3. NOISE

3.1 Introduction

3.1.1 This *Section* presents an assessment of the potential noise impacts associated with the construction and operation of the proposed widening of Sai Sha Road. The quantitative assessment methodology which has been adopted for the assessment is presented and control measures, to ensure the effective protection of the identified sensitive receivers, are recommended.

3.2 Baseline Conditions

3.2.1 At present the Sai Sha Road is a single two lane carriageway and provides the main access route between Ma On Shan and Sai Kung. The area through which the section of Sai Sha Road under consideration in this EIA passes is largely residential. To the west of the road alignment are several small villages, comprising of typical three storey dwellings, while to the east are a number of high rise residential developments (approximately 35 storeys). In addition to the existing residential areas, three future developments have been identified within the study area. These are the proposed residential development at DD206 Wu Kai Sha, the proposed residential development at STTL446 and the proposed residential development above LEO.

3.2.2 At present the noise levels in this area are dominated by traffic travelling along existing roads. Following the widening of the Sai Sha Road traffic noise is expected to remain a major noise source in the area however the future noise environment will also include train noise from the proposed MOS Rail.

3.2.3 *Figure 5* shows the areas which contain noise sensitive receivers (NSRs) and where potential noise impacts may arise from the construction or operation (or both) of the widened section of Sai Sha Road.

3.3 Noise Sensitive Receivers

3.3.1 For the purpose of this assessment, nine NSRs have been considered represented by a total of fifty-four Assessment Points (APs). These represent residential properties in the following areas:

- Wu Kwai Sha New Village (3 APs);
- Lok Wu Sha (5 APs);
- Kam Lung Court (26 APs);
- Lee On Estate (10 APs);
- proposed development STTL 446 (1 AP);
- proposed residential development above LEO (5 APs);
- residential development in DD206, Wu Kai Sha (2 APs);
- Villa Athena (1 AP); and
- Saddle Ridge Gardens (1 AP).

3.3.2 In most cases a single assessment point will represent a number of properties, having been selected as the facade which is most affected of those represented. In some cases, because of the orientation of the building with respect to the

proposed road, it is necessary to assess the impacts at more than one facade, in such cases a separate AP is considered for each facade. For low rise developments, noise levels are predicted for each of the floors (ground, first and second), whilst for high rise developments a selection of floors are considered (first floor and every 5th floor).

3.3.3 The NSRs and APs considered in this assessment are shown in *Figures 6a* to *6f* and are described in *Table 3.3a*.

Table 3.3a Noise Sensitive Receivers

NSR/AP	Description	Affected Facade	Type
NSR1 Wu Kwai Sha New Village			
N101	Village House	SE	Low Rise Residential
N102	Village House	NE	Low Rise Residential
N103	Village House	SE	Low Rise Residential
NSR2 Lok Wo Sha			
N201	Village House	SE	Low Rise Residential
N202	Village House	NE	Low Rise Residential
N203	Village House	SE	Low Rise Residential
N204	Village House	NE	Low Rise Residential
N205	Village House	NE	Low Rise Residential
NSR 3 Kam Lung Court			
N301	Lung Sing House	N	High Rise Residential
N302	Lung Sing House	W	High Rise Residential
N303	Lung Sing House	N	High Rise Residential
N304	Lung Sing House	N	High Rise Residential
N305	Lung Sing House	W	High Rise Residential
N306	Lung Sing House	W	High Rise Residential
N307	Lung Sing House	S	High Rise Residential
N308	Lung Sing House	S	High Rise Residential
N309	Lung Sing House	W	High Rise Residential
N310	Lung Sing House	S	High Rise Residential
N311	Lung Sing House	N	High Rise Residential
N312	Lung Sing House	N	High Rise Residential
N313	Lung Sing House	E	High Rise Residential
N314	Lung Yiu House	N	High Rise Residential
N315	Lung Yiu House	N	High Rise Residential
N316	Lung Yiu House	W	High Rise Residential
N317	Lung Yiu House	N	High Rise Residential
N318	Lung Yiu House	N	High Rise Residential
N319	Lung Yiu House	W	High Rise Residential
N320	Lung Yiu House	W	High Rise Residential
N321	Lung Yiu House	S	High Rise Residential
N322	Lung Yiu House	S	High Rise Residential
N323	Lung Yiu House	W	High Rise Residential
N324	Lung Yiu House	N	High Rise Residential
N325	Lung Yiu House	N	High Rise Residential
N326	Lung Yiu House	E	High Rise Residential

NSR/AP	Description	Affected Facade	Type
NSR4 Lee On Estate			
N401	Lee Wing House	NE	High Rise Residential
N402	Lee Wing House	NW	High Rise Residential
N403	Lee Wing House	N	High Rise Residential
N404	Lee Wing House	NW	High Rise Residential
N405	Lee Wing House	SW	High Rise Residential
N406	Lee Wing House	SW	High Rise Residential
N407	Lee Wing House	W	High Rise Residential
N408	Lee Wing House	SE	High Rise Residential
N409	Lee Wing House	E	High Rise Residential
N410	Lee Wing House	E	High Rise Residential
NSR5 Residential Development at STTL 446			
N501	Between T7 and Sai Sha Road Roundabout	NW	High Rise Residential
NSR 7 Residential Development in DD206, Wu Kai Sha			
N701	To the south-east of development	S	High Rise Residential
N702	Overlooking the Sai Sha Road Roundabout	S	(17 storeys)
NSR8 Villa Athena			
N801	Villa Athena	SE	High Rise Residential
NSR9 Saddle Ridge Gardens			
N901	Saddle Ridge Gardens	NE	High Rise Residential

3.4 Proposed Developments

Residential Development STTL 446

3.4.1 Details of this development were obtained from the *Traffic Noise Assessment for Proposed Residential Development in STTL 446 Area 108 Ma On Shan, Shatin (068), AEC, September 1996.*

3.4.2 Due to the relatively large separation distance between this development and Sai Sha Road, traffic noise predictions were made for only the nearest noise sensitive facade. Information obtained from the developer indicates that residences in this development are likely to be occupied by the end of 1999. As the road widening works are scheduled to commence in 2001 this development has also been considered in the construction assessment of the EIA.

Proposed Railway Depot and Residential Development at Lee On (LEO)

3.4.3 The area immediately north of the Residential Development STTL 446 has been earmarked for a proposed railway depot with commercial/residential developments above it. A total of five APs have been selected to represent the NSRs identified in the proposed layout. It assumed that these dwellings will not be occupied before the LEO construction has been completed in early 2004. Since the new road is scheduled to open in 2003 no construction impacts resulting from this scheme are likely to occur at this development. This NSR has, therefore, been excluded from the construction noise assessment.

Proposed Residential Development in DD206, Wu Kai Sha

3.4.4 This development lies to the north west of the T7 Interchange. At present there is no specific programme for this development, however it is expected that construction will not be completed before that of Trunk Road T7 which is scheduled for completion in December 2002. A review of the noise impact assessment carried out for this development indicates that no site specific mitigation has been included in the design layout. Two APs have been considered in this area to allow potential noise impacts to be evaluated.

3.5 Construction Noise

Potential Sources of Impact

3.5.1 Construction works associated with this scheme are scheduled to commence in early 2001, are likely to be completed within a 26 month period and will include the construction of a footbridge and pedestrian subways as well as the main road alignment.

3.5.2 The works will require a number of noisy activities including the use of heavy plant for excavation, filling, concreting and piling operations as well as on-site haul road traffic and potential increases in off-site traffic along site access routes. No percussive piling is anticipated.

3.5.3 Although full details of the construction activities and methods are not available at this stage, it is anticipated that the construction phase is likely to entail the following:

- site clearance;
- bored piling;
- pile capping;
- precast super structure construction;
- in-situ super structure construction;
- paving;
- drainage construction;
- road construction;
- on-site haulage; and
- site access haulage.

3.5.4 MOS Rail, the alignment of which will run between the two separate

carriageways of the widened Sai Sha Road, will be constructed during the same period as the Sai Sha Road construction works. This assessment therefore considers the cumulative impacts likely to arise during the construction period.

3.5.5 The expected scheduling is shown in *Figure 2*, whilst the equipment to be used for, and noise levels of, each of these activities are presented in *Table A2* of *Annex A*.

Noise Legislation and Standards

3.5.6 It is anticipated that the majority of the construction works will be undertaken during normal working hours (Monday to Saturday 07.00 -19.00), excepting Public Holidays. The statutory limit for construction noise during normal working hours is specified in the *Technical Memorandum on Environmental Impact Process* (EIAO-TM) as $L_{Aeq,\ 30min}$75 dB. This limit has therefore been adopted in this assessment to protect the NSRs to an appropriate extent.

Noise Criteria

3.5.7 This assessment covers the noise generated by general construction activities operating during normal working hours. The relevant noise criterion has been established using the guidance given in EIAO-TM , shown in *Table 3.5a*.

Table 3.5a Daytime Noise Criterion EIAO-TM ($L_{Aeq,\ 30\ min}$ dB)

Noise Sensitive Receiver	Criteria (0700-2300)
Dwelling	75

Assessment Methodology

3.5.8 The methodology for assessing construction noise other than percussive piling has been developed based on GW-TM and is as follows:

- locate NSRs that may be affected by the works;
- calculate distance attenuation to NSRs from notional noise source point;
- predict construction noise levels at NSRs in the absence of any mitigation measures; and
- calculate the maximum total site sound power level (SWL) for construction activities such that noise levels at NSRs comply with appropriate noise criteria.

3.5.9 The distance correction for each NSR with respect to each construction activity is calculated from the distance between the NSR and the worksite notional point. The notional point is established in accordance with GW-TM.

3.5.10 The noise predictions consider the noise contribution from the various activities (including MOS Rail construction) that may occur simultaneously in the working areas or in adjacent working areas.

3.5.11 Mitigation measures have been considered where noise criteria exceedances are likely. These measures include the use of silenced power mechanical equipment and movable barriers, scheduling of construction activities and reducing the number of noisy plant working simultaneously.

Potential Impacts

3.5.12 Potential noise impacts are likely to arise at neighbouring NSRs as a result of the construction activities associated with Sai Sha Road widening and MOS Rail. The construction activities are likely to occur within six distinct sites. These are indicated in *Figure 7.* The activities likely to occur in each site are:

- Site A - road widening works;
- Site B - construction of footbridge;
- Site C - subway construction;
- Site D - construction of MOS Rail elevated bridge;
- Site E - construction of the underground section of MOS Rail; and
- Site F - construction of LEO.

3.5.13 Noise predictions have been made at each NSR for each quarter (3 months) of the construction period. The calculations are based on the construction programmes for both MOS Rail and the road widening as indicated in *Table A1*, as well as the assumed plant teams presented in *Table A2* of *Annex A*

3.5.14 In order to include such effects, worst case scenarios have been considered in which construction activities likely to take place during the same quarter are assumed to operate simultaneously.

3.5.15 The results are presented in *Table A5* of *Annex A.*

3.5.16 The results of the calculations indicate that if the construction activities remain unmitigated, cumulative construction noise impacts of up to 17dB(A) above the established criterion are likely to occur at all NSRs considered during the entire construction phase.

Recommended Mitigation Measures

3.5.17 Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant and quiet working methods and through the use of temporary barriers. These methods are discussed in the following paragraphs.

Good Site Practice

3.5.18 Good site practice and noise management can considerably reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;

- machines and plant that may be in intermittent use should be shut down

between work periods or should be throttled down to a minimum;

- plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs;

- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;

- mobile plant should be sited as far away from NSRs as possible; and

- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quieter Plant and Working Methods

3.5.19 The Contractor may be able to obtain particular models of plant that are quieter than standard types given in the GW-TM. The benefits achievable in this way will depend on the details of the Contractors' chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total SWL of all plant on the site so that the Contractor is allowed some flexibility to select plant to suit his needs.

3.5.20 It should be noted that various types of silenced equipment can be found in Hong Kong. However, the EPD, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

Temporary Noise Barriers

3.5.21 In general, noise barriers located between noisy construction activities and NSRs could give up to 5 dB(A) reduction from screening (estimated in accordance with TM). It would be possible for the Contractor to provide barriers, in the form of site hoardings, to achieve this level of reduction. Certain types of PME, such as generators and compressors, can be completely enclosed giving a total noise reduction of 10 dB(A) or more. Movable vertical barriers that can be located close to noisy plant can also be very effective at screening NSRs from particular plant.

3.5.22 By considering the above methods of mitigation it is possible to develop a mitigation package, which can be adopted to minimise potential noise impacts. Two mitigation options are considered in this assessment.

Mitigation Option 1

3.5.23 Mitigation Option 1 utilises quiet plant, where appropriate, and movable noise barriers. The revised inventory of plant noise data and the corresponding construction noise levels are presented in *Tables A3* and *A6* in *Annex A,* respectively.

3.5.24 The results indicate that mitigation option 1 can be successfully used to reduce the number of noise impacts generated by construction activities. However, residual impacts are likely at the following locations:

- Wu Kwai Sha New Village (up to 5 dB(A) for approximately 27 months);
- Kam Lung Court (up to dB(A) for approximately 27 months); and
- Lee On Estate (up to 8 dB(A) for approximately 27 months);

Mitigation Option 2

3.5.25 In areas where mitigation option 1 is not sufficient to protect NSRs from noise impacts further mitigation will be required. This will necessitate restricting the construction activities which can operate simultaneously as well as the of number of plant used to carry out the specific activities. The necessary measures are:

- *Site Clearance* - reduce the number of bulldozers/rippers, compressors and lorries to one and ensure that the excavator, bulldozer, scraper and motor grader do not operate simultaneously.

- *Pile Capping* - separate the individual tasks (i.e. ground, reinforcement, concreting and backfilling activities) and ensure that the backhoe and excavator do not operate simultaneously.

- *In-situ Superstructure* - formwork and reinforcement to be carried out separately from concreting.

- *Paving* - ensure the asphalt paver and road roller do not operate simultaneously.

- *Drainage* - separate all sub-tasks (i.e. excavation of trench and placement of pipes).

- *Road Construction* - separate all sub-tasks (i.e. levelling of new road, laying base and sub-base, kerbing and laying new surface). In addition it will be necessary to avoid simultaneously operation of the following items of plant: grader and bulldozer; dumper truck and roller; asphalt paver and road roller.

- *Fourth quarter of 2001* - reschedule construction of utilities services and road furniture to avoid this period.

- *Fourth quarter of 2002* - reschedule construction of road furniture to avoid this period.

3.5.26 The revised plant inventory and predicted results are presented in *Tables A4* and *7A, Annex A,* respectively and indicate that noise impacts can be prevented at almost all NSRs. Noise impacts of up to 2 dB(A) above the criterion, for up to 18 months are, however, still predicted for Lee On Estate.

3.5.27 The residual noise impacts at Lee On Estate are, in general, dominated by construction of the main alignment, footbridge and MOS Rail. It is recommended that the construction of the alignment in the vicinity (within 40 m) of Lee Wing House (Lee On Estate) is scheduled so it will not coincide with the construction of the footbridge and the elevated section of MOS Rail (within 40m of Lee Wing House). The results of this mitigation option are shown in *Tables A8 and A9 of Annex A.*

3.5.28 The application of the above mitigation measures should ensure that no residual construction impacts occur. It is however recommended that noise levels are monitored on a regular basis during the construction phase to ensure that the potential impacts are avoided.

3.6 Operational Noise

Potential Sources of Impact

3.6.1 Traffic travelling along Sai Sha Road has the potential to generate noise impacts at nearby residential properties. Potential impacts are likely to be greatest during the peak hourly flow, therefore only the peak hour is considered in this assessment.

Noise Criteria

3.6.2 Traffic noise impacts are assessed using the guidance given in the EIAO-TM which recommends a noise limit of 70 dB $L_{A10,\ peak\ hour}$ for residential areas. This is used as the target level for all 'direct' forms of mitigation (i.e. those that can be applied to the road itself). Any predicted impacts exceeding the EIAO-TM level are considered to constitute significant impacts and practicable direct mitigation measures are recommended in order to alleviate the noise impact to acceptable levels.

3.6.3 In cases where practicable and effective direct mitigation measures are not available, or the identified measures cannot provide adequate protection to reduce the noise levels to within the EIAO-TM standard, provision of indirect technical remedies to existing sensitive receivers, in the form of acoustic insulation and air-conditioning should be considered under the ExCo directive *Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads*. The eligibility of an NSR for indirect technical remedies is assessed against the following criteria:

i) the predicted overall noise level from the new road together with other traffic noise in the vicinity must be above the specified noise level ($L_{A10\ peak\ hour}$ 70 dB for residential dwellings);

ii) 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 works to construct were commenced; and

iii) the contribution to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A);

and recommendations should be presented to ExCo for approval.

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

- *existing roads*: includes existing roads which will remain either completely unchanged or which will undergo only very minor alterations; or

- *new roads*: includes roads which will be built as part of the proposed scheme as well as existing roads which will be substantially altered.

3.6.5 This assessment considers the overall noise level generated by the traffic travelling along all roads (existing and new) in the area so that the overall road traffic noise level at each NSR can be determined.

Assessment Methodology

3.6.6 The road networks (baseline and future) have been modelled using the proprietary traffic noise computer program, HFANoise, which implements the methodology of the *UK Department of Transport's Calculation of Road Traffic Noise* (CRTN). Predictions of the traffic noise levels are based on the peak hourly traffic flow. The prospective traffic flows for the construction year 2001 and the design year (2018) are presented in *Figures 4a* and *4b*.

3.6.7 The MOS Rail alignment will run between the two carriageways of the widened Sai Sha Road. The preliminary alignment profile (see *Figure 3a*) [2] indicates that this section of the rail link will be in a retained cut between the Kam Ying Road Junction and the proposed footbridge across Sai Sha Road. To the east of the proposed footbridge it shall be elevated rising from grade (approximately 11.4 mPD) to meet the proposed LEO Station (approximately 16.5 mPD). A typical cross section of the proposed elevated section is shown in *Figure 3b*[3]

3.6.8 The elevated section of MOS Rail is likely to provide some degree of screening of the east bound carriageway from Lee On Estate. In order to include these potential screening effects, the MOS Rail structure was modelled within the HFANoise model as an elevated road with 4m high roadside noise barriers on each side.

3.6.9 Noise levels have been predicted at a total of 54 APs representing approximately 2670 residential dwellings. No school classrooms are likely to be affected by the operation of this scheme.

Evaluation of Operational Noise

3.6.10 The prevailing existing noise levels have been predicted using the projected traffic flow for the construction year. The results are presented in *Table B1* in *Annex B* and indicate that criteria exceedances (>70 dB(A)), would be

[2] Feasibility Study for the Tai Wai to Ma On Shan Rail Link and the KCR Extension to Tsim Sha Tsui: Preliminary Alignment Profile. Maunsell Consultants Asia, Jul 96

[3] Ti Wai to Ma O Shan - Preliminary Environmental Review: Volume 1 - Main Report, ERM-HK, 5 May 1998

experienced, prior to the widening of Sai Sha Road, at 32 of the 54 APs considered. This equates to exceedances at total of approximately 990 dwellings.

3.6.11 The widened Sai Sha Road is scheduled to open in 2003. It is anticipated that the maximum peak traffic flows, and consequently the maximum noise levels generated, within fifteen years of the opening date will occur during the year 2018. This year has, therefore been selected as the design year for this study.

3.6.12 The noise levels predicted for the design year, are presented in *Table B2 of Annex B.*

3.6.13 Noise criteria exceedances of up to 7 dB(A) are predicted for 30 of the APs considered. This equates to exceedances at approximately 770 dwellings. Direct noise mitigation will therefore be proposed along the road alignment to protect against potential impacts at each of these NSRs.

Mitigation Measures

3.6.14 The extent of the mitigation required is presented in *Figure 8* with typical cross-sections of the noise barriers provided in *Figure 9.* The mitigated noise levels are presented in *Table B3* in *Annex B.*

3.6.15 The mitigation proposed in each area is described and the rationale behind it explained in the following paragraphs. An evaluation of the unmitigated and mitigated scenarios is also provided in terms of the number of dwellings exposed to road traffic noise impacts. These impacts are categorised as follows:

- *noise impact* - noise level predicted at a dwelling exceeds 70 dB(A);
- *noise impact not attributable to the widened section of Sai Sha Road* - a noise impact where the contribution of the existing roads exceeds that of the new roads by at least 7 dB(A); and
- *noise impact attributable to the widened section of Sai Sha Road* - any noise impact which does not fall into the second category (i.e. noise impacts dominated by new roads).

Wu Kwai Sha New Village and Lok Wu Sha

3.6.16 If unmitigated, traffic noise criteria exceedances of up to 3 dB(A) are predicted at four APs. These are: N101, N102, N201 and N203. The properties represented by these APs can be adequately protected by the following:

- 130 m long, 0.6 m parapet at a distance of 0.6 m from the left hand side of the Sai Kung bound carriageway; and
- constructing an abutment below the initial slope of the proposed footbridge on the left hand side of the Sai Kung bound carriageway (see *Figure 9a*). This abutment should be finished with an absorptive material on the side facing Sai Sha Road.

The mitigation proposed above will protect the majority of the dwellings in this area from noise impacts. Noise impacts are however expected at a 4 dwellings. These impacts are not attributable to the widened section of Sai Sha Road.

Kam Lung Court

3.6.17 If unmitigated, traffic noise criteria exceedances of up to 7 dB(A) are anticipated at N304-N310, N312 and N317-N326. However at the majority of these APs (all except N304-N308), traffic noise is dominated by traffic using existing roads and are therefore not considered to be attributable to the widened section of Sai Sha Road.

3.6.18 It is proposed that two noise barriers are used to reduce noise impacts at Kam Lung Court:

- a 100 m long, absorptive cantilever barrier (see *Figure 9* for detail), 2 m from the Sha Tin Bound Carriageway beginning immediately east of the Kam Ying Road junction.; and

- a 320 m long, cantilever absorptive (both sides) noise barrier, consisting of a 5 m vertical section with a cantilevered section protruding 1 m vertically and 2 m horizontally. The barrier will be positioned 1m from the right hand side of the Sai Kung bound carriageway, beginning immediately north east of the Kam Ying Road junction (see *Figure 8*).

3.6.19 Noise impacts are likely at 5 APs, representing approximately 106 dwellings. However, at each of these APs the predicted noise level is dominated (by more than 7 dB(A)) by noise from existing roads. Consequently none of these impacts are considered to be attributable to the widened section of Sai Sha Road.

Lee On Estate

3.6.20 If impacts remain unmitigated, properties within Lee On Estate (N403 - N407) are likely to experience noise impacts up to 5 dB(A) above the criterion. Despite their closer proximity to Sai Sha Road, noise impacts are marginally lower for this area than for Kam Lung Court. This is due to two factors. Firstly, the Lee Wing House facade closest to, and overlooking, the Sai Sha Road is non-noise sensitive (see *Figure 13 Photographs 1 - Photograph 3*) and secondly, noise emissions from the far carriageway will be screened to some extent by the elevated MOS Rail bridge structure which will rise, from grade, immediately east of the proposed footbridge to approximately 16 mPD at the roundabout[4].

3.6.21 It is proposed that two noise barriers are provided in this area to protect dwellings within Lee On Estate from potential traffic noise criteria exceedances. These are as follows:

[4] The screening provided by the MOS Rail structure has been taken into account in the calculation of noise levels at Lee On Estate in the design year. It has been estimated within the HFA noise model using the CRTN methodology based on the minimum path difference forced by the obstruction.

- a 120 m long, absorptive cantilever barrier (see *Figure 9* for detail) is erected 2 m from the left hand side of the Sha Tin bound carriageway, extending from the proposed footbridge to the proposed pedestrian subway at the roundabout.

- a 320 m long, cantilever absorptive (both sides) noise barrier, consisting of a 5 m vertical section and a cantilevered section protruding 1 m vertically and 2 m horizontally. The barrier will be positioned 1 m from the right hand side of the Sai Kung bound carriageway, beginning immediately north east of the proposed footbridge (see *Figure 8*).

3.6.22 The proposed mitigation will adequately protect all dwellings within Lee On Estate from potential traffic noise criteria exceedances. Therefore, no residual noise impacts are anticipated in this area.

Proposed Residential Development above LEO

3.6.23 It is assumed that the T7 slip roads will be surfaced using standard friction course as recommended in the EIA for T7. Therefore this type of low road noise surfacing has been assumed for both the unmitigated and mitigated scenarios.

3.6.24 The proposed layout of this development indicates that all residential blocks will be constructed on top of a podium structure set back between 10 and 55 m from the podium edge. The results of the noise modelling carried out as part of this assessment prove that these mitigation measures built into the design layout will be sufficient to protect the dwellings from traffic noise criteria exceedances. No further mitigation will be required in this area.

3.6.25 No residual impacts are predicted in this area.

Proposed Residential Development at Wu Kai Sha Village

3.6.26 It is proposed that a 100 m long, 5 m vertical absorptive noise barrier is located alongside the slip road leading from Sai Sha Road to the T7 interchange. This will prevent potential noise impacts arising within this residential development.

Further Noise Mitigation

3.6.27 Further noise mitigation has been considered in this assessment however its use is precluded due to practical limitations and engineering constraints. These are as follows:

- *low road noise surfacing on Sai Sha Road* - unlikely to be very effective due to the relatively slow speed and anticipated start/stop nature of the traffic conditions. Pervious surfacing exposed to traffic conditions of this type are, in general, much less resilient to wear than their impervious counterparts, thus requiring more regular maintenance. As a result this is not considered a viable mitigation option.

- *more extensive noise barriers* - because the residual impacts are dominated by existing roads the provision of taller and more extensive

noise barriers along the widened section of Sai Sha Road would be ineffective and would not reduce the number of residual impacts.

3.6.28 It should be noted that exact form of the noise barriers proposed in this assessment are subject to detailed design when suitable equivalent configurations may be considered to be more appropriate.

Residual Impacts

3.6.29 Residual noise impacts of up to 6 dB(A) are likely at eight of the fifty-four assessment points considered. This equates to approximately 170 dwellings. However these impacts arise as a result of traffic using existing roads and are therefore not considered to be attributable to the widened section of Sai Sha Road. The residual impacts are summarised in *Table 3.6 a.*

Table 3.6a Number of Dwellings affected by Residual Traffic Noise Impacts

	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6	NSR7	NSR8	NSR9	Total
Noise impacts	4	0	106	0	0	0	0	20	40	170
Noise impacts attributable to the widened section of Sai Sha Road	0	0	0	0	0	0	0	0	0	0
Noise impacts not attributable to the widened section of Sai Sha Road	4	0	106	0	0	0	0	20	40	170

3.6.30 It is estimated that the mitigation measures proposed will prevent noise criteria exceedances at a total of approximately 480 dwellings and is likely to benefit (by more than 1dB(A)) approximately 1210 dwellings.

3.6.31 Under the ExCo directive *Equitable Redress for Persons Exposed to Increased Noise resulting from the Use of New Roads,* where direct mitigation cannot adequately protect existing NSRs from traffic noise impacts, the provision of indirect technical remedies in the form of acoustic insulation and air-conditioning may be required. Whether or not an NSR qualifies for such equitable redress is dependent on a number of factors based on the contribution that any new road makes to the overall noise level at the NSR.

3.6.32 An eligibility test has been carried out for all existing NSRs at which noise impacts are predicted to occur. The results are presented in *Table C1 in Annex C.* The results show that since all three criteria are not met at any dwellings, no dwellings will qualify for indirect technical remedies.

3.7 Conclusions

Construction Phase

3.7.1 Potential noise impacts resulting from the widening of Sai Sha Road can be avoided through the use of suitable mitigation measures such as; the use of quiet plant and construction techniques, movable noise barriers and reducing the number of plant operating simultaneously.

3.7.2 Since the majority of the construction activities associated with this Project fall within a Designated Area, the use of any Specified Powered Mechanical Equipment or Prescribed Construction Works, during restricted hours, shall require a valid Construction Noise Permit.

Operational Phase

3.7.3 If unmitigated the Sai Sha Road widening scheme is likely to generate noise criteria exceedances of up to 7 dB(A) at thirty of the fifty-four APs considered in this assessment. This equates to exceedances at approximately 770 of 2670 dwellings (i.e.. 28 % non compliance).

3.7.4 If the proposed mitigation measures outlined in this assessment are implemented approximately 595 dwellings will be protected from EIAO-TM criteria exceedances. It is estimated that the mitigation will benefit (by at least 1dB(A)) approximately 1295 dwellings.

3.7.5 No residual noise impacts, atributable to the widening of Sai Sha Road are anticipated.

3.7.6 No NSRs will be eligible for equitable redress in the form of noise insulation works (NIW) under the ExCo directive.