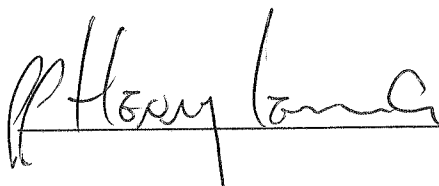


MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU -
SHENZHEN - HONG KONG EXPRESS RAIL LINK
(No. EP-349/2009/E)

Construction Ground-borne Noise Monitoring Plan
(Revision 1)

Certified by: 
Position: Environmental Team Leader
Date: 12 MAR 2012

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Independent Environmental Checker

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TABLE OF CONTENT

1.	INTRODUCTION.....	1
	Background	1
	Purpose of This Report.....	1
	Content of this Report	1
2.	MONITORING METHODOLOGY	2
	Monitoring Parameters and Criteria	2
	Monitoring Equipment	2
	Monitoring Locations.....	3
3.	BASELINE MONITORING RESULTS.....	4
	Monitoring Results.....	4
4.	IMPACT MONITORING PLAN	6
	Construction Phase	6
	Action and Limit Levels	7
	Event and Action and Plan	7

List of Tables

Table 2.1	Ground-borne Construction Noise Criteria.....	2
Table 2.2	Construction Ground-borne Noise Monitoring Locations	3
Table 3.1	Baseline Ground-borne Noise Monitoring Results.....	4
Table 4.1	Maximum Allowable Impact Level.....	6
Table 4.2	Action and Limit Levels for Construction Ground-borne Noise monitoring	7
Table 4.3	Event and Action Plan for Ground-borne Noise Monitoring	8

1. INTRODUCTION

Background

- 1.1 The “Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link” Project (“XRL”, hereinafter known as “the Project”) comprises a 26km long underground rail line on a dedicated track that runs from the terminus in West Kowloon to the Hong Kong boundary at Huanggang, where it connects with the Mainland section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link. The Project also comprises construction and operation of ventilation buildings, emergency access point, stabling sidings and maintenance facilities and an emergency rescue sidings.
- 1.2 An Environmental Impact Assessment (EIA) study for the Project was conducted in accordance with EIA Study Brief No. ESB-197/2008 and was based on the available information obtained during preliminary design stage. The EIA study concluded that the Project would be environmentally acceptable with the implementation of recommended mitigation measures.
- 1.3 The EIA Report (Register No.: AEIA-143/2009) was approved on 28 September 2009 under the *Environmental Impact Assessment Ordinance (EIAO)*. According to Section 4.15 of approved Environmental Monitoring and Audit (EM&A) Manual, construction ground-borne noise monitoring plan should be prepared and submitted to IEC and EPD for approval before the commencement of operation of the TBM.

Purpose of This Report

- 1.4 The purpose of this Construction Ground-borne Noise Monitoring Plan (CGNMP) is to provide impact ground-borne noise monitoring requirements at the designated ground-borne noise monitoring locations when the TBM head is operating underneath these locations to audit EIA findings and monitor the noise impact.

Content of this Report

- 1.5 The remainder of the report is organized as follows:
 - Section 2 presents monitoring methodology and criteria
 - Section 3 presents baseline monitoring results
 - Section 4 presents impact monitoring plan

2. MONITORING METHODOLOGY

Monitoring Parameters and Criteria

- 2.1 The construction ground-borne noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). L_{eq} (30 minutes) should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays.
- 2.2 Supplementary information for data auditing and statistical results such as L_{10} and L_{90} should also be obtained for reference.
- 2.3 With reference to the *Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites* (IND-TM) issued under the *Noise Control Ordinance* (NCO), the criteria for noise transmitted primarily through the structural elements of a building or buildings should be 10dB(A) less than the relevant Acceptable Noise Level (ANL).
- 2.4 Between 1900 and 0700 hours and all day on Sundays and public holidays, activities involving the use of powered mechanical equipment (PME) for the purpose of carrying out construction work is prohibited unless a Construction Noise Permit (CNP) has been obtained. A CNP may be granted in cases of noise being contained within the ANL at the NSRs. ANLs are assigned depending upon the Area Sensitivity Ratings (ASRs). The criteria applicable to ground-borne noise are summarised in **Table 2.1** below.

Table 2.1 Ground-borne Construction Noise Criteria

GBNSR Description	Ground-borne Construction Noise Criteria, dB(A)						
	Daytime (0700-1900 hrs) (except General Holidays & Sunday)	Daytime during general holidays and Sundays and all days during Evening (1900 to 2300 hrs) ^[b]			Night-time (2300 to 0700 hrs) ^[b]		
		A	B	C	A	B	C
Education institutions	60/55 ^[a]	50	55	60	[c]		
Domestic premises, hotels	65	50	55	60	35	40	45

Remarks:

[a] A 5dB(A) reduction in the ground-borne noise criterion is recommended for school during examination period.

[b] Noise criteria are 10dB(A) below the Basic Noise Levels stipulated in *Technical Memorandum on Noise from Construction Work Other Than Percussive Piling* (GW-TM).

[c] No sensitive use during this period.

Monitoring Equipment

- 2.5 According to the requirements of the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the difference between the calibration levels obtained before and after the noise measurement is less than 1.0 dB.
- 2.6 The ET Leader is responsible for the provision of the monitoring equipment. He should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled.

Monitoring Locations

- 2.7 In the EIA, it is predicted that the construction ground-borne noise will comply with the stipulated noise criteria at all ground-borne noise sensitive receivers (GBNSRs), except four GBNSRs in proximity to tunnel boring machine (TBM) operation. The designated construction ground-borne noise monitoring locations with predicted noise levels equal to 65dB(A) or above are listed in **Table 2.2** and their locations are shown in **Figures 1A to 1C**. All of the impact ground-borne noise monitoring locations will be same as the Baseline Ground-borne Noise Monitoring Report deposited to EPD on 18 August 2011 as far as practical.

Table 2.2 Construction Ground-borne Noise Monitoring Locations

GBNSR No. in EIA	Area Sensitive Rating	Monitoring Location ^[a]	Uses
GN3	B	Yaumati Catholic Primary School (Hoi Wang Road)	Educational Institution
GN5	B	Tower 5, Park Avenue	Residential
GN7	B	Tai Fung Building (Block F) Cosmopolitan Estates	Residential
GN8	B	Chung Yew Building	Residential
GN31 ^[b]	B	DD110 LOT 482, Wang Toi Shan	Residential

Remark:

[a] The monitoring station should be at the lowest sensitive floor of each designated monitoring location.

[b] Due to site constraint and consent to install monitoring station at other premises nearby GN31 was not granted, impact ground-borne noise monitoring at GN31 will be conducted at position of 0.8m above ground. Same monitoring location was adopted during baseline ground-borne noise monitoring. The approach was agreed by IEC.

- 2.8 The status and location of noise sensitive receivers may change after this plan is issued. In such event, and if changes to the monitoring locations are considered necessary, the ET Leader should propose alternative monitoring locations and seek approval from the ER and agreement from the IEC and EPD on the proposal. When alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:
- Monitoring at sensitive receivers close to the major site activities that are likely to have noise impacts;
 - Monitoring close to the noise sensitive receivers as defined in the Technical Memorandum; and
 - Assurance of minimal disturbance to the occupants during monitoring in the vicinity of sensitive receivers.
- 2.9 The monitoring station should be at the lowest sensitive floor of each designated monitoring location and normally be at a position 1.2m above ground inside the building structures. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. The ET Leader should agree with the IEC and EPD on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions.

3. BASELINE MONITORING RESULTS

- 3.1 Background ground-borne noise should be measured inside the GBNSRs before the commencement of operation of the TBM. The baseline ground-borne noise monitoring at the designated monitoring stations had been conducted for a continuous period of at least 7 consecutive days during 17 August 2010 to 14 March 2011. The baseline ground-borne noise monitoring was measured at a minimum logging interval of 30 minutes for daytime (between 0700 and 1900 hours of normal weekdays) and 15 minutes (as three consecutive $L_{eq, (5 \text{ minutes})}$ readings) for evening time (between 1900 and 2300 hours on normal weekdays), general holidays including Sundays (between 0700 and 2300 hours) and night-time (between 2300 and 0700 of all days). The L_{eq} , L_{10} and L_{90} were recorded at the specified interval.

Monitoring Results

- 3.2 Baseline ground-borne noise monitoring results are summarised in **Table 3.1** over the monitoring periods. The average daytime baseline ground-borne noise level at GN3 was below the ground-borne construction noise criteria for education institutions of 60 dB(A) and 55 dB(A) during normal school days and examination period respectively, and the average daytime baseline noise levels at all other monitoring locations are below the daytime criteria of 65 dB (A) for residential premises.

Table 3.1 Baseline Ground-borne Noise Monitoring Results

Monitoring result at GN3			
Period	$L_{eq(30min)}$ - dB(A) (Range)	$L_{10(30min)}$ - dB(A) (Range)	$L_{90(30min)}$ - dB(A) (Range)
0700 – 1900 (Daytime, Normal weekday)	41 (36 - 44)	43 (37 - 46)	36 (34 - 38)
Period	$L_{eq(5min)}$ - dB(A) (Range)	$L_{10(5min)}$ - dB(A) (Range)	$L_{90(5min)}$ - dB(A) (Range)
1900 – 2300 (Evening, Normal weekday)	35 (33 - 36)	35 (34 - 38)	34 (33 - 34)
0700 – 2300 (General Holiday including Sunday)	36 (34 - 40)	36 (34 - 43)	35 (33 - 36)
2300 – 0700 (Night-time, all days)	35 (34 - 35)	35 (34 - 36)	34 (33 - 35)
Monitoring result at GN5			
Period	$L_{eq(30min)}$ - dB(A) (Range)	$L_{10(30min)}$ - dB(A) (Range)	$L_{90(30min)}$ - dB(A) (Range)
0700 – 1900 (Daytime, Normal weekday)	45 (43 - 46)	46 (44 - 47)	36 (34 - 39)
Period	$L_{eq(5min)}$ - dB(A) (Range)	$L_{10(5min)}$ - dB(A) (Range)	$L_{90(5min)}$ - dB(A) (Range)
1900 – 2300 (Evening, Normal weekday)	45 (42 - 46)	45 (41 - 48)	38 (35 - 39)
0700 – 2300 (General Holiday including Sunday)	43 (35 - 52)	44 (38 - 50)	36 (30 - 43)
2300 – 0700 (Night-time, all days)	37 (28 - 42)	38 (30 - 43)	31 (26 - 36)
Monitoring result at GN7			
Period	$L_{eq(30min)}$ - dB(A) (Range)	$L_{10(30min)}$ - dB(A) (Range)	$L_{90(30min)}$ - dB(A) (Range)
0700 – 1900 (Daytime, Normal weekday)	48 (47 - 49)	50 (47 - 52)	46 (46 - 46)

Period	$L_{eq(5min)} - dB(A)$ (Range)	$L_{10(5min)} - dB(A)$ (Range)	$L_{90(5min)} - dB(A)$ (Range)
1900 – 2300 (Evening, Normal weekday)	48 (46 - 53)	50 (46 - 56)	46 (45 - 46)
0700 – 2300 (General Holiday including Sunday)	47 (46 - 57)	48 (47 - 61)	46 (45 - 47)
2300 – 0700 (Night-time, all days)	47 (46 - 53)	48 (46 - 55)	46 (46 - 46)
Monitoring result at GN8			
Period	$L_{eq(30min)} - dB(A)$ (Range)	$L_{10(30min)} - dB(A)$ (Range)	$L_{90(30min)} - dB(A)$ (Range)
0700 – 1900 (Daytime, Normal weekday)	39 (36 - 40)	40 (37 - 43)	33 (32 - 34)
Period	$L_{eq(5min)} - dB(A)$ (Range)	$L_{10(5min)} - dB(A)$ (Range)	$L_{90(5min)} - dB(A)$ (Range)
1900 – 2300 (Evening, Normal weekday)	36 (33 - 38)	37 (32 - 38)	33 (31 - 33)
0700 – 2300 (General Holiday including Sunday)	37 (32 - 48)	39 (31 - 48)	32 (23 - 37)
2300 – 0700 (Night-time, all days)	34 (32 - 37)	34 (32 - 39)	32 (31 - 33)
Monitoring result at GN31			
Period	$L_{eq(30min)} - dB(A)$ (Range)	$L_{10(30min)} - dB(A)$ (Range)	$L_{90(30min)} - dB(A)$ (Range)
0700 – 1900 (Daytime, Normal weekday)	53 (50 - 53)	54 (52 - 55)	49 (46 - 51)
Period	$L_{eq(5min)} - dB(A)$ (Range)	$L_{10(5min)} - dB(A)$ (Range)	$L_{90(5min)} - dB(A)$ (Range)
1900 – 2300 (Evening, Normal weekday)	50 (49 - 52)	52 (50 - 52)	46 (44 - 46)
0700 – 2300 (General Holiday including Sunday)	52 (51 - 60)	53 (53 - 61)	47 (47 - 50)
2300 – 0700 (Night-time, all days)	50 (50 - 51)	51 (51 - 52)	45 (45 - 46)

Remark:

Bold and italic indicates the exceedance of noise criteria presented in Table 2.1.

4. IMPACT MONITORING PLAN

Construction Phase

- 4.1 Impact ground-borne noise should be monitored continuously between 0700 and 1900 hours at logging interval of 30mins on normal weekdays at each designated monitoring location when the TBM head is operating within 50m radius from the designated monitoring locations. For GN31, which located about 100m from TBM shaft and TBM tunnel, impact ground-borne noise should be monitored when TBM head is operating within 100m radius from GN31. Monitoring methodology should follow those recommended in **Section 2**.
- 4.2 The impact ground-borne noise monitoring results will be compared with the EIA predicted ground-borne noise level at corresponding GBNSRs.
- 4.3 To account for cases in which ambient noise levels, as identified by the baseline monitoring, approach or exceed the stipulated Limit Levels presented in **Table 2.1** prior to commencement of construction, a Maximum Acceptable Impact Level (MAIL), which incorporates the baseline noise levels and the identified construction noise Limit Level, have been defined. The amended level will represent the maximum acceptable noise level at a specific monitoring station. The MAIL levels would not be applicable to other NSRs upon receipt of complaints. The MAIL identified at each GBNSRs between 0700 and 1900 hours on normal weekdays are summarised in **Table 4.1**.

Table 4.1 Maximum Allowable Impact Level

Period	Maximum Allowable Impact Level
Monitoring result at GN3	
0700 – 1900 (Daytime, Normal weekday)	60/55 ^[a]
Monitoring result at GN5	
0700 – 1900 (Daytime, Normal weekday)	65
Monitoring result at GN7	
0700 – 1900 (Daytime, Normal weekday)	65
Monitoring result at GN8	
0700 – 1900 (Daytime, Normal weekday)	65
Monitoring result at GN31	
0700 – 1900 (Daytime, Normal weekday)	65

Remark:

[a] A 5dB(A) reduction in the ground-borne noise criterion is adopted for school during examination period.

Action and Limit Levels

- 4.4 The Action and Limit Levels for ground-borne noise monitoring are defined in **Table 4.2**.

Table 4.2 Action and Limit Levels for Construction Ground-borne Noise monitoring

Time Period ^[a]	Ground-borne Noise Monitoring	
	Action Level	Limit Level
0700-1900 hours on normal weekdays	When one documented compliant related to Ground-borne noise impact	65 dB(A) for residential premises
		60 dB(A) for school and 55 dB(A) during examination period

Remark:

[a] Any general construction works carried out during restricted hours is controlled by Construction Noise Permit (CNP) under the NCO.

Event and Action and Plan

- 4.5 Should exceedance of Levels recorded, actions in accordance with the Event and Action Plan provided in **Table 4.3** should be taken.

Table 4.3 Event and Action Plan for Ground-borne Noise Monitoring

EVENT	ACTION			
	ET	IEC	ER	Contractor
Action Level	1. Notify IEC, ER and Contactor 2. Carry out investigation 3. Report the results of investigation to the IEC, ER and Contactor 4. Discuss jointly with the ER and Contractor and formulate remedial measures 5. Increase monitoring frequency to check mitigation effectiveness	1. Review the analysed results submitted by the ET 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly 3. Supervise the implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented	1. Submit noise mitigation proposals to ER with copy to IEC and ET 2. Implement noise mitigation proposals
Limit Level	1. Notify IEC, ER, EPD and Contractor 2. Identify source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Inform IEC, ER, EPD the causes and actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring	1. Discuss amongst ER, ET and Contractor on the potential remedial actions 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 3. Supervise the implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER with copy to IEC and ET 3. Implement the agreed proposals 4. Revise and resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

Figures

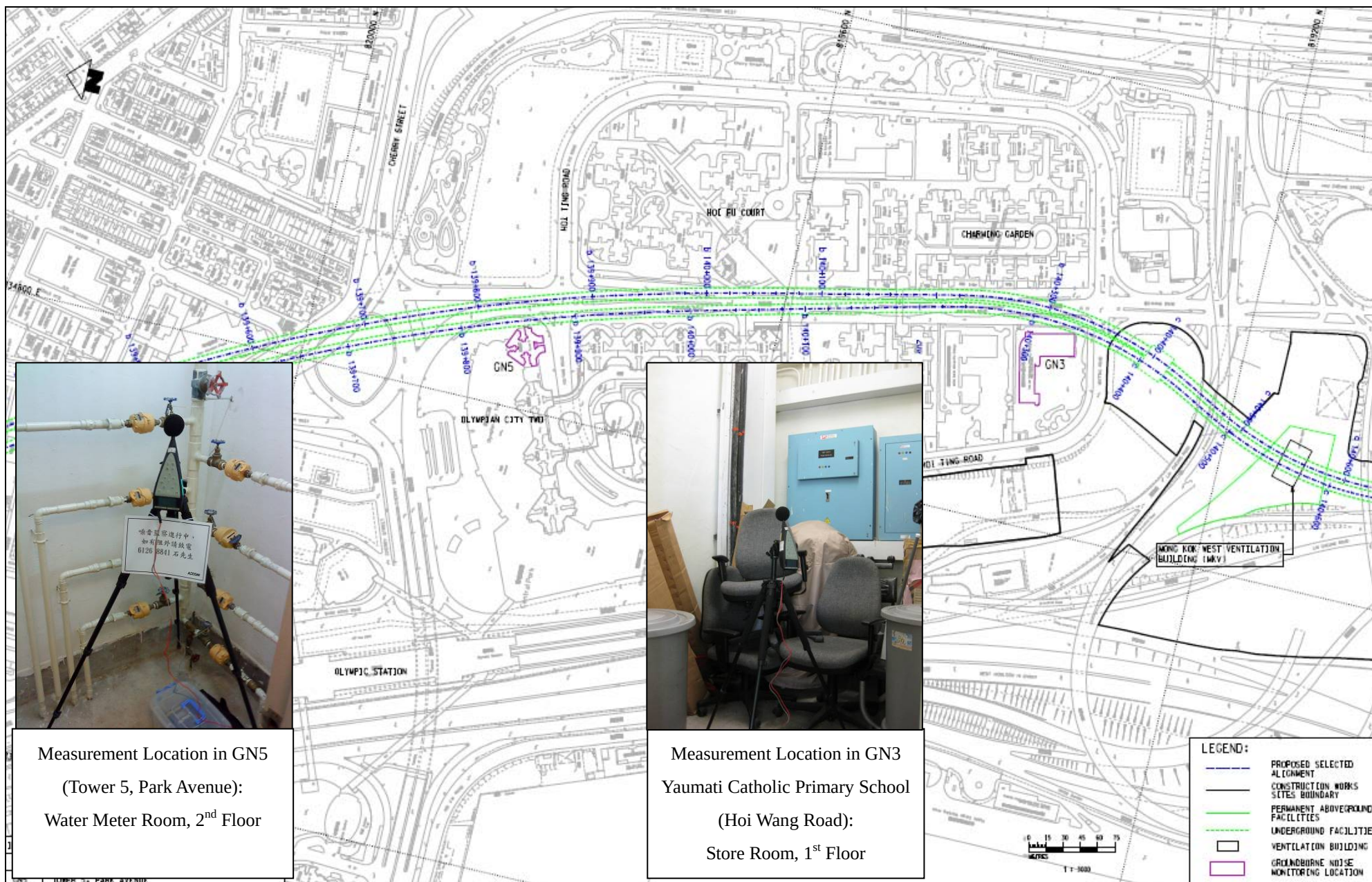


Figure 1A - Ground-borne Noise Monitoring Locations

Remarks: All measurement location are located approximately at the centre of the room.

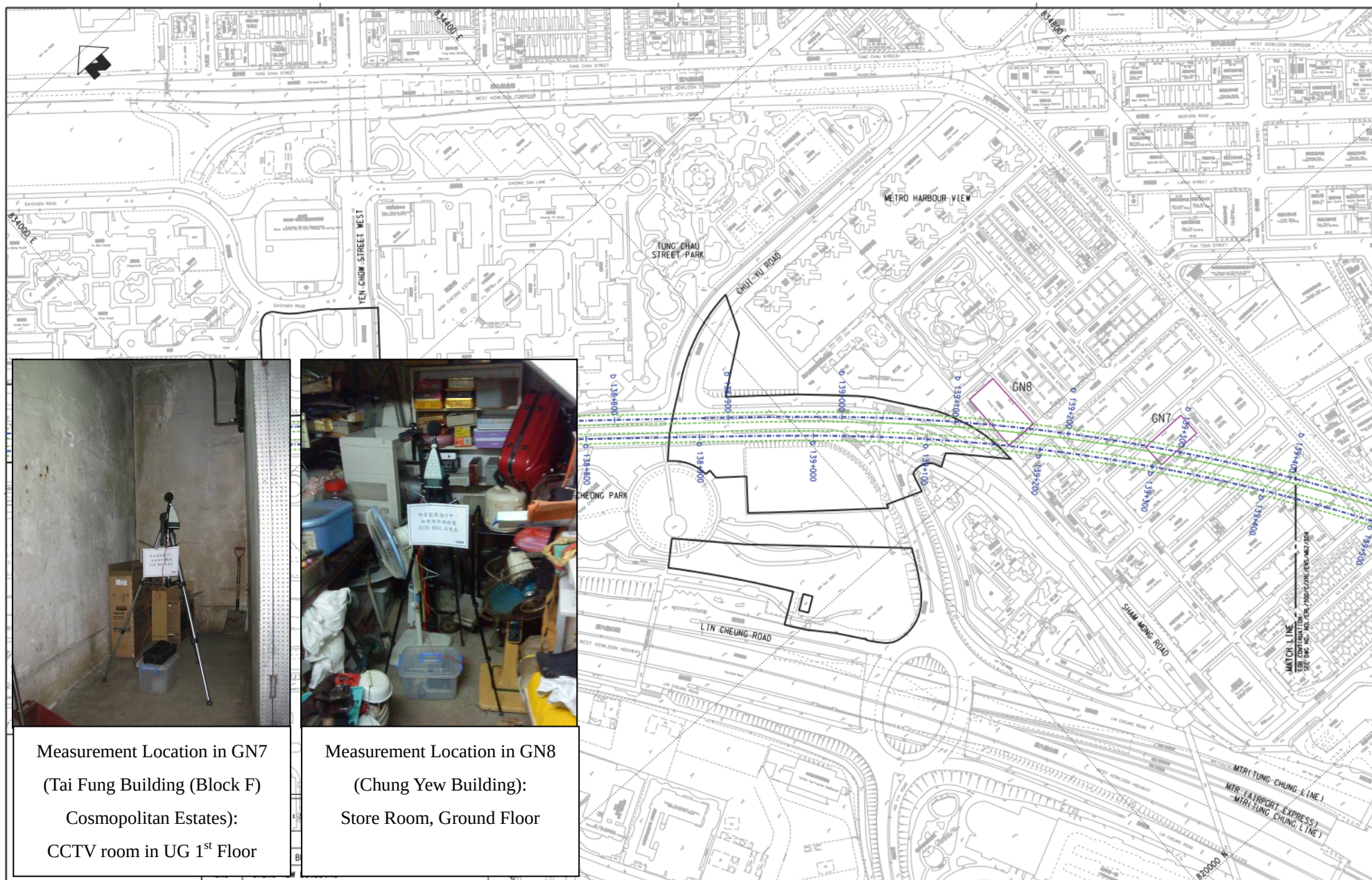


Figure 1B - Ground-borne Noise Monitoring Locations

Remarks: All measurement location are located approximately at the centre of the room.

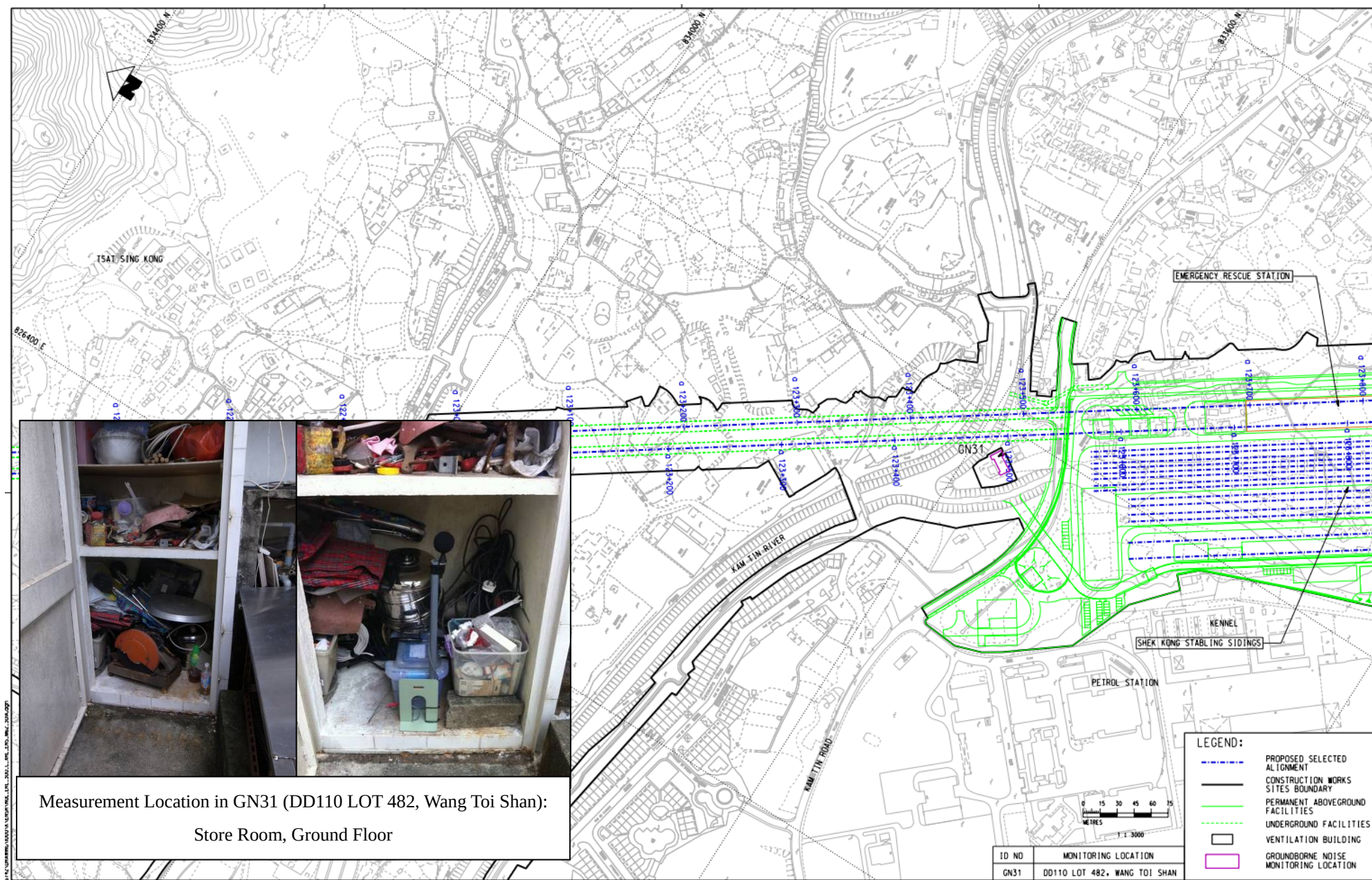


Figure 1C - Ground-borne Noise Monitoring Locations

Remarks: All measurement location are located approximately at the centre of the room.