

3. NOISE IMPACT ASSESSMENT

3.1 Introduction

- 3.1.1 This chapter presents an assessment of noise impacts associated with the construction and operation of the proposed development at Whitehead and Lee On (the Project). Worst case impacts (i.e. based on the preliminary Preferred Development Option) on the representative Noise Sensitive Receivers (NSRs) have been assessed. Details of the proposed development and associated infrastructure works are described in Chapter 2.
- 3.1.2 The proposed development intensity is a result of optimizing the development potential of the Study Area with respect to the major development parameters such as size of the recreation use, overall population threshold and target housing number, the public views solicited from the consultations with Sha Tin District Board (STDC) and Town Planning Board (TPB) and the conclusion made by the Study Steering Group and the CPLD in January 2002.
- 3.1.3 Whilst it is fully appreciated from the public consultations that there is a strong desire to limit the total population and development intensity of the Study Area, it is equally important to make use of the mass transportation system to achieve the best integration of transport and land use planning for the Study Area. With the implementation of the MOS Rail, higher intensity development should therefore be assumed at the Wu Kai Sha Station to optimize utilization of land in close proximity to rail station. To strike a balance, both the Study Steering Group and CPLD considered more appropriate to limit the development intensity of Wu Kai Sha Station Development to a plot ratio of 5. For the Lok Wo Sha site, only a maximum plot ratio of 3 is proposed in view of its prominent location at the headland and hence the visual impact resulting from more intensive development.
- 3.1.4 According to latest development proposal by KCRC, the prospective developer, circulated for Governmental departmental comment on 3 April 2002, the proposed development at the Wu Kai Sha Station Development would have a plot ratio of 5 and would comprise 7 towers of 40 to 48 storeys (maximum height 183 mPD). In this context, the Consultant then revised the development parameters of Wu Kai Sha Station Development to a plot ratio of 5, and the revised scheme (based on KCRC's proposal circulated on 3 April 2002) became the Preferred Development Option of the Study and served as the basis for the preparation of the final layout plan and its explanatory statement.
- 3.1.5 The KCRC's proposed residential development at the Wu Kai Sha Station Development will be on top of a main podium which will house a public transport interchange (PTI). The layout of the residential development is constrained by the

layout of the main podium, PTI and their foundations. The construction of the main podium by KCRC will commence in one or two months so that PTI within the main podium can be commissioned together with the MOS Rail in 2004. Material revisions to the layout of the residential development will require significant revisions to the main podium, PTI and their foundations which is impractical to achieve due to the impending commencement of the main podium works on site. Therefore, further material revision of the layout of the residential development is considered impractical.

3.1.6 The main noise impacts are identified as follows:

- (i) Construction phase – the noise generated from construction activities and related powered mechanical equipment have the potential to pose adverse noise impacts to the surrounding sensitive receivers.
- (ii) Operational phase – the future noise environment will be affected by road traffic noise, rail noise from Ma On Shan (MOS) Rail and fixed noise sources such as pumping station, rail station and ventilation systems.

3.1.7 Appropriate mitigation measures have been recommended, where necessary, in order to mitigate any adverse impacts.

3.2 Study Area

Noise Assessment Study Area

3.2.1 The “Assessment Area” for noise impact will be the areas within 300m from the “Study Area” as given in the Project Profile according to Item 3.7.3 (i) of EIA Study Brief No. ESB-029/1999.

3.2.2 The Study Area will be reduced if the first layer of the noise sensitive receivers, closer than 300m from the boundary, provides acoustic shielding to those receivers at further distance behind.

Description of the Noise Environment

3.2.3 Major land uses close to the proposed development are mainly residential, recreational and educational institution. The existing noise climate in the Whitehead area is dominated mostly by traffic noise along Sai Sha Road. To the south-west lie villages including To Tau, Cheung Kang, Lok Wo Sha, Kwai Po Lau and the Chinese YMCA of HK Wu Kai Sha Youth Village. To the south lies high rise residential development (Lee On Estate and Monte Vista). To the south-east lies the Li Po Chun United World College and the residential development of Symphony Bay. To the north is the former

Whitehead detention centre which has been developed into a golf driving range.

3.2.4 Currently, construction noise associated with the construction of MOS Rail and Road T7 contributes to the ambient noise level in the area.

3.2.5 There are no industrial activities in the area. But, an existing sewage pumping station is located in Ma On Shan Area 108 at the eastern part of Lee On Estate.

3.3 Noise Assessment Criteria

Construction Noise Criteria

3.3.1 The principal legislation on the control of construction noise is the *Noise Control Ordinance* (NCO) [Cap 400]. In addition, there is provision in the *Technical Memorandum on Environmental Impact Assessment Process* (TMEIA) for assessing noise from construction activities during daytime. Details of the environmental legislation and standards for construction noise are also listed in Annex B.

3.3.2 The noise standards for general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) under the TMEIA are given in Table 3.3.1.

Table 3.3.1
TMEIA Daytime Construction Noise Standards

Uses	Daytime Construction Noise Standards, Leq (30 minutes) dB(A)
Domestic Premises	75
Educational institutions (normal periods)	70
Educational institutions (during examination periods)	65

Note: These standards assume the use of open windows for ventilation. They are the maximum permissible noise levels assessed at 1 m from the NSR's external façade.

3.3.3 The NCO provides statutory controls on general construction works during the restricted hours (i.e. 1900 to 0700 hours Monday to Saturday and at any time on Sundays and public holidays). The Contractor shall comply with the NCO and with any regulations made under the Ordinance, including restrictions placed on noise from construction work and the requirements to seek Construction Noise Permit (CNP). At present, construction works during restricted hours are not expected. However, should works have to be carried out during restricted hours, a CNP must be obtained from the relevant Noise Control Authority (i.e. EPD) before the works are allowed to take

place. Percussive piling works are also subjected to CNP licensing under the NCO. The Contractors are also required to display these permits appropriately.

3.3.4 Despite the description or assessment made in the subsequent sections, the Noise Control Authority will be guided by the relevant Technical Memorandum (Memoranda) in assessing an application, once filed, for a CNP. There are some factors affecting the assessment results of a CNP application, such as assigning of Area Sensitivity Rating, Acceptable Noise Levels, etc. The Noise Control Authority would decide these factors at the time of assessment of such an application based on contemporary situations / conditions. It should be noted that the situations / conditions around the sites may change from time to time. Nothing in this report shall bind the Noise Control Authority in making its decision. There is no guarantee that a CNP will be issued. If a permit is to be issued, the Noise Control Authority will include any conditions considered appropriate and such conditions are to be followed while the works covered by the permit are being carried out. Failure to comply with the conditions stipulated will lead to cancellation of the permit and prosecution action under the NCO.

Operational Noise Criteria

3.3.5 Operational noise criteria are listed in Table 1A of Annex 5 of the TMEIA. The relevant criteria are summarised in Table 3.3.2 with the details listed in Annex B.

**Table 3.3.2
 Operational Noise Assessment Criteria**

Type	Uses	Criteria
Road Traffic Noise, L ₁₀ (1 hour) dB(A)	All domestic premises, hotels, offices and temporary housing	70
	Educational institutions and places of public worship	65
	Hospitals, clinics, and homes for the aged	55
Fixed Noise Sources, L _{eq} (30 min) dB(A)	All of above	Either Dependent on the Area Sensitivity Rating A/B/C: 0700 to 2300, 55/60/65 and 2300 to 0700, 45/50/55.* OR The prevailing background noise levels (For quiet areas with 5 dB(A) below the ANL)

Type	Uses	Criteria
Rail Noise (including heavy and light rail), L _{max} dB(A) L _{eq} (30 min) dB(A)	All of above	L _{max} of 85 dB(A) between 2300 to 0700. AND Dependent of the Area Sensitivity Rating A/B/C: 0700 to 2300, 60/65/70 and 2300 to 0700, 50/55/60.

* 5 dB(A) below the appropriate ANL shown in the *Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites*.

3.3.6 For road traffic noise, in cases where practicable direct mitigation measures would not be wholly adequate in mitigating noise impacts, Indirect Technical Remedies (ITR) in the form of Noise Insulation Works (NIW) under the ExCo directive “*Equitable Redress for Persons Exposed to Increase Noise Resulting from the Use of New Roads*” may be considered. In order for a NSR to qualify for NIW the resulting residual impacts must satisfy all the following three criteria:

- the predicted overall noise level, from the new road together with other traffic in the vicinity must be above specified noise standards (L_{10(1 hour)} 70 dB(A) for residential dwellings and L_{10(1 hour)} 65 dB(A) for educational institutions);
- the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the road works begin; and
- the contribution to the increase in the predicted overall noise level from the new or altered road must be at least 1.0 dB(A).

3.3.7 All NSRs considered eligible for NIW would be recommended to ExCo for approval.

3.3.8 For the purpose of this EIA Study, all roads are described as either:

- ‘existing’ which are unchanged by the Project except for possibly taking additional traffic; or
- ‘new’ which are completely new or are substantially altered by the Project (e.g. the location of the road has been altered or the road has been widened substantially). In the context of this EIA Study, upgrading of road in the form of provision of cycle track, footpath and planting strip will not be considered as new road.

3.4 Representative Noise Sensitive Receivers

3.4.1 Site surveys and desk-top study of government survey maps and the Ma On Shan Outline Zoning Plan (Ref. S/MOS/9 OZP) were conducted to check the existing and planned / committed land uses within 300 m from the boundary of the Study Area. For future land uses under the Project, worst scenario (i.e. the preliminary Preferred Development Option) was used. Representative Noise Sensitive Receivers (NSRs), as defined by the TMEIA and NCO, were selected to represent both existing and future land uses worst affected by the implementation of the Project.

3.4.2 The representative NSRs used for the construction noise assessment are tabulated in Table 3.4.1 and shown in Figure 3.4.1. The representative NSRs used for the operational noise assessment are tabulated in Table 3.4.2 and shown in Figure 3.4.2. The latest Ma On Shan OZP is shown in Figure 3.4.3.

Table 3.4.1
Details of the Representative NSRs during Construction Phase

SR	Status *	General Description	No. of Storey	Ground Level, mPD
C1	E	Village house in To Tau	1	4.3
C2	E	Village house in Lok Wo Sha	3	9.2
C3	E	Li Po Chun United World College	3	30.0
C4	E	Block 1, Symphony Bay	5	14.0
C5	E	Village house at Cheung Muk Tau	3	20.9
C6	E	Block 15, Monte Vista	30	29.2
C7	F	Wu Kai Sha Station development	42-50	29.2

* Notes:

E: Existing Sensitive Receivers

F: Future or Committed Sensitive Receivers

Table 3.4.2
Details of the Representative NSRs during Operational Phase

SR	Status *	General Description	No. of Storey	Ground Level, mPD
1	E	Villa Rhapsody Block No. 7	12	19.5
2	E	Village house at Cheung Muk Tau	3	19.5
3	E	Village house at Cheung Muk Tau	3	20.9
4	E	Villa Concerto Block No. 1	7	14.0
5	E	Li Po Chun United World College	3	30.7
6	F	Proposed Residential Block at Lok Wo Sha Development	32	8.0
7	F	Proposed Residential Block at Wu Kai Sha Station Development	50	29.2
8	F	Proposed Residential Block at Wu Kai Sha Station Development	50	29.2
9	F	Proposed Residential Block at Wu Kai Sha Station Development	50	29.2
10	F	Proposed Residential Block at Wu Kai Sha Station Development	42	29.2
11	E	Lee Wing House at Lee On Estate	37	14.2
12	E	Lung Sing House at Kam Lung Court	37	20.0
13	E	Village House at Wu Kai Sha New Village	3	16.1
14	E	Village House at Wu Kai Sha New Village	3	16.5
15	E	Village House at Wu Kai Sha New Village	3	16.1
16	E	Village House at Wu Kai Sha New Village	3	14.5
17	E	Village House at Cheung Kang	3	9.2
18	F	Proposed Residential Block at Lok Wo Sha Development	30	8.0
19	F	Proposed Residential Block at Lok Wo Sha Development	22	7.5
20	F	Proposed Residential Block at Lok Wo Sha Development	13	7.5
21	E	Village House at To Tau Village	1	8.0
22	E	Village House at To Tau Village	1	6.4
23	F	Proposed Residential Block at Whitehead Site 2 Development	7	8.0
24	F	Proposed Residential Block at Whitehead Site 2 Development	4	8.0
25	F	Proposed Primary School at Whitehead Site 3	6	8.0

SR	Status *	General Description	No. of Storey	Ground Level, mPD
26	F	Proposed Secondary School at Whitehead Site 3	6	8.0
27	F	Proposed Residential Block at Whitehead Site 3 Development	5	8.0
28	F	Proposed Residential Block at Lok Wo Sha Development	14	8.0
29	F	Proposed Residential Block at Lok Wo Sha Development	22	8.0
30	E	Village House at Wu Kai Sha New Village	3	9.2
31	E	Monte Vista Block No. 15	30	29.2
32	E	Monte Vista Block No. 1	30	29.2
33	F	Proposed Residential Block at Whitehead Site 2 Development	3	8.0
34	E	Village House at To Tau Village	1	3.0

* Notes:

E: Existing Sensitive Receivers

F: Future or Committed Sensitive Receivers

3.5 Construction Noise

Introduction

3.5.1 This section assesses the potential construction noise impacts during the construction phase of the Project. Worst construction scenarios have been selected and the construction noise impacts affecting the nearest representative NSRs have been predicted. Where impacts exceed the relevant criteria, appropriate mitigation measures have been recommended.

Representative Noise Sensitive Receivers (RNSR)

3.5.2 The RNSRs chosen for construction noise prediction are shown in Figure 3.4.1. A description of the sensitive receivers is tabulated in Table 3.4.1.

Potential Sources of Impacts

3.5.3 Various infrastructures would be provided to support the proposed development. These include road, water supply, drainage, sewerage system and ancillary facility such as pumping station. Details of the works under this Project are presented in Chapter 2.

3.5.4 To indicate the likely noise impact, the construction noise level is predicted according

to the construction programme. Construction activities that will be undertaken and which could cause potential construction noise impact include:

- site formation;
- road construction (including upgrading and widening);
- provision of drains, sewer and water reticulation system; and
- construction of buildings.

3.5.5 It should be noted that residential buildings works are not part of the engineering infrastructure works for the proposed development. It is included in the construction noise assessment to assess potential cumulative impacts on the RNSRs.

Construction Equipment

3.5.6 The type and quantity of Powered Mechanical Equipment (PME) likely to be used in each construction works described above and their Sound Power Level (SWL) are listed in Annex C1. These equipment have been recommended by design engineers based on information from similar projects. The project proponent (TDD) has indicated that these equipment represent a realistic and practicable approach to meet the construction programme, though there may be variation in the actual construction stage. A copy of TDD's memo (Ref.: () in NTE-ST 4/9/19 IX TC) dated 18 January 2002) is attached in Annex C1. It should be noted that this is an assumption of the most likely equipment to be used. The actual construction equipment will be determined by the Contractor performing the works.

Construction Schedule and Programme

3.5.7 The tentative construction programme of the Project is scheduled to commence in 2003 and will be completed in 2008 (a duration of about 6 years). The residential development at MOS Rail Wu Kai Sha Station would start construction around 2002 and is expected for completion in 2006. According to the current development programme, construction work during the restricted hours is unlikely.

3.5.8 Based on the tentative construction programme, three worst case construction scenarios have been worked out (Table 3.5.1).

Table 3.5.1
Worst Case Construction Scenarios

Scenario	Duration	Site	Construction Works
Programme A	2002 – 2003	Wu Kai Sha station development ⁺	Building construction ⁺
		Lok Wo Sha development	Site formation of residential development and Indoor Recreational Centre (IRC)
Programme B	2004	Wu Kai Sha station development ⁺	Building construction ⁺
		Lok Wo Sha	Building construction ⁺ including the Indoor Recreational Centre and salt water pumping station Construction works of Road D1 (including slip roads to Road T7) and local roads**
		Whitehead*	Site formation of Sites 1, 2 and 3
Programme C	2005 - 2008	Wu Kai Sha station development ⁺	Building construction ⁺
		Lok Wo Sha	Building construction ⁺ ; and construction of Indoor Recreational Centre and salt water pumping station Construction works of Road D1 (including slip roads to Road T7) and local roads**
		Whitehead*	Building construction ⁺ of residential development and recreational centres Construction works of local roads**

Notes:

- ⁺ The Wu Kai Sha Station development will be implemented by KCRC. The Lok Wo Sha development will be implemented by a private developer. The Whitehead residential development and recreational centres will be implemented by a private developer. These developments have been included to assess the potential cumulative impact.
- * Whitehead development denotes Sites 2, 3 and the various recreational centres in Site 1.
- ** Drains, sewers and water supply system will be constructed under the road and hence are included in the road construction works calculation.

Assessment Methodology and Assumptions

3.5.9 The construction noise assessment has been conducted based on standard acoustic principles, the methodology stated in the *Technical Memorandum on Noise from Construction Works Other Than Percussive Piling* (TM1) and Sections 5.3 & 5.4 of Annex 13 of the TMEIA. The assessment also made reference to the BS 5228: Part 1: 1984 *Noise Control on Construction and Open Sites, Part 1: Code of Practice for Basic Information and Procedures for Noise Control* (BS5228).

- 3.5.10 In general terms, the methodology used involves the following steps:
- (i) identification of the most likely worst case scenario from the construction programme;
 - (ii) identification of the nearest RNSRs to the work site;
 - (iii) calculation of the total Sound Power Level (SWL) of equipment to be used;
 - (iv) calculation of distance attenuation to the RNSRs from work site notional noise source point; and
 - (v) comparison of the Predicted Noise Levels (PNLs) with the relevant noise criteria.
- 3.5.11 The construction noise impact assessment is divided mainly into two parts. The first part is the noise due to various construction works employing PME. The second part, where applicable, is the noise from haulage traffic during site formation within the construction site. The noise levels at the RNSRs due to these two components are added together logarithmically.
- 3.5.12 The assessment has been undertaken on the basis of the assumption that all construction equipment will be located on a notional noise source point (in accordance with TM1) and is operating simultaneously at the same time. Shielding effect from existing building structures, topographic features and/or neighbouring construction sites have not been considered to simulate worst-case effect. In other words, all NSRs are assumed to have a direct line of sight to the construction activities. A façade correction of +3 dB(A) is added to account for the sound reflection from the building's surface of a NSR.
- 3.5.13 The calculation of haul road noise is based on the methodology stipulated in BS 5228. It is expected there would be a maximum of 120 trucks per day amounting to around 24 vehicle trips per hour (roundtrip) based on a 10-hour working day assumption. The main bulk of the haul road traffic is expected to occur during site formation and has been included in the construction noise calculation. The location of the haul road assumed in the construction site is shown in Figure 3.4.1. Details of the haul road noise calculation are presented in Annex C1.
- 3.5.14 To assess the worst case scenario, the highest noise level for each construction works was used in the noise calculation. Details of the construction activities and the noise levels are presented in Annex C1. For this planning study, detailed construction programme is not available and thus estimation on the duration of predicted construction impacts has not been undertaken.

Assessment Results

3.5.15 The unmitigated PNL at the RNSRs are summarised below in Table 3.5.2. Detailed calculations are presented in Annex C1.

Table 3.5.2
Predicted (Unmitigated) Construction Noise Level

RNSR	Predicted (Unmitigated) Construction Noise Level, dB(A)		
	Programme A (2002-2003)	Programme B (2004)	Programme C (2005-2008)
C1	73.7	79.6	81.7
C2	73.4	75.5	75.0
C3*	74.6	76.6	76.3
C4	71.1	74.2	74.0
C5	70.8	72.8	72.5
C6	76.3	77.2	77.1
C7	-	-	76.6

Notes:

* school

BOLD denotes exceedance of TMEIA daytime noise standards: 75 dB(A) for residential premises, 70 dB(A) for educational institution (65 dB(A) during examination).

3.5.16 Table 3.5.2 shows that the results of the unmitigated construction noise level would exceed the TMEIA daytime noise standards at some of the RNSRs. NSRs located relatively far from the proposed works, namely RNSR C4 (Symphony Bay) and RNSR C5 (Cheung Muk Tau), would not be affected by the works.

Construction Works in Programme A (2002-2003)

3.5.17 Due to the close proximity of RNSR 6 to the building construction work at Wu Kai Sha station development, RNSR C6 (Monte Vista) is expected to be subject to construction noise level above the daytime noise standard. In view of the lower criterion for school and the relatively close proximity of the site formation works at Lok Wo Sha (IRC), it is predicted that the construction noise levels at RNSR C3 (Li Po Chun United World College) is likely to exceed the construction noise criterion. Therefore construction noise mitigation will be required for RNSRs C3 & C6.

Construction Works in Programme B (2004)

- 3.5.18 RNSRC 1 (To Tau village) will be concurrently affected by road works for Road D1 and site formation works for Whitehead Sites 2, 3 & recreational centres. RNSR C2 (Lok Wo Sha village) will be affected by construction works for Road D1. In view of the lower criterion for school and the relatively close proximity of the infrastructure works for Road D1 and building construction for Lok Wo Sha (IRC), RNSR C3 would be exposed to noise level above the daytime criterion. RNSR C6 would be affected by construction works associated with the Wu Kai Sha station development as well as construction of slip roads to Road T7. Mitigation measures will be required for the above mentioned NSRs.

Construction Works in Programme C (2005-2008)

- 3.5.19 RNSR C1 will be concurrently affected by road works for Road D1 and nearby local roads. In view of the lower criterion for school and the relatively close proximity of the infrastructure works for Road D1 and building construction for Lok Wo Sha (IRC), RNSR C3 would be exposed to noise level above the daytime criterion. RNSR C6 would be affected by construction works associated with the Wu Kai Sha station development as well as construction of slip roads to Road T7. As construction progresses, Wu Kai Sha station development itself would become a NSR (RNSR C7) and will be affected by construction noise associated the construction of slip roads to Road T7. Mitigation measures will be required for the above mentioned NSRs.

Mitigation Measures

- 3.5.20 The predicted noise levels showed that construction works would give rise to adverse daytime noise impacts to some of the RNSRs. Mitigation measures are required and the following types of mitigation measures are recommended.

Use of Quiet Plant

- 3.5.21 The use of quiet plant (also referred as silenced equipment) can provide significant reduction in noise level. Quiet plant is defined as PME whose actual sound power level is less than the value specified in TM1 for the same piece of equipment. To allow the Contractor some flexibility to select equipment to suit his needs, it is considered too restrictive to specify which specific items of silenced equipment to be used for the construction operations. It should be noted that various types of silenced equipment can be found in Hong Kong and are readily available on the market. BS 5228 also provide examples of quiet construction plant and their sound power level.
- 3.5.22 The quiet plant used in the construction noise calculation is shown in Annex C1.

Use of Movable (Mobile) Barriers

- 3.5.23 Movable (mobile) barriers can be used to screen NSRs from particular items of plant or noisy operations. Movable barriers of 3 to 5 m height with a small cantilevered upper portion and skid footing can be located within a few metres of stationary plant (e.g. generator, compressor) and within about 5 m or more of a mobile equipment (e.g. excavator, mobile crane), such that the line of sight to the NSR is blocked by the barriers. It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material with a minimum superficial density of 15 kg/m² located close to operating equipment. Certain types of stationary equipment, such as generators and compressors, can be completely screened by movable barriers giving a total noise reduction of 10 dB(A) or more.
- 3.5.24 For this assessment, it was estimated that movable noise barriers can achieve a 10 dB(A) noise reduction for stationary plant and 5 dB(A) for mobile plant.

Use of Temporary Noise Screening Structures or Purpose-built Temporary Noise Barriers

- 3.5.25 Since some of the NSRs close to the Project area are typically low-rise village houses, it would be effective to have noise screening structures or temporary noise barriers purposely-built along the site boundary to provide additional protection to NSRs close to the construction site. This could be in the form of purposely-built site hoarding constructed from appropriate materials with a minimum superficial density of 15 kg/m². Merely using plywood would not be effective. The noise barrier should have a vertical height of 3.5 m or above, have no gaps or opening at joints. The Contractor should regularly inspect and maintain the noise barrier to ensure its effectiveness.
- 3.5.26 At least 10 dB(A) reduction is expected from the use of noise barriers if the line of sight of the NSR is totally blocked from the equipment.

Good Site Practices

- 3.5.27 Potential construction noise impact can also be minimized or avoided by imposing a combination of the following good site practices:
- (a) Noisy equipment and activities should be sited by the Contractor as far from close-proximity sensitive receivers as practical. Prolonged operation of noisy equipment close to dwellings should be avoided.
 - (b) The Contractor should minimise construction noise exposure to the schools (especially during examination periods) as much as possible. The Contractor should liaise with the school and the Examination Authority to ascertain the

exact dates and times of all examination periods during the course of the contract and to avoid noisy activities during these periods.

- (c) Noisy plant or processes should be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained.
- (d) Noisy activities should be scheduled to minimise exposure of nearby sensitive receivers to high levels of construction noise. For example, noisy activities can be scheduled for midday, or at times coinciding with periods of high background noise (such as during peak traffic hours).
- (e) Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary.
- (f) The power units of non-electric stationary plant and earth-moving plant should be quietened by vibration isolation and partial or full acoustic enclosures for individual noise-generating components.
- (g) Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided, thus reducing the cumulative impacts between operations. The numbers of operating items of powered mechanical equipment should be minimised. Noise can be reduced by increasing the distance between the operating equipment and the NSRs or by reducing the number of items of equipment and / or construction activity in the area at any one time.
- (h) Construction plant should be properly maintained (well-greased, damage and worn parts promptly replaced) and operated. Construction equipment often has silencing measures built in or added on, e.g. bulldozer silencers, compressor panels, and mufflers. Silencing measures should be properly maintained and utilised. Where possible, rubber or damping materials should be introduced between metal panels to avoid rattle and reverberation of noise.
- (i) Equipment known to emit sound strongly in one direction, should where possible, be oriented so that the noise is directed away from nearby NSRs.
- (j) Material stockpiles and other structures (such as site offices) should be effectively utilised to shield construction noise. Noise can also be reduced by construction of temporary noise barriers which screen the lower floors from viewing the sites. Temporary noise barriers should be installed at active parts of construction areas where construction equipment is being operated in close proximity to NSRs.

- (k) The Contractor should devise, arrange methods of working and carry out the works in such manner as to minimise noise impacts on the surrounding environment, and should provide experienced personnel with suitable training to ensure that these measures are implemented properly.

3.5.28 The implementation of the above good site practices could be readily applied to construction sites and can, in theory, provide additional reduction in construction noise levels. However, such noise reduction is difficult to quantify and is therefore not considered in the calculations.

Proposed Construction Noise Mitigation Measures

3.5.29 The use of quiet plant is considered to be one of the most effective ways of alleviating construction noise impacts. The use of equipment with sound power level lower than that stipulated in Technical Memorandum (TM1) is recommended as the first level mitigation (Mitigation 1) for construction works under this Project that are in close proximity to NSRs.

3.5.30 The use of movable (mobile) noise barriers on mobile and stationary equipment is recommended as the second level of mitigation (Mitigation 2). Such mitigation should be applied to construction works that are in close proximity to NSRs, specifically to RNSR C1 (To Tau Village) and RNSR C3 (Li Po Chun United World College).

3.5.31 Alternatively, purposely-built site hoarding as temporary noise barrier can be used instead of movable barrier where construction works are undertaken close to RNSRs C1 & C3. The noise barrier should be erected along the site boundary of the construction work which is closest to the NSRs.

3.5.32 Good site practices should be followed in all construction sites throughout the construction phase.

3.5.33 Table 3.5.3 shows the predicted noise level with the implementation of the proposed mitigation measures.

Table 3.5.3
Predicted (Mitigated) Construction Noise Level

RNSR	Predicted (Mitigated) Construction Noise Level, dB(A)					
	Programme A (2002-2003)		Programme B (2004)		Programme C (2005-2008)	
	Mitigation 1	Mitigation 2	Mitigation 1	Mitigation 2	Mitigation 1	Mitigation 2
C1	-	-	74.6	-	76.4	74.0
C2	-	-	71.3	-	-	-
C3*	69.8	-	72.2	70.0	71.1	70.2
C6	72.1	-	72.9	-	72.6	-
C7	NA	NA	NA	NA	71.2	-

Notes:

* school

BOLD denotes exceedance of TMEIA daytime noise standards: 75 dB(A) for residential premises, 70 dB(A) for educational institution (65 dB(A) during examination).

Mitigation 1 = use of quiet plant only

Mitigation 2 = use of quiet plant and use of movable / temporary barrier on selected RNSRs

RNSRs C4 & C5 not shown as they are predicted to be within the noise standard

NA = not applicable

3.5.34 Table 3.5.4 summarises the mitigation measures proposed for the construction works.

Table 3.5.4
Summary of Proposed Construction Noise Mitigation Measures

Proposed Mitigation Measures	Application to Construction Sites / Works		
	Programme A (2002-2003)	Programme B (2004)	Programme C (2005-2008)
Level 1 mitigation (use of quiet equipment)	Applicable to site formation works for Lok Wo Sha near NSR C3; building construction works near NSR C6	Applicable to construction of Road D1 (including the two slip roads to Road T7) and local roads near NSRs C1, C2 & C3; building construction works near NSR C6	Applicable to construction of Road D1 (including the two slip roads to Road T7) and local roads near NSRs C1, C2, C3, & C7; building construction works near NSR C6
Level 2 mitigation (use of quiet equipment plus (i) use of movable barrier, or (ii) use of temporary noise barrier along construction site boundary)	Not required	Applicable to construction of Road D1 (including the two slip roads to Road T7) and local roads near NSRs C1 & C3	Applicable to construction of Road D1 (including the two slip roads to Road T7) and local roads near NSRs C1 & C3
Good site practices	Applicable to all construction works	Applicable to all construction works	Applicable to all construction works

Note:

All the proposed construction noise mitigation measures are to be implemented by the Construction Contractor(s) during the construction stage of the works.

Cumulative Impacts

- 3.5.35 Projects that have potential cumulative construction noise impacts would be works associated with MOS Rail, Road T7 (EP no. AEP-057/2000) and Sai Sha Road Widening (EP no. AEP-119/2002).
- 3.5.36 The MOS Rail is currently under construction and is expected to be completed by 2004. Road T7 is also currently under construction and would be completed by mid 2004. Sai Sha Road Widening commenced in August 2002 and will be completed by late 2004.
- 3.5.37 It is expected that most of the civil and infrastructure works for MOS Rail would essentially be completed by the time works under this Project starts. The likely works remaining for MOS Rail would be E&M works, station internal fittings and trial run of trains. Similarly, the final construction phases of Road T7 and Sai Sha Road Widening would be E&M and fitting works. All these works would not create excessive construction noise.
- 3.5.38 It is likely that the construction of Sai Sha Road Widening project may overlap with this Project. The Sai Sha Road Widening EIA has proposed mitigation measures such as good site practices, quiet equipment, temporary noise barrier and where necessary operating restrictions. Based on the Sai Sha Road Widening EIA, Table A7 of Annex A, the highest mitigated noise level was predicted to be around 68 dB(A) at Lok Wo Sha. For NSR C2 considered in this EIA Study, which is the worst representative NSR for cumulative assessment and about 100 m away from Sai Sha Road project, the highest cumulative noise level from both projects with the implementation of mitigation measures will unlikely exceed 73 dB(A).
- 3.5.39 Hence, cumulative construction noise impact from concurrent projects is not expected.

Residual Impacts

- 3.5.40 Construction noise could be mitigated to EPD's daytime noise levels by the application of the recommended mitigation measures.
- 3.5.41 However, it should be noted that educational institution has a lower noise standard of 65 dB(A) during examination. The Contractor should minimise construction noise exposure to RNSR C3 (Li Po Chun United World College) especially during examination periods as much as possible. In addition, the Contractor should liaise with the school and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract and to avoid noisy activities during these periods.

3.5.42 With the implementation of the recommended mitigation measures and avoiding construction works during examinations, no residual construction noise impact is expected.

Monitoring and Audit Requirement

3.5.43 Noise monitoring should be carried out at selected NSRs during the construction period to monitor compliance with permissible noise levels for the construction activities being undertaken for the proposed development. Monitoring is also required to check the effectiveness of the recommended mitigation measures. Ad-hoc monitoring and audit should also be carried out at other NSRs in case of complaints, and measures taken to ensure acceptable noise levels are met as far as possible.

3.5.44 It is recommended that the following representative NSRs be monitored during construction stage of the Project development. These NSRs are selected to represent a particular area likely to be worst affected by the construction works.

- NSR C1 (To Tau Village)
- NSR C3 (Li Po Chun United World College)

3.5.45 Details of the monitoring and audit requirements for construction noise are presented in the separate EM&A Manual.

Summary (Construction Noise)

3.5.46 The use of powered mechanical equipment during the construction phase of the Project is expected to create construction noise nuisance given the extent of the development. Mitigation measures are available to reduce the construction noise impacts to acceptable levels. The recommended mitigation measures include the use of quiet plant and working methods, the use of temporary noise barriers and good site practices. Provided the Contractor implements the recommended mitigation measures, the construction noise levels can be kept to reasonable levels at all times.

3.5.47 Noise monitoring is recommended at selected NSRs during the construction period to monitor compliance with the daytime construction noise levels for the construction activities being undertaken for the proposed development.

3.6 Operational Noise – Traffic Noise

Introduction

3.6.1 Traffic travelling along the proposed roads has the potential to generate noise impacts on the NSRs of the proposed development as well as nearby existing / committed

NSRs. This section addresses potential traffic noise impacts from the proposed roads and recommends appropriate mitigation measures into the proposed development or road design if necessary.

- 3.6.2 During the course of the preparation of the development layout, the potential road traffic noise impact on the future NSRs is one of the key environmental factors being considered. As a result, the proposed development has incorporated a number of noise mitigation designs in terms of environmentally friendly layout design.

Environmentally Friendly Layout Design

- 3.6.3 The development is a rail-based development. The opening of Ma On Shan (MOS) Rail in 2004 will create an attractive public transport facility into the urban area of Kowloon and other parts of the New Territories. High-density residential developments at Wu Kai Sha Station and Lok Wo Sha are proposed within the 500m of the railway station. This will encourage the use of railway transport instead of the road-based transport, thereby potentially reducing the road traffic noise impact.
- 3.6.4 Road T7 (under construction) functions as a strategic route. Slip roads will be provided under this Project to facilitate traffic entering Road T7 which will provide direct access to and from Shatin, thus minimising vehicle movements within the development and Ma On Shan town centre.
- 3.6.5 Within the proposed development, buildings are to be carefully sited to avoid exposure to traffic noise. Several areas of woodland have been preserved alongside the proposed roads to enhance the amenity / ecological value and to serve as noise buffers.
- 3.6.6 The layout plan for the proposed development has already incorporated a number of practical direct noise mitigation measures in order to reduce the potential traffic noise impact as much as possible. The mitigation measures include the use of non-sensitive structures such as podium for sites at Wu Kai Sha Station development, Lok Wo Sha and Whitehead and commercial centre for the Lok Wo Sha site to shield traffic noise. Adequate setback distance away from noisy roads has been provided in the layout plan. The orientations of each residential block (and schools) are purposely arranged such that the worst affected units are subject to less traffic noise impact.
- 3.6.7 Pedestrian linkages to the MOS station have been proposed. Pedestrian linkages in the form of public central spine and a footbridge have been proposed. Pedestrian circulation within the development is provided by a continuous footpath system, which connects the development sites with each other and to the open space areas. Pedestrian links are also provided to other areas to minimize unnecessary internal traffic within the development.

Quiet Transportation Mode

- 3.6.8 The concept of using cul-de-sacs at the northern end of the road network at Whitehead was found to be not feasible due to the potential of traffic queuing. An underpass has replaced these cul-de-sacs.
- 3.6.9 Since the residential population has been greatly reduced in the Study Area, traveller was found to be neither necessary nor cost-effective to construct. Nevertheless, a well designed pedestrianization including a central spine connecting Wu Kai Sha Station, Lok Wo Sha and Whitehead headland, would still be useful to discourage / minimise the use of transportation in the area.

Assessment Methodology

- 3.6.10 The road traffic noise has been assessed based on the worst scenario traffic flows and has followed strictly the procedures stipulated in the “*Calculation of Road Traffic Noise (CRTN)*” (1988) published by Department of Transport, UK.
- 3.6.11 In order to predict impacts from future traffic conditions, traffic noise has been based on the worst case year traffic forecast within 15 years upon the commissioning of the programme project which is expected in 2008. The projected traffic flows associated with the development in 2023 are shown in Table C2.1 of Annex C2. The memo from Transport Department (Ref.: () in NR/171/200/100 dated 28 May 2002) indicating no comments on the traffic forecast is attached in Annex C2. The traffic data in 2003 is used to calculate the prevailing noise levels as the construction of the Project is expected to commence in 2003. Table C2.1 of Annex C2 presents the peak traffic data used in road traffic noise assessment.
- 3.6.12 Figure 3.6.1 shows the locations of the new roads in this proposed project. In addition, the cross-section of the proposed development is also shown in Figure C2.2 of Annex C2. The typical floor plan of the proposed development is shown in Figure C2.3 of Annex C2. In view of the noisy Sai Sha Road Roundabout, a special layout for NSR 18 is proposed where blank façades are facing Sai Sha Road (Figure C2.4 of Annex C2).
- 3.6.13 The following assumptions have been used for the assessment:
- The calculation points for the assessment are taken as 1.2 m above the floor level.
 - Standard road designs such as parapet, central divider, concrete planter box, cycle track and footpath will be provided for the proposed roads. Their potential noise reduction effect to the NSRs has been taken into account.

- No ground absorption is assumed.
- The gradient, width and elevation of the roads have been estimated based on the latest engineering study.
- Pervious road surface has been assumed for all road segments with design speed limit of 80 km/hr or higher.
- The speed limit for each type of future roads are shown in Table 3.6.1

Table 3.6.1
Characteristics of Roads

Road	Speed (km/hr)	Friction Course used
<i>Future</i>		
Road D1 (including slip roads to Road T7)	50	No
Other proposed local road (L1 & L2)	50	No
<i>Existing (based on actual speed limit)</i>		
Sai Sha Road	50	No
Road T7	80	Yes

3.6.14 A number of structures within the Study Area can provide natural barrier shielding effect to some of the NSRs. Since details on some of these structures were not available at the time of the EIA study, assumptions have been made based on experience and professional judgement. These assumptions are listed in Table 3.6.2. Location of the Commercial Centre and Indoor Recreation Centre are shown in Figures 2.3, 3.6.4 and 3.8.1

Table 3.6.2
Assumptions on Potential Noise Shielding Structures of the Preliminary Preferred Development Option

Site	Structures	Assumptions
Lok Wo Sha	Commercial Centre	3 storeys (20 metres tall)
Lok Wo Sha	Indoor Recreation Centre	3 storeys (20 metres tall)

3.6.15 A number of noise barriers have been proposed and are being constructed along the future Road T7 (EP no. AEP-057/2000) and widened Sai Sha Road (EP no. AEP-119/2002). All these future committed noise barriers have already been considered in the traffic noise assessment. Figure 3.6.2 shows the locations of these committed barriers. It should be noted that the noise mitigation measures on Road T7 (Figure C2.5 of Annex C2) as assumed in this EIA Report is the latest design and amendment of design would be submitted by TDD separately under the T7 Project. A copy of

TDD's memo (Ref.: (15) in NTE-ST 4/9/19 Pt. 11 dated 14 May 2002) is also attached in Annex C2.

Assessment Results

3.6.16 The predicted traffic noise levels at the representative future and existing NSRs are shown in Table C2.2 of Annex C2. The result shows that the predicted noise levels of some NSRs will still have traffic noise levels above the TMEIA noise standard even with the implementation of noise reduction design stated above. The predicted L_{10} noise levels in the design year 2023 would be in the range of 58 to 73 dB(A). Table 3.6.3 and Table 3.6.4 summarize the results of the noise levels on the proposed residential facades and proposed schools.

Table 3.6.3
Summary of Traffic Noise Assessment on the future NSRs
in the Preliminary Preferred Development Option

Location	Site Area (ha)	Predicted Unmitigated Traffic Noise Level dB(A)	Number of Units	Unit of Exceedance		Mitigation Applied*
				Number	Percentage	
Wu Kai Sha Station Development**	3.5	58 – 73	2,976	98	3.3 %	SD / podium
Lok Wo Sha Development	12.7	58 – 70	3,940	0	0 %	N/A
Whitehead Site 2	3.4	64 – 67	384	0	0 %	N/A
Whitehead Site 3	3.0					

Notes:

* N/A means not applicable. SD means specially designed, for example installation of insulation window together with air conditioning.

** Refers to plot ratio 6.5.

For plot ratio 5 unit of exceedance is 69 out of 2,528, about 2.7% exceedance.

3.6.17 Some of the existing NSRs such as Villa Rhapsody (NSR1) and a village house at Wu Kai Sha (NSR 30) are predicted to experience noise levels above the noise criterion due to the existing Sai Sha Road. Eligibility Test of Indirect Technical Remedies (ITR) has been undertaken and the findings are shown under the section of Residual Impact (see para. 3.6.35-3.6.36).

Wu Kai Sha Station Development

3.6.18 The proposed Wu Kai Sai (WKS) Station Development is surrounded by several trunk roads, namely Sai Sha Road, Road T7 and its associated slip roads. The traffic noise level experienced by the façade of this development is dominated by these noisy

roads. According to the Road T7 EIA¹ and the latest design, extensive roadside noise barriers and semi-enclosures have been proposed along Road T7 to protect the future sensitive façades at the WKS Station Development (Figure 3.6.2). In addition, the Wu Kai Sha Station and its associated podium will provide a screening effect against the traffic noise generated from Sai Sha Road.

- 3.6.19 With these mitigation measures, the traffic noise experienced by the development will be greatly reduced. In view of constraints which is described under the section of Evaluation of Constraints, NSR 10 adjacent to Sai Sha Road is subject to high traffic noise from the widened Sai Sha Road as well as the noise from Sha On Street which serves as the main access to the PTI. The percentage of the units likely exceeding the traffic noise criterion is expected to be about 3.3%. Consideration of mitigation measures has been undertaken and the findings are shown in the Evaluation of Constraints section.

Lok Wo Sha Development

- 3.6.20 The traffic flows of the roads surrounding the Lok Wo Sha Development are relatively less, ranging from 390 veh/hr (proposed road D1) to 2700 veh/hr (Sai Sha Road). According to the Sai Sha Road Widening EIA², 5m vertical absorptive barrier has been proposed along some section of Sai Sha Road. As shown in Table C2.2 (Annex C), all the planned residential façade will not be subject to high traffic noise due to the low local traffic volume of the adjacent roads and the adequate setback of the residential building blocks to the adjacent roads. In addition, a special layout design, shown in Figure C2.4 of Annex C2, is used for NSR 18, so that blank façades (or environmentally equivalent design) are facing the Sai Sha Road and its roundabout. As a result, NSR 18 is predicted to be within the noise criterion.

Whitehead Sites 2 and 3

- 3.6.21 In view of relatively low traffic along this section of Road D1(N), it is predicted that all facades at Site 2 and Site 3 would comply with the road traffic noise criterion.

Educational Uses in Whitehead Site 3

- 3.6.22 There are two new schools proposed within the development with adequate setback. Table 3.6.4 summarizes the road traffic noise assessments on these schools. Some of the facades of the proposed secondary school (Table C2.2) will exceed the noise criterion of 65 dB(A). However, with the application of approximately 90m long 3m tall boundary wall (Figure 3.6.3), all the schools façade will be below the noise criterion.

¹ Trunk Road T7 in Ma On Shan – Environmental Review Final Report (TDD, March 2000)

² Environmental Impact Assessment Study for Sai Sha Road (Highway Departments, August 1999)

Table 3.6.4
Summary of Traffic Noise Mitigation Incorporated into the
Preliminary Preferred Development Option (School)

Location	Zoning	Predicted Unmitigated Traffic Noise Levels, dB(A)	Mitigation Applied
Whitehead Site 3	Primary School	63 – 64	N/A
	Secondary School	62 – 67	3m tall boundary wall (approximately 90m long)

Note:
N/A means Not Applicable

Evaluation of Constraints

Wu Kai Sha Station Development

- 3.6.23 The findings of the road traffic noise assessment have shown that the facades on the western part of WKS Station Development are expected to experience noise levels above the noise criterion. In an effort to establish the extent of mitigation measures to be required by the developer to meet TMEIA requirement, an investigation has been undertaken based on the engineering feasibility and the effectiveness of the measures to mitigate the noise impact. The assessment has taken into account the physical constraints of the site, namely prescribed window, visual impact, sightline, etc.

Roadside noise barrier

- 3.6.24 The most effective noise mitigation measure is the mitigation at source, namely erection of the roadside noise barrier on Sha On Street and Sai Sha Road. However, the Sha On Street re-alignment works is a committed project undertaken by HyD. Covering up part of the road is impractical. Erection of roadside noise barrier within the roundabout of Sai Sha Road will have sightline problem. This solution is therefore not considered further. A copy of the memo from HyD (Ref.: () in HNT 54/180 INT(PRD) dated 7 August 2002) confirming the impracticality is attached in Annex C2.

Setback

- 3.6.25 Setback is considered not feasible since the disposition of building blocks are dictated by the PTI where construction would be undertaken in a couple of months.

An extended podium

- 3.6.26 Direct measure in the form of an extended podium / podium canopy to the western site boundary of the development has been investigated with an aim to protect the future WKS Station Development. Podium canopy is not effective as Sha On Street cannot be shielded by the canopy which is thus not considered further. For the extended podium, in view of the prescribed window requirement under the Building (Planning) Regulations, the height of barrier wall on the extended podium cannot exceed one metre from the floor level of the first domestic floor of the residential towers. Figure C2.6 of Annex C2 shows the extent of the extended podium to shield Sha On Street. Table C2.5 of Annex C2 shows the mitigated noise levels on the western side of facades and indicates that majority of the future facades will comply with the noise criterion with the implementation of the measure.
- 3.6.27 However, the findings indicate that even with the extended podium (see section 3.6.29 for constructability), about 11 units out of the 98 non-compliant units are expected to have traffic noise level above the noise criterion. The total number of units for plot ratio 6.5 (under the preliminary Preferred Development Option) is about 2,976 units; only about 98 units are non-compliant without mitigation measure, representing around 96.7% of noise compliance. If an extended podium can be built, around 99.6% compliance is expected.
- 3.6.28 For plot ratio 5 (under the Preferred Development Option), KCRC has proposed a layout of 7 blocks with the south-western block deleted (Figure C2.7). Without mitigation measure, 69 units out of the total 2,528 units exceed the noise criterion, representing around 97.3% noise compliance. If an extended podium can be built, about 11 units out of the 69 non-compliant units are expected to have traffic noise level above the noise criterion, representing around 99.6% compliance (Table C2.6).
- 3.6.29 The feasibility of an extended podium on the western side of the Wu Kai Sha Station development has been studied. The extended podium being considered has not been included in the current layout of main podium which will house a PTI. The construction of main podium by KCRC will commence in one or two months so that PTI within the main podium can be commissioned together with the MOS Rail in 2004. It is impractical to revise the design of the main podium to incorporate an extended podium at this late stage. Consideration has been given to constructing the extended podium in conjunction with the residential development after the main podium is in place but the findings were negative. The reasons are that at the location where the extended podium is to be built, there will be an Emergency Vehicle Access (EVA). Construction of the extended podium will be impractical due to the need of a sufficient wide EVA at all times. Temporary diversion of the EVA has been found to be not possible due to the existence of plantroom, columns and PTI in the adjoining main podium. Heavy equipment will be required to construct the foundation and superstructure of the extended podium. Since an effective EVA is required to be

maintained, the option of building an extended podium to mitigate traffic noise impact is considered impractical.

3.6.30 Table 3.6.5 summarises the major constraints that exhausts the direct noise mitigation measures and render the use of indirect noise mitigation as a last resort.

Table 3.6.5
Evaluation of Constraints associated with the Wu Kai Sha Station Development
in accordance with Annex 13 of TM-EIAO

Possible Mitigation Measures	Constraints
(a) Alternative land use arrangement	Residential uses close to rail station is appropriate and in line with environmentally friendly development concept. The existing zoning permits residential development.
(b) Alternative siting	
(c) Screening by noise tolerant buildings	The proposed development comprises only residential blocks which are all noise sensitive. There will not be any noise tolerant buildings.
(d) Decking over	Decking over of Sha On Street along the western side of the development is not feasible as it is outside the lot boundary.
(e) Extended podium	Podium canopy cannot shield Sha On Street. It is considered not practical to build the extended podium due to the requirement of an effective EVA at all times. Construction of the extended podium is technically not feasible.
(f) Setback	The building blocks disposition are dictated by the PTI.
(g) Building orientation	All facades of the proposed building are sensitive to traffic noise. The building orientation is constrained by prescribed window requirement.
(h) Treatment of source	Erection of roadside noise barrier at Sha On Street Roundabout at Sai Sha Road is not feasible due to sight line problem.
(i) Alternative alignment	The noise impact is due to the proposed widened Sha On Street. This is a committed project and does not form part of the new road network proposed under this Study.
(j) Noise barrier / enclosure	Erection of roadside noise barrier at Sha On Street Roundabout at Sai Sha Road is not feasible due to sight line problem.
(k) Special building design	Adopting single-aspect design is not desirable.
(l) Architectural features / balcony	Balcony is not effective for NSRs at low elevation. Podium canopy cannot shield Sha On Street.
(m) Open-textured road surfacing	Friction course cannot be used on the section of Sai Sha Road and Sha On Street due to the slow speed associated with the roundabout.

Conclusion

3.6.31 In accordance with the EIAO-TM, after consideration and evaluation of all direct mitigation measures, it is recommended that direct mitigation measures are found to be not practical and have been exhausted. Hence, indirect measure is the last resort to abate traffic noise impact and the requirement of acoustic insulation of buildings is proposed to be included in appropriate land grant and lease conditions. The developer will be responsible for the installation of insulated window and air conditioning for those non-compliant units.

Lok Wo Sha Development

- 3.6.32 The only constraint associated with the future Lok Wo Sha development is arising from the road traffic noise due to the upcoming Sai Sha Road widening. It is proposed that the closest future façades facing the Sai Sha Road should be blank facades. As such, no other on-site mitigation will be required.

Whitehead Sites 2 and 3

- 3.6.33 In view of low traffic projection around this site, no significance potential constraint is envisaged for the Whitehead development.

Summary of Proposed Mitigation Measures

- 3.6.34 Table 3.6.6 below summarizes the proposed mitigation measures / assumptions used in the proposed development in relation to traffic noise.

Table 3.6.6
Summary of Proposed Noise Mitigation Measures / Assumptions Used in the Proposed Development in Relation to Traffic Noise

Site	Mitigation Measures / Assumptions used in the Proposed Development	Implementation Stage	Implementation Agent
Wu Kai Sha Station Development	Proposed residential blocks to be built on top of podium (20m)	DD	DLO / PlanD / Developer
	Provision of indirect technical remedies on the flats exceeding the traffic noise criterion in the form of window insulation and air-conditioning	DD	DLO / PlanD / Developer
Lok Wo Sha Development	Use of 3 storeys (20m) commercial centre to shield traffic noise from Sai Sha Road	DD	DLO / PlanD and Developer
	Use of blank façade for the southern façade of NSR 18 facing Sai Sha Road and its roundabout	DD	DLO / PlanD and Developer
	Proposed residential blocks to be built on top of 2 storeys (10m) carpark podium	DD	DLO / PlanD and Developer
	In-situ preservation of 3 patches of woodland to the west and east of the development (also as part of ecological mitigation)	DD	DLO / PlanD and Developer
	Minimum setback distance of 15m from Road D1(W) (not applicable to the preserved woodlands)	DD	DLO / PlanD and Developer
	Minimum setback distance of 15m from Road D1(N)	DD	DLO / PlanD and Developer
	Minimum setback distance of 20m at the northeast and 22m at the southeast from Road D1(E) (not applicable to the preserved woodlands)	DD	DLO / PlanD and Developer
	Minimum setback distance of 20m at the southwest and 15m at the southeast from Sai Sha Road	DD	DLO / PlanD and Developer
Whitehead Site 2	Proposed residential blocks to be built on top of 1 storey (5m) carpark podium	DD	DLO / PlanD and Developer
	Minimum setback distance of 15m from Road D1(N)	DD	DLO / PlanD and Developer
	Minimum setback distance of 5m from Road L1	DD	DLO / PlanD and Developer

Site	Mitigation Measures / Assumptions used in the Proposed Development	Implementation Stage	Implementation Agent
Whitehead Site 3	Proposed residential blocks to be built on top of 1 storey (5m) carpark podium	DD	DLO / PlanD and Developer
	Minimum setback distance of 5m from Road L2	DD	DLO / PlanD and Developer
Whitehead Site 3 (proposed secondary school)	The school to be located at an orientation with the classroom block facing away from Road D1(N) i.e. facing north.	DD	ArchSD
	3m tall boundary wall along the southern school boundary facing Road D1(N) (approximately 90m long)	DD	ArchSD
Whitehead Site 3 (proposed primary school)	The school to be located at an orientation with the classroom block facing away from Road D1(N) i.e. facing north.	DD	ArchSD

Notes:

DD : detailed design stage

Minimum setback distance is shown in Figure 3.6.4.

Residual Impact

Existing Noise Sensitive Receivers

3.6.35 It is predicted that some of the existing NSRs, namely the Villa Rhapsody (NSR 1) and a village house at Lok Wo Sha (NSR 30), will be subjected to excessive traffic noise in 2023. The noise exceedance at NSR 1 and NSR 30 is due to the existing Sai Sha Road.

3.6.36 To check whether these traffic noise non-compliant units qualifying for Indirect Technical Remedies (ITR), eligibility test has been conducted and the results are presented in Table C2.3 of Annex C2. Based on the results of the eligibility test, the contribution of future traffic noise levels from the proposed new roads under this Project is less than 1 dB(A), therefore, additional mitigation measures are excluded from further considerations.

Monitoring and Audit Requirement

3.6.37 Although no traffic noise barriers were proposed for the roads under this Project, a number of other direct mitigation measures including boundary wall for school development and environmentally friendly layout design have been recommended for the proposed development. Traffic noise monitoring at the operational phase is proposed to check the effectiveness of these direct measures on road traffic noise.

3.6.38 It is recommended that the following representative NSRs be monitored during operational stage of the Project development. These NSRs are selected to represent worst affected NSRs from the Designated Project Road D1.

- NSR 26 (Proposed secondary school)
- NSR 28 (Proposed residential development at Lok Wo Sha)

3.6.39 Details of the monitoring and audit requirements for traffic noise are presented in the separate EM&A Manual.

Summary

3.6.40 Traffic noise impact assessment has predicted that the introduction of environmentally friendly layout design has resulted in noise compliance in majority of the planned NSRs within the development.

3.6.41 For those school-type NSRs exceeding noise criteria, noise mitigation measures have been proposed in the form of boundary wall. As a result, 6 classrooms are benefited.

3.6.42 Residual impacts on some of the façades at the Wu Kai Sha Station Development would require indirect technical remedies in the form of window insulation and air-conditioning or special layout design.

3.6.43 All these proposed measures are subject to the configuration of the development layout plans. The developers/project proponents are responsible for designing their own layouts with the recommendation stipulated in this EIA report. In the event that an alternative layout is proposed, the relevant developer/project proponents should prove that the new layout could meet the equivalent or better environmental standards as given in this EIA report. In addition, the relevant developer/project proponents should be aware of the site constraints assumed in this EIA. Table 3.6.6 summarizes the mitigation measures recommended for the proposed development.

3.7 **Rail Noise**

Introduction

3.7.1 This section presents the assessment on the potential railway noise impacts on the proposed residential areas in the vicinity of the Ma On Shan (MOS) Rail with the proposed Wu Kai Sha (WKS) Station. Mitigation measures are recommended, where appropriate, based on a worst-case scenario to ensure compliance with the statutory noise limit.

Assessment Criteria

3.7.2 Railway noise is controlled by the Noise Control Ordinance (NCO) [Cap 400], TMEIA and the associated *Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites* (TM2). Acceptable Noise Levels (ANLs) are stipulated in the TM as the noise criteria. ANLs are dependent on the Area Sensitive Rating (ASR) defined and the time period of the day. The ASR of a Noise Sensitive Receiver (NSR) is determined by the type of area containing it and the presence of any Influencing Factors such as industrial areas, major roads and airports. ANLs for different ASRs are summarised in Table 3.7.1.

Table 3.7.1
Acceptable Noise Levels (ANLs) in dB(A)

Time Period	Area Sensitivity Rating		
	A	B	C
Day and Evening (0700 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)*	50	55	60

* not applicable to educational institution

3.7.3 According to the “*Tai Wai to Ma On Shan Extension - Environmental Impact Assessment* (MOSEIA) and the proposed upzoning of the Lok Wo Sha development area, the ASR of ‘B’ is proposed for the Study Area. Thus, the rail noise level (Leq_{30min} dB(A)) at these NSRs must be 55 dB(A) or less during the night time period (2300-0700) which is considered the most stringent criterion and the maximum rail noise level (L_{max} , dB(A)) during the night time period (2300 – 0700) must be 85 dB(A) or less.

Noise Sensitive Receivers

3.7.4 The Preliminary Preferred Development Option for the development is shown on Figure 3.4.2. Two representative NSRs at the WKS Station Development and Lok Wo Sha development have been considered for rail noise assessment (Table 3.7.2).

Table 3.7.2
Information of the Selected NSRs for the Assessment

NSR	Description	Estimated Number of Storeys*	Distance between NSR and the nearest track centreline (m)	mPD level of the 1 st floor (m)
10-1 [#]	Proposed Residential Development at Wu Kai Sha Station	42	15	36.0
18-1	Proposed Residential Development at Lok Wo Sha Development	30	120	8.0

Note:

* Estimated no. of storeys subject to change

Assessment Methodology and Input Parameters

- 3.7.5 This rail noise impacts prediction is undertaken using an in-house model based on the principle and methodology which has been agreed with EPD and was used for the Spurline EIA.
- 3.7.6 According to MOSEIA, the multi-plenum system (MPS) is one of the major features of railway noise mitigation measures on MOS rail. The MPS (shown in Figure 3.7.3) consists of:
- Tracks mounted on a soft baseplate upon a floating mini slab to reduce vibration transmission to the viaduct structure;
 - Absorptive lined cascading plena consisting of vehicle skirts, an under walkway plena on either side of the viaduct and a central plenum; and
 - An edge wall along the viaduct provided for walkway safety.
- 3.7.7 According to the MOSEIA, an attenuation of approximately 18 dB(A) for the outboard plenum (skirt+walkway plenum) and approximately 13 dB(A) for the inboard plenum (skirt+central plenum) can be achieved.
- 3.7.8 The proposed WKS Station was included in the MOS EIA. According to the latest information from KCRC, the proposed WKS Station which is currently under construction is fully enclosed with station roof and screen (i.e. safety) doors at both platforms of the station (see Figures 3.7.1d to 3.7.1f). KCRC also confirmed that the maximum operation speed of MOS would be 80 kph (Annex C3).
- 3.7.9 North of WKS Station are two overrun tracks which are required by railway safety procedures. These tracks will only be used in the event of a train overrunning the station.
- 3.7.10 A rail expansion joint will be located near the WKS Station. According to the MOSEIA, an enclosure with length of 165m will be installed to protect the existing NSR at Lee On Estate and future NSRs at WKS Station from the potential noise impact arising from the train passing through the joints (Figure 3.7.1a).
- 3.7.11 According to Section 4.5.4 (p. 4.61) of the MOSEIA, adsorptive material has been recommended to be used within the enclosure to mitigate the enclosure portal noise. As a result, it is expected that the enclosure portal noise impact to the WKS Station Development is relatively minor.

- 3.7.12 The proposed NSRs from this project will experience the railway noise from the exposed tracks starting from the end of the enclosure to the WKS station. This exposed track segments and their cross-sections are shown in Figure 3.7.1b & c. From these figures, the track segment, which is just outside the enclosure, is a twin viaduct without central plenum between the tracks. This railway segment will then separate into two single viaducts and enter into the WKS Station separately.
- 3.7.13 In brief, the major parameters used in the assessments are summarised in Table 3.7.3. The procedures for railway noise calculation and sample calculation are annexed in Annex C3.

Table 3.7.3
Parameters and Equations Adopted
in the MOS Rail Noise Calculation

Parameters Adopted	(8-car train)
1. Maximum train frequency (number of trains per hour per direction) during the off-peak hours (2300 to 0700)	10
2. Number of cars	8
3. Train Speed, V (kph)	80
4. Enclosure at crossover	Yes

Assessment Results

- 3.7.14 The unmitigated noise levels has been predicted and presented in Table 3.7.4 and Annex C3. Comparison of the unmitigated noise levels in Leq (30min) at NSRs with night-time noise criteria³ are also given in Table 3.7.4.
- 3.7.15 Table 3.7.4 shows that without mitigation, exceedance of the noise criteria would be experienced at future NSR 10-1 by up to 3 dB(A). Mitigation measures are required to protect this NSR from train noise.
- 3.7.16 NSR 18-1 at Lok Wo Sha Development will be protected by the adequate setback as the reserve of the main spine road and the landscape corridor along the WKS Station. This reserve has been incorporated in the preliminary PDO design.

³ Night-time (2300-0700 hrs) noise criteria applicable to residential uses only. Educational institutions are not assessed during night-time since they are not in operation during these periods.

Table 3.7.4
Unmitigated Noise Levels

WRNSR	No. of Floor	Shortest Horizontal Distance From the Assessment Point to the Rail Track (m)	Worst Affected Floor	Rail Noise From the Track L_{eq} (30 min)	Total Noise Level L_{eq} (30 min)	Exceed noise criterion of 55 dB(A)
10-1	42	15	7	58	58	Yes
18-1	30	120	18	53	53	No

Mitigation Measures

3.7.17 To achieve a noise reduction of up to 3 dB(A), mitigation measures in terms of additional semi-enclosure or installation of central plenum on the twin viaduct section have been proposed and shown in Figure 3.7.2a & b. The option of central plenum is preferred as it has no visual impact. It should be noted that adequate allowance has been made on the viaduct design to support possible additional barrier for protecting future NSRs from rail noise. The mitigated noise level is shown in Table 3.7.5.

Table 3.7.5
Mitigated Noise Levels at NSR 10-1

WRNSR	No. of Floor	Additional Viaduct Edge Barrier (m)	Worst Affected Floor	Total Noise Level L_{eq} (30 min)
10-1	42	a) Semi-enclosure	7	53
		b) Additional Central Plenum	7	54

3.7.18 According to MOS Rail EIA, “the Multi-plenum System provides the flexibility for future enhancement as edge wall barrier heights can be incrementally extended for increased noise attenuation from 1.2m up to full enclosure”. In other words, adequate allowance has been made on MOS Rail’s viaduct design to support possible additional barriers for protecting future NSRs from rail noise. The proposed mitigation measures will be further reviewed in the detailed design stage of the residential development at Wu Kai Sha Station. The developers/ project proponents are responsible for designing their own layouts as well as the railway noise mitigation measures.

Summary

3.7.19 Railway noise assessment has been undertaken to investigate the potential noise impact from operational trains of MOS Rail on the proposed residential areas within the proposed development. It is predicted that the proposed high rise residential

developments in the vicinity of MOS Rail will be subject to railway noise impacts. Based on worst case calculations and mitigation at source, the required mitigation for various scenarios are identified and summarised below.

Table 3.7.6
Summary of the Mitigation Measures for MOS Train Noise

Development	Mitigation Measures
Residential Development at WKS Station	Approximate 60m long semi-enclosure along twin viaduct section OR Approximate 60m long central plenum along twin viaduct section

3.7.20 With the implementation of the recommended noise mitigation measures, the residential development at WKS Station would comply with the NCO noise limits. The proposed mitigation measures are to be further reviewed in the detail design stage of the residential development at WKS Station.

3.8 Operational Noise – Fixed-Noise Source

Introduction

3.8.1 The potential fixed-noise sources to be assessed are shown in Table 3.8.1 and their locations are shown in Figure 3.8.1.

Table 3.8.1
Categories of Fixed-Noise Assessment

Types of Fixed Noise	NSRs to be Assessed
Future fixed noise sources as a result of the development: - Public Transport Terminus / Open coach parking - Utility services (proposed salt water pumping station) - Ventilation system of the proposed commercial centre and Indoor Recreation Centre	Both existing and future NSRs including the proposed development
Existing / committed fixed noise sources not part of the development: - Existing sewage pumping station in Ma On Shan Area 108 near Lee On Estate - MOS Rail Wu Kai Sha Station	NSRs of the proposed development

- 3.8.2 There will be no future electric station or depot within the proposed development.
- 3.8.3 An existing wooden jetty is located in To Tau Tsuen to the west of Lok Wo Sha Development. According to on-site observation, the small wooden jetty is primarily used for recreational purposes only (such as leisure rowing and fishing). Noise impact from the jetty on the future Lok Wo Sha Development (located more than 130 m away) is not expected.
- 3.8.4 The assessment of the fixed noise sources has employed standard acoustic principles. The assessment has been based on the best available data and information.
- 3.8.5 In the absence of detail design information of the fixed sources, the maximum at-source noise levels were calculated to ensure compliance with the relevant noise criteria as specified in the TMEIA (i.e. ANL – 5 dB(A)). These maximum noise levels should be used by the detailed design team to work out the mitigation in order to meet the acceptable noise levels.
- 3.8.6 In any event, the ASR assumed in this EIA report is for indicative assessment only. It should be noted that fixed-noise sources are controlled under Section 13 of the NCO. Nothing in this EIA Report shall bind the Noise Control Authority in assessing noise from these sources upon the receipt of complaints. The Authority shall assess the noise impacts based on the contemporary conditions / situations.

Existing Sewage Pumping Station at Lee On Estate

- 3.8.7 An existing sewage pumping station in Ma On Shan Area 108 is located about 70m west of the proposed Wu Kai Sha Station development (Figure 3.8.1). A noise measurement has been conducted to identify the potential fixed noise impact from this pumping station to the proposed development.

Noise Assessment Methodology

- 3.8.8 The noise assessment has been based on measured free-field noise levels, and the details of assessment methodology are shown in Annex C4.

Monitoring Results

- 3.8.9 A noise monitoring has been undertaken on 8 October 2001 to measure the noise generated due to the operation of the pumping station. The monitoring location is about 3 m from the louvre at the pumping station. The monitoring procedure follows the procedure stipulated in *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (TM2). The monitoring results are shown in Table 3.8.2. The monitoring location is shown in Figure 3.8.1.

Table 3.8.2
Monitoring Results of Pumping Station

Time	Distance from Pumping Station	Leq (30 mins), dB(A)
10:00a.m.- 10:30a.m.	3 m from Pumping Station	65.0
10:30a.m.- 11:00a.m.	3 m from Pumping Station	65.3
11:00a.m.- 11:30a.m.	3 m from Pumping Station	65.2

Pumping Noise Impact Assessment

- 3.8.10 The predicted noise levels at NSR 10-1 is shown in Table 3.8.3. The predicted result shows that the noise generated by the operation of the existing sewage pumping station is below the planning noise criteria of 50 dB(A) for night-time period. Therefore, it is expected that the existing sewage pumping station will not pose any noise nuisance to the proposed development. This is because the whole pumping station is fully enclosed in a building and the noise generated by the pump is effectively mitigated.

Table 3.8.3
**Predicted Noise Levels generated from the Pumping Station at
 Ground Level of NSR 10**

NSR	Predicted SWL dB(A)	Distance (m)	Distance Correction	Façade Effect	Predicted Noise Level, dB(A)
10-1	82.7	70	44.9	+ 3 dB(A)	40.8

- 3.8.11 It is understood that the pumping station is likely to be upgraded by other project. The future upgrading works on the pumping station should ensure that the noise levels emitted from the pumping station will not exceed the TMEIA night-time criteria for an area sensitivity rating of 'B' at NSR 10 (i.e. 50 dB(A)). Based on the noise limit of 50 dB(A) at a distance of 70 m (NSR 10), the maximum allowable sound power level emitting from the exhaust of the future upgraded pumping station must not exceed 92 dB(A).

MOS Rail – Wu Kai Sha Station

- 3.8.12 A future MOS Rail Station (Wu Kai Sha) is being constructed. Noise from fixed sources associated with the rail station likely includes ventilation exhaust and plant room. According to KCRC information on the station, passenger platform will be fully enclosed and air-conditioned, and so the public announcement system which is inside the enclosed platform will not have impact on the nearby sensitive receivers.

Assessment Methodology

- 3.8.13 The assessment of the fixed plant noise from the future WKS Station has employed standard acoustic principles in the prediction of the maximum at-source noise levels to ensure compliance with noise criteria specified in the TMEIA. This includes a review of the likely location of the fixed plant and the nearest NSR which could be potentially affected, a determination of the acceptable noise limit of NSR based on the assigned Area Sensitivity Rating (ASR) and a calculation of the maximum allowable total sound power level of the fixed plant at-source. The maximum allowable sound power level of the fixed plant was calculated based on the night-time noise criteria stipulated in the TMEIA (i.e. TM2 -5 dB(A)) of the selected NSR, the attenuation of noise due to separation distance and noise reflection from building façade.
- 3.8.14 In the absence of any detailed information and noise specification of the fixed-noise sources, detailed noise assessment cannot be accurately undertaken. In this case, a quantitative approach to define the noise limits of the fixed plant for the future detailed design of the fixed plant installation and buildings has been conducted.
- 3.8.15 To simulate a worst case scenario, the fixed-noise sources were assumed to be located at the boundary of the proposed service facilities closest to the identified NSRs. The shortest possible separation distance from identified NSRs to the noise sources was used in the calculation.
- 3.8.16 In general, the noise assessment has been based on free-field noise level.
- 3.8.17 In the case of the public announcement system, it was assumed that the station will be fully open without any screening effect from the station structures. The assessment methodology is shown in Annex C4.

Assessment Results

- 3.8.18 The maximum allowable sound pressure level for the fixed noise sources (ventilation exhaust and plant room) associated with MOS Rail Wu Kai Sha Station is tabulated below in Table 3.8.4.

Table 3.8.4
Maximum Allowable Sound Pressure Level for Fixed-Noise Sources
Associated with MOS Rail Wu Kai Sha Station

Fixed Noise Sources	Worst Affected NSR	Approximate Separation Distance (m)	TMEIA Fixed Noise Limit (ANL – 5 dB(A))* (dB(A))	Maximum Allowable Sound Pressure Level** (Design Noise Limit) (dB(A))
Ventilation exhaust and plant room of MOS Wu Kai Sha Station	6	75	50	93
	10	14	50	78
	18	90	50	94

* Area Sensitivity Rating of “B” applied.

** The sound pressure level is 1m from façade of the source.

Façade correction of 3 dB(A) included.

Fixed-Noise Impact Assessment and Mitigation Measures

Ventilation Exhaust and Plant Room

- 3.8.19 No adverse noise impacts on the nearby NSRs would likely be expected when the specifications (Table 3.8.4) are strictly adhered to in the detailed design. In general, noise from the ventilation exhaust and plant room of MOS Wu Kai Sha Station can be readily reduced by locating it as far from the NSRs as possible, and by orientating the noise source away from the NSRs. A design noise limit (i.e. 78 dB(A)) for the detailed design of fixed noise source of Wu Kai Sha Station is recommended. Alternatively, the future detailed design of any fixed noise sources of Wu Kai Sha Station undertaken by KCRC will need to satisfy the TMEIA or findings of this EIA report.

Proposed Public Transport Terminus and Open Coach Parking

- 3.8.20 A Public Transport Terminus (PTT) is proposed within the sites of Lok Wo Sha and Whitehead. The PTT would incorporate two franchised bus bays, two green mini-bus bays, two taxi stands and one general pick-up / drop-off bay. The open coach parking has a capacity of 20 numbers of coaches.

Assessment Methodology

- 3.8.21 The assessment of the noise from the future PTT has employed standard acoustic principles in the prediction of the maximum at-source noise levels to ensure compliance with noise criteria specified in the TMEIA. This includes a review of the

nearest NSR which could be potentially affected, a determination of the acceptable noise limit of NSR based on the assigned Area Sensitivity Rating (ASR) and a calculation of the maximum allowable total sound power level of the PTT at-source. The maximum allowable sound power level of the PTT was calculated based on the night-time noise criteria stipulated in the TMEIA (i.e. TM2 -5 dB(A)) of the selected NSR, the attenuation of noise due to separation distance and noise reflection from building façade.

- 3.8.22 A noise monitoring was undertaken on 11 January 2002 to measure the noise generated from a similar PTT (bus stop outside HKUST). The monitoring location is about 15 m from the PTT. The monitoring procedure follows the procedure stipulated in *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (TM2). The monitoring results are shown in Table 3.8.5.

Table 3.8.5
Monitoring Results of PTT (HKUST Bus Stop)

No of vehicles	166
% heavy vehicles	79.5 %
Approximate distance from the PTT	15 m
Measured Leq (30 minutes)	65.2 dB(A)

Assessment Results

- 3.8.23 The area sensitivity rating for the NSRs at Whitehead site is assumed to be "A". The acceptable noise levels based on TMEIA (i.e. ANL – 5B(A)) are 55 dB(A) from 0700-2300 hours and 45 dB(A) from 2300-0700 hours.
- 3.8.24 The nearest NSR (NSR 33) at Whitehead site is located approximately 85 m from the boundary of the proposed PTT. Based on this distance, the maximum allowable sound power level emitting from the PTT is tabulated below in Table 3.8.6.

Table 3.8.6
Maximum Allowable Sound Power Level for the proposed PTT

Worst Affected NSR	Approximate Separation Distance (m)	TMEIA Fixed Noise Level (ANL-5dB(A)) (dB(A))	Maximum Allowable Sound Power Level (dB(A))
33	85	55 (for daytime and evening from 0700-2300 hours)	98.6
		45 (for night time from 2300-0700 hours)	88.6

Note:
 Area Sensitivity Rating of "A" is applied.

- 3.8.25 Applying the noise monitoring result taken in the HKUST PTT, the sound power level of the proposed PTT is predicted to be 96.7 dB(A) which is below the proposed maximum allowable sound power level.
- 3.8.26 It is expected that the heavy vehicle traffic using the PTT and carpark during the night time is relatively light. It is likely that majority of the recreational facilities except the restaurant will be closed by 11:00 p.m., therefore, the frequency of the public bus would be reduced. Also, the operation of coach would be ceased. As a result, noise impact arising from heavy vehicles during night time is expected to be minor.

Proposed Utility Services

- 3.8.27 A salt water pumping station is proposed west of the proposed Whitehead Site 2 development and an indoor recreation center is proposed at the eastern part of the PDO. The ventilation/ cooling systems of the indoor recreation center and the pumping station are considered to be fixed-noise sources.

Assessment Methodology

- 3.8.28 The assessment of the fixed plant noise from utility services proposed under this Project has employed standard acoustic principles in the prediction of the maximum at-source noise levels to ensure compliance with noise criteria specified in the TMEIA. Where the fixed noise source is generated as a result of the proposed development, these maximum noise levels should be used by the detailed design team to workout the mitigation in order to meet the TMEIA noise criteria.
- 3.8.29 The assessment assumption and methodology is essentially the same as that for the MOS Wu Kai Sha Station calculation described previously.

Assessment Results

- 3.8.30 The maximum allowable sound power level of the proposed utility services is tabulated in Table 3.8.7.

Table 3.8.7
Maximum Allowable Sound Pressure Level for Fixed Noise Sources
associated with the proposed Utility Services

Fixed Noise Sources	Worst Affected NSR	Approximate Separation Distance (m)	TM-EIA Fixed Noise Limit (ANL - 5 dB(A)) (dB(A))	Maximum Allowable Sound Pressure Level# (Design Noise Limit) (dB(A))
Salt Water Pumping Station west to Whitehead Site 2	24	25	45*	78
Ventilation system of the Indoor Recreation Centre	5	125	60**	107
Ventilation system of the Commercial Centre at Lok Wo Sha Development	18	6	60**	81

Notes:

- * Area Sensitivity Rating of "A" is applied. For those education uses, only daytime and evening noise limit is applied, 55 dB(A). For Residential Development, nighttime noise limit is applied, 45 dB(A).
- ** Area Sensitivity Rating of "B" is applied. As the Indoor Recreation Centre and the Commercial Centre will only operate from 07:00 to 23:00, only daytime and evening noise limit is applied, 60 dB(A).
- # The sound pressure level is 1m from façade of the source. Façade correction of 3 dB(A) is included.

Fixed Noise Impact Assessment and Mitigation Measures

Salt Water Pumping Station

- 3.8.31 The main sources of fixed noise are from the pumps and ventilation system. It is recommended that the exhaust of the ventilation system and any opening of the building should be located facing away from any NSRs, i.e. facing west, to avoid noise nuisance to the nearby NSRs. Louver or other acoustic reduction system should also be applied to the exhaust exit of the building.
- 3.8.32 Given the fully enclosed design with louver at the exhaust system, operational noise from the pumping station is not expected to pose any adverse impact to the proposed development.

Ventilation System of Indoor Recreation Centre and Commercial Centre

- 3.8.33 For the indoor recreation centre and commercial centre, the major fixed noise source will be the ventilation system. No adverse noise impacts on the nearby NSRs would likely be expected when the specifications are strictly adhered to in the detailed design. In general, noise from the ventilation/cooling system can be readily reduced by locating it as far from the NSRs as possible, and by orientating the noise source away from the NSRs. It is recommended that the ventilation/cooling system at the indoor recreation centre should be located at the southern part of the indoor recreation centre with opening facing towards south. For the commercial centre, the ventilation system should be located at the southern part of the commercial centre with opening facing towards either east or west. Also, with incorporation of silencer and acoustic louver, the noise emitted out from the ventilation system to the surrounding environment will be greatly reduced.

Existing Industrial Establishments

- 3.8.34 According to the findings of site surveys, there are currently no industrial establishments within 300 m of the Study Area.

3.9 **Conclusion**

Construction Noise

- 3.9.1 Noise from the use of powered mechanical equipment during construction activities and the haulage of material may potentially cause exceedance of construction noise standard at the nearby existing noise sensitive receivers (NSRs) if construction noise is not appropriately mitigated. Adequate mitigation measures will be required for the construction works to meet the noise standard.
- 3.9.2 The construction noise assessment shows that unmitigated noise levels might exceed EPD's recommended maximum noise levels for day-time construction work when construction activities occur in close proximity to NSRs or when several construction works occur simultaneously.
- 3.9.3 Exceedance of noise level is unavoidable because of the close proximity between the construction works and some of the NSRs. Adequate mitigation measures will be required for the construction works to meet the criteria.
- 3.9.4 The use of quiet plant and working methods, reducing the number of equipment, restricting the number of works and the use of temporary noise barriers to protect the closest residences, and schools has been recommended and would be sufficient to reduce noise levels to compliance levels at the NSRs.

- 3.9.5 A noise monitoring programme is proposed to ensure that construction noise is within the recommended criteria throughout the construction stage.

Operational Noise

Traffic Noise

- 3.9.6 Traffic noise impact assessment for the proposed development has been conducted. Most of the sensitive receivers within the proposed development will not be subject to traffic noise nuisance with the introduction of environmentally friendly layout design, except for some of the façades at the Wu Kai Sha Station Development due to the technical inapplicability of direct noise mitigation measure such as noise barrier at Sha On Street. Provision of window insulation and air-conditioning or special layout design has been proposed to resolve the traffic noise nuisance.
- 3.9.7 For those school-type NSRs exceeding the noise criterion, noise mitigation measures have been proposed in the form of boundary wall.
- 3.9.8 All the proposed measures are subject to the configuration of the development layout plans. The developers/project proponents are responsible for designing their own layouts with the recommendation stipulated in this EIA report. In the event that an alternative layout is proposed, the relevant developer/project proponents should prove that the new layout could meet the equivalent or better environmental standards as given in this EIA report. In addition, the relevant developer/project proponents should be aware of the site constraints assumed in this EIA.
- 3.9.9 Residual impacts may arise at some units of the Symphony Bay and one village house at Lok Wo Sha. Eligibility test on these façades has been conducted, but none of these façades qualify for the noise insulation works under ExCo directive.
- 3.9.10 An operational traffic noise monitoring is proposed to check the effectiveness of the proposed mitigation measures such as boundary wall and environmentally friendly design layout.

Rail Noise

- 3.9.11 Rail noise assessment has been undertaken to investigate the potential noise impact from operational trains of MOS Rail on the residential areas within the proposed development.

- 3.9.12 With the implementation of the recommended noise mitigation measures such as central plenum or equivalent on the concerned viaduct section of MOS Rail, the nearby noise sensitive uses will not be subject to train noise level above the NCO noise limit.

Fixed-Noise

- 3.9.13 No existing industrial noise sources were identified during site surveys. An existing sewage pumping station is found to be located near Lee On Estate. With the enclosure and sufficient buffer distance, the fixed-noise generated from the sewage pumping station will not pose any noise nuisance to the proposed development.
- 3.9.14 Potential fixed noise sources assessed include noise from public transport terminus / open coach parking, ventilation system of the proposed commercial centre within the proposed development and that of the indoor recreational centre, proposed salt water pumping station, ventilation exhaust and plant room of MOS Rail Wu Kai Sha Station. Noise impacts on the nearby NSRs from these fixed noise sources will not be insurmountable provided that the noise levels from the different fixed plants do not exceed the maximum allowable sound pressure level (design noise limit) predicted in the assessment.