during the restricted periods. The majority of the Study Area falls within the Kowloon and New Territories Designated Areas (Plans Nos.EPD/NP/NT-03 and EPD/NP/KLN/-01). Construction noise in such areas is controlled by the Technical Memorandum on Noise from Construction Work in Designated Areas (the TM). Controls in designated areas are more stringent and the noise criteria to be achieved are set significantly lower

7.6.3 In addition it is important to note that the recent revisions to the Technical Memorandum on Noise from Percussive Piling creates more stringent controls and the proximity of some NSRs to certain areas of the alignment will restrict the use of percussive piling.

7.6.4 Potential noise impacts are generally calculated based on typical suites of noisy site equipment using the methodology given in the various technical memorandums. They include TM on Noise from Construction Work other than Percussive Piling, TM on Construction work involving Percussive Piling and TM on Noise from Construction Work in Designated Areas. The potential sources of noise impact will arise from:

- drilling and blasting;
- general earth works and spoil removal;
- percussive and vibratory piling;
- viaduct building works; and
- all construction activities.

7.6.5 Night work may exceed the criteria in some locations and would require measures to reduce noise to levels prescribed in the Technical Memoranda (TM) on noise from

construction work. Percussive piling and drilling and blasting for the tunnel construction could cause significant impacts in the area and to the NSRs.

7.6.6 The large diameter of the tunnel effectively precludes the use of tunnel boring machine and therefore drill and blast methods will most probably be used in the tunnel excavation. If drill and blast methods are used, experience from previous projects, such as the Route 3 Cheung Ching Tunnel, indicates that the blast shock-waves (particle velocity limit of 25mm/sec for reinforced concrete structure and 12mm/sec for sensitive structures) can easily be complied with by controlling the amount of explosive charge used and well designed blasting patterns. It should be noted that the R3 Cheung Ching Tunnel, which is located a depth of 35m below the Cheung Ching Estate, is closer to adjacent structures than for the proposed Nam Wan Tunnel. Therefore it is expected that fewer constraints in terms of blast vibrations and shock waves be envisaged from the construction of the Nam Wan Tunnel. However additional structures such as the new visiting staff quarters at the Tsing Yi Technical College and existing buildings near the eastern portal of the Nam Wan Tunnel will also need to be taken into account.

Noise Source Inventory

7.6.7 Table 7.1 provides an indication of the main construction activities, the numbers of equipment and the sound power levels arising from each activity.

Table 7.1 : Equipment Schedule and Sound Power Levels

Activity	PME	TM ref.	Unit	SWL dB(A)	Sub-SWL dB(A)	Total SWL dB(A)
1 Piling	Bored piling rig	CNP166	1	100.0	100.0	
	Dump truck	CNP067	1	117.0	117.0	
	Excavator	CNP081	1	112.0	112.0	118.3
2 Pile/pile Cap/pier formation	Concrete lorry	CNP044	1	109.0	109.0	
	Concrete pump	CNP047	1	109.0	109.0	
	Concrete vibrator	CNP170	1	113.0	113.0	
	Bar bender	CNP021	1	90.0	90.0	
	Compressor	CNP002	1	102.0	102.0	115.7
3 Deck construction	Launching girder	---	1	100.0	100.0	
	Crane	CNP049	1	95.0	95.0	101.2
4 Surfacing	Asphalt spreader	CNP004	1	109.0	109.0	109.0
5 Bridge towers	Concrete lorry	CNP044	2	109.0	112.0	
	Concrete pump	CNP047	1	109.0	109.0	
	Concrete vibrator	CNP170	1	113.0	113.0	
	Bar bender	CNP021	1	90.0	90.0	
	Compressor	CNP002	1	102.0	102.0	
	Crane	CNP049	1	95.0	95.0	116.6
6 Anchor blocks	Excavator (in hole)	CNP081	5	112.0	119.0	
(Foundation excavation)	Excavator (surface)	CNP081	3	112.0	116.8	

Activity	PME	TM ref.	Unit	SWL dB(A)	Sub-SWL dB(A)	Total SWL dB(A)
	Dump trucks	CNP067	3	117.0	121.8	
	Tower Cranes	CNP049	3	108.0	112.8	124.7
7 Anchor blocks (Foundation concreting)	Concrete lorry	CNP044	2	109.0	112.0	
	Concrete pump	CNP047	1	109.0	109.0	
	Concrete vibrator	CNP170	6	113.0	120.8	
	Generator	CNP101	3	108.0	112.8	122.1
8 Anchor blocks (Concreting)	Concrete lorry	CNP044	8	109.0	118.0	
	Concrete pump	CNP047	4	109.0	115.0	
	Concrete vibrator	CNP170	20	113.0	126.0	
	Generator	CNP101	10	108.0	118.0	
	Crane	CNP049	2	95.0	98.0	127.5
	Still saw	---	2			
9 Bridge deck	Barge	CNP061	1	104.0	104.0	
	Crane	CNP049	1	95.0	95.0	104.5
10 Tunnel (portals)	Dump truck	CNO067	3	117.0	121.8	
	Excavator	CNP081	1	112.0	112.0	122.2

Methodology

7.6.8 The construction noise calculation was based on the procedure contained in the Technical Memorandum on Noise from Construction Work other than Percussive Piling. The corrected noise levels were calculated by taking into account the following influencing factors:

- Sound Power Level – The sound power level of each item of Powered Mechanical Equipment (PME) is listed in the Technical Memorandum.
- Distance Attenuation – All items of PME were grouped at the notional source position which is a point mid-way between the approximate geographical centre of the construction site and its boundary nearest to the Noise Sensitive Receiver (NSR). The corresponding correction factors are set out in the Technical Memorandum.
- Barrier Effect – According to the Technical Memorandum, a negative correction of 10 dB(A) can be applied to the predicted noise level when NSR is considered to be totally screened. In addition, a negative correction of 5 dB(A) can be applied if the NSR is considered to be partially screened.
- Façade Correction – A positive correction of 3 dB(A) has been applied to consider the effect of reflection from facades.

7.6.9 The maximum construction noise levels at facades of dwellings and schools are 75 dB(A) and 70 dB(A) respectively during the non-restricted period.

7.6.10 A set of representative existing and planned NSRs has been compiled with regard to the proposed alignment of Route 9 and is summarised in Table 7.2.

Potential Impacts

7.6.11 The sensitive receivers located near the Lai Wan Interchange at Mei Foo and the KMB site will be most affected by the construction phase noise impacts. The proposed developments on the West Kowloon Reclamation will also be affected if these are in place prior to construction of Route 9. Other areas affected are the Stonecutters Military Base, Mayfair Garden, the Tsing Yi Technical college and Staff Quarters.

7.6.12 Based on the above assumed equipment schedules and probable sequence of activities, estates of noise impact are shown in Table 7.2.

Table 7.2 : Unmitigated Construction Noise Levels at Noise Sensitive Receivers (NSRs)

NSR	Activity	Total SWL dB(A)	Shortest Distance (m)	Predicted Noise Level dB(A)	Maximum Allowable No. of Activity
Existing Mei Foo Sun Chuen (MF1)	Piling	118	200	67	6
	Pile/pile cap/pier formation	116	200	65	10
	Deck construction	112	200	61	25
	Road pavement	112	200	61	25
Planned Site 10 Landuse	Piling	118	60	77	-
	Pile/pile cap/pier formation	116	60	75	1
	Deck construction	112	60	71	2
	Road pavement	112	60	71	2
Planned Site 6 Landuse	Piling	118	75	75	1
	Pile/pile cap/pier formation	116	75	73	1
	Deck construction	112	75	69	3
	Road pavement	112	75	69	3
Existing Stonecutter Island (SC1)	Piling	118	75	75	1
	Pile/pile cap/pier formation	116	75	73	1
	Deck construction	112	75	69	3
	Road pavement	112	75	69	3
	Bridge tower	117	650	56	84
	Anchor block (Foundation excavation)	124	650	63	16
	Anchor block (Foundation concreting)	122	650	61	26
	Anchor block (concreting)	127	650	66	8
	Bridge deck	113	650	52	211
Technical College Quarter (QTC1)	Piling	118	90	74	1
	Pile/pile cap/pier formation	116	90	72	2
	Deck construction	112	90	68	5
	Road pavement	112	90	68	5
Existing Technical College (TYCT1)	Piling	118	80	75	0
	Pile/pile cap/pier formation	116	80	73	0
	Deck construction	112	80	69	1
	Road pavement	112	80	69	1
Existing Mayfair Garden (MAY1)	Piling	118	200	67	6
	Pile/pile cap/pier formation	116	200	65	10
	Deck construction	112	200	61	25
	Road pavement	112	200	61	25
Existing Cheung Ching Estate (CCE1)	Piling	118	265	65	11
	Pile/pile cap/pier formation	116	265	63	17
	Deck construction	112	265	59	44
	Road pavement	112	265	59	44

Mitigation

7.6.13 Table 7.2 indicates that for the majority of activities there will be compliance with the 75 dB(A) guideline. Piling activity may cause noise levels to reach 77 dB(A) at the proposed development Site 10. If this site is developed and occupied prior to the construction of Route 9, there may be potential impacts. Tables 7.3 and 7.4 show the Sound Power Levels generated if silenced equipment is used and the impacts on receivers.

Table 7.3 : Silenced Equipment Schedule and Sound Power Levels

No.	Activity	PME	Silenced Type	TM ref.	@SWL dB(A)	No. of Pcs	Sub-SWL dB(A)	Total-SWL dB(A)
1	Piling	Bored piling rig	-	CNP166	100	1	100	113
		Dump truck	Yes	CNP067	112	1	112	
		Excavator	Yes	CNP081	107	1	107	
2	Pile/pile cap/ pier formation	Concrete lorry	Yes	CNP044	104	1	104	111
		Concrete pump	Yes	CNP047	104	1	104	
		Concrete vibrator	Yes	CNP170	108	1	108	
		Bar bender	-	CNP021	90	1	90	
		Compressor	Yes	CNP002	100	1	100	
3	Deck construction	Mobile Crane	-	CNP048	112	1	112	112
4	Road pavement	Road roller	-	CNP185	108	1	108	112
		Asphalt paver	-	CNP004	109	1	109	
5	Bridge tower	Concrete lorry	Yes	CNP044	104	2	107	112
		Concrete pump	Yes	CNP047	104	1	104	
		Concrete vibrator	Yes	CNP170	108	1	108	
		Bar bender	-	CNP021	90	1	90	
		Compressor	Yes	CNP002	100	1	100	
		Tower crane	-	CNP049	95	1	95	
6	Anchor block (Foundation Excavation)	Excavator (in hole)	Yes	CNP081	107	5	114	119
		Excavator (surface)	Yes	CNP081	107	3	112	
		Dump truck	Yes	CNP067	112	3	117	
		Tower crane	-	CNP049	95	3	100	
7	Anchor block (Foundation Concreting)	Concrete lorry	Yes	CNP044	104	2	107	117
		Concrete pump	Yes	CNP047	104	1	104	
		Concrete vibrator	Yes	CNP170	108	6	116	
		Generator	Yes	CNP101	100	3	105	
8	Anchor block (concreting)	Concrete lorry	Yes	CNP044	104	8	113	122
		Concrete pump	Yes	CNP047	104	4	110	
		Concrete vibrator	Yes	CNP170	108	20	121	
		Generator	Yes	CNP101	100	10	110	
		Tower crane	-	CNP049	95	2	98	
9	Bridge deck	Barge	-	CNP061	104	1	104	113
		Mobile crane	-	CNP048	112	1	112	
10	Tunnel (portal)	Dump truck	-	CNP067	117	3	122	122
		Excavator	-	CNP081	112	1	112	

Table 7.4 : Mitigated Construction Noise Levels at Noise Sensitive Receivers (NSRs)

NSR	Activity	Total SWL dB(A)	Shortest Distance m	Predicted Noise Level dB(A)	Maximum Allowable No. of Activity
Existing Mei Foo Sun Chuen (MF1)	Piling	113	200	62	20
	Pile/pile cap/pier formation	111	200	60	31
	Deck construction	112	200	61	25
	Road pavement	112	200	61	25
Planned Site 10 Landuse	Piling	113	60	72	2
	Pile/pile cap/pier formation	111	60	70	2
	Deck construction	112	60	71	2
	Road pavement	112	60	71	2
Planned Site 6 Landuse	Piling	113	75	70	2
	Pile/pile cap/pier formation	111	75	68	4
	Deck construction	112	75	69	3
	Road pavement	112	75	69	3
Existing Stonecutter Island (SC1)	Piling	113	75	70	2
	Pile/pile cap/pier formation	111	75	68	4
	Deck construction	112	75	69	3
	Road pavement	112	75	69	3
	Bridge tower	112	650	51	266
	Anchor block (Foundation excavation)	119	650	58	53
	Anchor block (Foundation concreting)	117	650	56	84
	Anchor block (concreting)	122	650	61	26
	Bridge deck	113	650	52	211
Planned Technical College Quarter (QTC1)	Piling	113	90	69	4
	Pile/pile cap/pier formation	111	90	67	6
	Deck construction	112	90	68	5
	Road pavement	112	90	68	5
Existing Technical College (TYTC2)	Piling	113	80	70	1
	Pile/pile cap/pier formation	111	80	68	1
	Deck construction	112	80	69	1
	Road pavement	112	80	69	1
Existing Mayfair Garden (MAY1)	Piling	113	200	62	20
	Pile/pile cap/pier formation	111	200	60	31
	Deck construction	112	200	61	25
	Road pavement	112	200	61	25
Existing Cheung Ching Estate (CCE1)	Piling	113	265	60	35
	Pile/pile cap/pier formation	111	265	58	55
	Deck construction	112	265	59	44
	Road pavement	112	265	59	44

Cumulative Impacts

7.6.14 The construction programme is only approximate at this stage, however, an estimate of cumulative impacts from multiple construction activities is required. It is estimated that 5 piling and pier formation activities will be undertaken simultaneously along the alignment. In view of the extent of the alignment, these will not result in cumulative impacts. It is likely that within each of these 5 locations, piling and pier formation will be undertaken simultaneously, albeit with a distance separation of approximately 40m. Subsequently, deck construction and road paving will also be undertaken simultaneously. For Stonecutters Bridge, all bridge construction works are considered together as a cumulative impact. As shown in Table 7.5, no areas are expected to have cumulative noise impacts in exceedance of 75 dB(A) with the provision of mitigation. The tables provided will enable a future contractor to establish the acceptable number of simultaneous activities in any one area, and plan the construction programme and degree of mitigation accordingly.

Table 7.5 - Cumulative Construction Noise Impacts

Receiver	Activity	Maximum Cumulative Noise Impact (with Mitigation)
Existing Mei Foo Sun Chuen (MF1)	Piling/Cap & pier formation	64
	Desk construction/road paving	64
Planned Site 10	Piling/Cap & pier formation	74
	Desk construction/road paving	74
Planned Site 6	Piling/Cap & pier formation	72
	Desk construction/road paving	72
Existing Stonecutters Island (SC1)	Piling/Cap & pier formation	72
	Desk construction/road paving	72
	Bridge Construction	64
Planned Technical College Quarter (QTC 1)	Piling/Cap & pier formation	71
	Desk construction/road paving	71
Existing Technical College (TYTC2)	Piling/Cap & pier formation	72
	Desk construction/road paving	72
Existing Mayfair Garden (MAY1)	Piling/Cap & pier formation	64
	Desk construction/road paving	64
Existing Cheung Ching Estate (CCE1)	Piling/Cap & pier formation	62
	Desk construction/road paving	62

7.7 Air Quality

7.7.1 The principal impact on air quality during the construction of Route 9 will be from increased dust concentrations. Some SO_2 and NO_x will be produced from diesel-powered equipment and vehicles involved in the works, but these will be readily dissipated and should not reach significant concentrations. This section of the Report aims to highlight the potential air pollution problems associated with the Project and to present an assessment of air quality resulting from construction. Recommendation of some generic mitigation measures made.

7.7.2 Activities contributing to construction dust include excavation and earthworks, loading/unloading of friable materials, aggregate stockpiles of materials, concrete batching and finishing, and vehicle movements on unpaved haul roads. Dust generating activities will include site levelling and excavation works, handling and stockpiling of excavated spoil, vehicle movements on unpaved haul roads, concrete batching processes and other general construction works

7.7.3 These activities may have the potential to create considerable dust concentrations and impacts. Construction dust is controlled by the Construction Dust Regulations under Air Pollution Control Ordinance. The APCO places statutory limits (Air Quality Objectives (AQOs)) on typical air pollutants and the maximum allowable concentrations, which should not be exceeded (Table 3.2).

7.7.4 The extent of dust impact exceeding the established standards depends on type and intensity of activities, weather conditions and distances between work areas and receiver. A computer model, Fugitive Dust Model (FDM) was used to assess the potential dust impact arising from the construction activities. Potential air quality impacts for various sites will be calculated based on emission factors derived from USAEPA AP-42.

7.7.5 There is insufficient available information such as detailed construction programme, methodologies and location of active works or haul road alignment to enable detailed assessment. However, a quantitative estimate of likely construction dust impact has been made to highlight areas of potential dust problems and technical approaches for dust control.

Likely Dusty Construction Activities

7.7.6 Based on the nature of the Project, the following activities and / or facilities are regarded as the major dust sources and attention to the following operations will be needed to minimise dust nuisance.

(a) haul roads for transport of spoil / rock away from the construction sites to suitable dumping areas;

(b) excavation / site formation work;

(c) tunneling and portal formation work;

(d) any in-situ concrete batching plant and/or crushing plant; and

(e) stockpiling/aggregate storage on site.

Construction Dust Impact Assessment

Meteorological Input

7.7.7 Meteorological data from the Tsing Yi station was used. The input data include wind speed, wind direction and mixing height.

Dust Emission Rates

7.7.8 Emission factor for typical construction operations given in the *US EPA -Compilation of Air Pollutant Emission Factors, AP-42, 4th Edition, 1985* was used and it is: 1.2 tons per acre of construction per month of activity.

7.7.9 Dust emission factor of 1.319×10^{-4} gm/sec sq. m. was input in the model and it was obtained by converting the above emission factor based on 26 working day per month and 10 operation hours per day.

7.7.10 An active construction site area was assumed to be $500m^2$.

7.7.11 No Mitigation Measure was considered in the model.

Model Results

7.7.12 The maximum TSP level at receptors with different distance from the construction site boundary are shown in the Tables 7.6 and 7.7 below:

Table 7.6 : Predicted TSP levels at Distances from the Construction Works

Distance (m)	Maximum 1 Hour Average TSP (mg/m3)	Maximum 24 Hour Average TSP (mg/m3)	Maximum Long- Term TSP (mg/m3)
20	513	145	11
40	460	112	7
60	395	69	4
80	371	52	3
100	338	44	2
150	249	30	1
200	179	21	1
250	133	15	1
300	102	12	1

Table 7.7 : Predicted TSP levels at Receivers

Sensitive Zone	ASR	Distance (m)	Maximum 1 hour average TSP (mg/m3)	Maximum 24-hour average TSP (mg/m3)	Maximum Long-term TSP (mg/m3)
Lai Wan Interchange Zone	Mei Foo Sun Chuen (MF1)	200	179	21	1
	Planned Site 10 Landuse	60	395	69	4
	Planned Site 6 Landuse	75	377	56	3
Stonecutters Island Zone	Existing Stonecutter Island (SC1)	75	377	56	3
CT9 Terminal Zone	Planned Technical College Quarter (QTC1)	90	355	48	3
	Existing Technical College (TYTC2)	80	371	52	3
	Existing Mayfair Garden (MAY1)	200	179	21	1
	Existing Cheung Ching Estate (CCE1)	265	124	14	1

7.7.13 From these results it would not be expected that there would be dust impacts at the existing and planned receivers (including the stadium).

Dust Suppression Measures

7.7.14 Although predictions indicate that dust impacts will be unlikely, the following measures outline both administrative and technical measures that will form the principal framework for minimising dust generation. These include such measures as :

(a) provision of adequate wheel/vehicle washing facilities;

(b) covering the vehicle loads with tarpaulins;

(c) limitations on the size, weight or axle loads of vehicles using particularly difficult roads;

(d) use of wind-breaks/net screens/semi-permeable fences;

(e) reduce speeds and limit movement of vehicles, use upward exhausts;

(f) sealing of open areas and well trafficked areas of the site, and

(g) use water bowsers, sprays or vapour mists.

7.8 Water Quality

7.8.1 Construction phases of the development of the Stonecutters Bridge and any other activities at the waterfront have the ability to produce intrusive impacts. These can include impacts from construction runoff and drainage, workforce sewage arisings and general construction work.

7.8.2 Site formation work for Stonecutters Bridge on the Stonecutters Island side has been completed as part of the CT8 reclamation. On the Tsing Yi side, the reclamation works

associated with the Bridge are planned to be carried out by the CT9 developer as part of the CT9 reclamation. The environmental issues associated with reclamation works such as mud dredging and disposal have already been addressed under the CT9 project. The current timings are that the reclamation will be complete before Route 9. The construction of the bridge foundations or piers takes place as part of the CT9, the additional construction works for R9 will have no additional significant effect on the water quality at the Rambler Channel.

7.8.3 The greatest potential water quality impact in the area will come from the construction of CT9. At the present position is that CT9 will be constructed before R9.

Mitigation

7.8.4 Construction sites around the R9 will require storm-water drainage and possibly foul drainage to serve lavatories for site staff. Such drainage should be designed to the satisfaction of the authorities and prevent contamination of surrounding waters. Such facilities must be maintained and cleared by the operators.

7.8.5 The following mitigation measures should be implemented during the construction phase to ensure minimal environmental impact:

- Provision of perimeter channels to intercept storm runoff from the site. These should be constructed in advance of site formation works and earthworks.
- Sediment removal facilities such as sand traps, silt traps and sediment basins should be provided to remove particles from runoff. These facilities should be properly maintained.
- Programming of the works to minimise soil excavation works during rainy season.
- Exposed soil and slope surfaces should be protected by shotcrete or hydroseeding as soon as possible to reduce the potential for soil erosion.
- Temporary access roads should be protected by crushed gravel.
- Trench excavation should be avoided in the wet season and if this is unavoidable then these should be excavated and backfilled in short sections.
- Open stockpiles of construction materials and tunnel spoil should be covered with tarpaulin during rainstorms.
- Septic tanks and chemical toilets should be provided for the work force. Grease traps should be provided for wastewater generated from canteens.
- Drainage serving an open oil filling point should be connected to storm drains via a petrol interceptor.
- Vehicle and plant servicing areas, vehicle wash bays, and lubrication bays should be located within roofed areas and the drainage in these areas should be connected to foul sewers via a petrol interceptor.
- Wheel wash should be provided at site exits and washwater should be reused as far as possible. Washwater should be disposed of in storm drains via a silt trap.

7.8.6 Parameters for regular measurement should include turbidity, dissolved oxygen, suspended solids and nutrients. Temperature and pH should also be noted. Monitoring should be undertaken at the site discharge locations.

Summary

7.8.7 The current position is that construction of CT9 will precede R9, hence impacts from R9 will be minimal.

7.9 Construction Waste

7.9.1 Waste arising from construction work will typically comprise:

- excavated material;
- construction waste;
- vegetation waste;
- chemical waste; and
- general refuse.

7.9.2 The waste may typically cause nuisances in the form of dust and odour but providing it is segregated, stored, transported and disposed of in line with the Waste Disposal Ordinance (WDO), Waste Disposal (Chemical Waste)(General) Regulations and other recommended guidelines no significant adverse impacts need be anticipated. Efforts will be made during the planning stage to minimise waste impacts and a system for segregating construction waste for recycling and reuse will be designed.

7.9.3 Excavated material will either be stockpiled for use on Site or transported off-site for disposal. On-site stockpiles should be properly covered with tarpaulins or sprayed with an encrusting agent to prevent wind-blown dust emissions. Excavated material for disposal should be taken to public fill or other reclamation areas.

7.9.4 To facilitate reuse and recycling, construction waste should be sorted on site into construction & demolition (C&D) waste for disposal to landfill and public fill (inert waste such as soil, rock, concrete, asphalt, brick etc.) to be delivered to public filling areas or reclamation sites.

7.9.5 Chemical waste, including spent oil and waste fuel drums, should be stored either in a central bunded facility or on metal pallets to avoid contamination of soil and water from chemical leakage. Chemical wastes should be collected and disposed of by a licensed chemical waste handler per the Waste Disposal (Chemical Waste) (General) Regulations.

7.9.6 Approximately 1 ha of vegetated area will be cleared. Standard practice is to cut standing vegetation and bulldoze the remainder. Vegetation waste will then be loaded on trucks for transportation off-site disposal to landfill. Disposal procedures will be same as those for general refuse.

7.9.7 General refuse should be collected in skips located throughout the site area, and should undergo separation before being transported off-site for disposal to landfill.

Disposal of Tunnel Spoil

7.9.8 Tunnel excavation will be through medium to strong granitic and volcanic rocks. It is anticipated that the tunnelling will proceed 24 hours a day. Current estimates indicate that over 370,000m^3 of tunnel spoil (primarily rock fill) will be excavated (figures estimated at +/-5%). The rate of production will be approximately 3,500m^3/week from

both the eastbound and westbound tunnels and the tunnel excavation is anticipated is anticipated to take almost one year assuming working from both ends simultaneously

7.9.9 Spoil mucked out at night from the tunnel should be stockpiled at a convenient location near the portals for disposal in the daytime. In this context attempts should be made to minimise disturbance to areas of local ecological interest at the eastern portal. There is much more space at the western portal and there are unlikely to be constraints to stockpiling. Dust suppression methods would not normally be anticipated for damp spoil but provision of adequate wheel/vehicle washing facilities, covering the vehicle loads with tarpaulins, limitations on the size, weight or axle loads of vehicles using particularly difficult roads, use of wind-breaks/net screens/semi-permeable fences, reduction of speeds and limitations to movement of vehicles, use of upward exhausts, sealing of open areas and well trafficked areas of the site and use water bowsers, sprays or vapour mists are still relevant for general dust suppression.

7.9.10 If the rock tunnel spoil is of suitable quality it may be made available for reuse on-site or delivered to a third party for crushing and gravel production. Given the linear nature of the site works immediate on site reuse may not be feasible. However, it is possible that a good portion of tunnel spoil could be sent to a third party, processed, and reused in the R9 construction. Remaining spoil can subsequently be removed by barge or by road to the appropriate gazetted dump. Barging would be favoured for reducing traffic movement through Tsing Yi, but double handling of material would result in additional dust generation. Land should be made available for the stockpiling and barging point(s) may be needed for the spoil disposal. The Fill Management Committee (FMC) will be consulted in identifying suitable dumping sites.

7.10 Construction Control

Table 7.8 identifies recommend measures for inclusion in the Contract Documentation.

Table 7.8 : Environmental Mitigation Measures for Route 9 Contractors

Impact	Activity	Location	Environmental Control
Air	Material Storage	Construction site	Covers for dusty stockpiles
	Vehicle movement	Construction site, site exit	Haul road watering, vehicle wheel wash prior to exit.
	Plant maintenance	Plant maintenance area	All plant shall be maintained to prevent any undue air emissions.
Noise	All plant activity	Construction site	Unrestricted work areas are 0700-1900 weekdays. Any restricted hours works will require a permit. Permits shall be copied to the environmental team. Noisy works on Saturday shall be delayed where possible to the late morning. Recommendation to use silenced equipment where practical and available. Use of noise screens where practical.
	Plant maintenance	Plant maintenance area	All plant shall be maintained to prevent any undue noise nuisance.
Water	Wheel wash	Site exit	All wheel wash water shall be diverted to a sediment pit.
	Concrete Truck Washout	Construction site	All concrete trucks shall wash out into a lined pit.
	Surface water diversion	Construction site	All clean surface water shall be diverted around the site.
	Sediment control	Rambler Channel	Sediment bunds shall be maintained and excavated as necessary to prevent sedimentation of the channel.
	Fuel can storage	Construction site	All fuel cans shall be placed within a bunded area. Any fuel spills shall be mopped up as necessary.
	Slope covers	Construction site	Finished slopes and other slopes near drainage areas shall be covered prior to rains to reduce sedimentation of runoff.
Ecology	Excavation works	East/West Tsing Yi	Excavation works shall avoid sensitive areas.
Contaminated Land	Material, plant movement and fuel can refilling.	Construction site	Any fuel or oil spills shall be excavated and disposed of.
	Generators	Construction site	All generators shall be placed within a bunded area. Any fuel spills shall be mopped up as necessary.

Waste	Material containers	Construction site	All empty bags and containers shall be collected for disposal.
	Legal requirements	Construction site	Different types of waste should be segregated, stored, transported and disposed of in accordance with the relevant legislative requirements and guidelines
	On-site separation	Construction site	On-site separation of municipal solid waste and construction/demolition wastes should be conducted as far as possible in order to minimize the amount of solid waste to be disposed to landfill.
	Temporary storage area	Construction site	Separated wastes should be stored in different containers, skips, or stockpiles to enhance reuse or recycling of materials and encourage their proper disposal.
	Record of wastes	Construction site office	Records of quantities of wastes generated, recycled and disposed (with locations) should be properly kept.
	Trip-ticket system	Construction site	To monitor the disposal of waste at landfills and control fly-tipping, a "trip-ticket" system for all solid waste transfer/disposal operations should be implemented. The system should be included as a contractual requirement, and monitored by the Environmental Team and audited by the Independent Checker (Environment).
	Worker generated litter	Construction site	Litter receptacles shall be placed around the site. Litter shall be taken regularly to the refuse collection points.
Complaints	Neighborhood nuisance	All areas	All complaints regarding construction works shall be relayed to the environmental team.
Legal	Permits	Construction Site	All environmental permits shall be copied to the environmental team.