

A2 NOISE IMPACT ASSESSMENT

A2.1 Introduction

This Section presents an assessment on the potential noise impacts associated with the construction and operation of the Project.

The quantitative assessment methodology that has been adopted for the assessment is presented and control measures for the identified sensitive receivers are recommended.

A2.2 Government Legislation and Standards

A2.2.1 Construction Phase – Noise from General Construction Works

The principal legislation on the control of construction noise is the Noise Control Ordinance (NCO). The Environmental Impact Assessment Ordinance also makes provision for assessing noise from construction activities during daytime. The following are Technical Memorandums issued under the NCO and the EIAO that are relevant to this Project:

- Technical Memorandum on Noise from Construction Work other than Percussive Piling (TM-GW);
- Technical Memorandum on Noise from Construction Work in Designated Areas (TM-DA); and
- Technical Memorandum on Environmental Impact Assessment Process (TMEIA).

According to TMEIA, noise standards from general construction works during normal working hours (i.e. 0700-1900 hour on any day not being a Sunday or public holiday) assessed at 1m from the external façade of the domestic premises is $75dB(A)$ [$L_{eq(30mins)}$].

The NCO provides statutory controls on general construction works during the restricted hours (i.e. 1900-0700 hour Monday to Saturday and at any times on Sundays and public holidays), which requires a Construction Noise Permit (CNP) for use of powered mechanical equipment (PME).

A2.2.2 Operational Phase

According to the TMEIA, the criterion for evaluating road traffic noise planning for *domestic premises* is $70dB(A)$ [$L_{10,(1hr)}$].

For both existing and planned NSRs that are envisaged to be affected by the noise from “new” road, direct mitigation measures should be provided as far as practicable when the predicted road traffic noise exceeds the relevant noise criteria.

If, after implementation of the direct mitigation measures, any facades of existing NSR are still exposed to predicted noise levels exceeding the relevant noise criteria, provision of indirect technical remedies in the form of acoustic insulation and air-conditioning should be considered. The eligibility for indirect technical remedies will be tested against the following 3 criteria:

1. The predicted overall noise level from the new road, together with other traffic noise in the vicinity must be above the specified noise level;
2. The predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level; and

A2.3 Baseline Condition

Existing Environment

The location of the proposed works is within the restricted area in the Lok Ma Chau border. *Figure A2.1* shows the extent of the Study Area for noise impact assessment, which covers a 300m radius from the works site boundary. The land within the Study Area is mainly undeveloped land that had been used for aqua-cultural purposes in the form of fishponds. Most of these fishponds, however, have become inactive in recent years.

The population density in the vicinity is considered low within the Study Area.

Existing Noise Regime

The dominant noise source in the vicinity is the traffic noise from the existing Bridge Crossing, San Sham Road and the boundary control area.

There are several construction programme currently being carried out in the vicinity, which includes the

1. “KCRC Lok Ma Chau Station” (April 2002 to June 2007);
2. “Expansion of Kiosks and Other Facilities at Lok Ma Chau Crossing” (anticipated to complete by September 2003); and
3. “San Tin Eastern Main Drainage Channel” (October 2002 to June 2006).

A2.4 Noise Sensitive Receivers

Existing Noise Sensitive Receivers

There are 3 representative NSRs, as defined by the TMEIA, have been identified and the respective distance from the Project during the construction and operational phases are presented *Table A2.3*. These representative NSRs are mainly aqua-cultural farmers residing in low-rise village houses adjacent to the fishponds as shown in *Figure A2.1*.

Table A2.3 – Location of NSRs

NSR	Location	No. of NSRs represented	Ground level (mPD)	No. of Storeys	Buffer distance (m)	Sensitive Uses
NSR-1	Scattered House to the north-west of Ha Wan Tusen	1	+ 3.4	2	50	Residential
NSR-2	Scattered House to the west of Ha Wan Tusen	1	+ 3.9	2	123	Residential
NSR-3	Ha Wan Tusen	55	+ 3.7	2	158	Residential

Planned Noise Sensitive Receivers

As the works site is located in the boundary restricted area, there is currently no plan for either private or public noise sensitive development within the Study Area.

A2.5 Construction Phase

A2.5.1 Potential Sources of Impacts

A preliminary construction programme prepared by HyD is shown in *Figure A2.2* and a preliminary construction equipment schedule in *Figure A2.3*. They represent the current best estimates of the types and number of equipment to be used at various stages of the Project.

The works can be divided into two parts – the construction of the viaducts on land and construction of the Bridge Crossing over Shenzhen River.

The main construction activities that are envisaged to have a significant noise contribution are:

- Diversion of existing Ha Wan nullah and subsequent site formation for the viaduct construction;
- On and offshore piling for bridge piers foundation;
- Bridge deck erection; and
- Construction of road pavement and other finishing works.

Part of the existing Vehicle Holding Area at the southern end of the Works Limit adjacent to San Sham Road will be taken as part of the works area. This area will be used only as works area and no works will be carried out within this area and hence no noise-generating activities is expected.

A2.5.2 Assessment Methodology

The sound power levels of concurrent construction activities at each stages of the construction programme are calculated based on the preliminary construction programme and construction equipment schedule.

The construction noise assessment is undertaken based on acoustic principles, following the methodology given in *Section 2* of the *GW-TM* of the *Noise Control Ordinance* and the *British Standards (BS) 5228: Part 1*.

The methodology adopted in this Study is as follows:

1. Identify the sequence of principal noisy construction activities at any given time of the project duration in accordance with the programme;
2. Identify the type and list of plants required for any particular construction activity;
3. Determine the maximum total Sound Power Level (SWL) for each construction activity according to the planned schedule and the SWL data given in the Technical Memorandum;
4. Calculate the distance attenuation to the identified NSRs from worksite NSP; and
5. Estimate individual and cumulative noise level at the NSRs with and without mitigation measures implemented.

Haulage Equipment Noise

Minor truck movements is expected for moving spoil from the works site to temporary stockpiling area, with no fixed layout for haul roads in this area at present. Truck movements within the site will be very limited, where a maximum of two dump trucks at any time should be sufficient for manoeuvres between stockpiles and excavation locations.

A2.5.3 Evaluation of Impacts

An analysis has been carried out for the assessment noise impact during the construction phase. Taking into consideration the tentative programme, the plant schedule and the location of the identified NSRs, the analysis results indicate that the worst period in terms of noise impacts would occur at the early stages of the programme (around November 2003 to January 2004), when the diversion of Ha Wan Nullah, site formation works for the land viaducts and the construction of the marine bridge foundation works are being carried out.

Table A2.4 shows both the predicted unmitigated noise levels and mitigated noise levels at the identified NSRs at different stages of the Project based on the tentative construction programme and the preliminary plant schedule.

Table A2.4 – Construction noise impacts on the identified NSRs

Period	Predicted Noise Levels, dB(A)					
	NSR-1		NSR-2		NSR-3	
	Un mitigated	Mitigated ¹	Un Mitigated	Mitigated ¹	Un Mitigated	Mitigated ¹
Nov 03 – Jan 04	85	72	77	64	74	62
Feb 04 – Apr 04	86	69	78	62	75	60
Apr 04 – Jun 04	81	67	73	59	71	57
Jul 04 – Dec 04	81	72	73	64	71	62

Note: 1. The values shown have taken into account an additional 3dB(A) for 'façade effect'.

2. Only max. values during the prescribed periods are shown.

The "predicted mitigated noise levels" are calculated assuming the following mitigation measures have been implemented:

1. All plants assumed to be silenced-type; and
2. Where there is hoarding (2.5m tall) provided around that part of the site, a 5dB(A) reduction in noise level would be allowed. Where practical, temporary movable barriers will be placed to reduce noise level by 10 dB(A). If neither movable barriers nor hoarding is available between the activity in question and the NSR, no reduction is assumed. A detailed breakdown of the noise contribution from individual PME's is attached in *Figure A2.3*.
3. It is considered that conventional movable barriers would be sufficient in blocking the line-of-sight between the notional noise sources (the activity or the noise-generating PME) and the identified NSRs, since all of these NSRs comprise only low-rise structures usually of less than two storeys.

Table A2.4 shows that the maximum calculated noise level due to the construction activities of this Project will be 72 dB(A) at NSR-1 with mitigation measures (taking into account 3 dB(A) due to the 'façade effect' at the NSR), which is still under the statutory requirement of 75dB(A).

A2.5.4 Cumulative Effect from other Projects

The following are the construction programmes in the vicinity that will interface with this Project:

1. KCRC Sheung Shui to Lok Ma Chau Spurline;

The proposed works site will be required by the KCRC project after works under this Project is completed. The sequence of works and site possession would effectively exclude the possibility of concurrency of both projects. Therefore, arrangement will be made with KCRC to complete part of the works within the site boundary before April 2004. However, it is envisaged that, while no works under the KCRC project will be carried out within the site area during the construction of project, works will be carried out along other sections of the Spur Line and contributing to the cumulative impacts.

Figure A2.5 is excerpt from the Spur Line EIA report showing the noise impacts from activities which are likely to affect NSRs identified in this study. It shows that NSR-3 (NSR at Ha Wan Tsuen) would be subject to the greatest noise impact of 73 dB(A).

2. Eastern Main Drainage Channel

The project had commenced in October 2002 and anticipates to complete in June 2006. It is expected that the construction of the project will be carried out in stages, involving different plant teams and with the following activities:

- Dredging and pond draining operations;
- Excavation;
- Embankment formation and access road construction;
- River bed construction; and
- Pumping station construction.

Figure A2.6 has been extracted from its EIA report, which indicates that the worst noise impact would be 66 dB(A) to NSR at Ha Wan Tsuen.

The following table summaries the cumulative construction noise impacts (mitigated) on individual identified NSRs concurrent with this Project within the Study Area:

Table A2.5 – Cumulative construction noise impacts (mitigated) at identified NSRs

Project	Period	Activity	Noise Impact, dB(A)		
			NSR-1	NSR-2	NSR-3
KCRC Spur Line* ¹	Jun03 onwards	Foundation Works / Pier Works	65	71	73
San Tin East MDC* ²	2002 – 2006	See text	66	66	66
This Project	2003 – 2004	See text	72* ³	64* ³	62* ³
Cumulative impacts * ⁴			74	73	74

*¹ See Figure A2.5

*² See Figure A2.6

*³ From Table A2.4

*⁴ Summation equals: $10 \times \text{Log}(\Sigma 10^{n1/10} + 10^{n2/10} + ..)$

The above analysis has been carried out with the following underlying assumptions:

- The noise data, apart from those for this Project, has been adopted from EIA reports of the relevant projects. Since the exact location of the NSRs identified under other EIA reports would vary slightly, the NSRs referred in this analysis are those identified under this Project;
- The worst noise impact from the San Tin East MDC has assumed to occur throughout the whole of the construction period for conservatism. It is

acknowledged that noise level would be considerably lower than that used in the analysis for most part of the project (see *Figure A2.6*).

The results show that the cumulative impact of 74 dB(A) still falls within the statutory requirement of 75 dB(A). Taking into consideration the conservative assumptions made in this analysis, it is prudent to conclude that the cumulative noise impact due to daytime construction activities will fall within the requirement as stipulated in TMEIA.

A2.5.5 Mitigation Measures

Although it is anticipated that noise levels during the construction phase of the Project will remain under the statutory requirement, it is recommended that certain standard mitigation measures be implemented to further reduce the potential noise impacts:

- Noisy equipment and activities should be positioned as far as practicable from the NSRs. Prolonged operation of noisy equipment close to dwellings should be avoided;
- Noisy plants or processes should be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors should be adopted;
- Noisy activities should be scheduled to minimise exposure of nearby sensitive receivers to high levels of construction noise. For example, noisy activities can be scheduled for midday, or at times coinciding with periods of high background noise (such as during peak traffic hours);
- Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary;
- Material stockpiles and other structures (such as site offices) should be effectively utilised to shield construction noise. Noise can also be reduced by construction of temporary noise barriers that screen the lower floors from viewing the sites. Temporary noise barriers should be installed at active parts of construction areas where construction equipment is being operated in close proximity to NSRs.

A2.6 Operational Phase

A2.6.1 Potential Source of Impacts

This Section will present an assessment of the potential noise impact during operation of the proposed Bridge Crossing.

The operational noise from this Project is primarily road traffic noise and all identified NSRs within the Study Area are single to 2-storey village dwellings. In accordance with TMEIA, the corresponding noise criterion is L_{10} (1 hour) of 70dB(A).

A2.6.2 Assessment Methodology

Road Traffic Noise

The road traffic noise calculations have been undertaken based on the worst scenario traffic flows provided by the Transport Department (TD) and followed strictly the procedures stipulated in the *Calculation of Road Traffic Noise (CRTN)* published by *Department of Transport, U.K.*

The proposed Bridge Crossing and the adjacent road network have been divided into 42 road segments, each of which has been assigned with respective road width, level, surface type, parapets, traffic conditions etc. The segmentation process and the noise modeling were carried out using commercial software “*ROADNOISE 2000*”, which is based on CRTN procedures and methodologies. Hard ground, as defined by CRTN, has been assumed throughout the Study Area and all other features that may result in noise screening have been defined in the model. A segmentation plan for the model is shown in *Figure A2.7* and *A2.7a*.

In accordance with TD’s traffic forecast, the traffic volume will be increasing year by year until the year 2006 when the Shenzhen Western Corridor will be opened (see *Figure A2.10* for TD’s memo on traffic figure forecast). Thereafter, the traffic volume will start declining. Therefore, the peak traffic flows will occur in the year 2006 which has been adopted as the worst case scenario for this traffic noise assessment. The percentage of heavy vehicles (i.e. all vehicles with an unladen weight of 1,525 kg, which includes Light Goods Vehicles, Medium Goods Vehicles, Heavy Goods Vehicles, Container Vehicles and Buses/Coaches) during the peak traffic flow period has been taken into account in this traffic noise assessment.

The baseline and design years have been considered in this assessment for operational noise predictions. A design speed of 50 km/hour has been assumed in the assessment. They are described as follows:

1. Baseline Year (2003): this represents the prevailing traffic noise levels prior to the construction of the new road. Details of the 2003 peak traffic pattern and are shown in *Figure A2.8* and summarized in *Table A2-5*
2. Design Year (2006): this is the worst-case year when the peak traffic flows are reached. The 2006 design traffic pattern is shown in *Figure A2.9* and summarized in *Table A2-6*.

Table A2.5– 2003 Peak Traffic Flow

	One way Peak traffic flow (vehs/hr)	Private (Passenger) % (vehs.hr)	Coaches (Passenger) % (vehs/hr)	Goods % (vehs/hr)	Container % (vehs/hr)
Existing Dual-2	1150	7% (81)	16% (184)	36% (414)	41% (472)

Table A2.6 – 2006 Design Traffic Flow

	One way Peak traffic flow (vehs/hr)	Private (Passenger) % (vehs.hr)	Coaches (Passenger) % (vehs/hr)	Goods % (vehs/hr)	Container % (vehs/hr)
Existing Dual-2	1500	10% (150)	16% (240)	-	-
Proposed Dual-2		-	-	35% (525)	39% (585)

The calculation points for the ground floor of the NSRs are taken as 1.2m above the ground level and 1m from the facade of openable windows. The calculation points for the first floor are taken as 3m vertically above the ground floor points.

It is worth noting that the proposed bridge will be installed with 900mm high reinforced concrete parapets along its edges. These parapets are considered to have a significant noise screening effect and have been taken into account in this assessment.

A2.6.3 Assessment Results

The results of the traffic noise modelling for the year 2003 and the year 2006 at the representative NSRs are summarized in *Table A2.7*.

Table A2.7– Traffic Noise Levels in Year 2003 and Year 2006 at NSR1

NSR		2003 Noise Level dB(A)			2006 Noise Level (unmitigated) dB(A)				
		Existing Bridge		Combined	Existing Bridge		Proposed Bridge		Combined
		North-bound	South-Bound		North-bound	South-bound	North-Bound	South-bound	
1	G floor	65	69	70	54	56	64	67	69
1	1 th floor	66	70	71	56	58	65	68	70
2	G floor	63	67	68	53	57	62	66	68
2	1 th floor	64	67	69	54	57	63	67	69
3	G floor	62	66	67	52	52	61	65	68
3	1 th floor	63	66	67	53	56	61	65	67

The results indicate that the noise level from the proposed new bridge at the critical representative assessment point NSR 1 without mitigation measures will be 70dB(A) in round figure which is in compliance with the noise criteria and comparatively less than the prevailing traffic noise. Therefore, no mitigation measure is required for the construction of the proposed new bridge.

A2.7 Conclusion

A2.7.1 Construction Phase

It is envisaged that the Project will prohibit the usage of noisy construction activities such as percussive piling. With the use of silenced construction plants and placement of temporary movable barriers, it is concluded that the identified NSRs will not be subject to levels above the acceptable levels throughout the duration of the project.

A2.7.2 Operational Phase

The unmitigated noise level from the proposed new bridge at the critical representative assessment point at the closest NSR reaches 70dB(A) but would be comparatively less than the prevailing traffic noise. No mitigation measure is therefore required for the construction of the proposed new bridge.