

5. NOISE IMPACT ASSESSMENT

5.1 Introduction

This section presents the assessment of potential noise impacts associated with the construction and operational phases of the EPIWs. Practical mitigation measures are recommended, where appropriate, to reduce the noise impacts at the identified NSRs in order to satisfy the relevant noise standards described in *Section 3.1*.

For the operational phase impact assessment of road traffic noise, the key requirements of the study are as follows:

- use approved noise calculation methodologies, traffic data prepared by the traffic specialists and consultants of KCRC which is acceptable to Transport Department (see Annex A), sites visits and the latest mapping information available to identify the existing sensitive uses, identify planned development and draw direct reference to appropriate Governmental guidance in the application of mitigation measures;
- predict the existing road traffic noise levels ($L_{A10,peak\ hour}$) based on the peak hour traffic flow in the year prior to commencement of EPIWs' construction (the prevailing year) and describe the existing noise environment;
- predict future road traffic noise levels ($L_{A10,peak\ hour}$) based on the peak hour traffic flow of the maximum traffic projection within 15 years of the Project opening;
- assess the potential impact of the maximum future change in noise levels within 15 years of opening of the EPIWs;
- recommend direct technical remedies (mitigation measures) to reduce traffic noise levels to the established criteria or to maximise the protection of the noise sensitive receivers as far as practicably possible;
- as a last resort, nominate indirect technical remedies for eligible sensitive receivers (in accordance with the ExCo directive, *Equitable Redress for Persons Exposed to Increased Noise resulting from the Use of New Roads*) where the practicable application of direct methods would leave residual impacts; and
- all the recommended direct and indirect technical remedies should be included in the Implementation Schedule for relevant parties to act on.

The mitigation options that may be considered to reduce any identified noise impacts in are, but not restricted to, the following:

- all forms of acoustic barriers and screening measures;
- low noise road surfacing;
- buffer zones and landscaping; and

- site layout and building design.

Since the EPIWs principally involve minor modification of existing roads, the application of buffer zones and landscaping for noise mitigation will be limited by the existing spatial relationship between the roads and the as-built receiving environment.

For future development that is presently uncommitted or not finalised in detailed design, it will not wholly be feasible for this assessment to pre-empt the design of sensitive receivers, although modification of site layout and or building design will be a subsequent option to the developer and the project proponent. Therefore, the application of direct mitigation within the boundaries of the EPIWs (principally at or close to the roadside) will be the primary available method of control for noise impacts: where the practicable maximisation of these measures within the boundaries of the EPIWs and civil and traffic imposed constraints would leave residual impacts, it is taken that the formal development planning process (i.e. review of *Section 16* application) will ensure appropriate site and building layout measures are incorporated in the future by the developer to meet the road traffic noise standards.

Where direct technical remedies for existing dwellings and schools are considered by this assessment to be exhausted, the identification of the property that may be eligible for indirect technical remedies will be defined, and the details of the mitigation proposals detailed in the Implementation Schedule in order to ensure that they are fully and appropriately addressed at the correct stages of the Project's development. The detailed specification of noise insulation works and schedule of eligible property would be undertaken by the Project Proponent following approval of the EIA Study and in accordance with guidelines approved by the EPD and the *ExCo Directive*. This will include inter alia review of existing glazing performance, condition of existing windows and casements as well as review of electrical service provisions for air conditioners and the full and detailed inventory and specification of all noise insulation works.

5.2 Construction Phase

5.2.1 Potential Sources of Impact

The source of noise during each construction stage of the EPIWs is mainly from the use of PME on site. The works will require a number of noisy activities including the use of heavy plant for excavation, filling, concreting and road paving. The key construction stages and activities for each EPIW are outlined below:

- Drainage Works (for Yuen Long, Tin Shui Wai and Tuen Mun)
 - i) excavation;
 - ii) preparation of formation;
 - iii) laying of pipes;
 - iv) construction of manholes; and
 - v) backfilling.
- Road Construction (for Yuen Long, Tin Shui Wai and Tuen Mun)

- i) excavation;
 - ii) placement of road base;
 - iii) levelling of new road (not required in Tuen Mun); and
 - iv) curbing and road paving.
- Barrier Construction (for Yuen Long and Tin Shui Wai)
 - i) excavation for foundation;
 - ii) bored piling; and
 - iii) barrier erection.

The relocation of footbridge in Tin Shui Wai and the construction of access ramp in Tuen Mun Centre are outside the scope of EPIW package, noise impacts associated with the works are not addressed in this Study.

5.2.2 Assessment Methodology

The assessment of daytime (and all unrestricted hours) noise impact from the works associated with the EPIWs will be undertaken based on the procedure outlined in the GW-TM and *Annex 13* of the EIA O TM. In general, the methodology is as follows:

- locate representative NSRs that may be affected by the works (the temporal scope of the EIA study assumes all committed and planned development will be operational during the works);
- determine plant teams for corresponding construction activities; based on the plant inventories agreed by KCRC;
- assign sound power levels (SWL) to the PME proposed based on the GW-TM or other sources;
- calculate the correction factors based on the distance between the NSRs and the notional noise source position of the work sites;
- apply corrections such as potential screening effect and acoustic reflection, if any, in the calculations; and
- predict construction noise levels at NSRs in the absence of any mitigation measures.

The total SWL associated with each activity has been established based on the assumed plant inventory and are presented in *Annex B*. The notional “noise source” point of each work site is established in accordance with the procedure stated in the GW-TM. Noise impacts at selected representative NSRs have been quantified by comparing the predicted noise levels with the EIA O TM daytime construction noise limits ($L_{eq, 30 \text{ min}}$ dB(A)), as given in *Section 3.1.1*.

Given that the detailed construction programme information is not presently available for the EPIW works and West Rail construction works, an assessment of cumulative noise levels has been assessed by assuming that construction activities would be undertaken

simultaneously at work sites with the same distance from a particular NSR: in practice, noise from other sites, in particular, West Rail Phase I, will be more distant given the close proximity of EPIWs to the majority of NSRs. Based upon this assumption, the cumulative noise levels are therefore calculated using a worst case factor of +3 dB(A) for the EPIW construction noise.

As evening and night-time (restricted hours) construction works are not expected for the EPIWs, noise from the EPIW work sites has not been assessed during this period. However, as the criteria stipulated for the restricted hours period apply to the EPIWs, should work be planned during these times, it will be the responsibility of the contractor to ensure compliance with the NCO and relevant technical memoranda: in this event, the contractor will be required to submit CNP applications to the Noise Control Authority. These will be assessed by the Noise Control Authority and approval on a strictly "case by case" basis. Should approval be granted (and this cannot be guaranteed), the contractor will be required to strictly follow the conditions stated in the CNP.

In the assessment of planned daytime construction activities, mitigation measures are considered where noise impacts at the NSRs are identified. The assessment is based upon a re-evaluation of the total SWL for each construction activity by the use of practical mitigation measures such as quiet plant, purpose-built noise barriers and limiting the usage of noisy plant in a particular location or within particular busy construction period.

5.2.3 Prediction and Evaluation of Impacts

5.2.3.1 Yuen Long

The unmitigated construction noise levels at the worst case representative NSRs have been predicted and the results based upon the detailed construction noise calculations as presented in *Annex C* are given in *Table 5.2a*. The predictions were undertaken by taking account of distance attenuation and façade reflection at the worst receiver level of representative NSRs.

The predicted results show that the majority of NSRs would be adversely impacted by the works during daytime period in the absence of any noise abatement measures. During drainage works and road construction, noise levels at representative NSRs exceed the daytime noise criteria (i.e. 75 dB(A) for residential use, 70 dB(A) for educational use and 65 dB(A) for schools during examination periods) by a range of 1-10 dB(A). The construction of the proposed noise barrier close to Nam Ping Wai would also cause adverse impacts to the surrounding uses. Owing to the close proximity of the construction activities, NSRs at Ying Lung Wai, Nam Pin Wai, Tai Wai Tsuen and the residential development in Areas 12 and 15 would be affected.

The construction activities found to cause the highest unmitigated adverse impacts include excavation works during various stages of construction, placement of road base and road paving in road construction. The cumulative noise impacts at the NSRs would be high and in the range of 4-15 dB(A), when there are works on two or more closely

adjacent sites. The estimated indicative number of affected dwellings during the construction phase would be about 1,000, and there would be approximately 10 classrooms likely to be impacted by the works (the estimation excluded the developments in CDA 12 and CDA 15 as the design of these two sites has not been finalised yet).

Table 5.2a Yuen Long EPIW - Predicted Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Max. PNL- Barrier Construction	Worst Case Max. Cumulative PNL
1	Nam Pin Wai (west)	69	71	-	74
2	Tai Wong Temple - Nam Pin Wai	69	71 (1)	-	74 (4)
5	Shung Tak School	76 (6)	78 (8)	82 (12)	85 (15)
6	Nam Pin Wai (east)	78 (3)	80 (5)	83 (8)	86 (11)
7	Tung Tau Tsuen	75	76 (1)	70	79 (4)
8	Tsoi Uk Tsuen	75	76 (1)	67	79 (4)
9	Ying Lung Wai	78 (3)	80 (5)	-	83 (8)
10	Tai Wai Tsuen (west)	81 (6)	83 (8)	-	86 (11)
12	Sun Yuen Long Centre (north-west)	75	76 (1)	74	79 (4)
15	Sun Yuen Long Centre (south)	76 (1)	77 (2)	-	80 (5)
17	Future Residential Development Area 15 (north-west)	82 (7)	84 (9)	-	87 (12)
19	Future Residential Development Area 15 (south-west)	81 (6)	83 (8)	-	86 (11)
20a	Future Residential Development Area 12	84 (9)	85 (10)	-	88 (13)
21	Shap Pat Heung Rural Committee Building	71	72	-	75
22	Cheong Wai	69	70	-	73
23	Far East Consortium Yuen Long Building	70	71	-	74

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

In view of the small buffer distance between the work sites and NSRs and consequent adverse impacts, effective mitigation measures and proper environmental control practises should be considered during the construction phase of the EPIW. The recommended noise mitigation measures to address the construction noise impacts are presented in *Section 5.2.4*.

5.2.3.2 Tin Shui Wai

The unmitigated predicted noise levels at the worst case representative NSRs of Tin Shui Wai are listed in *Table 5.2b* below and the detailed construction noise calculations are presented in *Annex C*.

Table 5.2b Tin Shui Wai EPIW - Predicted Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Max. PNL- Barrier Construction	Worst Case Max. Cumulative PNL
25	Proposed Secondary School (south)	78 (8)	79 (9)	85 (15)	88 (18)
26	Tin Shing Court (west)	73	74	76 (1)	79 (4)
28	Proposed Primary School (east)	80 (10)	82 (12)	88 (18)	91 (21)
29	Tin Shing Court (east)	75	76 (1)	80 (5)	83 (8)
31	Tin Shing Court (east)	74	75	77 (2)	80 (5)
33	QE School Old Student's Association Primary School	74 (4)	76 (6)	82 (12)	85 (15)
35	Yiu Hong House (east)	77 (2)	78 (3)	78 (3)	81 (6)
36	Yiu Foo House (south) – Tin Yiu Estate	80 (5)	82 (7)	92 (17)	95 (20)
38	Yiu Yat House – Tin Yiu Estate	78 (3)	80 (5)	86 (11)	89 (14)
39	Yau Hong House	82 (7)	84 (9)	76 (1)	87 (12)
40	Yau Ning House	70	72	-	75
42	Tin Tsz Estate (south)	69	70	-	73
45	TWGHs Kwok Yat Wai College	79 (9)	81 (11)	75 (5)	84 (14)
46	Residence in Ping Shan (west)	80 (5)	82 (7)	82 (7)	85 (10)
49	Sheung Cheung Wai	70	72	-	75

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

The predicted results indicate that noise impacts during construction phase of the EPIW would be likely at the identified NSRs. Noise levels at the worst representative NSRs would exceed the daytime noise criteria in the range of 1-12 dB(A) during drainage works and road construction. Noise impacts of up to 18 dB(A) associated with the works for barrier construction were also predicted. Given the small buffer distance from the work sites, NSRs such as the proposed schools in Tin Shui Wai Area 3, Yiu Foo House and Yau Hong House would be the worst affected. A higher degree of construction noise impact at school is expected during the examination period due to the increased sensitivity at this time.

The construction activities found to cause the highest unmitigated adverse impacts are excavation works during various stages of construction, placement of road base and road paving in road construction. Cumulative noise impacts of up to 21 dB(A) were predicted. The estimated indicative number of affected dwellings during the construction phase would be about 1,500, and there would be approximately 180 classrooms likely to be impacted by the works.

Mitigation measures and proper environmental control practises are therefore required to reduce the predicted noise impacts during the construction phase of the EPIW. These are presented in detail in *Section 5.2.4*.

5.2.3.3 Tuen Mun Centre

The unmitigated predicted noise levels at the worst case representative NSRs of Tuen Mun Centre are listed in *Table 5.2c* and the results of the detailed construction noise calculations are presented in *Annex C*.

The prediction results indicate that the majority of NSRs would adversely be impacted by the works in the absence of any noise mitigation measures. During drainage works and road construction, noise exceedances of up to 14 dB(A) beyond the daytime construction noise criteria were predicted. The NSRs at Koon Hing Building, Ming Wai Building and Castle Peak Catholic Primary School would be the worst affected.

Table 5.2c Tuen Mun Centre EPIW - Predicted Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Worst Case Max. Cumulative PNL
50	Hong Lai Garden (west)	68	70	73
52	Hong King Building	71	73	76 (1)
53	Bit Hing Building	73	74	77 (2)
54	Honeley Court	72	73	76 (1)
57	St Simon's Lui Ming Choi Secondary School (south-west)	75 (5)	76 (6)	79 (9)
59	Tuen Mun Mansion	80 (5)	82 (7)	85 (10)
61	Koon Hing Building	86 (11)	88 (13)	91 (16)
63	Ming Wai Building (south)	88 (13)	89 (14)	92 (17)
64	Castle Peak Catholic Primary School (west façade)	82 (12)	83 (13)	86 (16)
66	Top Court	85 (10)	87 (12)	90 (15)
68	Kam Wah Garden (west)	76 (1)	77 (2)	80 (5)

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

Noisy construction activities in conjunction with the EPIW in Tuen Mun include excavation works during various stages of construction, placement of road base and road paving during road construction.

The cumulative unmitigated noise impacts on the NSRs, with two concurrent work sites would be higher: a maximum cumulative noise exceedance of 17 dB(A) at Ming Wai Building (south) was predicted and is due to a small buffer distance between the works and the nature of activities. The estimated indicative number of affected dwellings during the construction phase would be about 800, and there would be approximately 90 classrooms likely to be impacted by the works.

The use of effective mitigation measures and proper environmental control practises are therefore required and these are recommended in *Section 5.2.4*.

5.2.4 Environmental Mitigation Measures During Construction Phase

Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant, adopting quieter working methods and restriction on the use of noisy equipment deployed on the site. The recommended control philosophies detailed in this section should be incorporated into the Contract Specification and Implementation Schedule in order to ensure the acceptable environmental performance of construction works.

The contractor may develop a different package of environmental control measures to meet the required noise standards, but the following illustrates a feasible approach to mitigate the predicted noise impacts during the construction phase. Should the Contractor propose alternative mitigation measures, these shall be demonstrated to the Proponent and the Noise Control Authority, to meet or better the performances given below to fully comply with the EIA O TM noise criteria and all the measures should be compatible with the construction programme.

5.2.4.1 Good Site Practice

Good site practice and noise management can considerably reduce the noise impact from 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 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.

Although it is difficult to quantify the noise reduction achieved, the environmental performance of the works would be improved through these control practices.

5.2.4.2 Selecting Quieter Plant and Working Methods

The use of quiet plant is identified to be a feasible solution to tackle the adverse impacts associated with the construction works. The contractor may obtain particular models of plant that are quieter than standard types as given in GW-TM. As the benefits achievable in this way will depend on the details of the contractors' chosen methods of working, 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 in terms of the total SWL of all PME on site so that the Contractor is allowed some flexibility to select plant to suit his needs.

Quiet plant is defined as PME whose actual SWL is less than the value specified in GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME taken from a British Standard, namely *Noise Control on Construction and Open Sites, BS5228 : Part 1 : 1997*, which are known to be used are given in *Table 5.2d*. The total SWLs for each construction activity with the recommended silenced PMEs are detailed in *Annex B*.

Table 5.2d Sound Power Levels for Specific Silenced PME

PME	BS5228		SWL dB(A)	Relative size or power rating (where applicable)
	Table no.	Ref no.		
Bulldozer	C3	65	111	46 kW
Mobile Crane	C7	110	106	56 kW
Air Compressor	C7	25	98	7 m ³ /min
Concrete Pump	C6	36	106	100 kW
Dump Truck	C9	29	109	35 t
Excavator	C3			
- for trenching		97	105	52 kW
- for ground excavation		35	106	45 kW
Generator	C7	62	100	-
Lorry	C9	27	105	35 t
Loader	C3	97	105	52 kW
Concrete Lorry Mixer	C6	35	100	5 m ³
Vibratory Roller	C3	115	102	9 kW

PME	BS5228		SWL dB(A)	Relative size or power rating (where applicable)
	Table no.	Ref no.		
Grader	C3	76	111	-
Breaker	C2	10	110	35 kg
Road Roller	C8	27	104	10 t
Poker Vibrator	C6	32	100	-

It should be noted that while various types of silenced equipment can be found in Hong Kong, the Noise Control Authority, when processing a CNP application, will apply the SWLs specified in the GW-TM, unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration. The onus is therefore placed with the Contractor to prove that his proposed plant deployment meets with the quiet plant noise levels should he choose this method of noise mitigation. With the use of quiet plant on site, the overall noise reduction in the worst case predicted unmitigated noise levels would be about 6 to 7 dB(A).

5.2.4.3 Use of Temporary Noise Barriers

In general, noise barriers of 3 m to 5 m height located between noisy construction activities and NSRs could give a noise reduction of up to 5 dB(A) from screening (estimated in accordance with the GW-TM). It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material (minimum superficial density of 15 kg/m²) located close to operating PME, in order to achieve this level of noise reduction. This could also be achieved by erecting temporary noise barriers along the proposed roads and at active work sites. Certain types of PME, such as generators and compressors, can be completely screened by portable barriers with skid footings and giving a total noise reduction of 10 dB(A) or more.

It is anticipated that a movable noise barrier with a suitable skid type footing and a small cantilevered upper portion can be located within a few metres of a static plant and within about 5 m of a mobile equipment such as excavator and mobile crane etc. such that the line of sight could be blocked by the barriers viewed from the NSRs. The estimated noise reduction by means of screening, provided that the barriers are carefully located, can provide at least 5 dB(A) attenuation for the plant used on site. This measure is particularly effective for low-rise noise sensitive premises or schools.

Based on the NSR heights and site geometry, it is estimated that movable noise barriers built on site can achieve a 10 dB(A) noise reduction for static plant and 5 dB(A) noise reduction for mobile plant provided that they are properly arranged before any activities proceed. The noise screening benefit for general plant types considered in this Study is listed as follows:

- stationary plant - 10 dB(A) screening for PME such as air compressor, generator, concrete pump and bar bender; and

- mobile plant - 5 dB(A) screening for PME such as excavator, breaker, concrete lorry mixer, mobile crane, poker vibrator, roller, loader and asphalt paver.

Any barriers designed by the contractor should satisfy this noise performance in order to control the emission of noise from PME. The Contractor may pay particular attention to ensure barriers are close fitting around plant items and gain greater benefit, but since this cannot be guaranteed such measures are left to his own planning of the site works.

5.2.4.4 Restriction of Plant Usage On-site During Critical Construction Stages

For most works involving contracting it is usually preferable to allow the onsite team to determine the usage of construction plant according to the construction programme or work schedule. However, in locations where adverse noise impacts may arise, it will be appropriate to restrict the usage of particular noisy equipment operating within certain parts of the site that are very close to the NSRs. The percentage of time that the noisy equipment is in operation may also need to be controlled so as to reduce the noise emissions during critical construction stages.

By restricting the percentage of operation (in terms of time usage) of PME to 50% within a 30-minute period, a noise reduction of 3 dB(A) could be achieved. Construction plant including excavator, grader, concrete pump, dump truck, asphalt paver, loader and breaker should be used with careful attention to ensure the engines are switched off or only idling at a low power setting when not in direct use. For these PMEs the operating time should be carefully controlled such that they are only operating for 15 minutes in every consecutive 30-minute period. This measure should be monitored and supervised by the Contractor and the Resident Engineer during implementation as this measure would have impact on the construction programme.

5.2.4.5 Noise Assessment with the Recommended Mitigation Packages

Without mitigation measures, construction activities associated with the works of EPIWs would cause exceedances of the 75 dB(A) noise standard for residential uses and 70 dB(A) (and 65 dB(A) during the examination period) for schools. Three mitigation packages, as outlined below, have been considered in this Study to develop the required control measures for tackling the noise impacts from construction works:

- **M1 - Use of Quiet/Silenced PMEs;**
- **M2 - M1 with the use of noise barriers; and**
- **M3 - M2 plus limiting the operating time of PMEs by 50%.**

The mitigated noise levels predicted for Yuen Long, Tin Shui Wai and Tuen Mun Centre EPIWs are shown in *Tables 5.2e-g*. The noise reduction which could be achieved with the use of silenced equipment ranges from 2 to 11 dB(A) for individual construction activity (mitigation package M1), depending on the type of silenced equipment chosen. For mitigation package M2 (use of quiet plant and barriers), noise reduction achieved

would be around 1-8 dB(A). Further limiting the operating time of PME on site could offer an extra 3 dB(A) noise reduction.

As it is considered too restrictive to insist that the Contractor to use specific items of plant, recommendations for mitigation to achieve the applicable noise standards have been specified as a combination of noise barriers and a plant noise performance specification. This performance specification requires the Contractor to incorporate silenced construction equipment not exceeding the SWL as given above or reduced plant inventories for the construction activities so that noise levels at nearby NSRs are kept below the relevant noise standards.

Table 5.2e Yuen Long EPIW - Mitigated Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Max. PNL- Barrier Construction	Worst Case Max. Cumulative PNL
1	Nam Pin Wai (west)	62/-/-	65/-/-	-	68/-/-
2	Tai Wong Temple - Nam Pin Wai	62/-/-	64/-/-	-	67/-/-
5	Shung Tak School	69/68/65	72(2)/69/66	76(6)/73(3)/70	79(9)/76(6)/73(3)
6	Nam Pin Wai (east)	71/70/67	74/71/68	77(2)/74/71	80(5)/77(2)/74
7	Tung Tau Tsuen	67/-/-	70/-/-	64/-/-	73/-/-
8	Tsoi Uk Tsuen	67/-/-	70/-/-	61/-/-	73/-/-
9	Ying Lung Wai	71/70/-	74/71/-	-	77(2)/74/-
10	Tai Wai Tsuen (west)	74/72/69	76(1)/74/71	-	79(4)/77(2)/74
12	Sun Yuen Long Centre (north-west)	67/-/-	70/-/-	68/-/-	73/-/-
15	Sun Yuen Long Centre (south)	68/-/-	71/-/-	-	74/-/-
17	Future Residential Development Area 15 (north-west)	75/73/70	77(2)/75/72	-	80(5)/78(3)/75
19	Future Residential Development Area 15 (south-west)	74/72/69	76(1)/74/71	-	79(4)/77(2)/74
20a	Future Residential Development Area 12	76(1)/75/72	79(4)/77(2)/74	-	82(7)/80(5)/77(2)
21	Shap Pat Heung Rural Committee Building	63/-/-	66/-/-	-	69/-/-
22	Cheong Wai	61/-/-	64/-/-	-	67/-/-
23	Far East Consortium Yuen Long Building	62/-/-	65/-/-	-	68/-/-

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

(3) - Predicted Noise Levels with mitigation package M1/M2/M3

Potential adverse noise impacts associated with drainage works, road construction and barrier construction could be controlled with the use of quiet plant (mitigation package M1) in most cases in Yuen Long. In view of the small buffer distance between NSRs and work sites, mitigation package M3 (use of quiet plant and noise barriers, with restriction on the operating time of PME on site) would be necessary for NSRs likely to be affected by the Project, as indicated in *Table 5.2e*. These measures are required for the works close to Shung Tak School, Nam Pin Wai, Tai Wai Tsuen and the residential developments in Areas 12 and 15.

Residual cumulative noise exceedances were still predicted at Shung Tak School and the residential development in Area 12 as shown in *Table 5.2e*. These residual impacts could be further mitigated by avoiding simultaneous EPIW construction activities at work sites close to these NSRs, through appropriate planning and scheduling of construction works. In addition, noise insulation has been proposed for Shung Tak School to reduce the predicted noise impacts associated with the construction works of West Rail; this measure will help to relieve any noise impacts caused by the EPIW works. Alternatively, construction activities could be scheduled during non-school hours during daytime period or during school holidays to avoid the potential noise nuisance.

Table 5.2f Tin Shui Wai EPIW - Mitigated Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Max. PNL- Barrier Construction	Worst Case Max. Cumulative PNL
25	Proposed Secondary School (south)	70/69/66	73(3)/70/67	79(9)/76(6)/ 73(3)	82(12)/79(9)/76(6)
26	Tin Shing Court (west)	65/-/-	68/-/-	70/-/-	73/-/-
28	Proposed Primary School (east)	73(3)/71(1)/ 68	75(5)/73(3)/70	82(12)/79(9)/ 76(6)	85(15)/82(12)/ 79(9)
29	Tin Shing Court (east)	67/66/-	70/67/-	74/71/-	77(2)/74/-
31	Tin Shing Court (east)	66/-/-	69/-/-	71/-/-	74/-/-
33	QE School Old Student's Association Primary School	67/65/62	69/67/64	76(6)/73(3)/70	79(9)/76(6)/73(3)
35	Yiu Hong House (east)	69/-/-	72/-/-	72/-/-	75/-/-
36	Yiu Foo House (south) – Tin Yiu Estate	73/71/68	75/73/70	86(11)/84(9)/ 81(6)	89(14)/87(12)/ 84(9)
38	Yiu Yat House – Tin Yiu Estate	71/70/67	74/71/68	80(5)/77(2)/74	83(8)/80(5)/77(2)
39	Yau Hong House	75/74/71	78(3)/75/72	70/68/65	81(6)/78(3)/75
40	Yau Ning House	63/-/-	66/-/-	-	69/-/-
42	Tin Tsz Estate (south)	61/-/-	64/-/-	-	67/-/-
45	TWGHs Kwok Yat Wai College	72(2)/70/67	75(5)/72(2)/69	69/67/64	78(8)/75(5)/ 72(2)
46	Residence in Ping Shan (west)	73/71/68	75/73/70	76(1)/73/70	79(4)/76(1)/73

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Max. PNL- Barrier Construction	Worst Case Max. Cumulative PNL
49	Sheung Cheung Wai	63/-/-	66/-/-	-	69/-/-

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

(3) - Predicted Noise Levels with mitigation package M1/M2/M3

For the construction works in Tin Shui Wai, mitigation packages M1 or M2 (use of quiet plant and/or noise barriers) would be adequate to address the noise problems for NSRs located relatively remote from the sites. While for other NSRs such as the proposed schools in Area 3, QE School Old Student's Association Primary School, high-rise residential developments in Tin Yiu Estate and TWGHs Kwok Yat Wai College, which are located close to the works of the Project, mitigation package M3 (use of quiet plant and noise barriers, with restriction on the operating time of PMEs on site) is recommended as indicated in *Table 5.2f*.

Residual impacts of 3-6 dB(A) were still predicted at the proposed schools in Area 3 and Yiu Foo House of Tin Yiu Estate from the works for barrier construction. Analysis of the prediction results indicates that the cause of residual noise impact is the use of dump truck during excavation works for the foundation of barrier. Further control measure such as using a lorry of small size or lower capacity as a substitute to dump truck will be considered and addressed in the following section. To address the noise impacts at schools, construction activities could also be scheduled during non-school hours during daytime period or during school holidays to avoid the potential noise nuisance. Cumulative noise impacts in the range of 2-9 dB(A) were also predicted, after implementing all the suggested measures. To eliminate the cumulative noise nuisance from the works, it is recommended to avoid simultaneously noisy activities at locations close to nearby NSRs.

Table 5.2g Tuen Mun Centre EPIW - Mitigated Construction Noise Levels (dB(A))

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Worst Case Max. Cumulative PNL
50	Hong Lai Garden (west)	61/-/-	64/-/-	67/-/-
52	Hong King Building	64/-/-	67/-/-	70/-/-
53	Bit Hing Building	65/-/-	68/-/-	71/-/-
54	Honeley Court	64/-/-	67/-/-	70/-/-
57	St Simon's Lui Ming Choi Secondary School (south-west)	67/66/63	70/68/65	73(3)/71(1)/68

NSR	Description	Max. PNL ⁽¹⁾ - Drainage Works	Max. PNL - Road Construction	Worst Case Max. Cumulative PNL
59	Tuen Mun Mansion	73/72/69	76(1)/73/70	79(4)/76(1)/73
61	Koon Hing Building	79(4)/78(3)/75	82(7)/79(4)/76 (1)	85(10)/82(7)/79(4)
63	Ming Wai Building (south)	80(5)/79(4)/ 76(1)	83(8)/80(5)/ 77(2)	86(11)/83(8)/80(5)
64	Castle Peak Catholic Primary School (west façade)	74(4)/73(3)/70	77(7)/74(4)/71 (1)	80(10)/77(7)/74(4)
66	Top Court	78(3)/77(2)/74	81(6)/78(3)/75	84(9)/81(6)/78(3)
68	Kam Wah Garden (west)	68/-/-	71/-/-	74/-/-

Notes:

(1) - Predicted Noise Level

(2) - Figure in brackets indicates the level of noise exceedance

(3) - Predicted Noise Levels with mitigation package M1/M2/M3

Referring to the results presented in *Table 5.2g*, mitigation package M3 is required for the works in Tuen Mun Centre. Residual noise impacts of up to 2 dB(A) were predicted for drainage works and road construction. Examination of the prediction results indicates that the use of dump truck during excavation activities and road paving would result in adverse noise impacts at nearby NSRs. These affected NSRs include Koon Hing Building, Ming Wai Building and Castle Peak Catholic Primary School. Further mitigation measure by substituting dump truck with lorry of appropriate capacity will be considered. To address the noise impacts at schools, construction activities could also be scheduled during non-school hours during daytime period or during school holidays to avoid the potential noise nuisance.

Cumulative noise exceedances in the range of 3-5 dB(A) were predicted when there are works in two adjacent sites undertaken at the same time. Accordingly, the planning and programming of construction activities in a strategic and “environmental friendly” manner to avoid works undertaken in parallel at critical areas should be considered.

5.2.5 Residual Impacts and Constraints

In the preceding section, mitigation measures to tackle the noise issues associated with the works in Yuen Long, Tin Shui Wai and Tuen Mun Centre were discussed. The suggested environmental control measures include:

- good site practices;
- selecting quieter plant and working methods;

- use of temporary noise barriers;
- restriction of plant usage on-site during critical construction stages; and
- avoidance of simultaneous noisy activities to eliminate cumulative noise impact.

With the recommended measures, predicted noise impacts could be well controlled and no residual noise impacts are anticipated at most of the NSRs. However, residual noise impacts were still predicted at:

- Yuen Long - Shung Tak School and the residential development in Area 12;
- Tin Shui Wai - the proposed schools in Area 3, QE School Old Student's Association Primary School, Yiu Foo House and Yiu Yat House of Tin Yiu Estate and TWGHs Kwok Yat Wai College; and
- Tuen Mun Centre - Koon Hing Building, Ming Wai Building, Castle Peak Catholic Primary School and Top Court.

Analysis of the prediction results indicates that the cause of residual noise impact is the use of dump truck during various construction activities. According to *BS 5228 : Part 1 : 1997 - Noise and Vibration Control on Construction and Open Sites*, a lorry of 10 t with SWL of 98 dB(A) could be used as a substitute for dump truck in performing the same construction activities. The associated changes in the SWL of individual construction activity will be 3-4 dB(A). A further noise reduction of 1-2 dB(A) for those noisy construction activities (i.e. excavation works for drainage and road construction, foundation construction for noise barrier and road paving exercise) should be considered by limiting the operating time of PME used on site (say the "on-time" percentage reduced to 30%). With these measures in place, residual noise impacts at NSRs would be limited. To eliminate the cumulative noise nuisance from the works, it is recommended to avoid simultaneously noisy activities at locations close to nearby NSRs.

According to *KCRC West Rail EIA FAR*, noise insulation has been proposed for some of the affected schools close to the West Rail works. These schools include Shung Tak School in Yuen Long, TWGHs Kwok Yat Wai College in Tin Shui Wai and St Simon's Lui Ming Choi Secondary School in Tuen Mun. Noise insulation and air conditioners were also noted at QE School Old Student's Association Primary School in Tin Shui Wai during a site visit. Since with the recommended mitigation controls, noise impacts at schools could be minimised, the indirect measures proposed would provide additional protection for the schools.

As a high degree of noise control is required to avoid adverse impacts, regular monitoring at the NSRs will be required during the construction phases. The purpose of the monitoring will be to examine the effectiveness of all the on-site measures, to enable the contractor to be aware of his environmental performance and provide necessary action if the assessment criteria are exceeded. Monitoring will also provide a direct response mechanism for the Project Proponent to manage the contractors action in effecting

reductions in noise emissions at specific areas. The monitoring requirements are described in *Section 11* of this report.

With the adoption of appropriate measures as stated above and the implementation of an effective monitoring exercise which would draw the contractor's attention to any adverse impact and to trigger appropriate corrective actions, it is expected that the residual impacts can be reduced to acceptable levels in accordance with the EIA O TM requirements.

5.3 Operational Phase

5.3.1 Potential Sources of Impact

As described in *Section 4.1*, road traffic noise is the dominant noise source affecting the existing NSRs and future development within each of the Study areas. This is principally due to the traffic flows being carried by existing highway network and the extent of land available for buffer distances during the past and present planning of noise sensitive development.

The prevailing road traffic noise and future levels expected from natural growth and West Rail associated traffic growth and the realignment proposed in the Project are addressed in the following sections. All traffic data used in this Study have been approved by Transport Department (see *Annex A*).

5.3.2 Assessment Methodology

5.3.2.1 Calculation of Prevailing Noise Levels

The road traffic noise calculations presented in this Study follow the methodology described by *Calculation of Road Traffic Noise (CRTN)*, published by the UK Department of Transport in 1988, and is required by the Study Brief. The computer software, *HFANoise*, developed by Halcrow Fox to implement CRTN on a wide scale basis using a links and nodes representation of the road network and receiving environment, was used for the implementation of this methodology.

The modelling scheme for the determination of prevailing noise levels is based upon a digitised representation of the existing unaltered roads in the vicinity and spatial scope of the Project. Each of the existing unaltered highway networks were divided into discrete road segments of homogeneous traffic and road layout characterisation. The segment parameters define the key elements of a road link with respect to traffic noise emissions such as traffic volume, composition, vehicle speed, road layout, and vertical and horizontal alignment. Road surfaces were taken to be standard wearing course based on existing conditions.

For the propagation of noise, a worst-case hard ground attenuation was assumed throughout the three Study areas given the urban nature of the receiving environments and

predominance of reflective ground planes. All other features that could potentially provide noise screening or reflection were defined in the *HFANoise* models.

Peak hour traffic flows for the year 1999, the year immediately prior to the commencement of construction of the Project, were used for the determination of prevailing noise levels. A design vehicular speed of 50 kph was used in the modelling scheme for all roads.

All road traffic noise levels presented in this Report are expressed in the $L_{A10+peak\ hour}$ dB index and have been predicted at representative and worst affected floor heights. Where the design of a proposed development is not presently defined, noise levels have been predicted at representative heights according to the type of planning zone and expected type of development. For the proposed primary and secondary schools in Tin Shui Wai Area 3, the latest school layout designs were used.

5.3.2.2 Prediction of Future Noise Levels

The prediction of future road traffic noise levels was based on a modelling methodology similar to the prevailing situation with road layouts and alignment derived from the Proponent's engineering design.

All roads that would be subject to significant variation and those which remain unaltered or subject to minor changes were classified in the *HFANoise* model as "new" and "unaltered" respectively with reference to the Study Brief. This has enabled the model to calculate noise levels classified by road link description according to the Study Brief and the *ExCo Directive*. The roads classified as "new" in this Study are shown in *Figures 5.3a-c*.

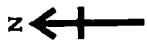
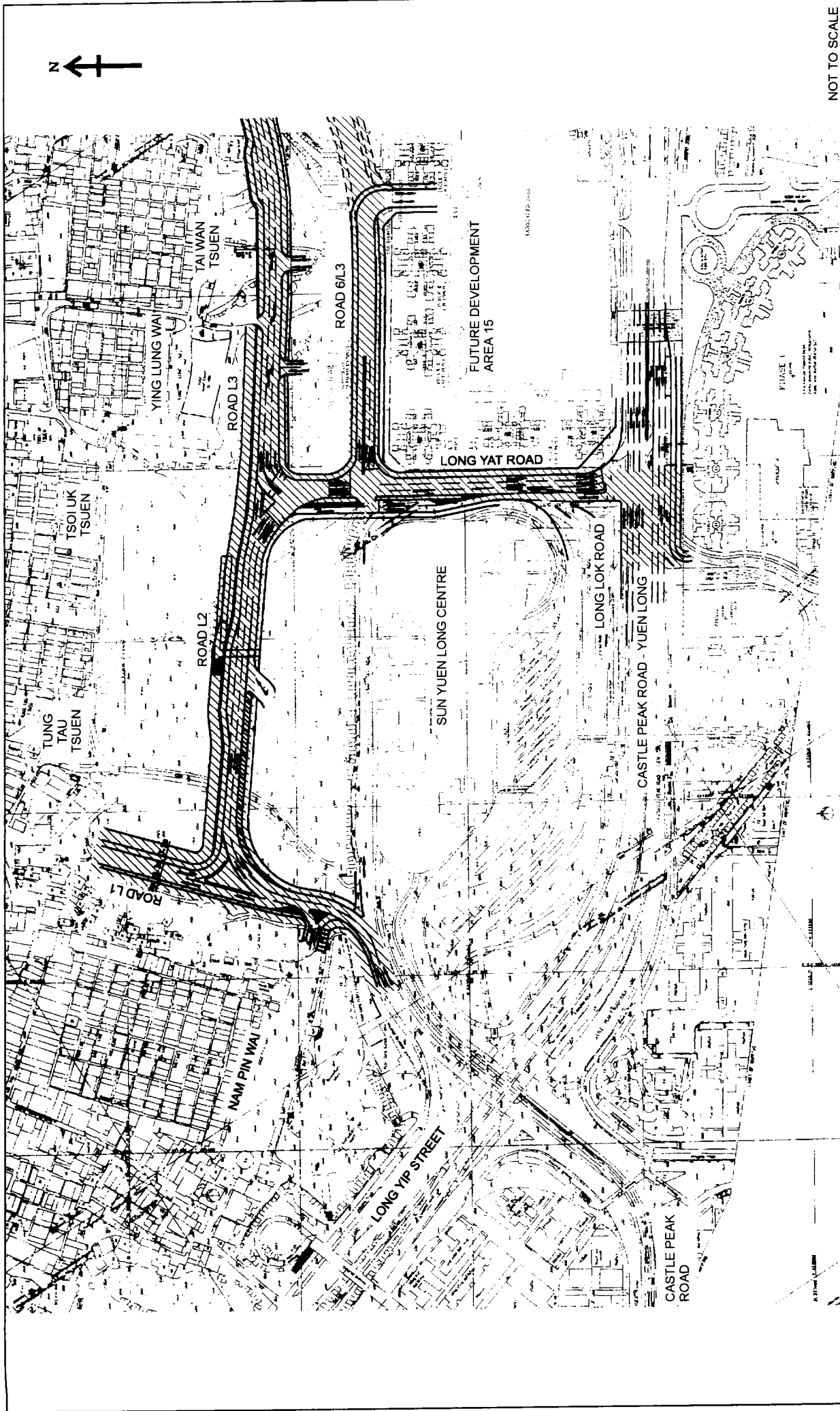
As with the prevailing road network, the Project was divided into discrete road segments and examples of the *HFANoise* digitised representation of these segments and the receiving environment are shown by *Figures 5.3d-f*. An example of the *HFANoise* results file is presented in *Annex D*.

Regarding the noise predictions for Tin Shui Wai EPIW, a comparison of noise emissions with respect to the traffic conditions in Years 2011 and 2018 has been made (see *Annex A*). The results concluded that the traffic condition in Year 2018 represents the worst case scenario of this Study for the determination of required noise mitigation measures.

5.3.3 Prediction and Evaluation of Impacts

5.3.3.1 Traffic Noise Levels in Yuen Long

The predicted road traffic noise levels at identified NSRs in Yuen Long for the model years of 1999 and 2018 are discussed below. Assessment has been undertaken at three different receiver heights (low, mid and high) representing the NSRs and the unmitigated predicted noise levels are given in *Table 5.3a*; in addition, during the assessment and design of mitigation, intervening receiver heights have been tested to ensure a worst case



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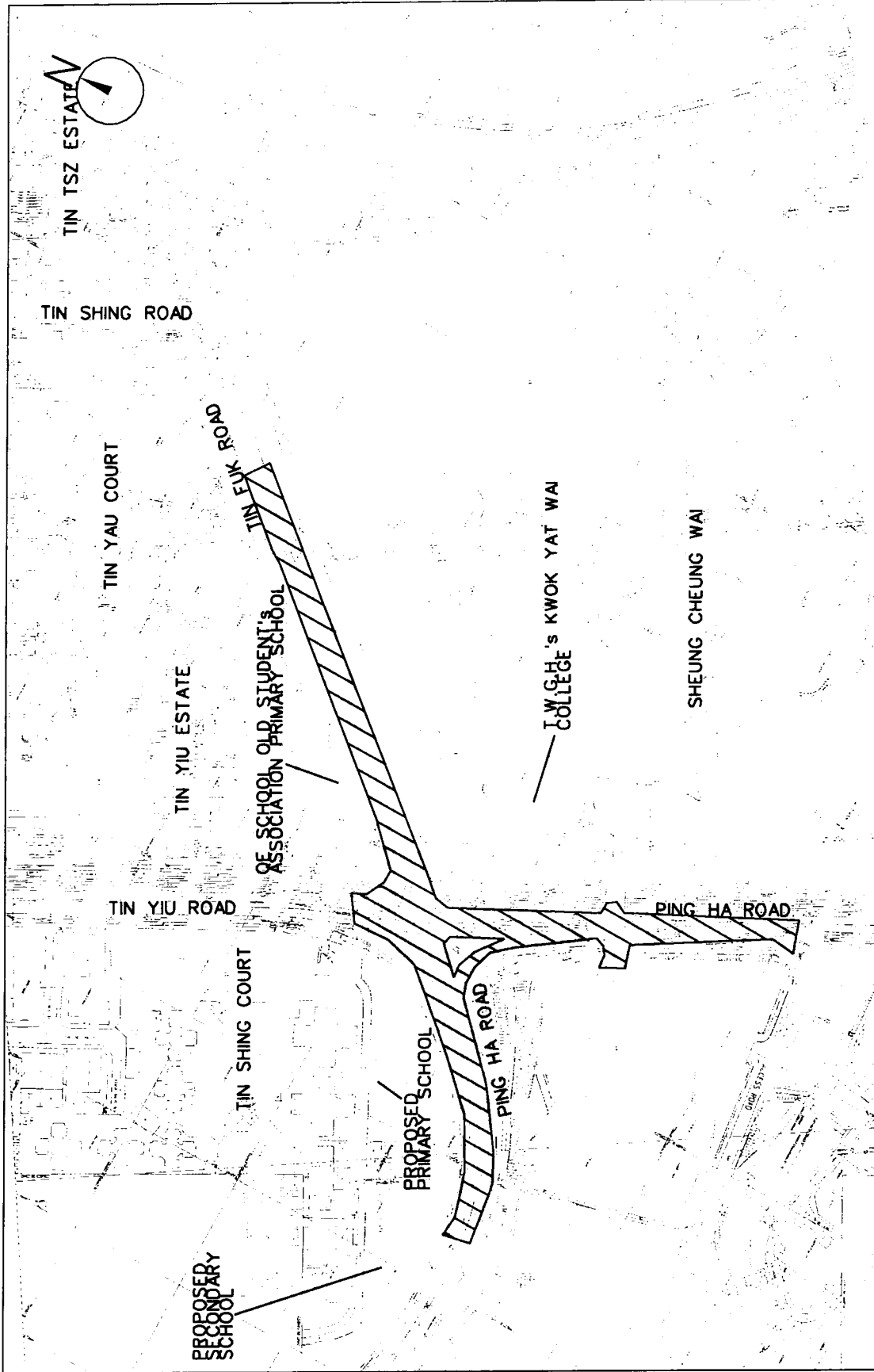
**KOWLOON - CANTON
 RAILWAY CORPORATION**
 WEST RAIL: DD-901 ENVIRONMENTAL SUPPORT SERVICES



FIGURE 5.3a

**ROAD CLASSIFIED AS "NEW" IN TRAFFIC NOISE ASSESSMENT
 FOR YUEN LONG**

C1800/26



ROAD CLASSIFIED AS "NEW" IN TRAFFIC NOISE ASSESSMENT FIGURE 5.3b
FOR TIN SHUI WAI

SCALE: 1/5000

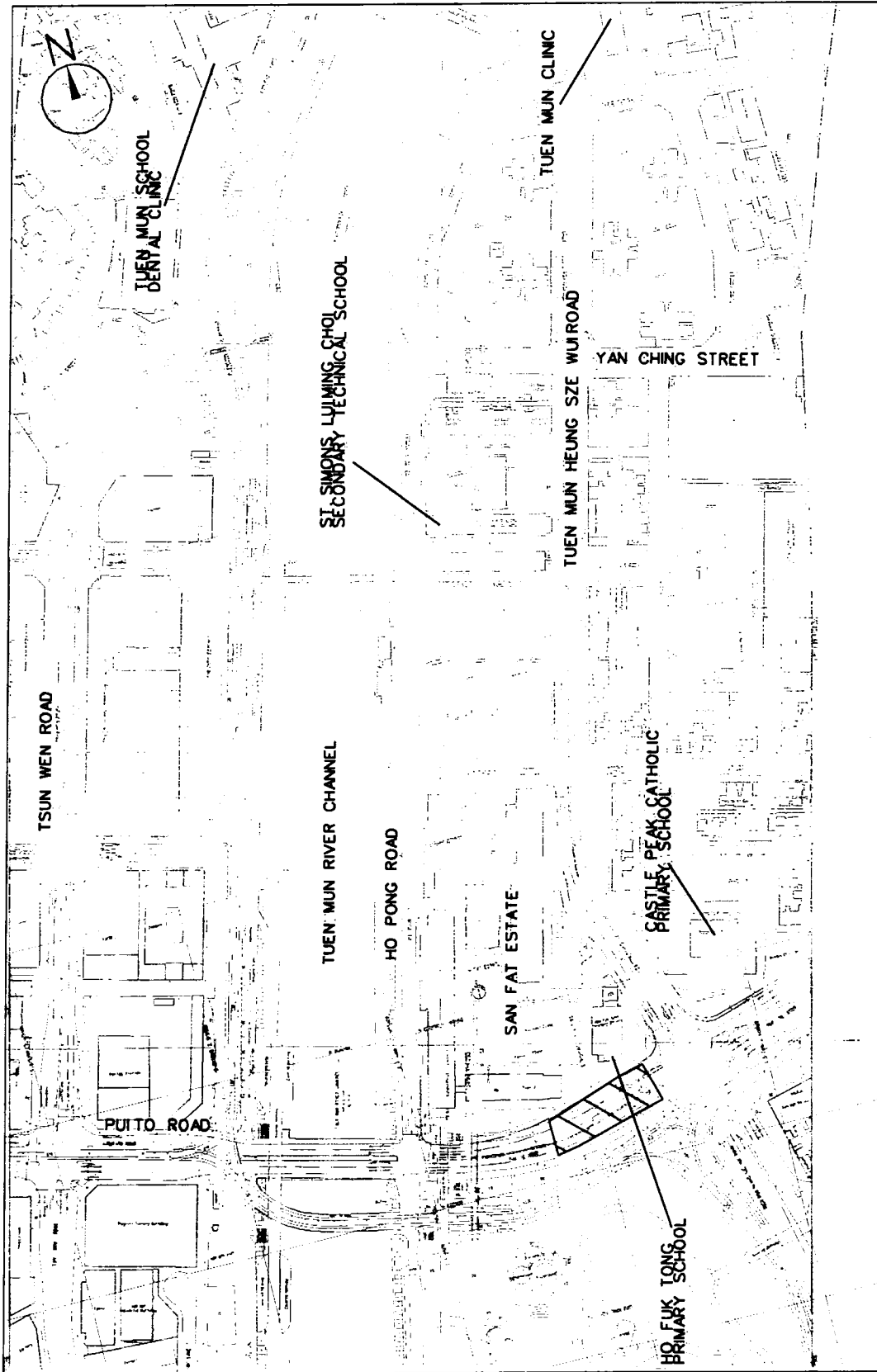
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ROAD CLASSIFIED AS "NEW" IN TRAFFIC NOISE ASSESSMENT FOR TUEN MUN CENTRE

FIGURE 5.3c

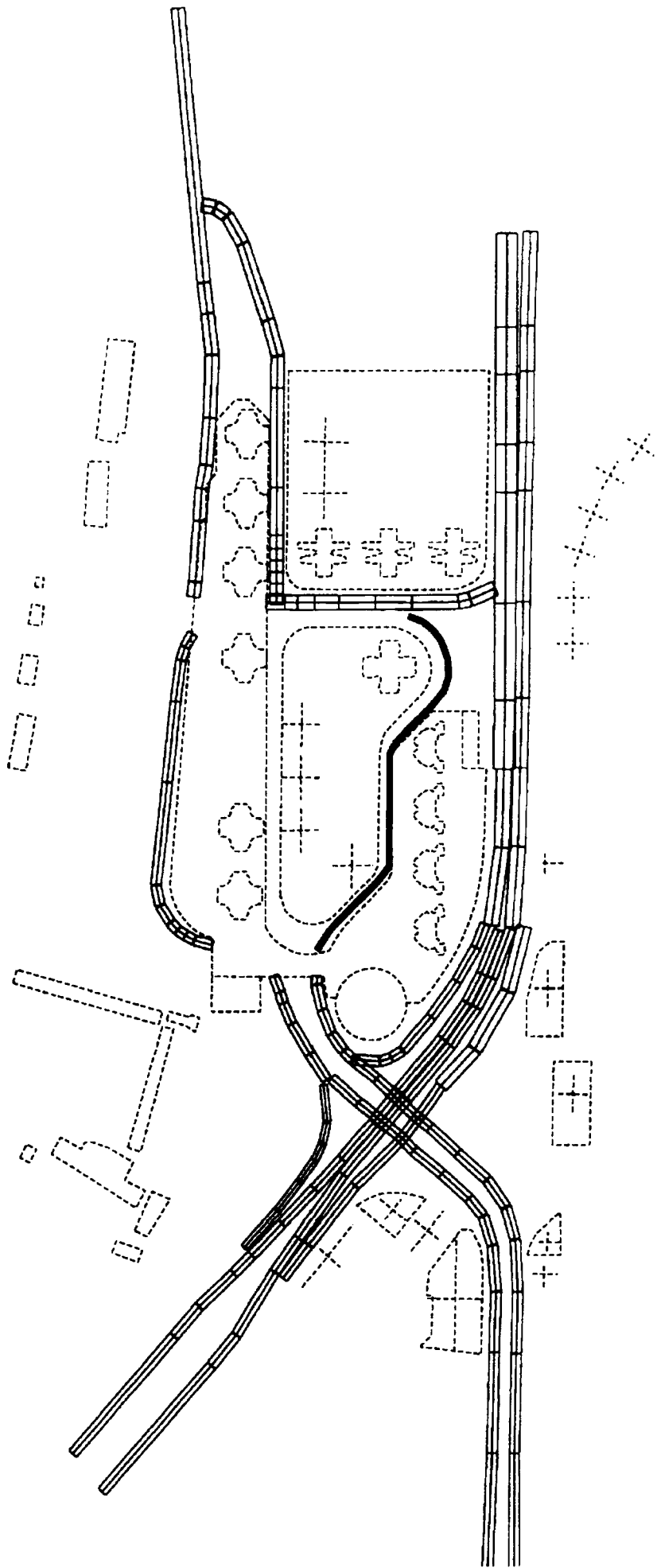
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WEST RAIL: DD-901 ENVIRONMENTAL SUPPORT SERVICES



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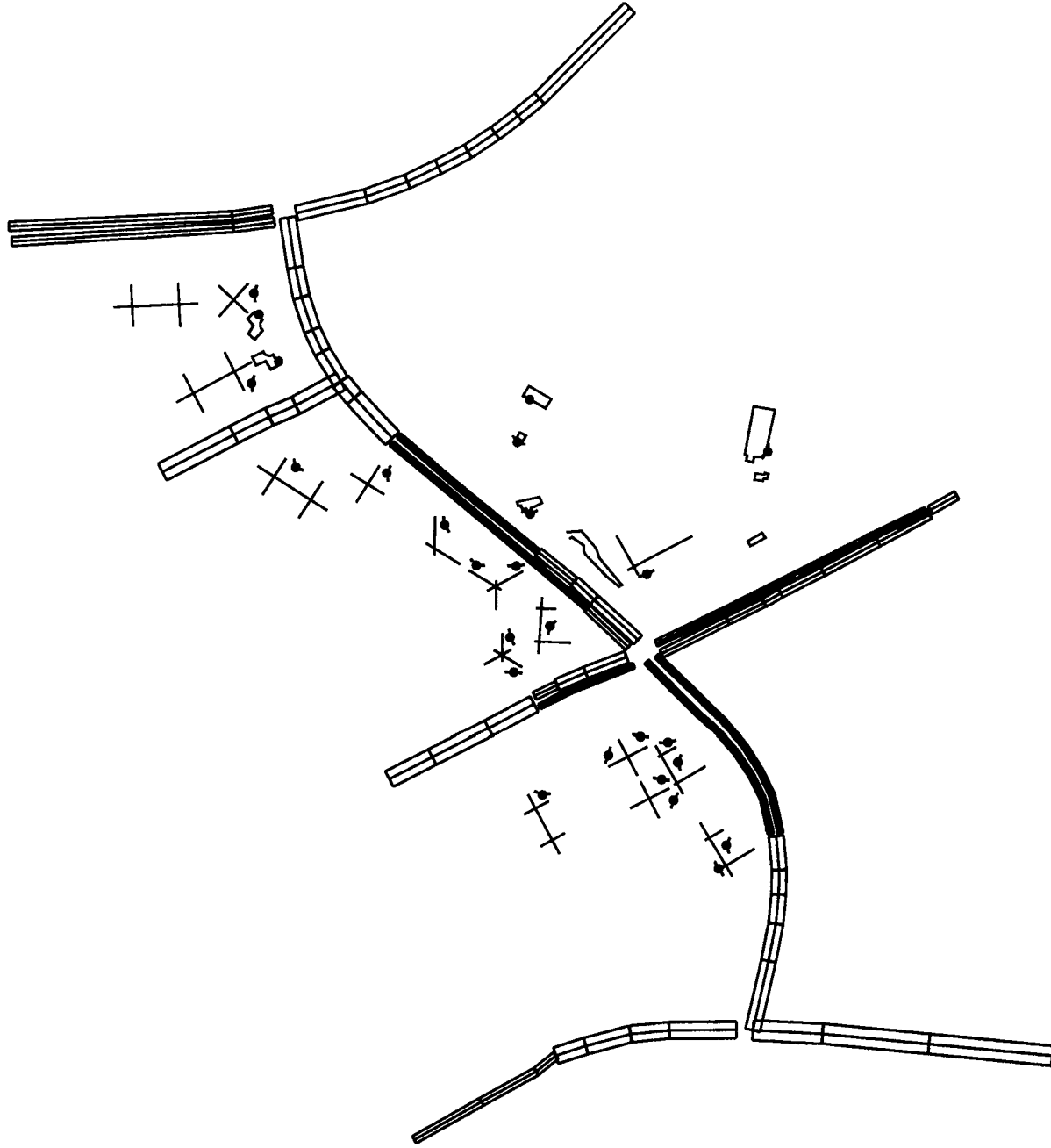
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FIGURE 5.3d

DIGITISED ROAD SCHEME FOR YUEN LONG

C180001



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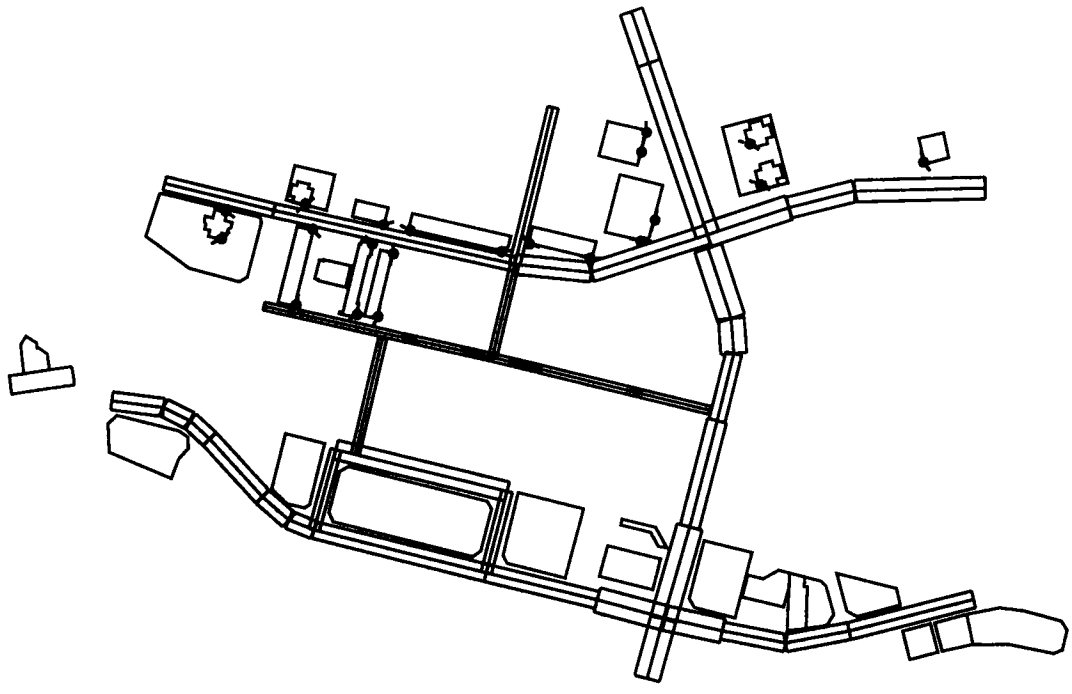
WEST RAIL: DD-901 ENVIRONMENTAL SUPPORT SERVICES



FIGURE 5.3e

DIGITISED ROAD SCHEME FOR TIN SHUI WAI

Contract/C/18000



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FIGURE 5.3f
Contract/C/1800a2

DIGITISED ROAD SCHEME FOR TUEN MUN CENTRE

review of all NSRs. Assessment of impacts associated with the Project during the worst prediction year (i.e. Year 2018) would base on the prediction results and compare with the road traffic noise criteria stipulated in EIA O TM.

According to *Table 5.3a*, adverse impacts in the range of 1-10 dB(A) were predicted at 15 of the 24 identified NSRs in the prevailing situation. In the future case, noise exceedances in the range of 1-14 dB(A) were predicted at 15 of the 24 NSRs.

Three NSRs will experience new adverse noise impacts: these will be Nam Pin Wai (west); Nam Pin Wai (east) and, the north-west towers of the CDA development in Area 15. Existing adverse impacts at two NSRs will be mitigated. These are the north-east and north-west towers of the Sun Yuen Long Centre, where, due to the realignment of Long Yat Road and the development of the proposed property at West Rail Yuen Long Station surrounding these NSRs, noise levels will reduce by 3 dB(A) to very substantially over 10 dB(A).

Table 5.3a Yuen Long EPIW - Predicted Noise Levels $L_{10,1\text{hour}}$ (dB(A)) for the Prevailing Year and Future Year (1999 & 2018)

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
1	Nam Pin Wai (west)	5	69	71 (1)	7.2	70	72 (2)	11	70	72 (2)
2	Tai Wong Temple - Nam Pin Wai	5.5	61	65	-	-	-	8.5	62	65
3	Nam Pin Wai (south-west)	4.5	70	72 (2)	7.5	71 (1)	72 (2)	10.5	71 (1)	73 (3)
4	Nam Pin Wai (south)	4.5	70	72 (2)	7.5	71 (1)	72 (2)	10.5	71 (1)	72 (2)
5	Shung Tak School	4.4	73 (8)	73 (8)	-	-	-	7.4	73 (8)	74 (9)
6	Nam Pin Wai (east)	4.5	69	71 (1)	7.5	70	71 (1)	10.5	70	71 (1)
7	Tung Tau Tsuen	4.6	67	70	7.6	67	70	10.6	68	70
8	Tsoi Uk Tsuen	4.9	66	69	7.9	66	69	10.9	66	69
9	Ying Lung Wai	4	66	69	7	66	69	10	66	69
10	Tai Wai Tsuen (west)	4.5	65	68	7.5	65	69	10.5	65	69
11	Tai Wai Tsuen (east)	4.5	64	69	7.5	64	69	10.5	64	70
12	Sun Yuen Long Centre (north-west)	34.5	74 (4)	56	70.5	72 (2)	67	109.5	70	67
13	Sun Yuen Long Centre (north-east)	34.5	74 (4)	46	70.5	71 (1)	58	109.5	69	59
14	Sun Yuen Long Centre (west)	34.5	73 (3)	69	70.5	73 (3)	71 (1)	109.5	72 (2)	71 (1)
15	Sun Yuen Long Centre (south)	34.5	59	63	70.5	71 (1)	76 (6)	109.5	70	74 (4)
16	Sun Yuen Long Centre (south)	34.5	64	60	70.5	71 (1)	74 (4)	109.5	70	73 (3)

Noise Impact Assessment

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
17	CDA Development in Area 15 (north-west)	37.7	72 (2)	70	89.2	70	72 (2)	145.2	69	70
18	CDA Development in Area 15 (north-east)	37.7	53	62	89.2	53	69	145.2	53	66
19	CDA Development in Area 15 (south-west)	37.7	76 (6)	79 (9)	89.2	74 (4)	77 (7)	145.2	73 (3)	75 (5)
20	CDA Development in Area 15 (south)	37.7	75 (5)	79 (9)	89.2	73 (3)	76 (6)	145.2	71 (1)	74 (4)
20a	CDA Development in Area 12 (north)	27	77 (7)	81 (11)	83.5	74 (4)	78 (8)	141.5	72 (2)	76 (6)
21	Shap Pat Heung Rural Committee Building	5.9	79 (9)	84 (14)	-	-	-	8.9	80 (10)	84 (14)
22	Cheong Wai	12.1	80 (10)	83 (13)	39.1	77 (7)	80 (10)	69.6	75 (5)	78 (8)
23	Far East Consortium Yuen Long Building	19.4	78 (8)	80 (10)	46.4	77 (7)	79 (9)	76.4	75 (5)	77 (7)

Note : Figure in brackets indicates the level of predicted noise exceedance.

In general, the noise level changes in the future year at NSRs experiencing adverse impacts will be in the range of -4 to +5 dB(A). This is attributed to the diversion of Long Yat Road, growth in road traffic in the majority of the highway network and the construction of Roads L1, L2, and L3. A large increase in noise will occur at the north-east towers of the CDA development in Area 15 owing to the construction of Road 6/L3 but adverse impacts are not expected.

The dominant noise sources contributing to adverse noise impacts will be Long Yat Road, Castle Peak Road and Road L2. The estimated indicative number of dwellings affected by the project would be about 250, and there would be approximately 10 classrooms likely to be impacted by the EPIW. The estimation has excluded the developments in CDA 12 and CDA 15 as the design of these two sites has not been finalised yet. Mitigation measures should be considered for these areas to alleviate the future adverse impacts.

5.3.3.2 Traffic Noise Levels in Tin Shui Wai

Prediction results for the prevailing and future cases are presented in *Table 5.3b*. There will be adverse impacts in both the prevailing and future scenarios. As shown by *Table 5.3b*, noise exceedances in the range of 1 to 7 dB(A) were predicted at 11 of the 26 identified NSRs. For the future case, noise exceedances in the range of 1 to 8 dB(A) would occur at 15 of the 26 NSRs.

Five NSRs will experience new adverse noise impacts: these will be the proposed secondary school (western facade), the proposed primary school (NSR 27), Tin Shing Court (east); Yiu Yat House - Tin Yiu Estate; and, Yau Ning House.

Table 5.3b Tin Shui Wai EPIW - Predicted Noise Levels $L_{10, 1hour}$ (dB(A)) for the Prevailing Year and Future Year (1999 & 2018)

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
24	Proposed Secondary School (west)	7.5	65	68 (3)	14.3	65	68 (3)	24.5	65	68 (3)
25	Proposed Secondary School (south)	11.8	67 (2)	61	18.6	67 (2)	63	28.8	69 (4)	67 (2)
26	Tin Shing Court (west)	11.8	64	65	60.3	66	69	110.3	66	70
27	Proposed Primary School	11.8	57	67 (2)	18.6	65	69 (4)	28.8	70 (5)	72 (7)
28	Proposed Primary School (east)	11.8	63	72 (7)	18.6	64	66 (1)	28.8	70 (5)	72 (7)
29	Tin Shing Court (east)	11.4	65	70	59.9	70	72 (2)	109.9	69	71 (1)
30	Tin Shing Court (south)	11.8	51	58	60.3	68	70	110.3	67	70
31	Tin Shing Court (east)	11.4	67	68	59.9	67	69	109.9	66	68
32	Tin Shing Court (north)	11.8	66	68	60.3	67	69	110.3	66	68
33	QE School Old Student's Association Primary School	12.0	65	65	18.8	66 (1)	67 (2)	29.0	68 (3)	72 (7)
34	Yiu Hong House (west)	11.3	71 (1)	72 (2)	59.8	69	70	109.8	68	68
35	Yiu Hong House (east)	11.5	61	61	59.8	67	69	109.8	67	68
36	Yiu Foo House (south) – Tin Yiu Estate	11.1	72 (2)	73 (3)	59.6	69	69	109.6	67	68
36a	Yiu Foo House (west) – Tin Yiu Estate	11.1	68	69	59.6	68	69	109.6	67	68
37	Yiu Foo House (north) – Tin Yiu Estate	11.1	69	69	59.6	68	69	109.6	67	67
38	Yiu Yat House – Tin Yiu Estate	11.1	70	71 (1)	59.6	68	69	109.6	67	68
39	Yau Hong House	11.0	70	70	59.5	67	68	109.5	65	66
40	Yau Ning House	11.4	69	71 (1)	59.9	69	70	109.9	67	69
41	Tin Tsz Estate (west)	10.3	72 (2)	73 (3)	58.8	70	72 (2)	108.8	70	71 (1)
42	Tin Tsz Estate (south)	10.3	75 (5)	76 (6)	31.8	74 (4)	76 (6)	52.8	73 (3)	75 (5)
43	Tin Tsz Estate (south)	11.3	74 (4)	75 (5)	32.8	73 (3)	75 (5)	53.8	72 (2)	74 (4)
44	Tin Tsz Estate (east)	11.3	73 (3)	75 (5)	59.8	72 (2)	73 (3)	109.8	70	71 (1)
45	TWGHs Kwok Yat Wai College	11.5	72 (7)	72 (7)	18.3	72 (7)	73 (8)	28.5	72 (7)	73 (8)

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
47	Residence in Ping Shan (north)	5.8	69	68	-	-	-	-	-	-
48	Residence in Ping Shan (east)	5.9	66	66	8.9	66	67	11.9	67	67
49	Sheung Cheung Wai	5.3	62	65	8.3	63	66	11.3	64	66

Note : Figure in brackets indicates the level of predicted noise exceedance.

In general, the noise level changes in the future year at NSRs experiencing adverse impacts are in the range of -4 to +10 dB(A) and are attributed to the growth in traffic across the majority of the highway network and the realignment of Tin Fuk Road, Ping Ha Road and Tin Yiu Road. The highest increases in noise will be to the north-west of the Ping Ha Road and Tin Yiu Road, particularly at the proposed primary school in Area 3, as a result of the junction realignment.

The modifications at these junctions will also resume an existing earth bund noise barrier on the northern side of the eastbound carriageway. Noise barriers previously proposed by Territory Development Department along Ping Ha Road have been incorporated in the noise predictions. The predicted noise levels at the proposed secondary school (NSR 25) therefore drop for the future case, although noise exceedance of 2 dB(A) is identified as indicated in *Table 5.3b* given the limited length and height of TDD's proposed barrier. In this regard, KCRC has liaised with the Education Department and has agreed to re-erect a new noise barrier adjacent to the new highway boundary as a mitigation measure to maximise the protection of the schools: the design of the barrier will be defined in this Study as well as the consideration of direct mitigation for adverse impacts at all affected NSRs.

The estimated indicative number of dwellings affected by the project would be about 360 in Tin Shui Wai, while there would be approximately 120 classrooms likely to be impacted by the EPIW during the operational phase.

5.3.3.3 Traffic Noise Levels in Tuen Mun Centre

Predicted traffic noise levels in Tuen Mun Centre are given in *Table 5.3c*. At NSRs identified within Tuen Mun Centre, there will be adverse impacts in both the prevailing and future scenarios. In the prevailing situation, adverse impacts in the range of 1 to 13 dB(A) occur at 15 of the 21 NSRs. While in the future case, adverse impacts in the range of 1 to 15 dB(A) are predicted at 15 of the 21 NSRs.

In general, the noise level changes in the future year at NSRs experiencing existing adverse impacts will be in the range of -12 to +9 dB(A) owing to: traffic growth; the improvement works which will enhance the Pui To Road junction to the south of the station; the traffic in association with the operation of public transport interchange that will attract/distribute traffic away from the NSRs to the north of the Station. The changes

in the noise levels at NSRs, as presented in *Table 5.3c* reflect the difference between the prevailing and future traffic condition of the area. The reduction in the predicted noise levels at Hong Lai Garden (east) and St Simon's Lui Ming Choi Secondary School (NSRs 56 and 58) is due to the drop in traffic volume on Tuen Mun Heung Sze Wui Road of that particular section; while the noise levels increase at Ming Wai Building and Castle Peak Catholic Primary School in the future because of the increased traffic across the major road junctions next to the West Rail Tuen Mun Centre Station.

The dominant noise sources will be the unaltered road sections of Tuen Mun Heung Sze Wui Road and Pui To Road which cause noise exceedances at the NSRs. Since only a small section of Pui To Road is classified as "new road" in this Study, the corresponding noise impact is also minimal and no sensitive receivers will be affected.

Table 5.3c Tuen Mun Centre EPIW - Predicted Noise Levels $L_{10,1hour}$ (dB(A)) for the Prevailing Year and Future Year (1999 & 2018)

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
50	Hong Lai Garden (west)	25	60	61	73.5	65	66	123.5	65	66
51	Hong Lai Garden (east)	25	70	58	73.5	70	62	123.5	68	63
52	Hong King Building	9.6	62	71 (1)	19.1	62	70	24.6	63	69
53	Bit Hing Building	9.6	64	55	19.1	64	57	24.6	64	58
54	Honeley Court	19.9	74 (4)	63	42.3	71 (1)	66	67.5	69	67
55	St Simon's Lui Ming Choi Secondary School (south-west)	10.7	64	73 (8)	17.5	68 (3)	73 (8)	27.7	68 (3)	72 (7)
56	St Simon's Lui Ming Choi Secondary School (south-east)	10.7	69 (4)	62	17.5	69 (4)	66 (1)	27.7	68 (3)	66 (1)
57	St Simon's Lui Ming Choi Secondary School (south-west)	6.4	68 (3)	73 (8)	-	-	-	9.4	68 (3)	73 (8)
58	St Simon's Lui Ming Choi Secondary School (south-east)	6.4	75 (10)	66 (1)	-	-	-	9.4	75 (10)	67 (2)
59	Tuen Mun Mansion	9.2	65	65	18.7	65	66	24.2	64	67
60	Tai Hing Building	9.6	65	66	19.1	65	67	24.6	65	67
61	Koon Hing Building	9.6	75 (5)	75 (5)	19.1	74 (4)	75 (5)	24.6	74 (4)	74 (4)
62	Ming Wai Building (north)	9.6	76 (6)	77 (7)	19.1	75 (5)	76 (6)	24.6	74 (4)	75 (5)
63	Ming Wai Building (south)	9.6	79 (9)	80 (10)	19.1	77 (7)	78 (8)	24.6	76 (6)	77 (7)
64	Castle Peak Catholic Primary School (west)	10.2	78 (13)	79 (14)	18.7	76 (11)	78 (13)	27.2	75 (10)	77 (12)

NSR	Name or Location of NSR	Low Level	Year 1999	Year 2018	Mid Level	Year 1999	Year 2018	High Level	Year 1999	Year 2018
		mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)	mPD	dB(A)	dB(A)
	façade)									
65	Castle Peak Catholic Primary School (south façade)	10.2	77 (12)	80 (15)	18.7	76 (11)	79 (14)	27.2	76 (11)	79 (14)
66	Top Court	9.7	76 (6)	79 (9)	38.4	74 (4)	78 (8)	66.4	73 (3)	76 (6)
67	Man Shing Building	9.7	78 (8)	82 (12)	38.4	75 (5)	79 (9)	66.4	73 (3)	77 (7)
68	Kam Wah Garden (west)	24.2	73 (3)	76 (6)	72.7	73 (3)	76 (6)	122.7	71 (1)	74 (4)
69	Kam Wah Garden (north)	24.2	66	70	72.7	71 (1)	75 (5)	122.7	70	73 (3)
70	The Trend Plaza	24.2	75 (5)	78 (8)	72.7	71 (1)	74 (4)	122.7	69	72 (2)

Note : Figure in brackets indicates the level of predicted noise exceedance.

5.3.4 Environmental Mitigation Measures During Operational Phase

The results of the assessment show that over half of the representative NSRs within the spatial scope of the Project will be adversely impacted with exceedances in the range of 1 to 13 dB(A) before work on the Project commences. Without the Project, such exceedances would only be exacerbated in the future fifteen years and beyond as a result of traffic growth. During the operational phase of the Project the number of adverse impacts will increase by just under ten *per cent* (by comparing the prevailing case and the worst future case), with exceedances in the range of 1 to 15 dB(A).

In accordance with the Study Brief, the Proponent is required to provide direct mitigation to new highways that contribute to noise exceedances or, where direct mitigation is not feasible or wholly ineffective, to provide indirect mitigation. Various mitigation measures listed in Section 6 of Annex 13 of the EIA TM have been given due consideration. The application of these assessment procedures and implementation of technical remedies is seen by HyD to be an opportunity to provide environmental improvements for noise sensitive property within the vicinity of the West Rail and in the wider context through the spatial scope of the Project.

For the design of barriers, reference has been made to Transport Department's *Transport Planning & Design Manual (TPDM)* which outlines the need to design barrier installations so as to preserve the driver's visibility of approaching traffic at road junctions. The *Manual* does not specify such visibility splay requirements for signalised junctions that will present in the Project and therefore guidance was taken from the design recommendations for priority junctions which are given as a function of vehicle speed. With a vehicle speed of 50 kph, barrier installations (barriers located at the kerb side) on new roads should not encroach within 70m of any adjoining major road at signalised junctions in general, and within 50m of adjoining minor roads.

Based on the predictions of future road traffic noise and identified adverse impacts, direct noise mitigation has been reviewed in detail for Yuen Long, Tin Shui Wai and Tuen Mun Centre and is presented *Sections 5.3.4.1, 5.3.4.2 and 5.3.4.3*. It is the objective of this EIA Study to recommend mitigation measures and to assess any potential side effects in conjunction with the proposed noise mitigation measures.

5.3.4.1 Yuen Long

Figure 5.3g indicates the location of proposed noise barriers in Yuen Long. Typical section of the proposed measure is given in *Figure 8.3c*. The mitigated future noise levels are presented in *Table 5.3d*.

A curb side barrier of 3 m high and 35 m in length is proposed on Road L1 (0.5 m from road kerb, starts at the location 28 m north of the village access of Nam Pin Wai, extending towards the north by 35 m) to protect the NSRs in Nam Pin Wai. A reflective barrier made of plexi-glass or concrete with a transmission loss of not less than 20 dB(A) (for road traffic noise spectrum) will be appropriate in this location and the barrier should be maintained by HyD to ensure the acoustic performance of the measure. The purpose of this barrier is to provide screening of traffic noise from Road L2 to Nam Ping Wai, those sensitive facades facing east will be protected.

Table 5.3d Yuen Long EPIW - Mitigated Noise Levels $L_{10,1\text{hour}}$ (dB(A)) for the Future Year (2018)

NSR	Name or Location of NSR	Low Level		Mid Level		High Level	
		mPD	dB(A)	mPD	dB(A)	mPD	dB(A)
1	Nam Pin Wai (west)	5	71 (1)	7.2	72 (2)	11	72 (2)
2	Tai Wong Temple - Nam Pin Wai	5.5	65	-	-	8.5	65
3	Nam Pin Wai (south-west)	4.5	72 (2)	7.5	72 (2)	10.5	73 (3)
4	Nam Pin Wai (south)	4.5	72 (2)	7.5	72 (2)	10.5	72 (2)
5	Shung Tak School	4.4	73 (8)	-	-	7.4	74 (9)
6	Nam Pin Wai (east)	4.5	68	7.5	69	10.5	70
7	Tung Tau Tsuen	4.6	70	7.6	70	10.6	70
8	Tsoi Uk Tsuen	4.9	69	7.9	69	10.9	69
9	Ying Lung Wai	4	69	7	69	10	69
10	Tai Wai Tsuen (west)	4.5	68	7.5	69	10.5	69
11	Tai Wai Tsuen (east)	4.5	69	7.5	69	10.5	70
12	Sun Yuen Long Centre (north-west)	34.5	56	70.5	67	109.5	67
13	Sun Yuen Long Centre (north-east)	34.5	46	70.5	58	109.5	59
14	Sun Yuen Long Centre (west)	34.5	69	70.5	71 (1)	109.5	71 (1)
15	Sun Yuen Long Centre (south)	34.5	63	70.5	76 (6)	109.5	74 (4)
16	Sun Yuen Long Centre (south)	34.5	60	70.5	74 (4)	109.5	73 (3)
17	CDA Development in Area 15 (north-west)	37.7	68	89.2	72 (2)	145.2	70

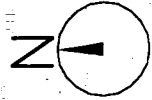
NSR	Name or Location of NSR	Low Level		Mid Level		High Level	
		mPD	dB(A)	mPD	dB(A)	mPD	dB(A)
18	CDA Development in Area 15 (north-east)	37.7	62	89.2	69	145.2	66
19	CDA Development in Area 15 (south-west)	37.7	79 (9)	89.2	77 (7)	145.2	75 (5)
20	CDA Development in Area 15 (south)	37.7	79 (9)	89.2	76 (6)	145.2	74 (4)
20a	CDA Development in Area 12 (north)	27	81 (11)	83.5	78 (8)	141.5	76 (6)
21	Shap Pat Heung Rural Committee Building	5.9	84 (14)	-	-	8.9	84 (14)
22	Cheong Wai	12.1	83 (13)	39.1	80 (10)	69.6	78 (8)
23	Far East Consortium Yuen Long Building	19.4	80 (10)	46.4	79 (9)	76.4	77 (7)

Note : Figure in brackets indicates the level of predicted noise exceedance.

The NSRs at Nam Pin Wai facing Long Yip Street and those with sensitive facades facing west are affected by the noise from Long Yip Street and Yuen Long On Lok Road. In arriving at the final mitigation solution, the following considerations have been taken during the course of the EIA and engineering studies :

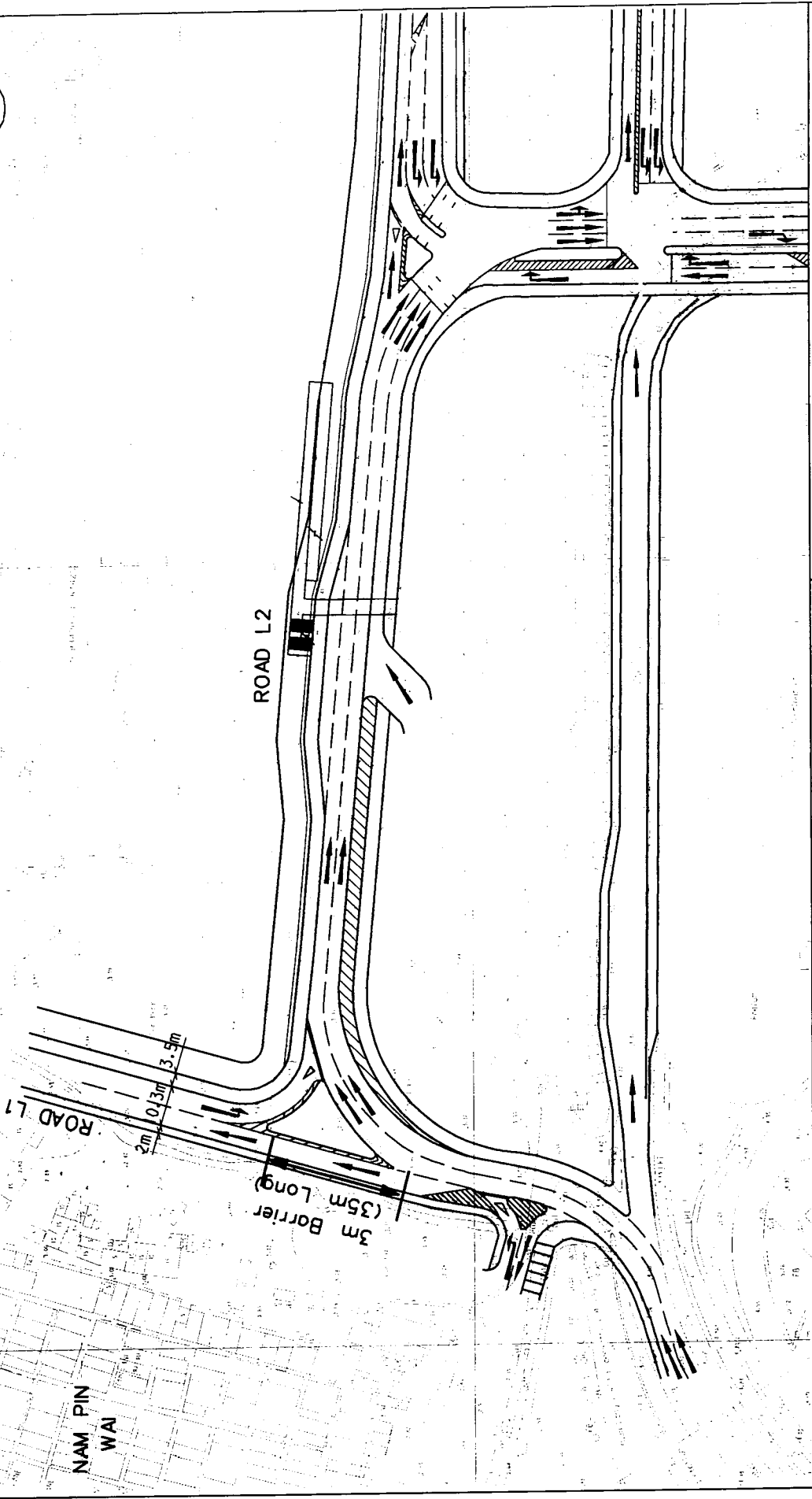
- The application of direct technical remedies to provide further protection to Nam Pin Wai is limited by the access to Nam Ping Wai village. Further increasing the height of the proposed 35 m long noise barrier was found to be acoustically ineffective in view of the low-rise nature of the sensitive premises. Subject to the alignment of any future road extension to the north of Road L1 and the future traffic conditions, additional technical remedies within or beyond the project limit may be required to protect the residents of Nam Pin Wai. However, this is outside the scope of this study and should be undertaken by the proponent of the future extension..
- The NSRs of Sun Yuen Long Centre and CDA Development in Areas 12 and 15 would be affected by the traffic on Long Yat Road, Road 6/L3 and Castle Peak Road. Both developments are constructed on podiums which provide a degree of self noise screening but not sufficient to protect from all residual exceedances. However, given the characteristics of the area, further opportunity to implement more mitigation is heavily constrained. The use of roadside barriers will not be effective given the high-rise nature of the nearby noise sensitive premises. In addition, the use of cantilever barrier, semi-enclosure or full noise cover to protect these premises is not feasible as Long Yat Road serves as an emergency vehicle access for these developments and such measures would otherwise create obstruction to fire services in the case of an emergency. And finally, the high percentage of heavy vehicles (exceeding 35%) in the traffic streams along Long Yat Road and Castle Peak Road for the future worst prediction year will render the use of low noise road surfacing within the scope of EPIW as not being feasible.

The remaining NSRs with adverse noise impacts, such as Cheong Wai and Far East Consortium Yuen Long Building, would predominantly be affected by the unaltered sections of Castle Peak Road (not subject to physical alteration in the Project) and are



TSUIUK
TSUEN

TUNG
TAU
TSUEN



NAM PIN
WAI

FIGURE 5.39

PROPOSED DIRECT ROAD TRAFFIC NOISE MITIGATION
MEASURES, YUEN LONG

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beyond the boundary of the Project. Direct technical remedies could therefore not be provided by the Proponent in these locations and, indeed, the properties would not be eligible for noise insulation under the ExCo Directive.

With the proposed feasible direct remedies, the NSRs of Nam Pin Wai (those facing Roads L1 and L2) would be protected. The estimated number of dwellings protected by the proposed measure would be about 70. In other areas, noise exceedances in the range of 1 to 14 dB(A) will be unavoidable at 14 NSRs (see *Table 5.3d*) as a result of the above highlighted constraints. Therefore, as last resort, the requirement for indirect technical remedies to protect the affected NSRs will be considered and addressed in *Section 5.3.5*.

Figures showing the alternative mitigation strategies considered in this study are presented in Annex G.

5.3.4.2 Tin Shui Wai

Figures 5.3h-i indicate the location of the proposed final noise barrier mitigation scheme and the extent of low noise road surfacing recommended in Tin Shui Wai for the Project. Typical sections of the proposed measures are given in *Figure 8.4c*. *Table 5.3e* below presents the results of mitigated noise levels. These measures have been proposed following analysis of environmental and engineering constraints during the course of this study.

Low noise road surfacing has been proposed for Tin Shui Wai EPIW as there are no sharp bends in road geometry, no inclined road sections and the annual average daily traffic will not exceed 18,500 in traffic volume with a percentage of heavy vehicles not exceeding 35%. The surface is designed to reduce tyre noise generated by the rolling action between tyres and road surface (see *Annex F* regarding the agreement on the use of low noise road surfacing for this EIA Study). The factors affecting the quantity of sound energy emitted with respect to this rolling action include vehicle speed, tyre loading and structure and road surface texture. According to CRTN, for impervious bituminous and concrete road surfaces, the reduction in tyre noise is 1 dB(A) for any traffic speed not higher than 75 kph. While for low noise road surfacing, CRTN specifies a reduction of 3.5 dB(A) for all traffic speeds. In Hong Kong, low noise road surfacing is normally made of pervious macadam.

During the course of the study alternative mitigation proposals have been considered and rejected because of certain practical constraints. These discarded options have included the following :

- Extensive high barriers up to 9.5 m in height were initially considered to protect the high-rise developments in the vicinity of the EPIW and close to the junction of Ping Ha Road/Tin Yiu Road/Tin Fuk Road. While such barriers would have afforded full protection to all of the noise sensitive property, having considered the potential visual intrusion to the residents and other engineering constraints to the Project including sight-line requirement, spatial requirement for foundation of tall barriers, conflicts with

existing sub-surface utilities, highway maintenance and road safety issues, a combination of both low noise road surface and lower height barriers that avoided these restrictions has been taken forward.

- Another set of options based upon a semi-enclosure and full noise cover of the highways have been considered for this area in the early stage of the Study. However, these too were also rejected in favour of the proposed mitigation strategy as the measures would have resulted in spatial conflict with other essential environs, road safety problems, unattainable highway maintenance implications, emergency access restrictions as well as sight-line issues.

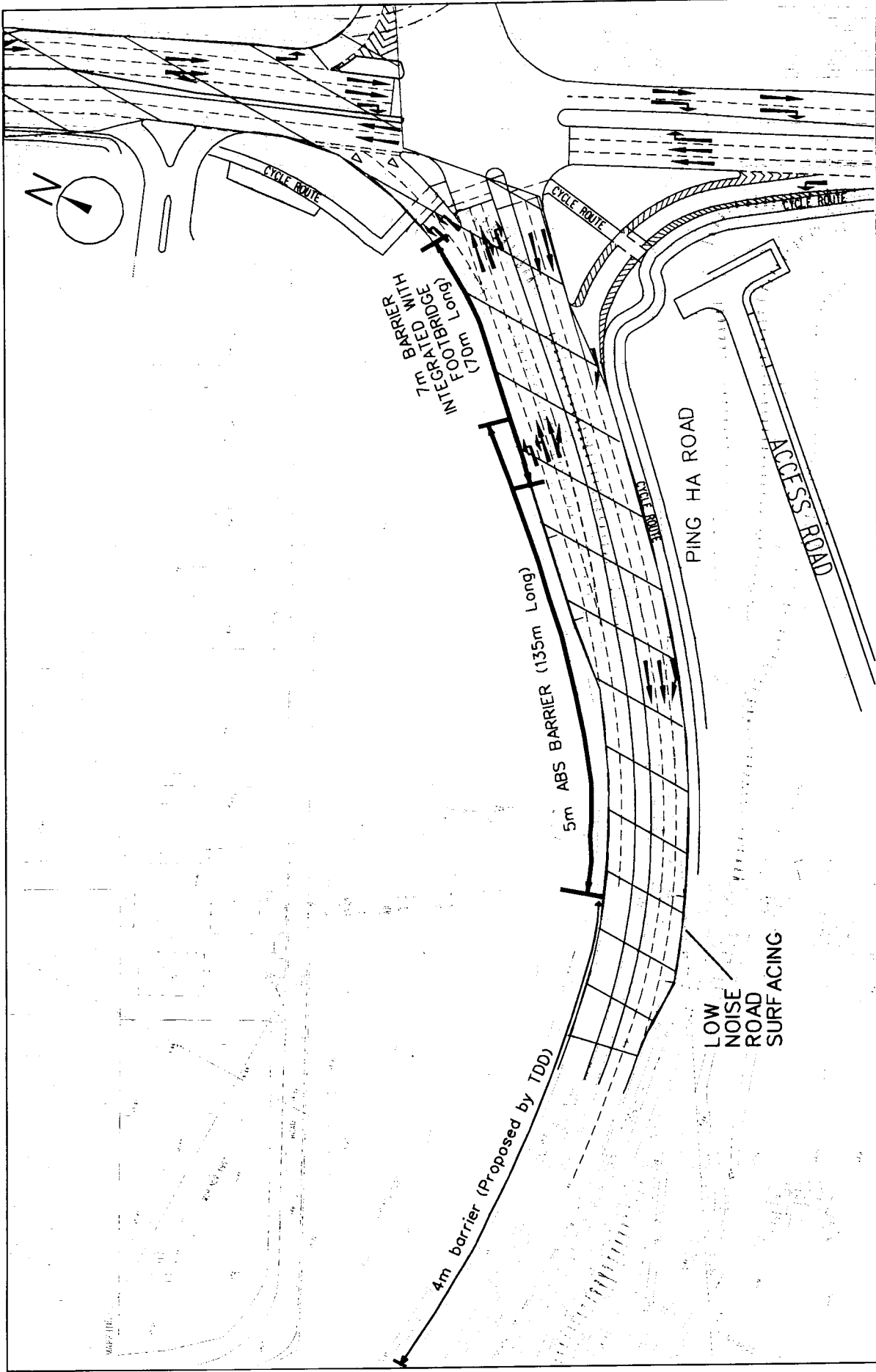
Figures showing some of the discarded mitigation options are presented in Annex G.


In the final proposed mitigation scheme, the road segments around the junction of Tin Fuk Road, Tin Yiu Road and Ping Ha Road are proposed to be surfaced with low noise road surface (see *Figures 5.3h* and *5.3i*). The extent will cover the east bound carriageway of Tin Fuk Road (approximately 290 m long), Tin Yiu Road (north and south bound carriageways, approximately 120 m long) and Ping Ha Road West (east and west bound carriageways, approximately 240 m long). In order to maintain the acoustic performance of this surface, the Highways Department will conduct routine site inspection regarding any defects, cracks or other physical deterioration and provide re-surfacing as and when required.

The final noise barrier scheme will comprise a 5 m high absorptive noise barrier of length 135 m adjacent to the outside edge of drainage reserve, along the school boundary of Area 3 and next to the eastbound carriageway of Ping Ha Road. The Project Proponent will provide a non-reflective barrier made of absorptive panels with a transmission loss of not less than 20 dB(A) (for road traffic noise spectrum) and sound absorption coefficient of not less than 0.9 in the 125 Hz to 2 kHz frequency range will be required. In addition, a reflective noise barrier of 7 m high, 70 m long, situated at a setback of 2 m from road kerb will also be provided along Ping Ha Road. This barrier will be constructed of plexi-glass or concrete with a transmission loss of not less than 20 dB(A) (for road traffic noise spectrum). The design of this barrier will also be integrated with the proposed footbridge. All the proposed noise barriers will be maintained by HyD to ensure the acoustic performance of the measure for protecting the NSRs.

The purpose of these barriers is to protect the proposed primary and secondary schools in Area 3. The use of absorptive barrier is to minimise potential noise reflection adversely affecting the proposed sensitive development above the West Rail Station PTI; the development will otherwise take full account of EPIW infrastructure. The 4 m high noise barrier along Ping Ha Road previously proposed by TDD has been considered in the noise predictions together with the direct measures recommended in this Study.

With the final package of mitigation measures, noise reductions in the range of 1 to 15 dB(A) will be achieved but there will be unavoidable residual impacts of up to 6 dB(A) at the proposed schools. However, further increasing the barrier height will not be effective



<p>— NOISE BARRIERS</p> <p>▨ LOW NOISE ROAD SURFACING</p>	<p>PROPOSED DIRECT ROAD TRAFFIC NOISE MITIGATION MEASURES ON PING HA ROAD, TIN SHUI WAI</p>	<p>FIGURE 5.3h</p> <p>ERM WEST RAIL, DD901 ENVIRONMENTAL SUPPORT SERVICES</p>	<p>KOWLOON - CANTON RAILWAY CORPORATION</p> 
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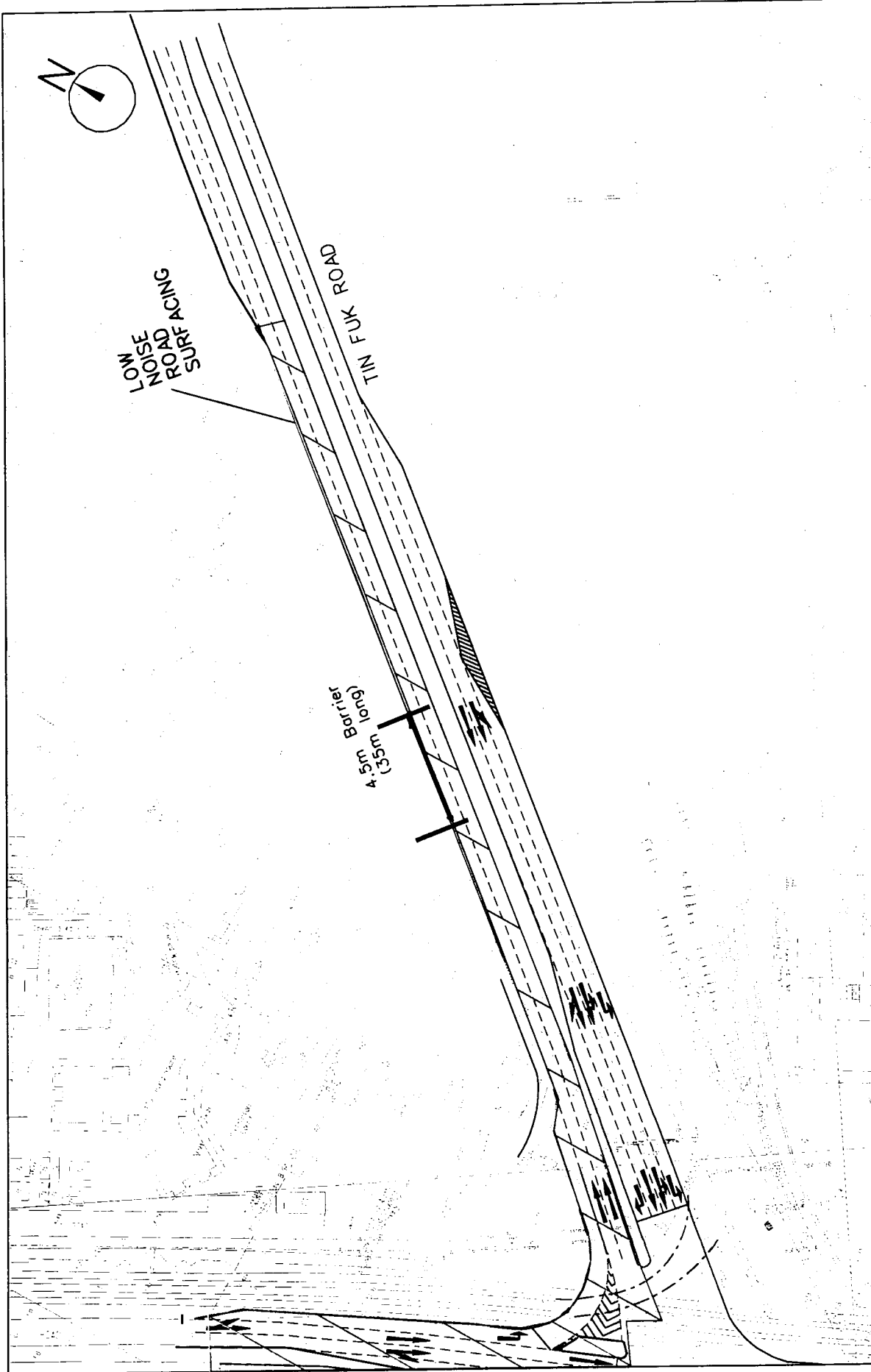


FIGURE 5.3i
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— NOISE BARRIER
 ▨ LOW NOISE ROAD SURFACING
 PROPOSED DIRECT ROAD TRAFFIC NOISE MITIGATION
 MEASURES ON TIN FUK ROAD, TIN SHUI WAI
 SCALE: 1/1500

for the schools. In addition, the linear extent of treatment in these locations has been maximised within the boundary of the Project with due regard to the sight line requirements at the Ping Ha Road and Tin Yiu Road junction and therefore no further avenues exist by which the criteria may be met by the use of direct technical remedies.

For Tin Yiu Estate, a 4.5 m high noise barrier of 35 m long, 1m from road kerb is proposed in conjunction with low noise road surface, as indicated in *Figure 5.3i*, to be integrated with the proposed footbridge located adjacent to the eastbound carriageway of Tin Fuk Road. The Project Proponent will provide a reflective barrier made of plexi-glass or concrete with a transmission loss of not less than 20 dB(A) (for road traffic noise spectrum) and this will be fully maintained by Highways Department. However, even with these available measures, residual noise impacts of up to 5 dB(A) would remain at QE School Old Student's Association Primary School. The provision of further direct mitigation is limited by the sight line requirements at the Tin Yiu Road and Tin Fuk Road junction, spatial constraints caused by the drainage reserve of Ping Shan culvert, room for pedestrian access and the planned LRT reserve.

Table 5.3e Tin Shui Wai EPIW - Mitigated Noise Levels $L_{10, 1hour}$ (dB(A)) for the Future Year (2018)

NSR Identity	Description	Low Level		Mid Level		High Level	
		mPD	dB(A)	mPD	dB(A)	mPD	dB(A)
24	Proposed Secondary School (west)	7.5	68 (3)	14.3	68 (3)	24.5	68 (3)
25	Proposed Secondary School (south)	11.8	57	18.6	60	28.8	65
26	Tin Shing Court (west)	11.8	64	60.3	68	110.3	69
27	Proposed Primary School	11.8	55	18.6	65	28.8	70 (5)
28	Proposed Primary School (east)	11.8	57	18.6	65	28.8	71 (6)
29	Tin Shing Court (east)	11.4	68	59.9	70	109.9	69
30	Tin Shing Court (south)	11.8	56	60.3	69	110.3	68
31	Tin Shing Court (east)	11.4	67	59.9	67	109.9	66
32	Tin Shing Court (north)	11.8	68	60.3	68	110.3	67
33	QE School Old Student's Association Primary School	12.0	64	18.8	67 (2)	29.0	70 (5)
34	Yiu Hong House (west)	11.3	71 (1)	59.8	70	109.8	68
35	Yiu Hong House (east)	11.5	58	59.8	68	109.8	67
36	Yiu Foo House (south) – Tin Yiu Estate	11.1	67	59.6	69	109.6	67
36a	Yiu Foo House (west) – Tin Yiu Estate	11.1	67	59.6	68	109.6	67
37	Yiu Foo House (north) – Tin Yiu Estate	11.1	67	59.6	68	109.6	67
38	Yiu Yat House – Tin Yiu Estate	11.1	70	59.6	68	109.6	67
39	Yau Hong House	11.0	69	59.5	68	109.5	66
40	Yau Ning House	11.4	71 (1)	59.9	70	109.9	69
41	Tin Tsz Estate (west)	10.3	73 (3)	58.8	72 (2)	108.8	71 (1)

NSR Identity	Description	Low Level		Mid Level		High Level	
		mPD	dB(A)	mPD	dB(A)	mPD	dB(A)
42	Tin Tsz Estate (south)	10.3	76 (6)	31.8	76 (6)	52.8	75 (5)
43	Tin Tsz Estate (south)	11.3	75 (5)	32.8	75 (5)	53.8	74 (4)
44	Tin Tsz Estate (east)	11.3	75 (5)	59.8	73 (3)	109.8	71 (1)
45	TWGHs Kwok Yat Wai College	11.5	71 (6)	18.3	72 (7)	28.5	72 (7)
47	Residence in Ping Shan (north)	5.8	68	-	-	-	-
48	Residence in Ping Shan (east)	5.9	66	8.9	66	11.9	67
49	Sheung Cheung Wai	5.3	65	8.3	66	11.3	66

Note : Figure in brackets indicates the level of predicted noise exceedance.

Residual noise impacts of 1 to 6 dB(A) were predicted at the residential blocks of Tin Tsz Estate owing to the predominance of noise from the unaltered Tin Shing Road and Tin Fuk Road. However, since the highways are outside of the Project boundary, the application of further direct technical remedies is not practicable.

The further application of direct technical remedies to protect TWGHs Kwok Yat Wai College is adversely restricted by sight line requirements as the predicted impacts were caused by the traffic on Tin Fuk Road, Ping Ha Road and the road junction; screening of these sections of highway would create poor forward visibility for drivers at the junction. However, all noise sensitive rooms will be insulated with suitable window glazing and air-conditioning under TDD project, therefore, no adverse impacts anticipated.

After exhausting all possible mitigation alternatives but developing a workable proposal of barriers and low noise road surface, some residual adverse impacts are still predicted at the schools only. The number of affected classrooms is reduced to about 110 (including the proposed primary and secondary schools in Area 3, QE School Old Student's Association Primary School and TWGHs Kwok Yat Wai College) with the proposed measures and all the noise impacts previously identified at the residential dwellings in conjunction with the EPIW could be reduced to within the EIA TM standard. Accordingly, the requirements for indirect technical remedies to protect the affected schools will be considered and addressed in *Section 5.3.5*.

5.3.4.3 Tuen Mun Centre

The assessment results indicate that adverse impacts at NSRs are dominated by existing or unaltered roadways and not from the new road section identified for the Study. Given the potential constraints such as sight-line requirement and spatial constraints adjacent to the new roadway section identified, no direct technical remedies have been proposed for Tuen Mun Centre. It is also anticipated that no NSR here will be eligible for indirect technical remedies as the contribution from new road is less than 1.0 dB(A).

5.3.5 Residual Impacts and Noise Insulation Eligibility

In the preceding section, direct technical remedies in the form of roadside barriers and low noise road surfacing are proposed in order to mitigate adverse impacts. Given the potential traffic constraints such as visibility splay and road safety aspect, emergency access requirements, the boundary limits of Project and presence of DSD culverts, the use of direct technical remedies will not fully mitigate adverse impacts within the spatial scope of the Project.

Since the use of direct technical remedies were seen to be exhausted, the residual noise impacts at NSRs were assessed against the noise insulation criteria embodied in the *ExCo Directive, Equitable Redress for Persons Exposed to Increased Noise Resulting From The Use of New Roads*.

The assessment results are detailed in *Annex F* and *Table 5.3f* summarises the NSRs eligible for noise insulation. As an initial indication and for the Project Proponent to determine the type of insulation for schools, in conjunction with the requirements for the construction phase, the type of insulation for NSRs is defined.

According to EIA O TM, the type of noise insulation, if proved to be eligible for existing NSRs, depends on the level of noise exceedance over the standard limit (i.e. 70 dB(A) for residential uses and 65 dB(A) for schools). For adverse impacts less than 10 dB(A), Type I noise insulation would be required: this specifies existing openable well-gasketed window, 6 mm pane, or transmission loss (TL) of 28 dB or above in the 250 Hz octave band and sound transmission class (STC) 31 or above. For predicted noise exceedances equal to 10 dB(A) or below 15 dB(A), Type II insulation would be required: openable well-gasketed window, 8 mm pane, or transmission loss (TL) of 32 dB or above in the 250 Hz octave band and STC 34 or above. For habitable rooms with adverse impacts, provided the transmission loss of the existing glazing systems meets with these requirements and air conditioners are already installed, no further work would be required. However, thorough site inspection and sample sound transmission loss testing will be required to confirm the extent of works. This would be undertaken by the Project Proponent between the EIA approval and the opening of the Project

As the developments in CDA 12 and CDA 15 of Yuen Long are not fully developed, it is the purpose of this Study to define an approximate scope of indirect measures required to protect the future residents due to the noise impacts associated with the Project. Should additional noise insulation be required as a result of this Study, there will be adequate opportunity to install the works prior to occupation by agreement between the Project Proponent and the developer.

For St Simon's Lui Ming Choi Secondary School, the noise impacts predicted are attributed to the traffic on a new access ramp of West Rail Station, which is outside the scope of the Designated Project under the EIAO. As previously mentioned in *Section 4*, this school will be upgraded and noise abatement measures will be provided by ED to relieve the traffic noise issues. For existing school eligible for noise insulation (i.e. QE School Old Student's Association Primary School), the glazing system should be checked

against the specifications mentioned above and should be reviewed with respect to the adequacy of indirect measures adopted. These should be undertaken by the Project Proponent before the opening of the roadworks through site inspection and sample sound transmission loss testing. Other schools such as the proposed primary and secondary schools in Area 3 and TWGHs Kwok Yat Wai College in Tin Shui Wai are not eligible for noise insulation under this EIA Study. The glazing system for the affected school should be upgraded by the Project Proponent in accordance with the recommendations made in this EIA Study if the existing systems are found to be inadequate. All the installation works or upgrading of existing glazing systems must be implemented before the commissioning of the EPIWs.

Table 5.3f Noise Sensitive Receivers Eligible for Noise Insulation

NSR Identity	Description	Type of Insulation Proposed
<u>Yuen Long</u>		
15 & 16	Sun Yuen Long Centre (Block 5, facades facing Long Yat Road and Castle Peak Road (road segment within EPIW scope), 3/F to top floor, about 180 dwellings requires noise insulation)	Type I
17 & 19	CDA Development in Area 15 (Blocks 1, 2 and 3, facades facing Long Yat Road and Castle Peak Road (road segment within EPIW scope): for Blocks 1 and 2, 1/F to top floor require noise insulation and for Block 3, 5/F to 36/F)	Type I
20a	CDA Development in Area 12 (Blocks 1 and 2, facades facing Castle Peak Road (road segment within EPIW scope) and those facades have a direct line of sight to Long Yat Road, 1/F to top floor)	Type II (1/F to 10/F) and Type I (11/F to top floor)
<u>Tin Shui Wai</u>		
33	QE School Old Student's Association Primary School (classrooms facing road junction, 5/F to top floor, about 15 classrooms requires noise insulation)	Type I

5.4 Conclusion

Unmitigated construction activities associated with the Project would cause exceedances of daytime construction noise standards stipulated in EIA O TM at most of the nearby NSRs. Noise exceedances in the range of 1 to 12 dB(A) have been predicted at Yuen Long. NSRs at Tin Shui Wai and Tuen Mun Centre would also be adversely impacted by the works, with predicted exceedances of up to 18 dB(A) and 14 dB(A) respectively. The critical noisy construction activities identified were excavation works during various construction stages and road paving in road construction.

Adequate control measures would be required for construction works to meet the EIA O TM daytime construction noise criteria. Mitigation measures including good site practices, use of quiet plant, installation of temporary noise barriers, reduce the percentage of time of noisy equipment in operation, avoidance of simultaneous construction activities on sites and substitution of particular noisy equipment were

recommended. Regular monitoring of noise at NSRs would be required during the construction phase of the Project in order to ensure the environmental performance of the works. The monitoring requirements and implementation schedule for mitigation measures are addressed in *Sections 11* and *12* respectively.

With the adoption of appropriate measures as stated above and the implementation of an effective monitoring exercise which would draw the contractor's attention to any excessive impact and to trigger appropriate corrective actions, it is expected that the residual impacts can be reduced to acceptable levels in accordance with the EIA O TM requirements.

Operational road traffic noise impact is a key issue raised by this EIA Study. Based upon the worst case traffic forecasts of year 2018, unmitigated noise impacts would be likely at most of the identified NSRs within the locality of the Project although the majority of these are already adversely affected prior to the opening of the EPIWs. The use of direct technical remedies including roadside barriers and low noise road surfacing for the proposed scheme has been considered in Yuen Long and Tin Shui Wai, taking account of existing and potential engineering constraints for each site, and other controlling factors including visibility splay at junctions, presence of drainage reserve and proposed footbridge.

With an exhaustive research of direct measures being completed, the residual noise impacts have been assessed against the noise insulation criteria. The Study finds that there will be three residential developments in Yuen Long (Sun Yuen Long Centre, residential development in CDA 12 and CDA15) and one school in Tin Shui Wai (QE School Old Student's Association Primary School) eligible to be considered for noise insulation. Type I and II noise insulation are required for the EPIWs and the existing/proposed noise insulation works under other projects will need to be reviewed in order to satisfy this requirement.

The recommended mitigation measures for the EPIWs are given in *Table 5.4a*.

Table 5.4a - Summary of Recommended Mitigation Measures During Construction and Operation of the Project

EPIW	Recommended Mitigation Measures
<i>Yuen Long</i>	
• Construction Phase	<ul style="list-style-type: none"> ◇ Good site practice; ◇ Use of quiet construction plant on all work sites and adopt quieter construction method; ◇ Install noise barriers next to all operating construction equipment at work sites (within a separation distance of 20 m) close to Shung Tak School, Nam Ping Wai, Ying Lung Wai, Tai Wai Tsuen, residential development in CDA 12 and CDA15; ◇ Restriction of plant usage (quiet plant) at work sites for drainage works, road construction and barrier construction (within a separation distance of 20 m) to protect Shung Tak School, Nam Ping Wai, Tai Wai Tsuen, residential development in CDA 12 and CDA15; and ◇ Avoidance of simultaneous noisy activities or construction works near Shung Tak School and residential development in CDA 12. ◇
• Operational Phase	<ul style="list-style-type: none"> ◇ 3 m high noise barrier (35 m long) on Road L1 to protect the residence of Nam Ping Wai; and ◇ Use of indirect technical remedies, in the form of suitable window glazing and air-conditioning to protect the affected NSRs (Sun Yuen Long Centre, residential development in CDA 12 and CDA15).
<i>Tin Shui Wai</i>	
• Construction Phase	<ul style="list-style-type: none"> ◇ Good site practice; ◇ Use of quiet construction plant on all work sites and adopt quieter construction method; ◇ Install noise barriers next to all operating construction equipment at all work sites to protect the nearby NSRs; ◇ Limit the plant usage on all work sites for drainage works, road construction and barrier construction to protect the nearby NSRs; ◇ Avoidance of simultaneous noisy activities or construction works near the proposed schools in Area 3, QE School Old Student's Association Primary School, Tin Yiu Estate and TWGHs Kwok Yat Wai College; and ◇ Use lorry of 10t or other model with a SWL of 98 dB(A) or lower to substitute dump truck within work sites close to the proposed schools in Area 3, QE School Old Student's Association Primary School, Tin Yiu Estate and TWGHs Kwok Yat Wai College, further limiting the plant usage on site may be required.
• Operational Phase	<ul style="list-style-type: none"> ◇ 5 m high absorptive noise barrier (135 m long) on the outside edge of drainage reserve and next to the eastbound carriageway of Ping Ha Road; ◇ 7m high barrier (70 m long) next to the eastbound carriageway of Ping Ha Road and integrated with the proposed footbridge; ◇ Use of low noise road surfacing on the east bound carriageway of Tin Fuk Road (approximately 290 m long), Tin Yiu Road (north and south bound carriageways, approximately 120 m long) and Ping Ha Road West (east and west bound carriageways, approximately 240 m long);

EPIW	Recommended Mitigation Measures
	<ul style="list-style-type: none"> ◇ 4.5 m high barrier integrated with the proposed footbridge at Tin Fuk Road (35 m long); and ◇ Use of indirect technical remedies, in the form of suitable window glazing and air-conditioning to protect the affected NSR (QE School Old Student's Association Primary School).
<i>Tuen Mun Centre</i>	
<ul style="list-style-type: none"> • Construction Phase 	<ul style="list-style-type: none"> ◇ Good site practice; ◇ Use of quiet construction plant on all work sites and adopt quieter construction method; ◇ Install noise barriers to protect the affected NSRs including St Simon's Lui Ming Choi Secondary School, Koon Hing Building, Ming Wai Building, Castle Peak Catholic Primary School and Top Court; ◇ Limit the plant usage on-site during drainage works and road construction protect the nearby NSRs including Koon Hing Building, Ming Wai Building, Castle Peak Catholic Primary School and Top Court ; ◇ Avoidance of simultaneous noisy activities or construction works near Koon Hing Building, Ming Wai Building, Castle Peak Catholic Primary School and Top Court; and ◇ Use lorry of 10t or other model with a SWL of 98 dB(A) or lower to substitute dump truck within work sites close to Koon Hing Building, Ming Wai Building and Castle Peak Catholic Primary School further limiting the plant usage on site may be required.
<ul style="list-style-type: none"> • Operational Phase 	<ul style="list-style-type: none"> ◇ None required.