5 NOISE IMPACT

5.1 Legislation, Standards and Guidelines

5.1.1 Construction Noise during Non-restricted Hours

5.1.1.1 The Noise Control Ordinance (NCO) (Cap. 400) provides the statutory framework for noise control in Hong Kong. Assessment procedures and standards are set out in the respective Technical Memoranda (TM) promulgated under the NCO. The following TMs are applicable to the assessment and control of construction noise.

- TM on Noise from Construction Work other than Percussive Piling (TM-GW);
- TM on Noise from Percussive Piling (TM-PP); and
- TM on Noise on Construction Work in Designated Areas (TM-DA).

5.1.1.2 To ensure a better environment, the TM-EIAO promulgated under the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) has imposed more stringent criteria. For construction, there is no statutory limit on daytime construction noise under the NCO and related TMs. Nevertheless, the TM-EIAO stipulates noise standards of 65 – 75 dB(A) for daytime construction activities, as shown in the table below.

Table 5.1 Noise Standards for Construction Activities

Uses	Noise Standards [1], $L_{eq\ (30\ mins)}$ dB(A)	
	0700 to 1900 hours on any day not being a Sunday or general holiday	1900 to 0700 hours or any time on Sundays or general holiday
All domestic premises including temporary housing accommodation	75	(See Note 2)
Hotels and hostels	75	
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examinations)	

Notes:
[1] The above standards apply to uses that rely on opened windows for ventilation.
[2] The criteria laid down in the relevant technical memoranda under the NCO for designated areas and construction works other than percussive piling may be used for planning purpose. A Construction Noise Permit (CNP) shall be required for the carrying out construction work during the period.

5.1.2 Construction Noise during Restricted Hours

5.1.2.1 The NCO also provides statutory control on general construction works during restricted hours (ie 1900 to 0700 hours (of the next day) from Monday to Saturday and at any time on Sundays or public holidays). The use of PME for construction works during restricted hours would require a Construction Noise Permit (CNP). The TM-GW details the procedures adopted by EPD for assessing such application. The granting of a CNP is subject to conditions stated in the CNP and it may be revoked at any time for failure to comply with the permit conditions.

5.1.2.2 In addition to the general controls on the use of PME during restricted hours, the use of Specified Powered Mechanical Equipment (SPME) and the undertaking of Prescribed Construction Work (PCW) during the restricted hours in a designated

area are controlled by the TM-DA. Construction plant or equipment classified as SPME under the TM-DA includes hand-held breakers, bulldozers, concrete mixer lorries, dump trucks and poker vibrators. The PCW includes the erection or dismantling of formwork or scaffolding, hammering, handling of rubble, wooden boards, steel bars, or scaffolding material, and the disposal of rubble through plastic chutes.

5.1.2.3 The TM-DA details the procedures that should generally be adopted by the Authority for assessing the use of SPME during restricted hours and for determining whether a CNP would be issued.

5.1.2.4 Maximum noise levels from construction activities during restricted hours at affected NSRs are controlled under the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings established for the NSRs. The ANLs for construction works in Designated Areas are more stringent than those given in the GW-TM and summarized in the table below.

Table 5.2 Acceptable Noise Levels for Construction during Restricted Hours

Time Period	Acceptable Noise Levels for Area Sensitivity Ratings, dB(A)		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60 (45)	65 (50)	70 (55)
All days during the night-time (2300 to 0700 hours)	45 (30)	50 (35)	55 (40)

Note:
[1] Figures in brackets are ANLs for SPME construction work in designated areas

Area Sensitivity Rating

5.1.2.5 The appropriate Area Sensitivity Rating for the NSR shall consider under consideration from below table.

5.1.2.6 Any NSR shall, irrespective of **Table 5.3**, be assigned an Area Sensitivity Rating of "C" if it is within 100 m of a zone designated as "Industrial" or "Industrial Estate" on a statutory Outline Zoning Plan, or an Area Sensitivity Rating of "B" if it is between 100 m and 250 m from such a zone, except in cases where **Table 5.3** indicates an Area Sensitivity Rating of "C".

Table 5.3 Area Sensitivity Ratings

Type of Area containing NSR	Degree to which NSR is affected by IF		
	Not Affected	Indirectly Affected	Directly Affected
(i) Rural area, including country parks or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
(iii) Urban area	B	C	C

Type of Area containing NSR	Degree to which NSR is affected by IF		
	Not Affected	Indirectly Affected	Directly Affected
(iv) Area other than those above	B	B	C

Note:

[1] For the purpose of **Table 5.3**, the following definitions apply:

"country park" means an area that is designated as a country park pursuant to section 14 of the Country Parks Ordinance;

"directly affected" means that the NSR is at such a location that noise generated by the IF is readily noticeable at the NSR and is a dominant feature of the noise climate of the NSR;

"indirectly affected" means that the NSR is at such a location that noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR;

"not affected" means that the NSR is at such a location that noise generated by the IF is not noticeable at the NSR; and

"urban area" means an area of high density, diverse development including a mixture of such elements as industrial activities, major trade or commercial activities and residential premises.

5.1.2.7 Despite any description made in this EIA, there is no guarantee that a CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant TMs issued under the NCO. The Noise Control Authority will take into account contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in the EIA report shall bind the Noise Control Authority in making a decision. If a CNP is to be issued, the Noise Control Authority shall include in it any conditions demand. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution under the NCO.

5.2 Noise Sensitive Receivers

5.2.1.1 With reference to Annex 13 of the TM-EIAO, NSRs could be, but not limited to: residential uses including temporary housing; institutional uses including educational institutions, hospitals, medical clinics, homes for the aged, convalescent homes, places of public worship, libraries, courts of law, performing arts centres, auditoria, amphitheatres; others such as hostels and country parks.

5.2.1.2 The existing NSRs are identified by means of topographic maps, aerial photos, land status plans, S.16 / S.12a Town Planning Ordinance and site inspections. Planned / committed NSRs are identified by making reference to relevant Outline Zoning Plans (OZP), Outline Development Plans (ODP), Layout Plans and other published plans in relation to the Town Planning Board. **Figure 5.1** shows the assessment area for the construction noise impact assessment. This assessment area includes areas within 300m from the boundary of the Project. All existing NSRs are identified by shading within the assessment area.

5.2.1.3 Assessment points of NSRs are selected (see **Appendix 5.1** for their photos) based on the criteria that one assessment point is selected on the first layer in each street block and it is near work fronts of the Project. Because the effect of distance attenuation is related to the proximity of NSRs to work fronts, nearer NSRs would be the most affected NSRs and therefore the assessment points would be representative for the noise impact assessment purpose. Their locations are shown in **Figure 5.1** and their details including name of building, use, number of floors are given in **Table 5.4**.

Table 5.4 List of assessments points of NSRs

Building name	Planned / Existing	NSD ID.	Use	Number of floors
Fook On House	Existing	N01	Residential	6
Kin Shing Building	Existing	N02	Residential	6
Siu Fung Building	Existing	N03	Residential	6
Man Yip Building	Existing	N04	Residential	8
Healey Building	Existing	N05	Residential	24
Fung Yue Building	Existing	N06	Residential	6
WRLPS (South)	Planned	N07	Residential	19-29
CCC Chun Kwok Primary School	Existing	N08	Educational	5
Village houses	Existing	N09	Residential	2
Po Fai Building	Existing	N10	Residential	6
Yuen Long Mansion	Existing	N11	Residential	16
Wah Cheong Mansion	Existing	N12	Residential	6
Happy House	Existing	N13	Residential	6
Tse King House Stage 1	Existing	N14	Residential	6
Ho Shun Fuk Building	Existing	N15	Residential	26
Ho Wang Building	Existing	N16	Residential	12
On Ning Building	Existing	N17	Residential	12
Caritas Yuen Long Chan Chun Ha Secondary School	Existing	N18	Educational	6

5.2.1.4 Tai Kiu Development is not selected as an assessment point because its construction programme is not available at the time of preparing this report.

5.3 Construction Airborne Noise Impact Assessment

5.3.1 Noise Sources

5.3.1.1 The latest construction methodology is described in **Section 3.5**. Based on the tentative construction methodology, the major construction works will include the following activities:

- Site clearance activities;
- Temporary erection;
- Piling works;
- Column and table top construction;
- Superstructure and steelworks; and
- Parapet Wall Construction, and Associated Landscape and Streetscape Works.

5.3.1.2 These construction activities will be carried out with the use of PME including breakers, generators, piling rigs, backhoes, dump trucks, air compressors, mobile cranes, water pumps, concrete lorry mixers, concrete pumps, etc. Sound Power

Level (SWL) for each PME is established according to TM-GW and other relevant information as appropriate.

5.3.2 Assessment Methodology

5.3.2.1 Construction airborne noise assessment has been conducted based on the following procedures:

- Determine the assessment area, and identify representative NSRs that may be affected by the works;
- Obtain the construction method and work sequence for the construction period;
- Obtain the plant items for each corresponding construction work sequence;
- Determine the sound power levels of the plant items according to the information stated in the TM-GW or other recognized sources of reference, where appropriate;
- Calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable;
- Quantify the level of impact at the NSRs in accordance with TM-GW;
- For any exceedance of noise criteria, all practical mitigation measures such as alternative construction methodology, quiet plant, silencer, enclosure, etc. shall be examined to alleviate the predicted noise impacts as much as practicable.

5.3.2.2 As there is no concurrent project identified, the construction airborne noise assessment focuses on the Project itself.

5.3.3 Utilization Rates and SWLs of Powered Mechanical Equipment

5.3.3.1 Practically, the PMEs will not be operating for all times within a work site. According to "EIAO Guidance Note No. 9/2010", a reasonable percentage on-time to reflect the actual situation could be accepted as basic assumption for that kind of PMEs in the assessment. The utilization rates will depend on the construction sequences, work fronts scale and nature of construction. For example, (1) hand-held breaker will only be used for breaking existing hard paving or existing nullah structure. It is expected that the breaker will be stopped during removing the debris; (2) concrete lorry mixer and concrete pump will only be used on the day of concreting. It is expected that the mixer and pump will not continuously stay and operate on site. They will be removed after pouring concrete; and, (3) for dump truck, it is understood that loading / unloading is the main source of noise from and it is expected that the loading / unloading will not continuously operate on site.

5.3.3.2 In this assessment, the utilization rates for each work front during different periods have been reviewed by the engineer and have been concluded to be practicable for the purpose of this EIA. **Appendix 5.2** summarizes the adopted utilization rates and the associated SWL for different construction sequences. **Appendix 5.3** assesses the total SWL for different types of construction activities.

5.3.4 Noise Assessment Tool

5.3.4.1 An in-house program has been used for construction noise assessment. Initially, the program runs were conducted without any mitigation measures (i.e. the "Unmitigated Scenario"). Where noise level exceedance was identified, further runs will be made assuming different combinations of mitigation measures to be incorporated (i.e. the "Mitigated Scenario").

5.3.5 Assessment Results – Unmitigated Scenarios

5.3.5.1 According to the latest engineering design, the construction works will mainly comprise of the activities as described in **Section 5.3.1**. The corresponding Sound Power Levels (SWLs) of these activities have been assessed according to the PME's SWLs and the assessment methodology in GW-TM. **Appendix 5.4** shows the locations of work fronts. **Appendix 5.5** presents the distance between the notional sources and the NSRs. **Appendix 5.6** presents the unmitigated construction noise impacts at selected representative NSRs. The predicted construction noise impacts on the NSRs are summarized in **Table 5.5** below.

Table 5.5 Predicted Maximum Unmitigated Construction Noise Levels at NSRs

NSR ID	NSR Description	Use	Criterion dB(A)	Unmitigated Noise Level[1] dB(A)	Exceedance [1] dB(A)
N01	Fook On House	R	75	**82**	**7**
N02	Kin Shing Building	R	75	**86**	**11**
N03	Siu Fung Building	R	75	**86**	**11**
N04	Man Yip Building	R	75	**86**	**11**
N05	Healey Building	R	75	**84**	**9**
N06	Fung Yue Building	R	75	**86**	**11**
N07	West Rail Long Ping Station (South)	R	75	**79**	**4**
N08	CCC Chun Kwok Primary School	E	70 (65)	**80 (77)**	**10 (12)**
N09	Village houses	R	75	**81**	**6**
N10	Po Fai Building	R	75	**87**	**12**
N11	Yuen Long Mansion	R	75	**85**	**10**
N12	Wah Cheong Mansion	R	75	**86**	**11**
N13	Happy House	R	75	**85**	**10**
N14	Tse King House Stage 1	R	75	**81**	**6**
N15	Ho Shun Fuk Building	R	75	**76**	**1**
N16	Ho Wang Building	R	75	**78**	**3**
N17	On Ning Building	R	75	74	-
N18	Caritas Yuen Long Chan Chun Ha Secondary School	E	70 (65)	68 (68)	- (**3**)

Notes:

[1] Bolded values mean exceedance of the relevant noise criteria.

5.3.6 Mitigation Measures

5.3.6.1 The predicted construction noise levels show that the unmitigated construction noise impacts will exceed the daytime noise criteria at all the representative NSRs except On Ning Building [N17]. Mitigation measures are therefore required. The following mitigation measures have been considered:

- Use of quiet plants and working methods;
- Use of shrouds / temporary noise barriers to screen noise from relatively static PMEs; and
- Alternative use of plant items within one worksite, wherever practicable.

Use of quiet plants and working methods and use of temporary noise barrier and enclosure (with sufficient ventilation) are further described below:

Use of "Quiet" Plant and Working Methods

5.3.6.2 The use of quiet plant is a feasible solution to tackle adverse noise impacts associated with construction works. It is generally known (supported by field measurement) that particular models of construction equipment are quieter than standard types given in the TM-GW. Whilst it is generally considered too restrictive to specify that the Contractor has to use specific models or items of plant, it is reasonable and practicable to set plant noise performance specifications for specific PME so that some flexibility in selection of plant is allowed. A pragmatic approach would be to request that the Contractor independently verifies the noise level of the plant proposed to be used and demonstrates through furnishing of these results, that the plant proposed to be used on the site meets the requirements.

5.3.6.3 An inventory of SWLs of quiet plant associated with the construction works is given in EPD's Quality Powered Mechanical Equipment (QPME) and additional reference is made to typical SWLs for international manufacturer. It should be also noted that while various types of silenced equipment could be found in Hong Kong, EPD when processing a CNP application for evening or night time works may apply the noise levels specified in the TM-GW and TM-DA. CNP applications which contain sufficient details of any particularly quiet items of PME or any special noise control measures which the CNP applicant proposes to employ on the site may be given special consideration by the Noise Control Authority.

5.3.6.4 A summary of the "Quiet" PMEs adopted and the associated SWLs is given in **Appendix 5.2**.

Use of Temporary Noise Barrier & Enclosure (with Sufficient Ventilation)

5.3.6.5 Movable temporary noise barriers that can be located close to noisy plant and be moved concurrently with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small-cantilevered on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs.

5.3.6.6 Movable barriers will be used for some PME (e.g. excavator, mobile crane, concrete lorry mixer, vibratory poker, etc.). It is anticipated that suitably designed barriers

could achieve at least 5 - 10dB(A) reduction. For a conservative assessment, only a reduction of 5dB(A) is assumed. Acoustic mat will be used for other plant items including piling machines. A 10 dB(A) noise reduction is anticipated. Barrier material with surface mass at least 7kg/m^2 is recommended to achieve the predicted screening effect. This assumption has been adopted in other approved EIA Reports.

5.3.6.7 The use of enclosure (with sufficient ventilation and surface mass at least 10 kg/m^2) has been considered in this assessment to shelter relatively static plant. The enclosures barriers can provide about 10-15dB(A) noise reduction.

5.3.6.8 A summary of the temporary movable barriers and enclosures adopted for various PMEs, and the associated noise reduction is given in **Appendix 5.2**. **Appendix 5.7** shows the sketch of typical temporary noise barrier / enclosure with air flow, allowing natural ventilation.

5.3.6.9 Regular site audit would be carried out during the construction for auditing the implementation of noise mitigation measures according to the EIA's recommendation and EM&A requirements.

5.3.7 Assessment Results – Mitigated Scenario

5.3.7.1 With the implementation of the abovementioned mitigation measures, the construction noise levels at the affected NSRs are predicted and presented in **Table 5.6**. **Appendix 5.8** presents the mitigated noise levels at selected representative NSRs.

Table 5.6 Predicted Maximum mitigated Construction Noise Levels at NSRs

NSR ID	NSR Description	Use	Criterion dB(A)	Mitigated Noise Level dB(A)	Exceedance dB(A)
N01	Fook On House	R	75	72	-
N02	Kin Shing Building	R	75	75	-
N03	Siu Fung Building	R	75	75	-
N04	Man Yip Building	R	75	75	-
N05	Healey Building	R	75	74	-
N06	Fung Yue Building	R	75	75	-
N07	West Rail Long Ping Station (South)	R	75	70	-
N08	CCC Chun Kwok Primary School [1][2]	E	70 (65)	70 (68)	- (3)
N09	Village houses	R	75	73	-
N10	Po Fai Building	R	75	75	-
N11	Yuen Long Mansion	R	75	75	-
N12	Wah Cheong Mansion	R	75	75	-
N13	Happy House	R	75	74	-
N14	Tse King House Stage 1	R	75	71	-
N15	Ho Shun Fuk Building	R	75	68	-
N16	Ho Wang Building	R	75	68	-
N17	On Ning Building	R	75	64	-

NSR ID	NSR Description	Use	Criterion dB(A)	Mitigated Noise Level dB(A)	Exceedance dB(A)
N18	Caritas Yuen Long Chan Chun Ha Secondary School [1]	E	70 (65)	58	-

Notes:
[1] Values in parentheses indicate the noise criterion during examination period.
[2] Based on the best available information from the school website about the examination periods over the school year of 2015/2016, it is assumed that the examination periods would remain the same in the future and would be in October/November, January, March and June.

Scheduling of Construction Activities during Examination Periods

5.3.7.2 The predicted construction noise impacts on CCC Chun Kwok Primary School (NSR8) are discussed for normal period and examination period respectively. According to the best available information from the school website for the school year of 2015/2016, there are four examination periods in October/November, January, March and June and each examination period would last for approximately one week.

5.3.7.3 For normal school periods in February, April, May, July, August, September and December over the year, the predicted noise impacts range from 38dB(A) to 70dB(A) which would not exceed the criterion of 70dB(A) for normal school hours throughout the construction period.

5.3.7.4 For examination periods, each examination would last for approximately one week. That is, there are typically four examination weeks in a year and 18 examination weeks over the planned construction activities for 53 months. The predicted noise impacts in October/November, January, March and June ranges between 51 and 68 dB (A). There are totally five examination weeks over the whole planned construction activities which may have potential noise exceedance over 65 dB(A) (predicted noise impacts at 66 – 68 dB(A)) but this potential noise exceedance can be avoided with the following arrangement:

- The contractor could daily liaise with the school management about the arrangements during examination weeks.
- Quieter work activities can be arranged and noisy works, such as concrete operation and operation of dump trucks should be avoided.
- As discussed in the Environmental and Audit Manual, a monitoring point (M01) is proposed at the school. If noise exceedance is found in monitoring during the examination weeks, construction works should be adjusted and rearranged according to the Event and Action Plan listed in the EM&A Manual.

5.3.7.5 With the above arrangements in place, noise exceedance at the school during examination weeks can be readily addressed.

5.3.8 Good Site Practice

5.3.8.1 In addition to the mitigation measures suggested in Section 5.3.6, other good site practices are useful to reduce noise impacts. For the purpose of conservative assessment, the following good site practices have not been included in the quantitative assessment as discussed in the following sections.

5.3.8.2 The good site practices include:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks, cranes) 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, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible and practicable;
- material stockpiles, site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities; and,
- Use of site hoarding to screen noise at ground level of NSRs. Site hoarding (approximately 2.5m high) is located on the site boundaries between construction activities and NSRs could generally reduce noise levels through partial screening. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period. For conservative assessments, however, the site hoarding has not been taken into consideration in the construction noise assessments.

5.3.8.3 The benefits of these techniques can vary according to specific site conditions and operations. The environmental noise climate would certainly be improved through these control practices, although the improvement can only be quantified during implementation when specific site parameters are known. The assessment has therefore not taken into account the effectiveness of the good site practices and noise management techniques.

5.4 Construction Groundborne Noise

5.4.1.1 As presented in **Section 5.3.1**, the Project does not involve drilling and blasting, or the use of Tunnel Boring Machine (TBM). Besides piling rigs would be used in the Project instead of percussive piling. Hence, it is anticipated that construction groundborne noise will not cause significant impact.

5.5 Conclusions

5.5.1.1 Construction airborne noise assessment has been conducted. All the practicable mitigation measures have been recommended to minimise the noise impacts. These mitigation measures include the optimisation of construction methodology (i.e. scheduling of PME uses, quiet plant, temporary noise barrier and good site practices). With the implementation of noise mitigation measures, no exceedance over relevant construction noise criteria is predicted at the representative noise sensitive receivers.

5.5.1.2 Because the Project does not involve drilling and blasting, or the use of TBM. It is anticipated that construction groundborne noise will not cause adverse impact.