MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU – SHENZHEN – HONG KONG EXPRESS RAIL LINK

(No. EP-349/2009/J)

Updated Ground-borne Noise Prediction Report

Verified by: _____

Position: Independent Environmental Checker

Date: 9 August 2013

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AECOM

MTR Corporation Limited

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Updated Operational Ground-borne Noise Prediction Report

August 2013

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1 INTRODUCTION

1.1 Background

1.1.1 The "Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link" Project (hereinafter known as "the Project") covers a 26km long underground rail line on a dedicated track that runs from the terminus in West Kowloon to the boundary at Huanggang, where is connect with the XRL Mainland section. XRL Project also covers ventilation buildings, emergency access points, stabling sidings and maintenance facilities and an emergency rescue siding (ERS) (formerly known as rescue emergency station).

1.1.2 An Environmental Impact Assessment (EIA) study for the Project was conducted in accordance with the EIA Study Brief No. ESB-197/2008. The EIA study concluded that the Project would be environmentally acceptable with the implementation of mitigation measures.

1.1.3 The EIA Report (Register No.: AEIA-143/2009) was approved on 28th September 2009 by the Director of Environmental Protection (DEP) under the Environmental Impact Assessment Ordinance (EIAO). Following the approval of the EIA Report, an environmental permit (EP) was granted on 16th October 2009 (EP No: EP-349/2009) for the construction and operation of the Project. Variations of environmental permit (VEP) were subsequently applied and the latest Environmental Permit (EP No: EP-349/2009/J) was issued by Director of Environmental Protection (DEP) on 11 July 2013.

1.1.4 AECOM Asia Co. Ltd has been commissioned by the MTR to conduct an updated operational ground-borne railway noise assessment based on the measured values of Line Source Response (LSR), Force Density Level (FDL) of China Railway High-Speed (CRH) train as well as the updated geological profile obtained during the construction stage.

1.2 Purpose of This Report

1.2.1 This Report presents the updated operational ground-borne noise assessment findings and the required mitigation measures proposal based on the latest findings.

1.3 Report Structure

1.3.1 This Report comprises the following sections:

- Section 1 presents the background information of the Report.
- Section 2 presents the details of operational ground-borne noise assessment.
- Section 3 presents the conclusion of the assessment findings.

2 OPERATIONAL GROUND-BORNE NOISE ASSESSMENT

2.1 Environmental Legislation, Standards and Guidelines

2.1.1 With reference to the IND-TM under the NCO, the criteria for noise transmitted primarily through the structural elements of the building or buildings should be 10dB(A) less than the relevant acceptable noise level (ANL). The same criteria are applied to all residential buildings, schools, clinics, hospitals, temples and churches.

2.1.2 The operational ground-borne railway noise criteria for the representative ground-borne noise sensitive receivers (GBNSRs) along the Project alignment are presented in **Table 2.1** below

Table 2.1 Operational Ground-borne Railway Noise Criteria

GBNSR Description	Ground-borne Railway Noise Criteria, dB(A)					
	Day and Evening Periods (0700 to 2300 hrs)			Night-time Period (2300 to 0700 hrs)		
	A	B	C	A	B	C
Churches/temples, schools, medical clinics, libraries, courts and performing arts	50	55	60	[a]		
Domestic premises, hotels and hospitals	50	55	60	40	45	50

Note:
[a] No sensitive use during this period.

2.2 Identification of Ground-borne Noise Sensitive Receivers

2.2.1 Representative GBNSRs (both existing and planned NSRs) within 300m of the Project boundary and at the most critical locations (e.g. on top of alignment/close to alignment where appropriate) have been selected, according to the criteria set out in the Annex 13 of EIAO-TM.

2.2.2 Sensitive receivers along the alignment generally include educational institutions, performing arts and domestic premises. Domestic premises are taken into account during both the daytime and night time periods, while performing arts and educational institutions are considered to be noise sensitive during daytime and evening only. Consultation with the Housing Department was conducted to obtain the layout plan of Site 6 and the latest available information has been adopted in this updated ground-borne noise calculation. In addition, according to the latest information on the topside development at WKT, the future usages of NSRs GN2a – GN2c, which are assessed in the EIA Report, have been planned for office use. As such, these building will not be considered as NSRs. Additional NSRs, GN1a and GN1b, which are located within West Kowloon Cultural District (WKCD), are included in this assessment to demonstrate that the Lmax levels at areas within the WKCD site and outside the WKT boundary in general lower than 25dB(A) as concluded in the EIA Report remains valid.

2.2.3 The information including the geometry of the closest point on a GBNSR relative to the alignment as well as the structure characterisation for noise prediction are listed in **Table 2.2**. Their locations are shown in **Figure C8016/C/XRL/ENS/M53/020** to **045**. As a conservative approach, it is assumed that the sensitive receivers are not affected by any Influencing Factor (IF).

2.3 Potential Source of Impact

2.3.1 When trains operate in tunnels that are located in close proximity to occupied structures, there is a possibility that vibrations associated with train passbys will be transmitted through the ground and structure, and be radiated as noise in the occupied spaces within the structure. The vibration and noise transmitted through the structure may have impact to the GBNSRs.

Table 2.2 Operation Phase Ground-borne Railway Noise Sensitive Receivers

GBNSR No. [i]	Location	Uses	Type of Area Containing NSR	Degree to which NSR is affected by IF[a]	ASR	No. of storeys	Building Type[b]	Basement[c]	TCF[h]	BCF Type[g]	Slant Distance to nearest Track, m
GN1	Future Development at West Kowloon Cultural District	Performing Art	Urban	Not Affected	B	N.A.	N.A.	N.A.	R	2	31
GN1a	Future Development at West Kowloon Cultural District	Performing Art	Urban	Not Affected	B	N.A.	N.A.	N.A.	R	2	89
GN1b	Future Development at West Kowloon Cultural District	Performing Art	Urban	Not Affected	B	N.A.	N.A.	N.A.	R	2	29
GN2	Future Development at West Kowloon Cultural District	Performing Art	Urban	Not Affected	B	N.A.	N.A.	N.A.	R	2	47
GN2d	Block 6 Phase 1 Sorrento	Residential	Urban	Not Affected	B	52	0	0	R	2	47
GN2e	Man King Building	Residential	Urban	Not Affected	B	19	0	0	R	2	62
GN3	Yaumati Catholic Primary School (Hoi Wang Road)	School	Urban	Not Affected	B	8	0	0	S	1	30
GN4	Block 9, Charming Garden	Residential	Urban	Not Affected	B	23	0	0	S	3	32
GN5	Tower 5 Phase 1 Park Avenue	Residential	Urban	Not Affected	B	48	0	0	R	2	36
GN6	Hing Wong Mansion	Residential	Urban	Not Affected	B	16	0	0	R	1	34
GN7	Tai Fung Building (Block F) Cosmopolitan Estates	Residential	Urban	Not Affected	B	14	0	0	R	1	34
GN8	Chung Yew Building	Residential	Urban	Not Affected	B	15	0	0	R	1	34
GN9	West Kowloon Disciplined Services Quarters Block 1	Institutional	Urban	Not Affected	B	38	0	0	S	3	40

GBNSR No. [i]	Location	Uses	Type of Area Containing NSR	Degree to which NSR is affected by IF[a]	ASR	No. of storeys	Building Type[b]	Basement[c]	TCF[h]	BCF Type[g]	Slant Distance to nearest Track, m
GN10	Fu Yun House, Fu Cheong Estate	Residential	Urban	Not Affected	B	8	0	0	S	3	35
GN11[j]	Planned Nam Cheong Station Property Development	Residential	Urban	Not Affected	B	N.A.	N.A.	N.A.	S	3	32
GN11a	Planned Residential Development in Site 6	Residential	Urban	Not Affected	B	39	0	0	S	3	31
GN11b	Planned Residential Development in Site 6	Residential	Urban	Not Affected	B	39	0	0	R	2	32
GN11c	Planned Residential Development in Site 6	Residential	Urban	Not Affected	B	39	0	0	S	3	39
GN11	Planned Residential Development in Site 6	Residential	Urban	Not Affected	B	39	0	0	S	3	50
GN11e[k]	Planned Residential Development in Site 6	Residential	Urban	Not Affected	B	2	2	0	S	0	27
GN12	SKH St. Mary's Church Mok Hing Yiu College	School	Urban	Not Affected	B	9	0	0	S	3	42
GN12a	Tack Ching Girls' Secondary School	School	Urban	Not Affected	B	8	0	0	S	3	50
GN13	Tower 6 Aqua Marine	Residential	Urban	Not Affected	B	46	0	0	S	1	40
GN14	HKIVE Haking Wong Waterfront Annex	School	Urban	Not Affected	B	2	2	0	S	0	34
GN14a	Lai Chi Kok Reception Centre	Institutional	Other	Not Affected	B	8	0	0	R	1	43
GN14b	Ward A, Lai Chi Kok Hospital	(e)	Other	Not Affected	B	2	2	0	R	0	94
GN15	40A Cheung Hang Village	Residential	Low Density Residential Area	Not Affected	A	2	2	0	R	0	235
GN16	Tower 6 Regency Park	Residential	Other	Not Affected	B	17	0	0	R	2	248
GN17	Block 21 Wonderland Villas	Residential	Other	Not Affected	B	20	0	0	R	2	275

GBNSR No. [i]	Location	Uses	Type of Area Containing NSR	Degree to which NSR is affected by IF[a]	ASR	No. of storeys	Building Type[b]	Basement[c]	TCF[h]	BCF Type[g]	Slant Distance to nearest Track, m
GN18	Block 2 Greenknoll Court	Residential	Urban	Not Affected	B	31	0	0	R	2	93
GN18b	Kwai Ying Building	Residential	Urban	Not Affected	B	19	0	0	R	2	76
GN19	Tower B Kwai Sing Centre	Residential	Urban	Not Affected	B	28	0	0	R	2	57
GN19a	Ming Tak Building	Residential	Urban	Not Affected	B	6	0	0	R	2	59
GN20	Block B Hutchison Estate	Residential	Urban	Not Affected	B	23	0	0	R	2	53
GN21	184 Yau Ma Hom Resite Village	Residential	Other	Not Affected	B	3	1	0	R	0	73
GN22	18 Da Chuen Ping Village	Residential	Rural Area	Not Affected	A	3	1	0	R	0	87
GN23	35 Sheung Kwai Chung Village	Residential	Rural Area	Not Affected	A	4	1	0	R	0	98
GN24	Sau Shan House, Cheung Shan Estate	Residential	Urban	Not Affected	B	25	0	0	R	2	124
GN25	Tsuen Wan Lutheran School	School	Urban	Not Affected	B	7	0	0	R	2	124
GN26	426A Tsang Uk Tsuen	Residential	Rural	Not Affected	A	3	1	0	S	0	23
GN27	431A Tsang Uk Tsuen	Residential	Rural	Not Affected	A	3	1	0	S	0	26
GN28	510B Nam Hing Lei	Residential	Rural	Not Affected	A	3	1	0	S	0	26
GN29	630 Sheung Tsuen	Residential	Rural	Not Affected	A	2	2	0	S	0	28
GN30	51A Leung Uk Tsuen	Residential	Other[f]	Not Affected	B	3	1	0	S	0	113
GN30a	Village Zone West Boundary, Leung Uk Tsuen	Residential	Other[f]	Not Affected	B	3	1	0	S	0	61

GBNSR No. [i]	Location	Uses	Type of Area Containing NSR	Degree to which NSR is affected by IF[a]	ASR	No. of storeys	Building Type[b]	Basement[c]	TCF[h]	BCF Type[g]	Slant Distance to nearest Track, m
GN30b	Village house in Leung Uk Tsuen	Residential	Other[f]	Not Affected	B	3	1	0	S	0	46
GN31	DD110 LOT 482, Wang Toi Shan	Residential	Other[f]	Not Affected	B	1	2	0	R	0	19
GN33	348 Tsat Sing Kong	Residential	Rural Area	Not Affected	A	1	2	0	S	0	25
GN34	349 Tsat Sing Kong	Residential	Rural Area	Not Affected	A	2	2	0	S	0	25
GN35	374 Chuk Yau Road	Residential	Rural Area	Not Affected	A	1	2	0	S	0	46
GN36	DD104 LOT 1786, Chuk Yau Road	Residential	Rural Area	Not Affected	A	2	2	0	S	0	31
GN37	DD104 LOT 1396, Yau Tam Mei Tsuen, Chuk Yau Road	Residential	Rural Area	Not Affected	A	1	2	0	S	0	30
GN37a	Chun Shin Road, Yau Tam Mei Tsuen	Residential	Rural Area	Not Affected	A	2	2	0	S	0	53
GN38	45 Wai Tsai Tsuen	Residential	Rural Area	Not Affected	A	2	2	0	S	0	33
GN38a	Petrus Avenue House 21 Phase 1 The Vineyard	Residential	Low Density Residential Area	Not Affected	A	3	1	0	S	0	34
GN38b	China Bible Seminary	School	Rural Area	Not Affected	A	3	1	0	S	0	29
GN39	62D Wai Tsai Tsuen	Residential	Rural Area	Not Affected	A	3	1	0	S	0	34
GN40	House 1, Green Crest	Residential	Low Density Residential Area	Not Affected	A	3	1	0	R	0	42
GN41	House A73 Maple Gardens	Residential	Low Density Residential Area	Not Affected	A	3	1	0	S	0	39
GN42	House A78 Maple Gardens	Residential	Low Density Residential Area	Not Affected	A	3	1	0	S	0	38

GBNSR No. [i]	Location	Uses	Type of Area Containing NSR	Degree to which NSR is affected by IF[a]	ASR	No. of storeys	Building Type[b]	Basement[c]	TCF[h]	BCF Type[g]	Slant Distance to nearest Track, m
GN43	Planned Development	Residential	Low Density Residential Area	Not Affected	A	N.A.	N.A.	N.A.	S	3	31
GN44	House 5 Phase A Royal Palms	Residential	Low Density Residential Area	Not Affected	A	3	1	0	S	0	51
GN45	Village house in Mai Po	Residential	Rural Area	Not Affected	A	1	2	0	S	0	32

Remark:
(a) As a conservative assessment, it is assumed that the sensitive receivers will not be affected by any IF.
(b) Building Type: 0 – Heavy Tall Structures; 1 – 2 to 4 storeys medium height; 2 – 1 to 2 storeys.
(c) Basement: 0 – no basement; 1 – basement.
(d) N.A.: Information for future property development is not available during the preparation of report.
(e) The future usage of Ex-Lai Chi Kok Hospital was announced to be converted as holiday camp, hostel, arts and cultural village, educational institute under Revitalising Historic Buildings Through Partnership Scheme.
(f) "Area other than those above" as the SSS by virtue of its size and characteristics plays a major role in determining the type of area within which the NSR is located in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites.
(g) BCF Type: 0 – No piles, with BCF; 1 – Piles not to rock, with BCF; 2 – Piles to rock & tunnel in rock, no BCF; 3 – Piles to rock & tunnel not in rock, with BCF
(h) TCF: R – Tunnel in rock, no TCF; S – Tunnel in soil, with TCF
(i) The uses of GN2a, GN2b and GN2c as assessed in the EIA Report were unknown during EIA stage. Based on latest information, these buildings have been planned for office use in future. As such, these buildings are not considered as sensitive receivers.
(j) A worst case scenario has been considered for the future Nam Cheong Station Properties Development by consideration of the whole development area as noise sensitive use, and the assessment point is located at only 7m from the nearest track. The latest available development layout (http://www.info.gov.hk/tpb/tc/plan_application/Attachment/20130122/s16_A_K20_119_0_gist.pdf) is provided in **Appendix 2.10** for reference.
(k) Based on latest available information at Site 6, the proposed usage at GN11e would be carpark / market block. As a worst case scenario, GN11e is considered as a NSR in this assessment.

2.4 Ground-borne Noise Prediction Methodology

2.4.1 The railway vibration and ground-borne noise levels were calculated by incorporating the algorithms in a 3-D model, MoleRat, developed by Wilkinson Murray Limited.

2.4.2 The methodology adopted for the vibration and ground-borne noise impact assessment is in accordance with the procedures outlined in Transit Noise and Vibration Impact Assessment[1] published by U.S. Department of Transportation Federal Transit Administration (FTA) (FTA Guidance Manual) and High-Speed Ground Transportation Noise and Vibration Impact[2](FRA High-Speed Guidance Manual). This is a similar methodology as used for WIL EIA Study. The vibration levels in GBNSRs were calculated as follows:

$$L = FDL + TIL + TOC + TCF + LSR + BCF + BVR + CTN + SAF$$

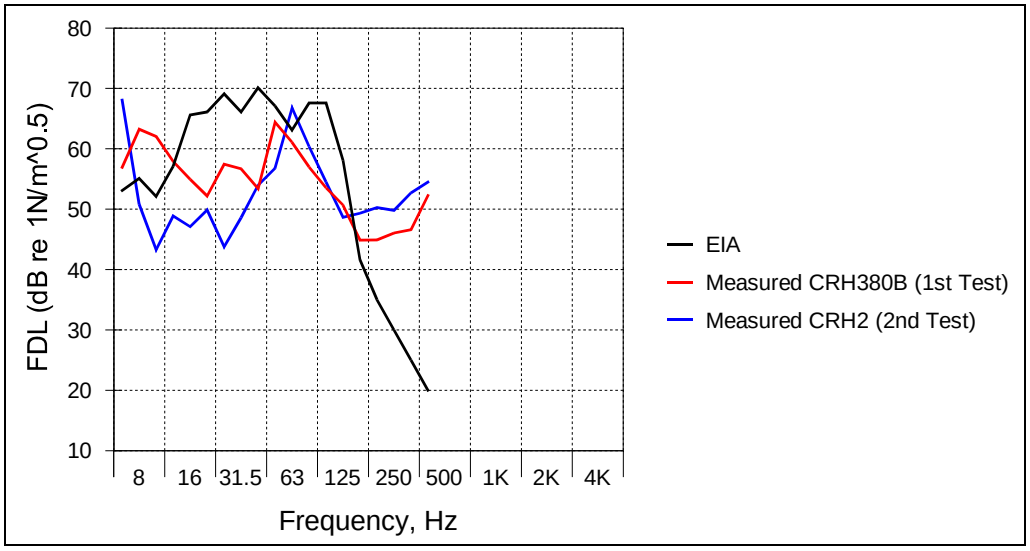
where

L	ground-borne noise level within the structure, dB re: 20 μ-Pascal
FDL	force density level, in dB re $1N/m^{1/2}$
TIL	trackform attenuation or insertion loss, relative level
TOC	turnout and crossover factor
TCF	vibration coupling between the tunnel and the ground for soil based tunnels, relative level
LSR	line source transfer mobility, in dB re 1(nm/s)/(Nm^0.5)
BCF	adjustment to account for building coupling loss, in dB
BVR	building vibration amplification within the structure, in dB
CTN	conversion from vibration to noise within the building, in dB
SAF	safety factor to account for wheel/rail condition and uncertainties in ground conditions, in dB

Force Density Level

2.4.3 The vibration and transfer mobility measurements for CRH trains were conducted in July 2011 and November 2012. The vibration and transfer mobility measurements were conducted at suitable testing location which is an at-grade section with trackforms similar to that proposed for the Project (i.e. standard trackform with 50kN/mm (e.g. Rheda)) to obtain representative information for the vibration source levels (force density levels, FDL) determination. The train types measured are CRH 380B and CRH 2. Details of the measurements are presented in **Appendices 2.1A** and **2.1B** respectively. The measured FDL values are compared with the FDL values (i.e. Acela) adopted in the EIA Report in **Drawing 1.**

Drawing 1 Comparison of Measured FDL with EIA FDL



[1] Transit Noise and Vibration Impact Assessment. Report No. FTA-VA-90-1003-06
[2] Final Report of High-Speed Ground Transportation Noise and Vibration Impact Assessment, HMMH Report No. 293630-4

2.4.4 The measurements were made after rail grinding and transverse marks from the grinding process were observed during measurements. The measured FDL results for both CRH 380B and CRH 2 trains were in general lower than those adopted in the EIA Report at frequencies that contribute to groundborne noise. Lower ground-borne noise level predictions are anticipated based on the measured FDL for CRH380B and CRH2 trains.

2.4.5 Nevertheless, a conservative approach has been adopted in this assessment. The FDL values (i.e. Acela) adopted in the EIA Report have been used in this updated ground-borne noise calculation for reviewing the operational ground-borne noise levels at the GBNSRs and the mitigation proposal, if required.

Trackform Alternatives or Insertion Loss (TIL)

2.4.6 Trackform attenuation has two components including the magnitude of the attenuation and the frequency above which attenuation occurs (resonance frequency of the trackform). Generally, more compliant trackform support and more massive elements in the trackform will result in a greater magnitude of attenuation occurring at lower frequencies. In addition, more massive trackform elements would take up more space in tunnels and may cause spatial incompatibilities that are difficult to be overcome in the design.

2.4.7 The unmitigated ground-borne noise levels at GBNSRs were calculated for a standard trackform of embedded concrete sleepers with slightly resilient fixings (approximately 50kN/mm) on top (e.g. Rheda system).

2.4.8 A 600mm deep provision was designed for the tunnel to allow for further enhancement of mitigation measures, such as installation of appropriate low noise trackform, if required.

Tunnel Coupling Factor

2.4.9 Tunnel Coupling Factor (TCF) is the vibration coupling between the tunnel and the ground for soil based tunnels. Vibration attenuation occurs at the interface between a transit tunnel and the surrounding soil on account of a mismatch in the soil and tunnel wall impedances. The TCF adopted in this study was referenced from the WIL EIA Study. In general, tunnels borne in rock generally do not exhibit any significant vibration attenuation across the tunnel rock interface, thus no TCF attenuation is applied for rock-founded tunnels. However, with reference to the FTA Manual, a 3dB(A) and 5dB(A) reduction in ground-borne noise level was assumed for cut-and-cover tunnels and station structures respectively in soil.

2.4.10 For tunnels in soil, separate tests have been carried out in Hong Kong, and these are reported in the WIL EIA study. The results showed a strong relationship to BCF, and the TCF adopted is the maximum envelope of the measured TCF and the type 2 BCF, as shown in **Appendix 2.3**.

Turnout and Crossover Factor

2.4.11 At points and crossings, where the wheel transitions from one rail to another, the sudden loading/unloading of the leading and trailing rails results in increased broad band vibration levels over that of plain line continuous rail. While it is not possible to machine grind the rails through either the points or crossings, surface deterioration would often be evident. For standard level turnouts and crossings receiving average maintenance, the FTA Manual recommends a correction of 10dB. For modern inclined turnouts in good condition, where impact loads are lessened, a correction of 5dB would be appropriate. As in the recent WIL EIA study, 5dB(A) adjustment was added for inclined turnout.

Line Source Response

2.4.12 The LSR determines the vibration levels or attenuation in the ground as a function of distance caused by an incoherent line source of unit force point impacts, with line source (train) orientated along the alignment. Thus, the basic quantity required for the determination of the

LSR would be the vibration response caused by a unit point source impact, which is defined as the Point Source Response (PSR). Given that the PSR would be along the alignment, the LSR would follow directly by incoherent integration of the PSR values. However, the determination of the PSR for force point impacts along the alignment over the length of the alignment is neither practical nor affordable. For example, at underground sections, force impacting would have to be performed in numerous boreholes drilled to the depth of the alignment and closely spaced along the alignment. Thus, certain assumptions have been invoked, which allow one PSR to be taken as representative along the alignment near a building receiver and to be used in the determination of the LSR. These assumptions include:

- ground is layer-wise homogeneous;
- ground is transversely isotropic along the alignment over the length of the train; and
- ground is between the alignment segment and the vibration receivers at which the LSR is to be determined.

2.4.13 LSR has already been measured in Hong Kong at a number of locations, and the most relevant measured results (taking into account the ground type) will be used for the calculations. The LSR was referenced from the data adopted in West Island Line (WIL) EIA Study (EIA Register No. AEIAR-126/2008) and the measured LSR at two representative locations along the alignment (i.e. Shek Kong and Kwai Chung respectively) as required under XRL EP Condition 2.23. LSR for different geological characteristics obtained from WIL EIA Study and the LSR measurement results in the Performance Test Plan (PTP) which was submitted under XRL EP Condition 2.23 and approved by EPD are presented in **Appendix 2.4**. The LSR measurement sites in PTP were selected to represent areas/ground configurations where high ground-borne noise levels were predicted, and to cover as many ground types as possible but not all ground types. The results from the test sites were applied to all those NSRs where the intervening ground had similar characteristics.

2.4.14 Based on the latest geological information obtained during the construction stage, appropriate LSR has been selected for the assessment accordingly with consideration of geological characteristics along alignment, which is characterised by similar ground material. Mostly the rock through which the tunnel will pass is granite with highly decomposed granite and alluvium on top, and the LSR values used from WIL and recent measurement are those obtained by testing in the similar rock and ground material. Where the ground and rail conditions are similar to Shek Kong and Kwai Chung (rock head depth, tunnel depth and soil type), the measured LSR values have been used. For other soil conditions that were different from those at Shek Kong and Kwai Chung, appropriate LSRs have been selected from the data in WIL EIA Study with similar geological characteristics.

2.4.15 **Table 2.3** below shows the LSR values adopted for assessment.

Table 2.3 LSR Values Used for Assessment

Alignment						Corresponding LSR selected from WIL EIA Study / PTP Test Result		
Chainage (Northbound)		Chainage (Southbound)		Track Depth (m)	Rockhead Depth (m)	LSR Name	Borehole Depth (m)	Rockhead Depth (m)
From	To	From	To					
116+015	116+815	116+000	116+800	No GBNSR				
116+815	118+015	116+800	118+000	30	60	D012-18m	18	34.4
118+015	118+465	118+000	118+450	40	40	D012-41.4m	41.4	34.4
118+465	119+695	118+450	119+680	27	55	D012-18m	18	34.4
119+695	119+815	119+680	119+800	60	25	D049-60.4m	60.4	19.4
119+815	119+915	119+800	119+900	80	25	D049-87.8m	87.8	19.4
119+915	120+015	119+900	120+000	110	25	D049-87.8m	87.8	19.4
120+015	122+115	120+000	122+100	No GBNSR				
122+115	122+315	122+100	122+300	65	15	D064-66.7m	66.7	14.7

Alignment						Corresponding LSR selected from WIL EIA Study / PTP Test Result		
Chainage (Northbound)		Chainage (Southbound)		Track Depth (m)	Rockhead Depth (m)	LSR Name	Borehole Depth (m)	Rockhead Depth (m)
From	To	From	To					
122+315	122+415	122+300	122+400	45	10	B01(1)	30	2
122+415	122+515	122+400	122+500	38	20	D028-44.3m	44.3	22.3
122+515	122+675	122+500	122+660	38	25	B02(1)	17.1	12
122+675	122+975	122+660	122+960	27	30	D002-19.6m	19.6	24.1
122+975	123+175	122+960	123+160	20	32	D012-18m	18	34.4
123+175	123+515	123+160	123+500	17	13	B02(1)	17.1	12
123+515	125+365	123+500	125+350	20	25	D002-19.6m	19.6	24.1
125+365	125+465	125+350	125+450	25	15	B02(1)	17.1	12
125+465	125+565	125+450	125+550	50	10	B01(1)	30	2
125+565	125+665	125+550	125+650	75	10	D049-87.8m	87.8	19.4
125+665	125+765	125+650	125+750	95	10	D049-87.8m	87.8	19.4
125+765	131+815	125+750	131+800	No GBNSR				
131+815	132+365	131+800	132+350	100	10	D049-87.8m	87.8	19.4
132+365	132+835	132+350	132+820	90	15	D049-87.8m	87.8	19.4
132+835	133+035	132+820	133+020	65	10	D064-66.7m	66.7	14.7
133+035	133+765	133+020	133+750	55	15	B01(1)	30	2
133+765	134+135	133+750	134+120	80	10	D049-87.8m	87.8	19.4
134+135	135+515	134+120	135+500	185	20	D049-87.8m	87.8	19.4
135+515	136+465	135+500	136+450	No GBNSR				
136+465	136+695	136+450	136+680	95	25	D049-87.8m	87.8	19.4
136+695	136+915	136+680	136+900	35	20	B02(1)	17.1	12
136+915	137+235	136+900	137+220	35	35	D002-33.7m	33.7	24.1
137+235	137+595	137+220	137+580	35	40	D002-19.6m	19.6	24.1
137+595	137+835	137+580	137+820	33	55	D012-18m	18	34.4
137+835	137+935	137+820	137+920	33	33	D002-33.7m	33.7	24.1
137+935	138+115	137+920	138+100	33	50	D012-18m	18	34.4
138+115	138+465	138+100	138+450	33	80	D012-18m	18	34.4
138+465	139+115	138+450	139+100	35	50	D012-18m	18	34.4
139+115	139+315	139+100	139+300	35	30	B02(1)	17.1	12
139+315	139+815	139+300	139+800	40	20	D028-44.3m	44.3	22.3
139+815	139+905	139+800	139+890	38	38	D012-41.4m	41.4	34.4
139+905	140+215	139+890	140+200	40	60	D012-18m	18	34.4
140+215	141+115	140+200	141+100	30	50	D012-18m	18	34.4
141+115	141+315	141+100	141+300	30	30	D002-33.7m	33.7	24.1
141+315	141+671	141+300	141+656	27	40	D012-18m	18	34.4

Remark:
(1) PTP test result B01 refers to test location in Kwai Chung; while B02 refers to test location in Shek Kong.

Building Coupling Factor (BCF)

2.4.16 In general, larger and heavier structures have greater vibration attenuation than smaller and lighter structures. The recommended practice established within FTA Manual has been followed. Receivers in this study were divided into 4 types according to its structures and have different BCF attenuation as below:

- Type 0 – Large masonry buildings
- Type 1 – 2-4 storeys masonry buildings
- Type 2 – 1-2 storeys buildings
- Type 3 – Single family detached residences

2.4.17 The BCF for different types of structure is presented in **Appendix 2.5**. It is indicated that larger and heavier structures have greater vibration attenuation than smaller and lighter structures. In fact, the extent of the attenuation is governed by the difference in mechanical impedance between the soil and the foundation, with impedance being determined by differences in mass and stiffness within the soil and foundation. For structures founded on rock, there is no impedance contrast between the soil and the foundation, as a conservative approach, the BCF is considered to be zero.

2.4.18 It has been assumed that buildings up to three stories in height do not have piles, and buildings over this height do, unless specific information is available for assessment. For most of the high-rise buildings, details of the piles are available, including whether the piles are to rock or are friction piles. In those cases where no details of the piles were available, a worst case scenario has been assumed; that the piles are to rock such that no coupling loss was taken into account.

Building Vibration Response (BVR)

2.4.19 The BVR is generally determined by three factors as described below:

I. Resonance amplification due to floor, wall and ceiling spans: This resonance amplification is usually an issue for small and lightweight houses. In large, heavy framed structures, generally multi-floor concrete construction, structural resonances usually occur at sub-audible frequencies, with small resonance amplification due to massive structural elements having low mobility. FTA Manual recommends a 6 dB correction at the likely natural frequency of structures to account for structural resonances. The corrections given in **Appendix 2.6** were adopted, as was the case for the WIL EIA Study.

II. Floor-to-floor attenuation: A floor-to-floor attenuation of 2 dB reduction per floor was assumed. Where there is a multi-floor occupancy, only the structure-borne noise impact on the lowest occupied floor is considered.

III. Attenuation across a structure, in the direction away from the alignment: When the noise sensitive area is situated in the back of the building away from the alignment, vibration attenuation across a structure would occur. Attenuation of 2 dB reduction was considered in this study, and this is conservative for large setbacks.

Safety Factor (SAF)

2.4.20 To tackle the problem of differences in overall predicted and measured A-weighted noise levels, a safety factor was applied in the model. As a conservative approach, a 10 dB safety factor was adopted to account for uncertainty and variation in geological characteristics.

Conversion to Noise (CTN)

2.4.21 Based on FTA Manual, a -27 dB correction for conversion of vibration velocity (re: 10^{-9} m/s) in room walls, floors and ceiling to noise (re: 20 micro Pa) was assumed in this study.

Calculation of Leq

2.4.22 The Leq values have been calculated using MoleRat, by the following procedures:

- Calculate the noise level from a full train at each of many locations at 10m intervals along the whole line
- Sum the energy from these levels and calculate the SEL level
- Calculate the Leq levels from

$$Leq = 10 \log [10^{(SELlong + 10 \log Vlong)/10} + 10^{(SELshort + 10 \log Vshort)/10}] - 35.6$$

where

Vlong Number of long haul train movements in the relevant 30 minute or 24 hour period, expressed as the average number of movements per hour:
For Leq(30min): V = N(30min) x 2 (N = number of movements)

For Leq(24hour): V = N(24hour) / 24 (N = number of movements)

Vshort Number of short haul train movements in the relevant 30 minute or 24 hour period, expressed as the average number of movements per hour:
For Leq(30min): V = N(30min) x 2 (N = number of movements)
For Leq(24hour): V = N(24hour) / 24 (N = number of movements)

2.5 Operational Ground-borne Noise Impact Assessment

2.5.1 Operational vibration and ground-borne noise levels were calculated by incorporating the algorithms discussed in a 3-D model, MoleRat, which is developed by Wilkinson Murray Limited. $Leq_{(30min)}$ for day and night, Leq(24hr) and Lmax levels were calculated at most affected floor levels and the noise impact has been quantified by indicating the total number of dwellings or other sensitive elements exposed to levels exceeding the criteria.

Operational Information

2.5.2 Two train types are expected to operate for the Project; a long haul train of length 427m and a short haul train of length 214m.

2.5.3 The maximum train movements during daytime and evening (0700 – 2300 hours) and night-time (2300 – 2400 and 0600 – 0700 hours) have been updated according to latest time table of XRL and are presented in **Table 2.4**. In addition to this, there will be launching movements between SSS and WKT during the operational hours, and these need to be added to allow calculation of total ground-borne noise levels. However, since no speed profiles are available for launching trains, a conservative approach has been adopted whereby the shunting trains are assumed to travel the full length of the project.

Table 2.4 Train Movements

Track	Train Type	Movements per Hour				
		Mainline Operation(1)		Train Launching to/from SSS		Total
		Daytime and evening	Night-time	Daytime and evening	Night-time	24 Hour(2)
Northbound	Short	13	6	1	3	6
	Long	4	0	2	1	2
	Total	*17*	*6*	*3*	*4*	*8*
Southbound	Short	12	6	1	0	6
	Long	3	0	3	1	2
	Total	*15*	*6*	*4*	*1*	*8*

Notes:
(1) Long haul and short haul trains will be operated during the period of 0600 – 2400 hours only.
(2) Train frequency for 24 hours was calculated based on the average hour of total 24-hour train movements.

2.5.4 The worst hours for mainline operation and launching trains at night are not the same. Nevertheless, the worst hours were added in a conservative approach. Where 30 minute train movements are required, these are derived by dividing the hourly movements by two.

2.5.5 The latest speed profiles of XRL are presented in **Appendix 2.7**. As a worst case scenario, speed profiles for train not stopping at Futian, i.e. higher speed passing through Hong Kong Boundary, have been adopted in the present assessment.

2.5.6 Based on latest detailed design, the turnouts of the inclined type have been proposed at the locations as shown in **Table 2.5**.

Table 2.5 Locations of Turnouts

Up	Down
120+069	119+892
121+893	121+633
123+510	123+545
124+374	124+310
124+925	124+910
126+195	126+061
126+219	126+321
137+811	137+785
137+966	137+940
140+738	140+774
140+787	140+832
140+829	140+889
140+902	140+942
140+955	140+980
141+028	141+016
141+086	141+074
141+143	141+132
141+193	141+181

Predicted Ground-borne Noise Levels

2.5.7 The predicted ground-borne noise levels as a result of Project operation at the lowest occupied floor of GBNSRs, together with the distances used in the calculation are shown in **Table 2.6** with sample calculation presented in **Appendix 2.8**. The calculation of the noise levels assumes the following conditions:

- For the case where the tunnel will be in rock and the NSR is piled down to rock, the vibration path has been assumed to be across the rock and up the piles into the building
- For the cases where the tunnel will be in soft ground, the NSR is not on piles or the NSR is on piles not down to rock, the vibration path has been assumed to be through the ground along a slant path to the nearest part of the NSR or piles.
- Where piling details are not known and the tunnel will be in rock, it has been assumed that the piles are down to rock (worst case assumption).

Table 2.6 Predicted Ground-borne Railway Noise Levels (Unmitigated)

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN1	Future Development at West Kowloon Cultural District	24	20	21	34	N.A.	N.A.	20	20
GN1a	Future Development at West Kowloon	21	17	18	29	N.A.	N.A.	86(2)	86(2)

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
	Cultural District								
GN1b	Future Development at West Kowloon Cultural District	20	16	17	30	N.A.	N.A.	16	16
GN2	Future Development at West Kowloon Cultural District	<15	<15	<15	19	N.A.	N.A.	40	40
GN2d	Block 6 Phase 1 Sorrento	<15	<15	<15	<15	55	45	52	42
GN2e	Man King Building	<15	<15	<15	15	55	45	59	67
GN3	Yaumati Catholic Primary School (Hoi Wang Road)	29	23	26	41	55	45	16	5
GN4	Block 9, Charming Garden	26	21	23	37	55	45	5	17
GN5	Tower 5 Phase 1 Park Avenue	25	20	22	37	55	45	21	6
GN6	Hing Wong Mansion	16	<15	<15	28	55	45	37	37
GN7	Tai Fung Building (Block F) Cosmopolitan Estates	18	<15	15	30	55	45	36	36
GN8	Chung Yew Building	29	24	26	43	55	45	18	21
GN9	West Kowloon Disciplined Services Quarters Block 1	24	19	21	38	55	45	22	39
GN10	Fu Yun House, Fu Cheong Estate	23	18	21	39	55	45	15	31
GN11	Planned Nam Cheong Station Property Development	29	24	26	43	55	45	7	7
GN11a	Planned Residential Development in Site 6	40	35	37	54	55	45	28	15
GN11b	Planned Residential Development in Site 6	38	33	35	51	55	45	28	15
GN11c	Planned Residential Development in Site 6	29	24	26	43	55	45	41	28
GN11d	Planned Residential Development in Site 6	21	15	18	32	55	45	55	42
GN11e(3)	Planned Residential Development in Site 6	27	22	24	42	55	45	27	30
GN12	SKH St. Mary's Church Mok Hing Yiu College	21	15	17	34	55	45	36	23
GN12a	Tack Ching Girls' Secondary School	<15	<15	<15	23	55	45	40	53

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN13	Tower 6 Aqua Marine	<15	<15	<15	19	55	45	22	36
GN14	HKIVE Haking Wong Waterfront Annex	<15	<15	<15	28	55	45	35	41
GN14a	Lai Chi Kok Reception Centre	28	23	25	41	55	45	25	23
GN14b	Ward A, Lai Chi Kok Hospital	15	<15	<15	29	55	45	90	74
GN15	40A Cheung Hang Village	<15	<15	<15	<15	50	40	235	235
GN16	Tower 6 Regency Park	<15	<15	<15	<15	55	45	249	248
GN17	Block 21 Wonderland Villas	<15	<15	<15	<15	55	45	275	275
GN18	Block 2 Greenknoll Court	<15	<15	<15	24	55	45	90	90
GN18b	Kwai Ying Building	22	17	19	34	55	45	60	63
GN19	Tower B Kwai Sing Centre	22	17	19	34	55	45	44	46
GN19a	Ming Tak Building	20	15	17	31	55	45	48	51
GN20	Block B Hutchison Estate	26	21	23	40	55	45	36	38
GN21	184 Yau Ma Hom Resite Village	15	<15	<15	28	55	45	73	73
GN22	18 Da Chuen Ping Village	15	<15	<15	28	50	40	87	87
GN23	35 Sheung Kwai Chung Village	<15	<15	<15	<15	50	40	98	98
GN24	Sau Shan House, Cheung Shan Estate	<15	<15	<15	<15	55	45	125	125
GN25	Tsuen Wan Lutheran School	<15	<15	<15	<15	55	45	124	124
GN26	426A Tsang Uk Tsuen	16	<15	<15	29	50	40	26	23
GN27	431A Tsang Uk Tsuen	15	<15	<15	25	50	40	27	26
GN28	510B Nam Hing Lei	<15	<15	<15	25	50	40	26	29
GN29	630 Shueng Tsuen	17	<15	<15	32	50	40	28	42
GN30	51A Leung Uk Tsuen	<15	<15	<15	<15	55	45	113	132
GN30a	Village Zone West Boundary, Leung Uk Tsuen	<15	<15	<15	<15	55	45	61	79
GN30b	Village house in Leung Uk Tsuen	<15	<15	<15	20	55	45	46	64
GN31	DD110 LOT 482, Wang Toi Shan Choi Yuen Tsuen	35	30	32	51	55	45	35	19

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN33	348 Tsat Sing Kong	21	16	18	33	50	40	29	27
GN34	349 Tsat Sing Kong	20	16	18	33	50	40	27	34
GN35	374 Chuk Yau Road	19	<15	16	32	50	40	46	52
GN36	DD104 LOT 1786, Chuk Yau Road	21	16	18	34	50	40	31	33
GN37	DD104 LOT 1396, Yau Tam Mei Tsuen, Chuk Yau Road	21	16	19	35	50	40	30	29
GN37a	Chun Shin Road, Yau Tam Mei Tsuen	<15	<15	<15	18	50	40	67	55
GN38	45 Wai Tsai Tsuen	21	16	18	35	50	40	33	32
GN38a	Petrus Avenue House 21 Phase 1 The Vineyard	<15	<15	<15	30	50	40	33	39
GN38b	China Bible Seminary	17	<15	<15	31	50	40	33	29
GN39	62D Wai Tsai Tsuen	22	17	19	36	50	40	34	34
GN40	House 1, Green Crest	<15	<15	<15	19	50	40	53	43
GN41	House A73 Maple Gardens	17	<15	<15	32	50	40	42	39
GN42	House A78 Maple Gardens	<15	<15	<15	26	50	40	38	40
GN43	Area Zoned as R(A)	20	15	17	34	50	40	31	32
GN44	House 5 Phase A Royal Palms	<15	<15	<15	15	50	40	65	51
GN45	Village house in Mai Po	20	15	17	34	50	40	36	32

Note:
(1) Distances were measured from latest survey plan.
(2) Distance was measured from the southern end of platform at WKT where the front end of trains stop.
(3) Based on latest available information at Site 6, the proposed usage at GN11e would be carpark and market block. As a worst case scenario, GN11e is considered as a NSR in this assessment.

2.5.8 All of the predicted levels at existing residential receivers and at possible CDA developments over WKT are well below the stipulated noise criteria, generally as a result of deep underground alignment. After reviewing the prediction results, it is noted that the planned GBNSRs in Site 6 (i.e. GN11a – GN11e) would be subject to relatively higher predicted ground-borne noise levels, and therefore installation of low noise trackform at this area would be implemented to further minimise the groundborne noise levels. In addition, to minimise the noise impact to the future WKCD, low noise trackform will also be provided at WKT.

2.5.9 Based on the prediction results as shown in **Table 2.6**, the locations along the alignment where the predicted noise levels at the GBNSRs are comparatively high among other GBNSRs have been identified and their approximate chainages are presented in **Table 2.7**. Nevertheless, as a conservative consideration, the mitigation proposal would follow the recommendation stipulated in the EIA Report/by the EP Condition 2.28 as given in **Table 2.8**

to further minimise the ground-borne noise levels. With considerations given to suitability, environmental performance, constructability, maintenance constraints of different types of low noise trackform, the low noise trackform suitable for XRL includes alternative 1 fastening system (Alt 1) (or similar such as Vossloh 300-1U and low vibration trackform (LVT)), isolated slab trackform (IST), Vanguard and floating slab track (FST), with their insertion loss values shown in **Appendix 2.2**.

Table 2.7 Approximate Chainages where GBNSRs subject to Relative High Groundborne Noise Levels

Location	From	To
Nam Cheong		
Southbound	137+835	137+935
Northbound	137+860	137+960
West Kowloon Terminus		
Long Haul Platform	141+150	141+600
Short Haul Platform	141+385	141+600

Table 2.8 Chainages with Low Noise Trackform as Stipulated in EIA Report/EP Condition 2.28

From	To
Southbound	
123+040	123+640
133+160	133+660
137+600	138+350
139+100	139+600
140+900	141+600
Northbound	
123+050	123+650
133+170	133+670
137+620	138+370
139+120	139+620
140+900	141+600

2.5.10 The noise levels at the representative GBNSRs would be reduced to those shown in **Table 2.8** with the provision of low noise trackform. With the provision of low noise trackform at WKT, the Lmax levels at areas within the WKCD site and outside the WKT boundary were predicted to be in general lower than 25dB(A). **Appendix 2.9** shows the sample calculation of selected GBNSRs with the provision of low noise trackform.

Table 2.9 Predicted Ground-borne Railway Noise Levels (Mitigated)

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		$L_{eq,30min}$ (day)	$L_{eq,30min}$ (night)	Leq (24hr)	Lmax	$L_{eq,30min}$ (day)	$L_{eq,30min}$ (night)		
GN1	Future Development at West Kowloon Cultural District	15	<15	<15	21	N.A.	N.A.	20	20

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance[1] (m)	Up Track Calculated Distance[1] (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN1a	Future Development at West Kowloon Cultural District	<15	<15	<15	22	N.A.	N.A.	86[2]	86[2]
GN1b	Future Development at West Kowloon Cultural District	<15	<15	<15	20	N.A.	N.A.	16	16
GN2	Future Development at West Kowloon Cultural District	<15	<15	<15	15	N.A.	N.A.	40	40
GN2d	Block 6 Phase 1 Sorrento	<15	<15	<15	<15	55	45	52	42
GN2e	Man King Building	<15	<15	<15	<15	55	45	59	67
GN3	Yaumati Catholic Primary School (Hoi Wang Road)	27	22	24	40	55	45	16	5
GN4	Block 9, Charming Garden	26	21	23	37	55	45	5	17
GN5	Tower 5 Phase 1 Park Avenue	25	20	22	37	55	45	21	6
GN6	Hing Wong Mansion	<15	<15	<15	25	55	45	37	37
GN7	Tai Fung Building (Block F) Cosmopolitan Estates	<15	<15	<15	27	55	45	36	36
GN8	Chung Yew Building	24	18	21	37	55	45	18	21
GN9	West Kowloon Disciplined Services Quarters Block 1	19	<15	16	31	55	45	22	39
GN10	Fu Yun House, Fu Cheong Estate	23	18	20	39	55	45	15	31
GN11	Planned Nam Cheong Station Property Development	20	15	17	34	55	45	7	7
GN11a	Planned Residential Development in Site 6	29	24	26	42	55	45	28	15
GN11b	Planned Residential Development in Site 6	26	21	23	38	55	45	28	15
GN11c	Planned Residential Development in Site 6	24	18	21	36	55	45	41	28
GN11d	Planned Residential Development in Site 6	20	15	17	32	55	45	55	42
GN11e[3]	Planned Residential Development in Site 6	16	<15	<15	31	55	45	27	30
GN12	SKH St. Mary's Church Mok Hing Yiu College	19	<15	16	33	55	45	36	23
GN12a	Tack Ching Girls' Secondary School	<15	<15	<15	22	55	45	40	53
GN13	Tower 6 Aqua Marine	<15	<15	<15	19	55	45	22	36
GN14	HKIVE Haking Wong Waterfront Annex	<15	<15	<15	28	55	45	35	41
GN14a	Lai Chi Kok Reception Centre	26	21	24	39	55	45	25	23

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN14b	Ward A, Lai Chi Kok Hospital	<15	<15	<15	27	55	45	90	74
GN15	40A Cheung Hang Village	<15	<15	<15	<15	50	40	235	235
GN16	Tower 6 Regency Park	<15	<15	<15	<15	55	45	249	248
GN17	Block 21 Wonderland Villas	<15	<15	<15	<15	55	45	275	275
GN18	Block 2 Greenknoll Court	<15	<15	<15	24	55	45	90	90
GN18b	Kwai Ying Building	22	17	19	34	55	45	60	63
GN19	Tower B Kwai Sing Centre	21	16	18	32	55	45	44	46
GN19a	Ming Tak Building	20	15	17	29	55	45	48	51
GN20	Block B Hutchison Estate	25	20	22	38	55	45	36	38
GN21	184 Yau Ma Hom Resite Village	15	<15	<15	28	55	45	73	73
GN22	18 Da Chuen Ping Village	15	<15	<15	28	50	40	87	87
GN23	35 Sheung Kwai Chung Village	<15	<15	<15	<15	50	40	98	98
GN24	Sau Shan House, Cheung Shan Estate	<15	<15	<15	<15	55	45	125	125
GN25	Tsuen Wan Lutheran School	<15	<15	<15	<15	55	45	124	124
GN26	426A Tsang Uk Tsuen	16	<15	<15	29	50	40	26	23
GN27	431A Tsang Uk Tsuen	<15	<15	<15	25	50	40	27	26
GN28	510B Nam Hing Lei	<15	<15	<15	25	50	40	26	29
GN29	630 Shueng Tsuen	17	<15	<15	32	50	40	28	42
GN30	51A Leung Uk Tsuen	<15	<15	<15	<15	55	45	113	132
GN30a	Village Zone West Boundary, Leung Uk Tsuen	<15	<15	<15	<15	55	45	61	79
GN30b	Village house in Leung Uk Tsuen	<15	<15	<15	20	55	45	46	64
GN31	DD110 LOT 482, Wang Toi Shan Choi Yuen Tsuen	24	18	21	36	55	45	35	19
GN33	348 Tsat Sing Kong	21	15	18	33	50	40	29	27
GN34	349 Tsat Sing Kong	20	15	17	33	50	40	27	34
GN35	374 Chuk Yau Road	19	<15	16	32	50	40	46	52

GBNSR No.	Location	Predicted Ground-borne Noise Level, dB(A)				Criterion, dB(A)		Down Track Calculated Distance(1) (m)	Up Track Calculated Distance(1) (m)
		Leq, 30min (day)	Leq, 30min (night)	Leq (24hr)	Lmax	Leq, 30min (day)	Leq, 30min (night)		
GN36	DD104 LOT 1786, Chuk Yau Road	21	16	18	34	50	40	31	33
GN37	DD104 LOT 1396, Yau Tam Mei Tsuen, Chuk Yau Road	21	16	19	35	50	40	30	29
GN37a	Chun Shin Road, Yau Tam Mei Tsuen	<15	<15	<15	18	50	40	67	55
GN38	45 Wai Tsai Tsuen	21	16	18	34	50	40	33	32
GN38a	Petrus Avenue House 21 Phase 1 The Vineyard	<15	<15	<15	30	50	40	33	39
GN38b	China Bible Seminary	17	<15	<15	31	50	40	33	29
GN39	62D Wai Tsai Tsuen	19	<15	16	33	50	40	34	34
GN40	House 1, Green Crest	<15	<15	<15	19	50	40	53	43
GN41	House A73 Maple Gardens	17	<15	<15	32	50	40	42	39
GN42	House A78 Maple Gardens	<15	<15	<15	26	50	40	38	40
GN43	Area Zoned as R(A)	20	15	17	34	50	40	31	32
GN44	House 5 Phase A Royal Palms	<15	<15	<15	15	50	40	65	51
GN45	Village house in Mai Po	20	15	17	34	50	40	36	32

Note:
(1) Distances were measured from latest survey plan.
(2) Distance was measured from the southern end of platform at WKT where the front end of trains stop.
(3) Based on latest available information at Site 6, the proposed usage at GN11e would be carpark / market block. As a worst case scenario, GN11e is considered as a NSR in this assessment.

Cumulative Effect from Other Rail Lines

2.5.11 The Project will run close to other existing rail lines and the cumulative effect from other rail lines has been reviewed. Locations where other rail lines are relatively close are as follows:

- The WKT will be located in the vicinity of the KSL Austin Station
- The XRL will be parallel to KSL and reasonably close just north of WKT, and also parallel to, but further away, Tung Chung Line (TCL) and Airport Express Link (AEL)
- The XRL will pass close to the Tung Chung Line (TCL) Nam Cheong station
- The XRL will pass under the Tsuen Wan Line (TWL) at Lai Chi Kok

2.5.12 Any cumulative effect from KSL would relate to West Kowloon Cultural District. Whilst predicted noise levels Lmax at GN1b, the nearest GBNSRs to WKT and KSL, which is located at approx. 16m from the tracks at WKT, is 20dB(A), KSL would be at least 100m from GN1b. At this distance low ground-borne noise levels are expected. As such cumulative impact from the Project and KSL is not anticipated at GN1b. According to the WKCD EIA Report (Application No. EIA-215/2013), appropriate noise and vibration control measures such as building isolation and/or box-in-box installation would be adopted by future developers to

minimise the potential ground-borne noise impact from the existing and planned railways to WKCD.

2.5.13 Just north of WKT where the Project will be parallel to KSL, TCL and AEL, there are no GBNSRs located in proximity to these rail lines. Any cumulative effect is therefore considered irrelevant. At the point where XRL diverges from the other lines, GBNSR GN3 is 30m from the nearest XRL track and approximately 135m from KSL and further from the other lines. Given that the mitigated level predicted for GN3 is 27dB(A) $L_{eq,day}$, it is unlikely that other rail lines would increase the Leq levels at GBNSRs.

2.5.14 The nearest GBNSR near TCL Nam Cheong station and the project alignment is GN11a-e With the mitigated ground-borne noise level of up to 24dB(A) $L_{eq,night}$ at GN11a, the cumulative noise levels are therefore unlikely to be over the criteria, in particular TCL trains would slow down and stop at Nam Cheong station.

2.5.15 In Lai Chi Kok, the tracks will pass close to the TWL tracks. At the intersection, the nearest GBNSR is GN14a with slant distance from XRL of 43m. However, this GBNSR is 100m from TWL and it is anticipated that the Leq levels from TWL would be low, especially considering the fact that the intersection is near Lai Chi Kok station and MTR trains would be at low speed. Therefore, the operation of TWL would not add significantly to the ground-borne noise level of 21dB(A) $L_{eq,night}$ at GN14a, as predicted from XRL to the extent of making the cumulative levels up towards the criteria..

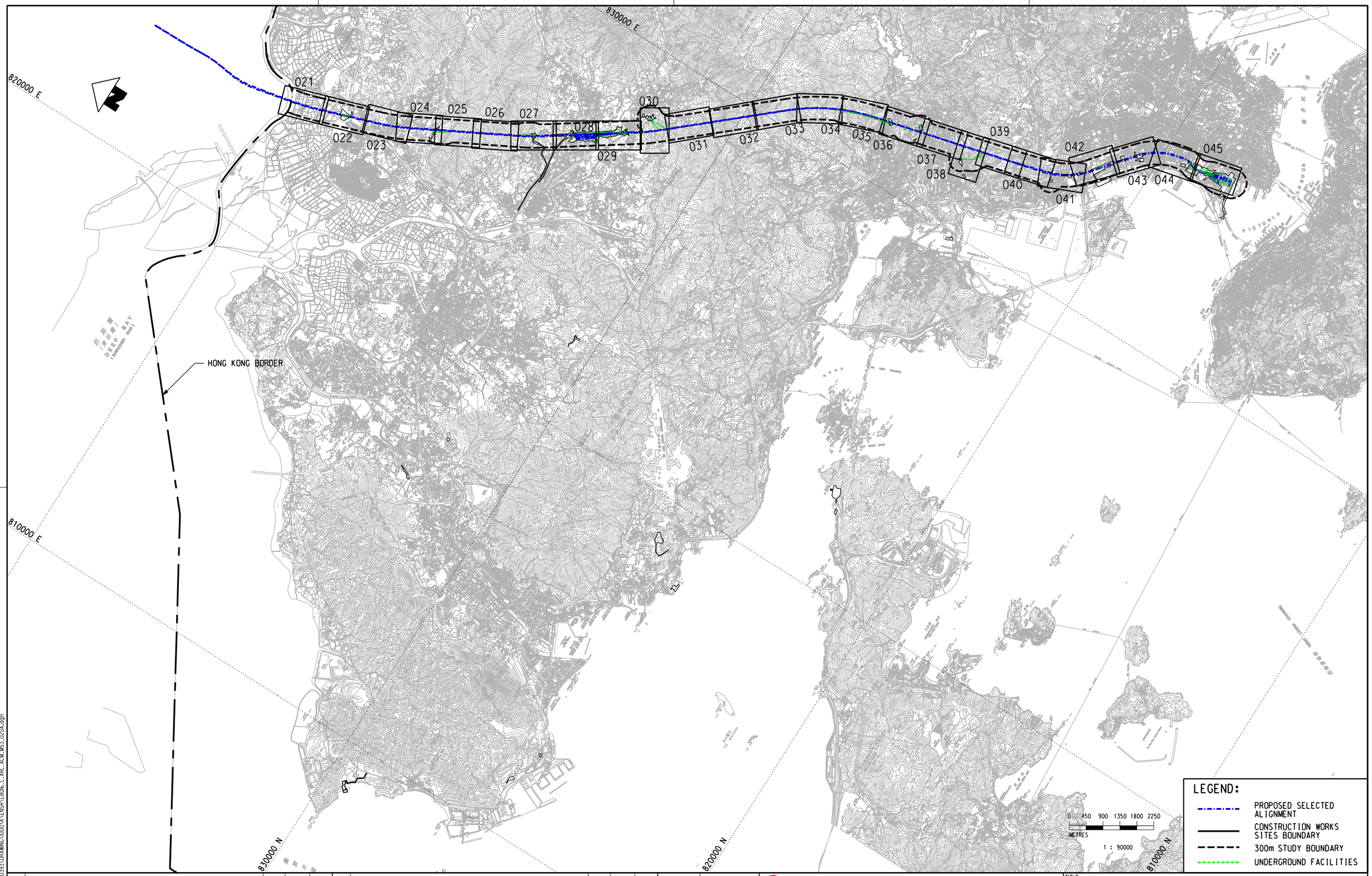
3 CONCLUSION

3.1.1 FDL measurements on CRH trains were conducted. Measurement results indicate that the FDL values of both CRH 380B and CRH 2 trains were in general lower than those adopted in the EIA Report at frequencies that contribute to groundborne noise. Lower ground-borne noise level predictions were therefore anticipated based on the measured FDL of CRH380B and CRH2 trains.

3.1.2 A conservative assessment approach was adopted by using the FDL values in EIA report in the groundborne noise prediction, with consideration of the latest design information on railway system including alignment, turnout location, train frequency, and the measured LSR values. Assessment results indicated that the predicted ground-borne noise levels at the GBNSRs would comply with the stipulated EIAO-TM noise criteria, and thus no special trackform will be required to meet these criteria. Nevertheless, as a conservative consideration, the mitigation proposal would follow the recommendation stipulated in the EIA Report/by the EP Condition 2.28 to further minimise the groundborne noise levels.

3.1.3 Since the predicted ground-borne noise levels at the GBNSRs are low, it is anticipated that there would be no cumulative effect from other rail lines, including KSL, TCL, AEL and TWL.

FIGURES



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DESIGNED	TWF
CHECKED	KCC
APPROVED	PL
DATE	19/AUG./2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

AECOM

CADD REF.
C8016_C_XRL_ACM_M53_020A.dgn

TITLE

C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS PLAN OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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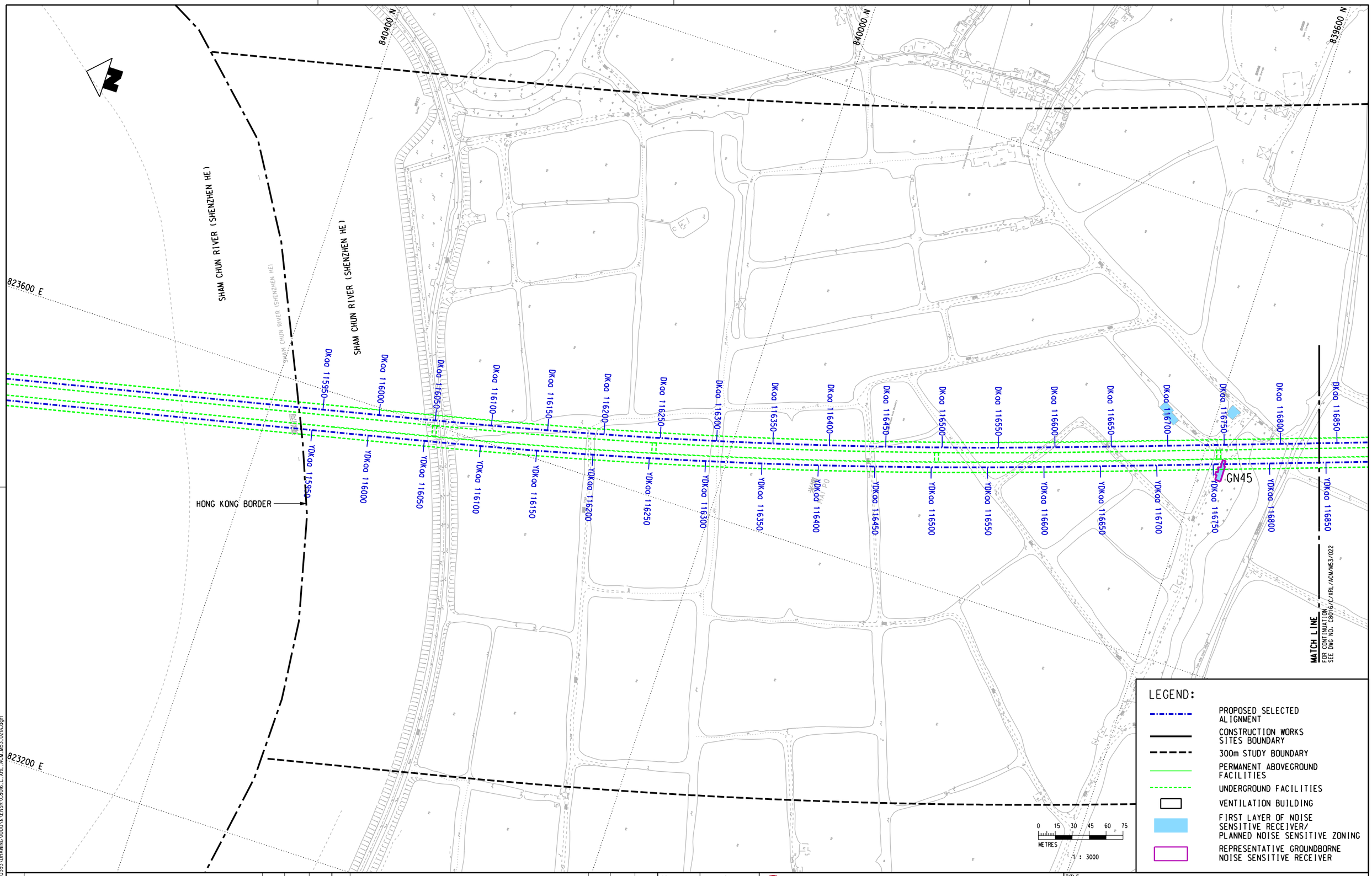

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CHECKED	KCC
APPROVED	PL
DATE	19/AUG./2008

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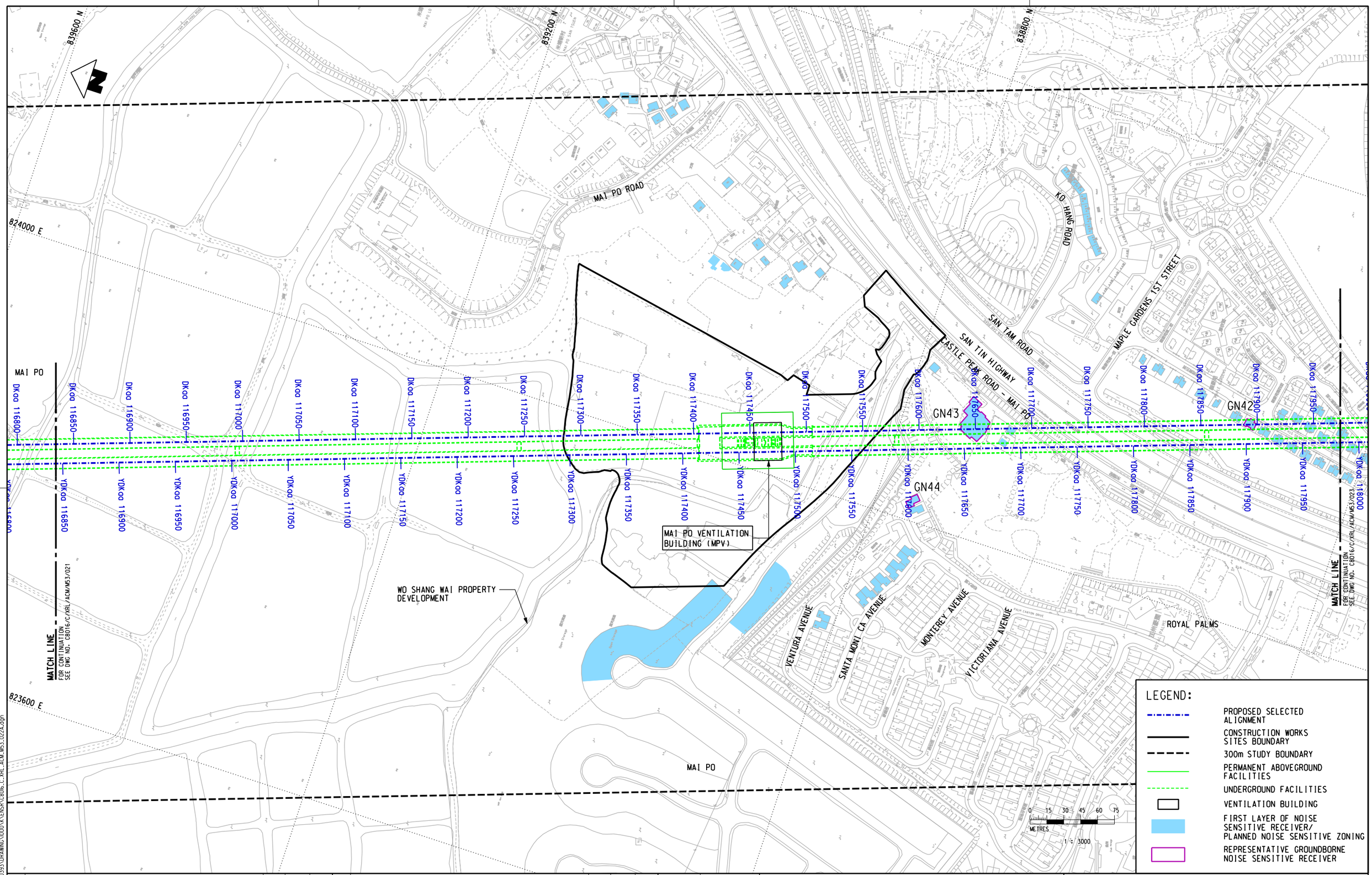
TITLE

C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/021

REV. A



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TITLE

C8016

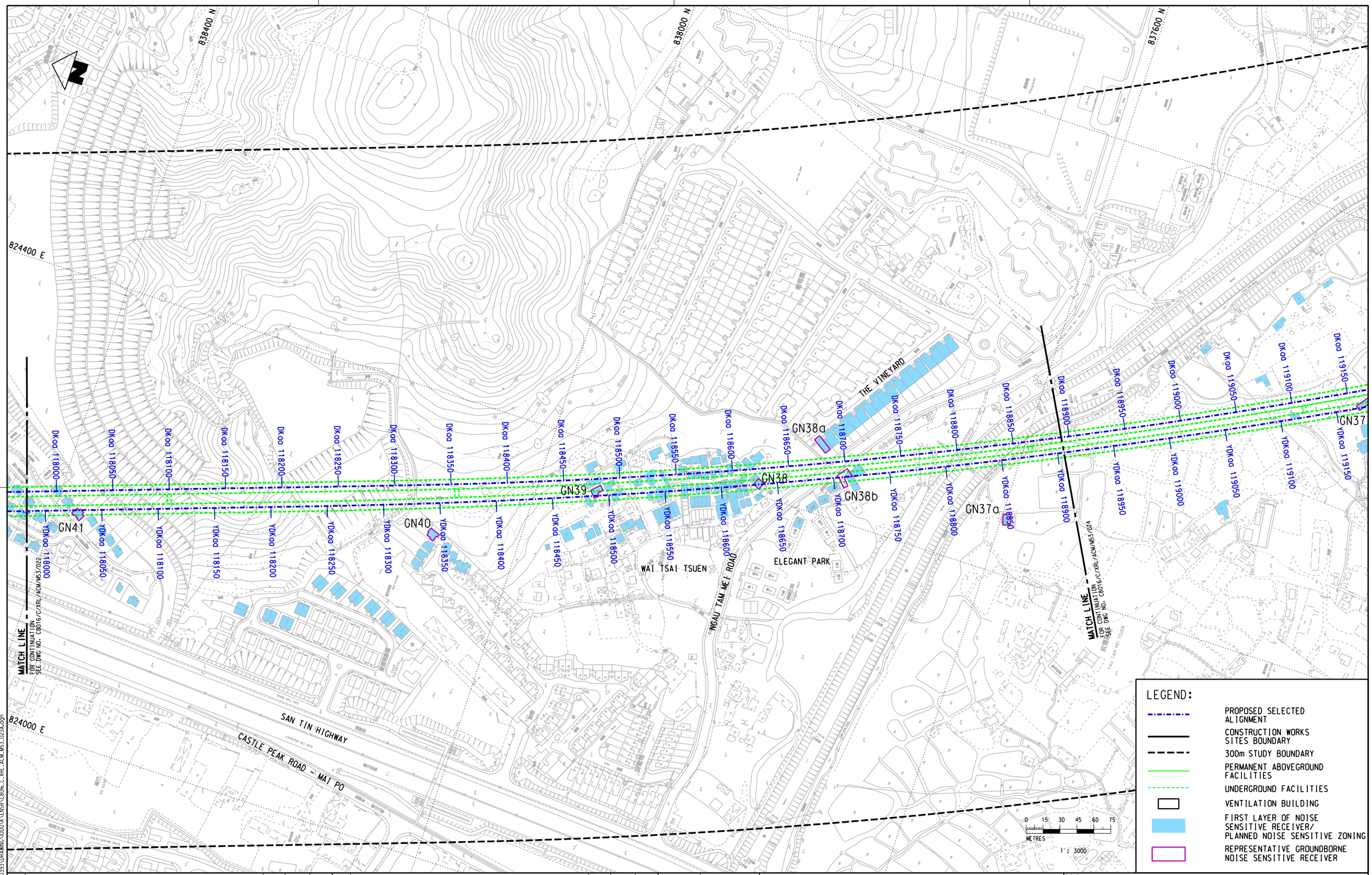
ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/022

REV. A



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CHECKED	KCC
APPROVED	PL
DATE	19/AUG./2008

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AECOM

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TITLE

C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/023

REV. A

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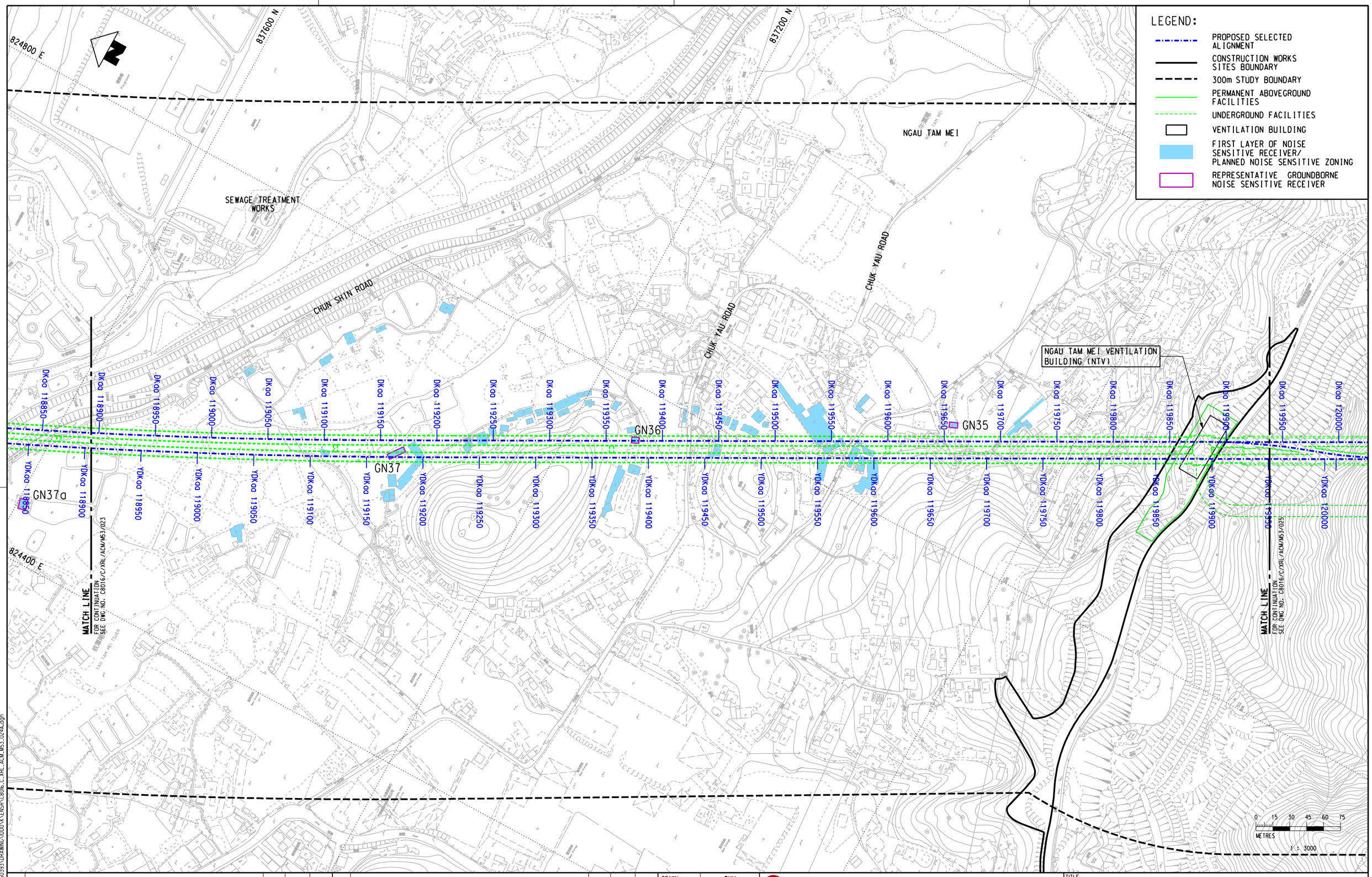

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CHECKED	KCC
APPROVED	PL
DATE	19/AUG./2008

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ORIGINATOR

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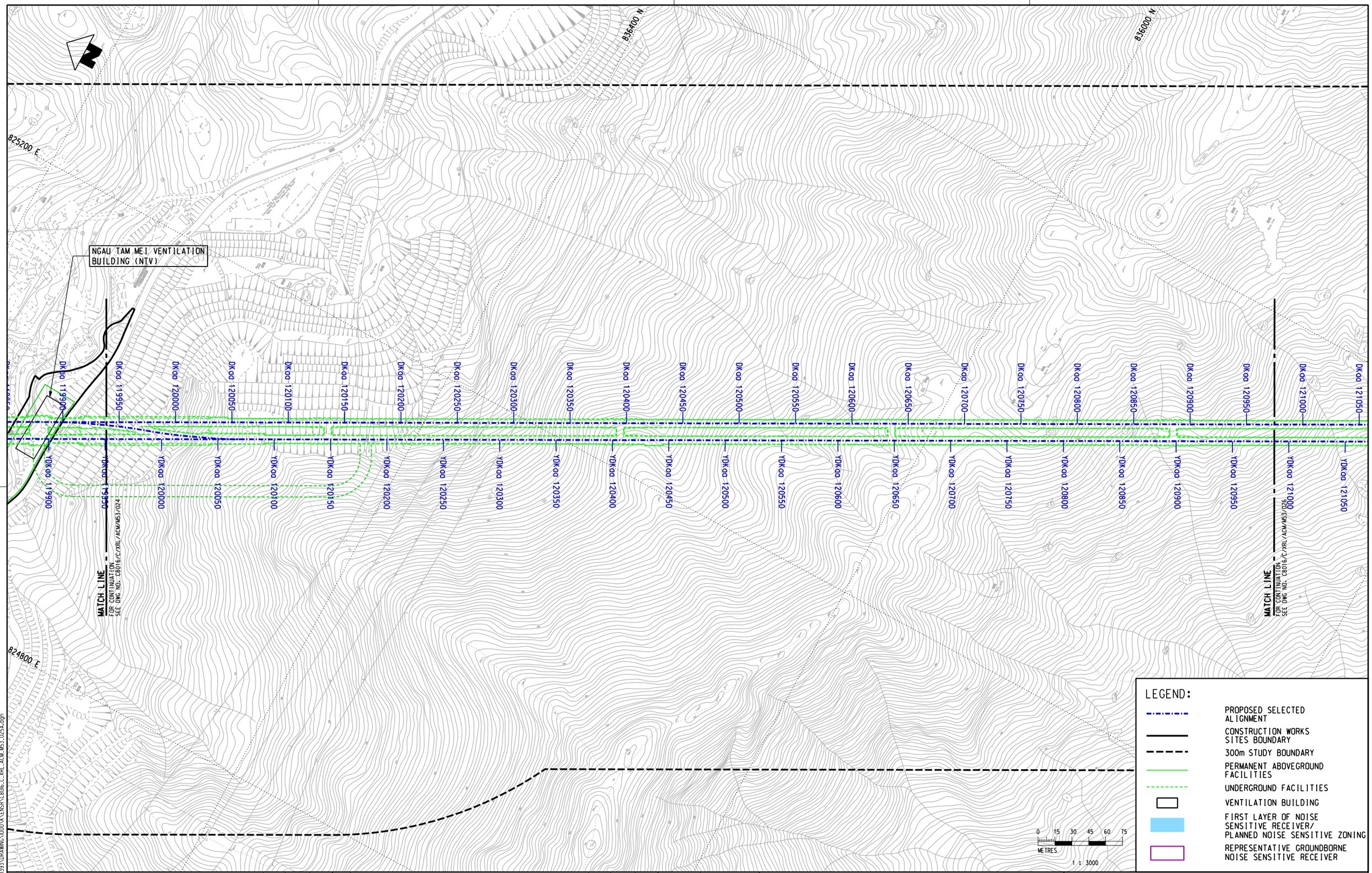
TITLE

C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/024

REV. A



LEGEND:

- PROPOSED SELECTED ALIGNMENT
- CONSTRUCTION WORKS SITES BOUNDARY
- 300m STUDY BOUNDARY
- PERMANENT ABOVEGROUND FACILITIES
- UNDERGROUND FACILITIES
- VENTILATION BUILDING
- FIRST LAYER OF NOISE SENSITIVE RECEIVER/ PLANNED NOISE SENSITIVE ZONING
- REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVER

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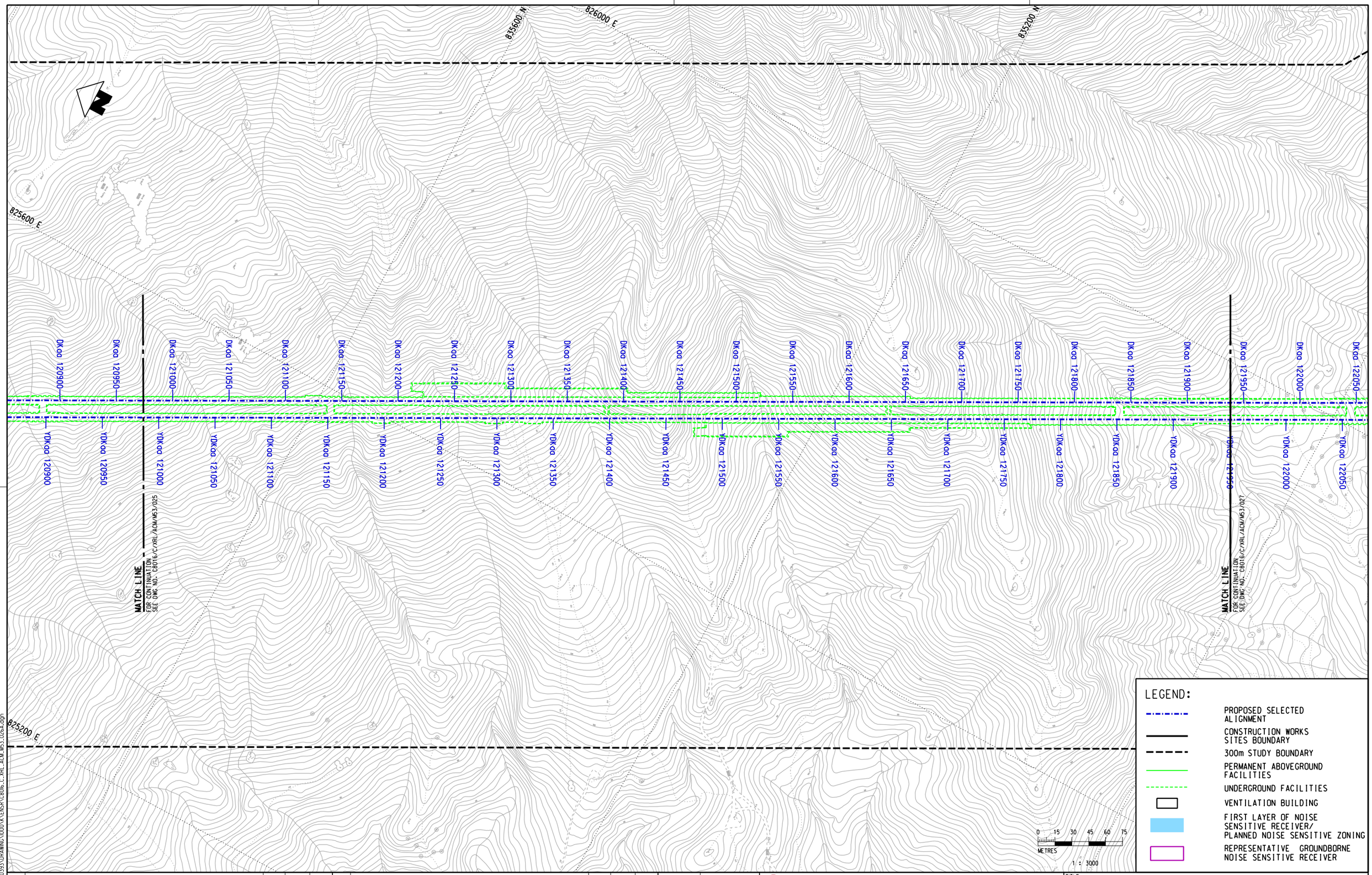
C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/025

REV. A



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- CONSTRUCTION WORKS SITES BOUNDARY
- 300m STUDY BOUNDARY
- PERMANENT ABOVEGROUND FACILITIES
- UNDERGROUND FACILITIES
- VENTILATION BUILDING
- FIRST LAYER OF NOISE SENSITIVE RECEIVER/ PLANNED NOISE SENSITIVE ZONING
- REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVER

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

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CHECKED	KCC
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DATE	19/AUG./2008

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C8016_C_XRL_ACM_M53_026A.dgn

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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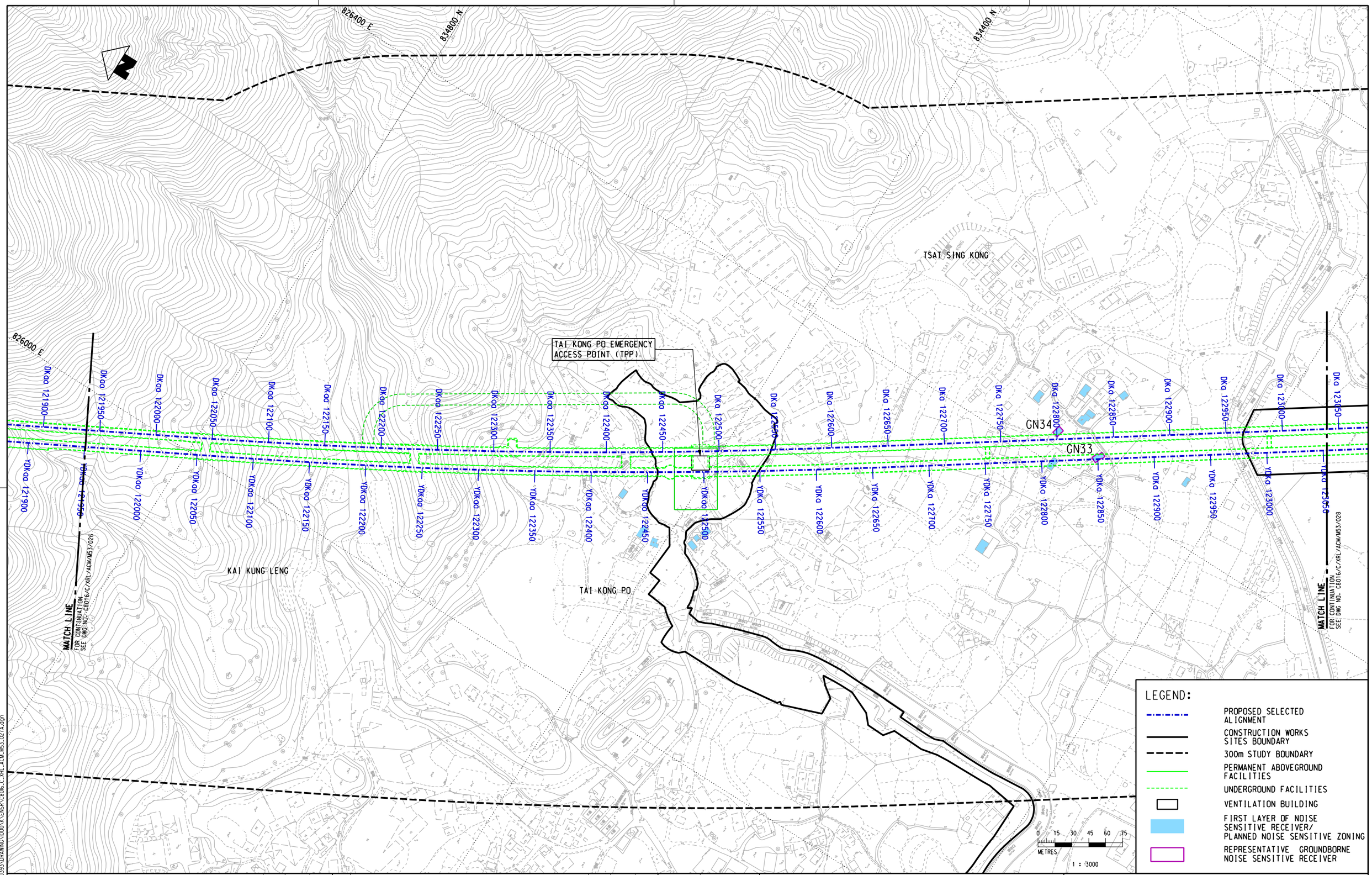

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C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/027

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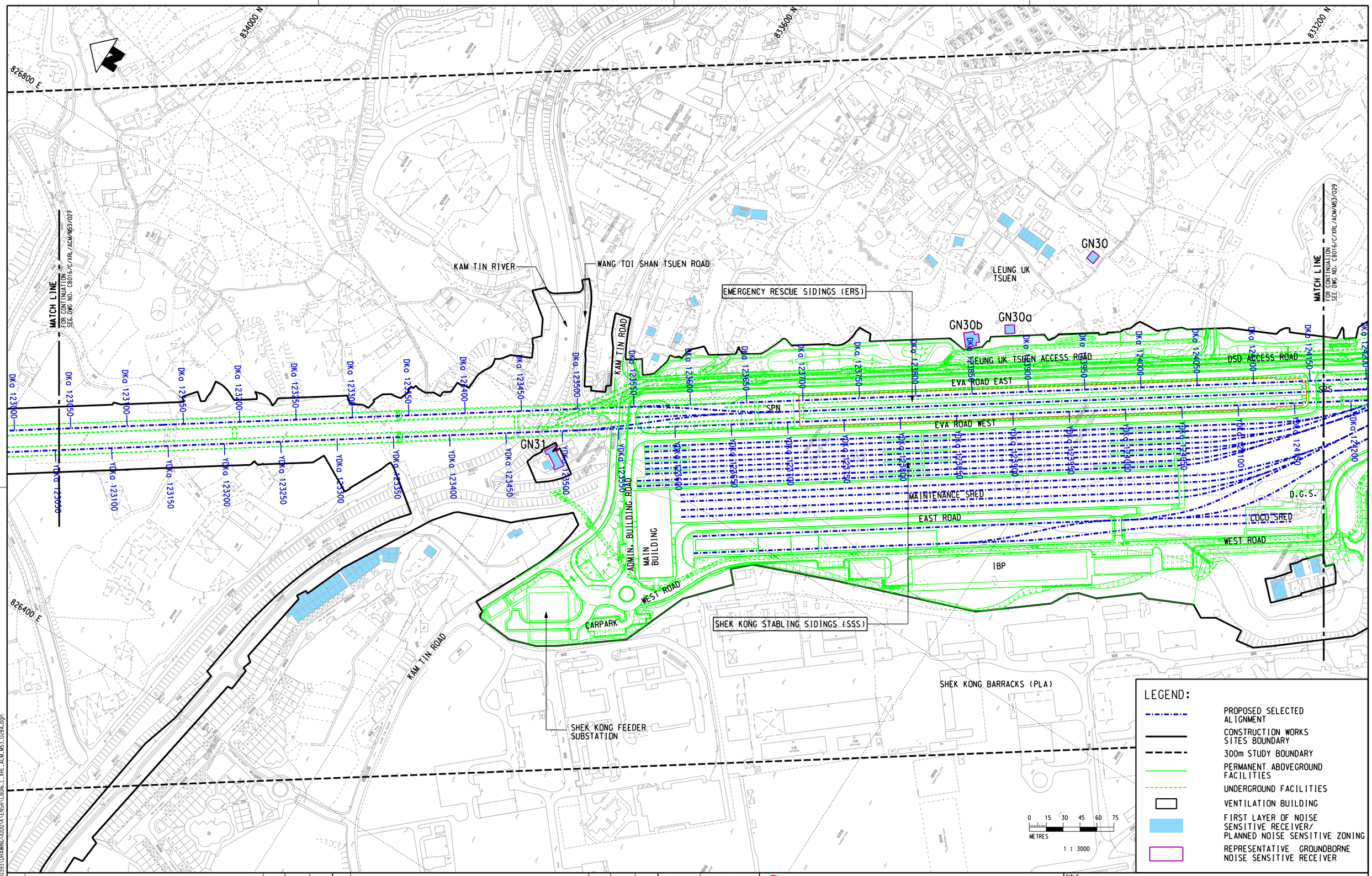

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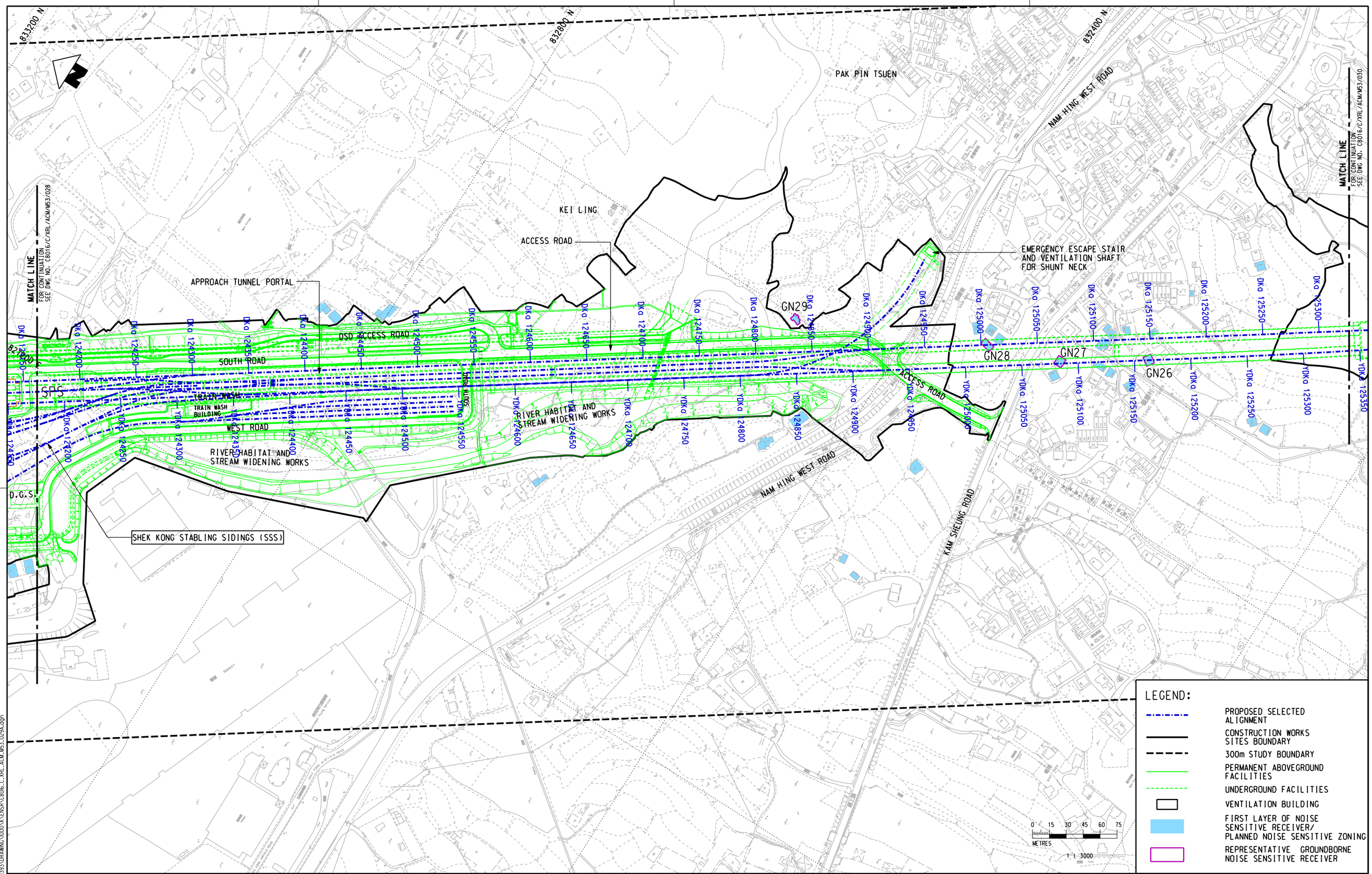
TITLE

C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE
GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/028

REV. A



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- PROPOSED SELECTED ALIGNMENT
- CONSTRUCTION WORKS SITES BOUNDARY
- 300m STUDY BOUNDARY
- PERMANENT ABOVEGROUND FACILITIES
- UNDERGROUND FACILITIES
- VENTILATION BUILDING
- FIRST LAYER OF NOISE SENSITIVE RECEIVER/ PLANNED NOISE SENSITIVE ZONING
- REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVER

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CADD REF. C8016_C_XRL_ACM_M53_029A.dgn

TITLE

C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
1 : 3000 (A3)	C8016/C/XRL/ACM/M53/029	A

MATCH LINE
FOR CONTINUATION
SEE DWG NO. C8016/C/XRL/ACM/M53/029

TSE UK TSUEN
CONSTRUCTION SHAFT (TUW)

TAI LING

PAT HEUNG VENTILATION
BUILDING (PHV)

827600 E
828000 E
828400 E
831600 N
831200 N

YDKB 125350
DKB 125350
YDKB 125400
DKB 125400
YDKB 125450
DKB 125450
YDKB 125500
DKB 125500
YDKB 125550
DKB 125550
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DKB 126000
YDKB 126050
DKB 126050

0 15 30 45 60 75
METRES
1 : 3000

LEGEND:

- PROPOSED SELECTED ALIGNMENT
- CONSTRUCTION WORKS SITES BOUNDARY
- 300m STUDY BOUNDARY
- PERMANENT ABOVEGROUND FACILITIES
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- REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVER

MATCH LINE
FOR CONTINUATION
SEE DWG NO. C8016/C/XRL/ACM/M53/031

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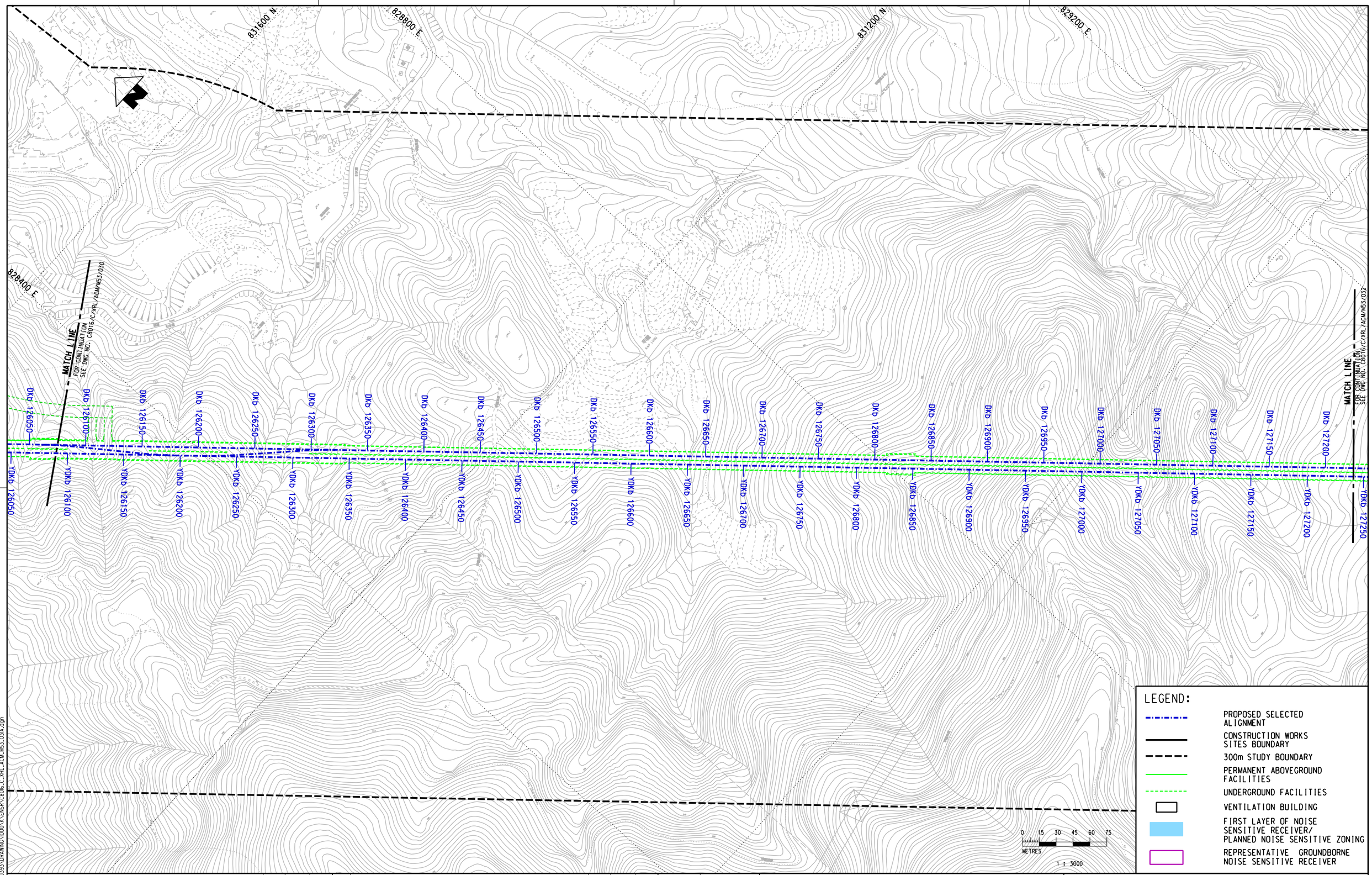
TITLE
C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE
GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)
FIGURE NO. C8016/C/XRL/ACM/M53/030
REV. A



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DATE	19/AUG./2008

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EXPRESS RAIL LINK

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TITLE

C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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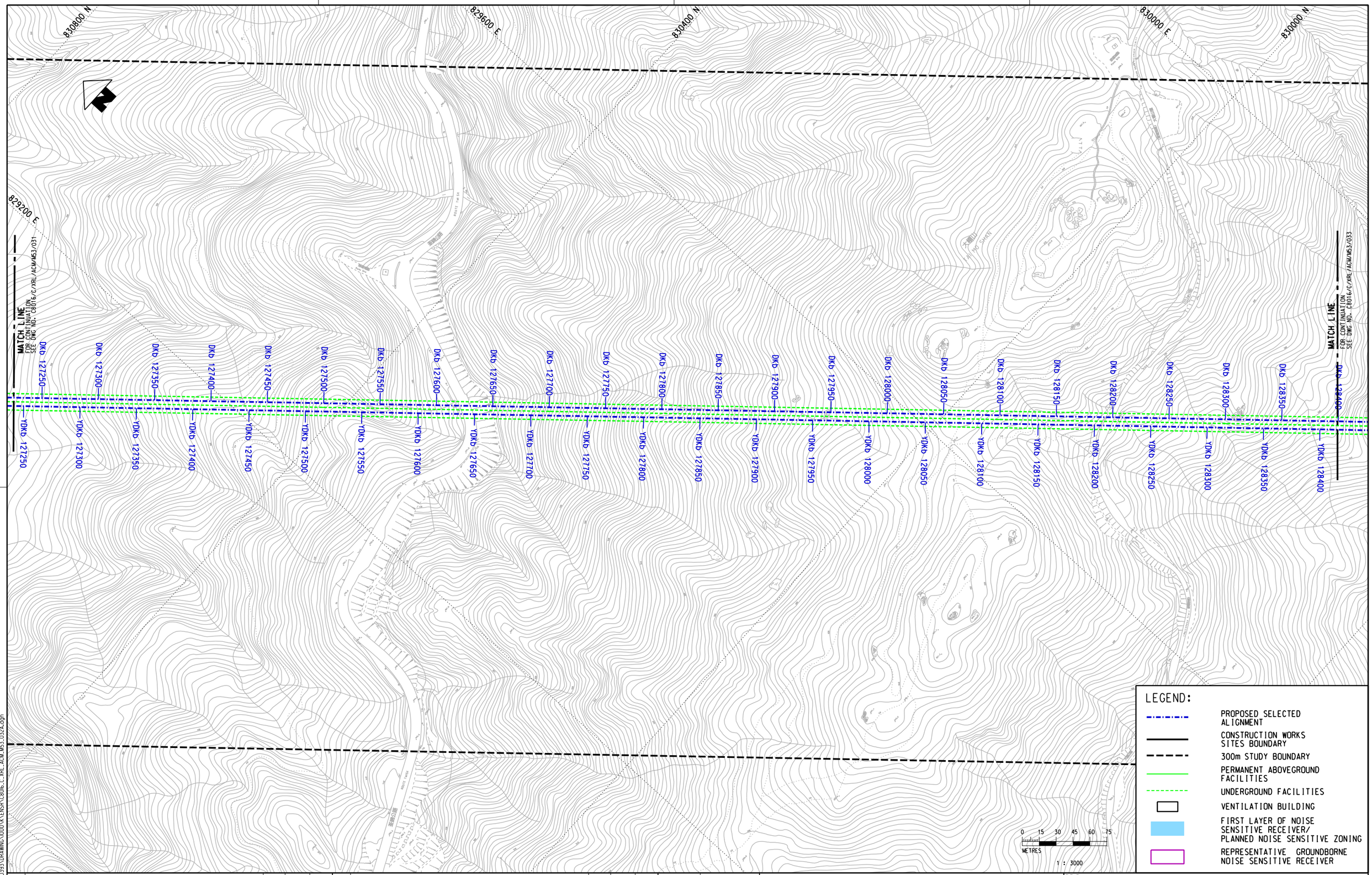

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

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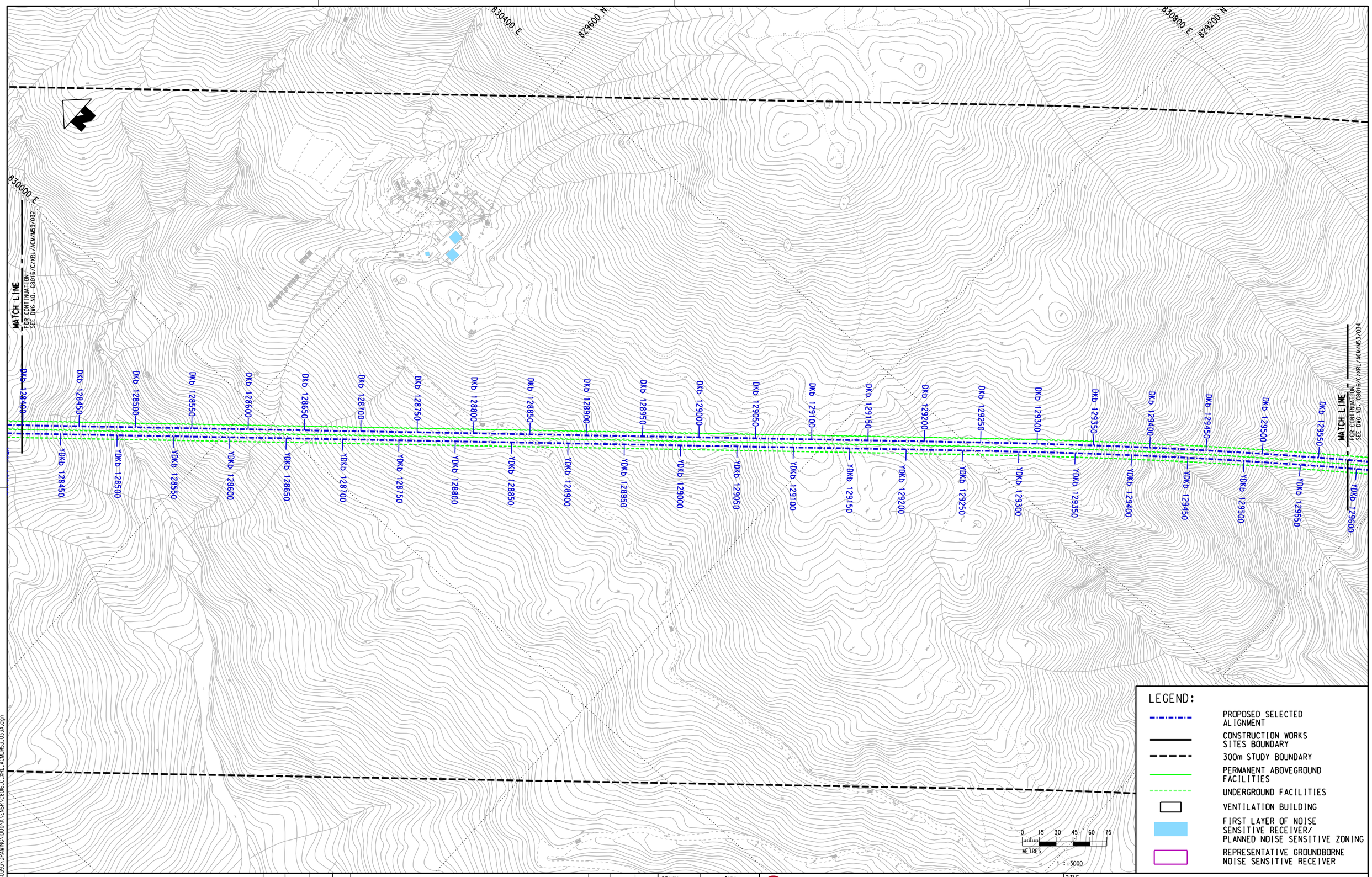

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- VENTILATION BUILDING
- FIRST LAYER OF NOISE SENSITIVE RECEIVER/ PLANNED NOISE SENSITIVE ZONING
- REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVER

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DESIGNED	TWF
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DATE	19/AUG./2008

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LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

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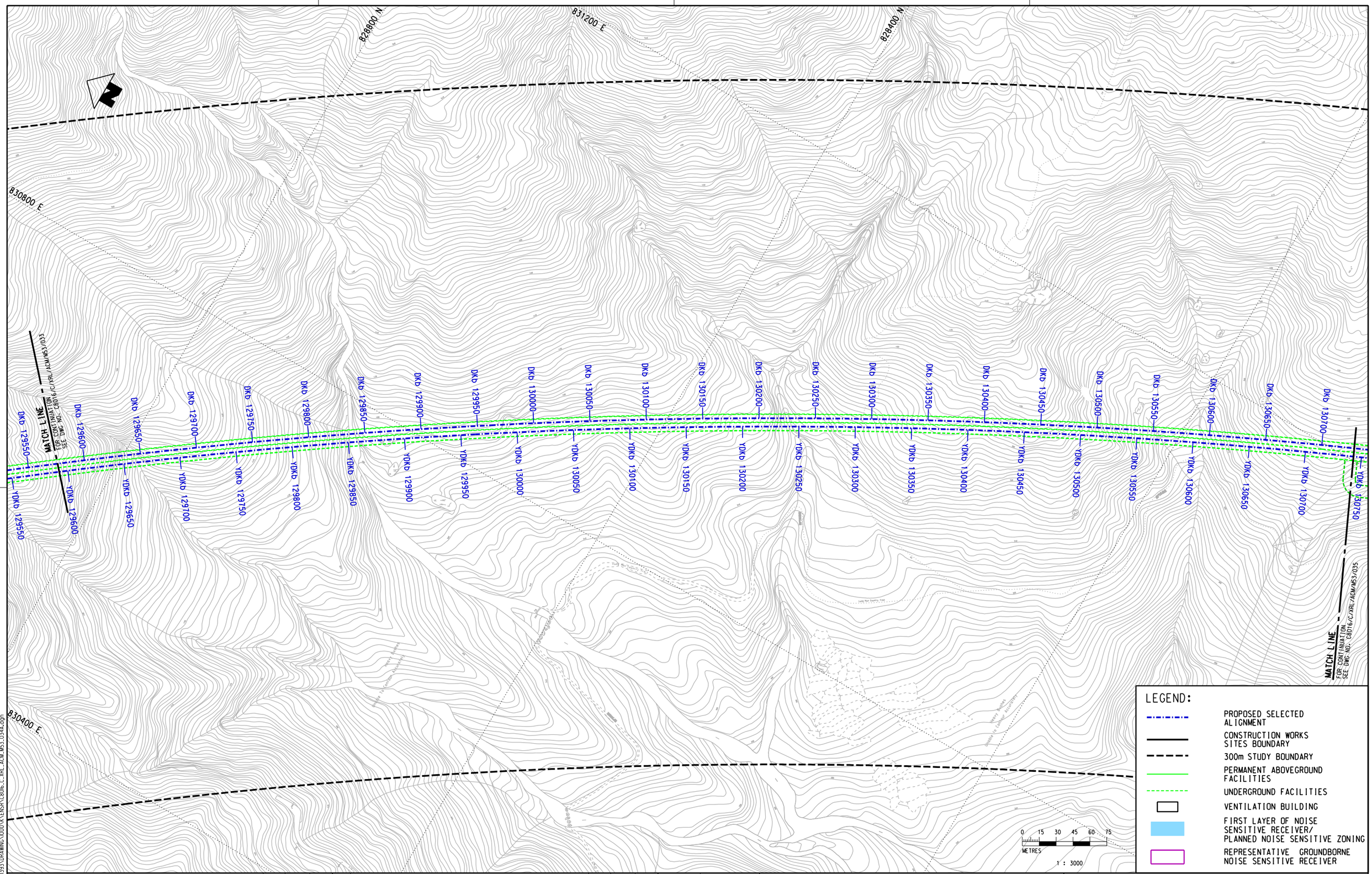

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LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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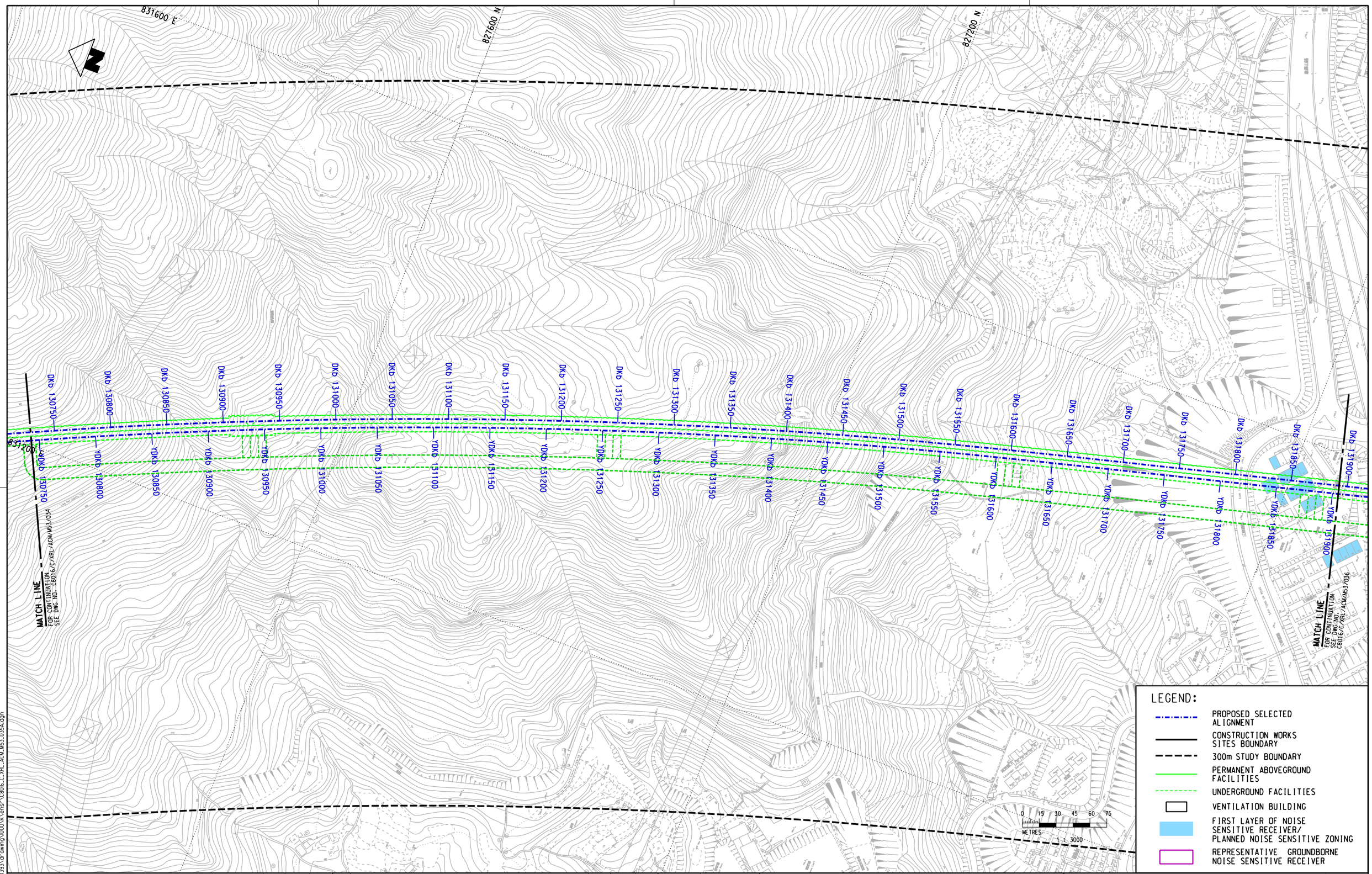

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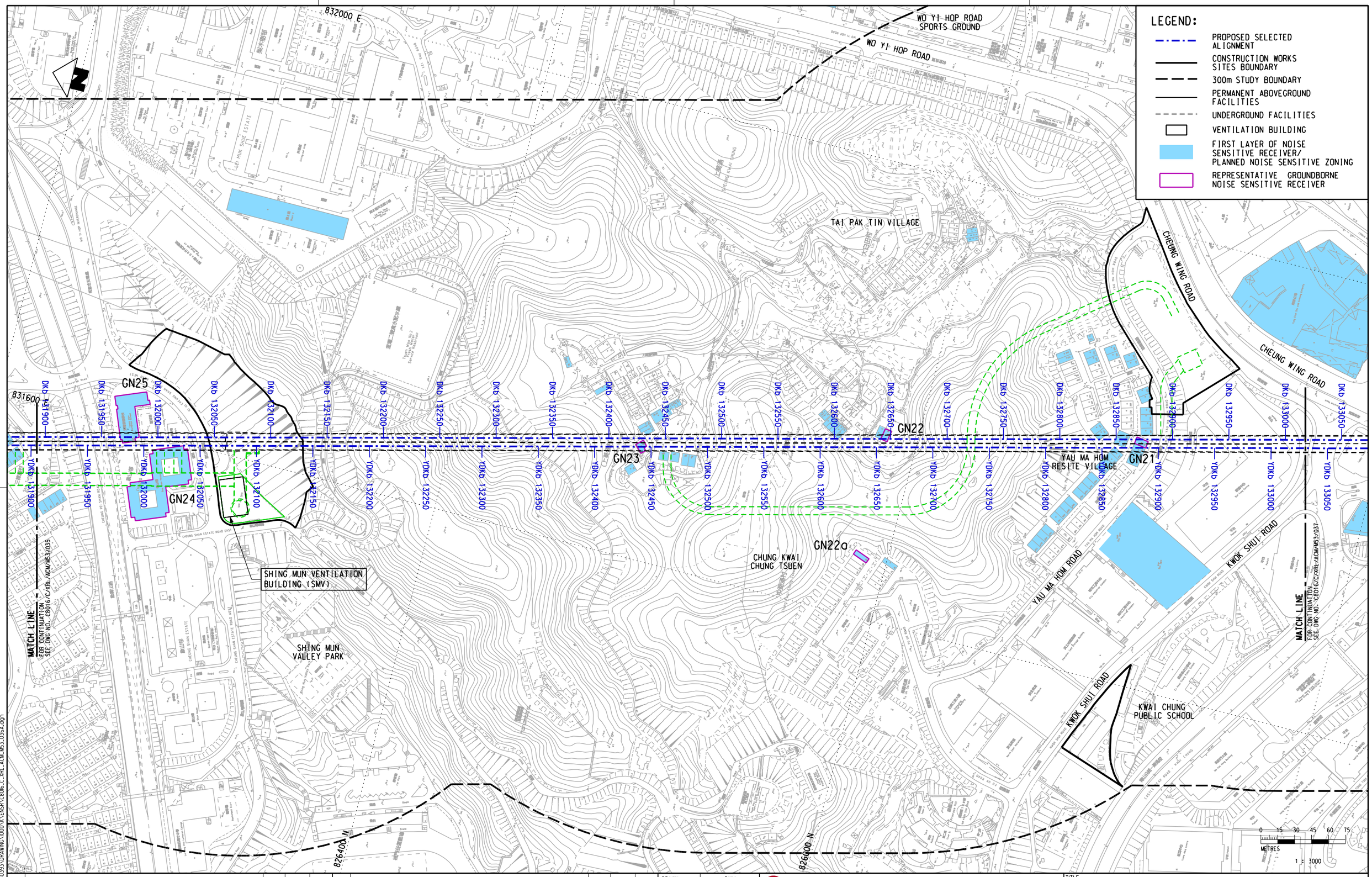
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE
GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/035

REV. A



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LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3) | FIGURE NO. C8016/C/XRL/ACM/M53/036 | REV. A

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ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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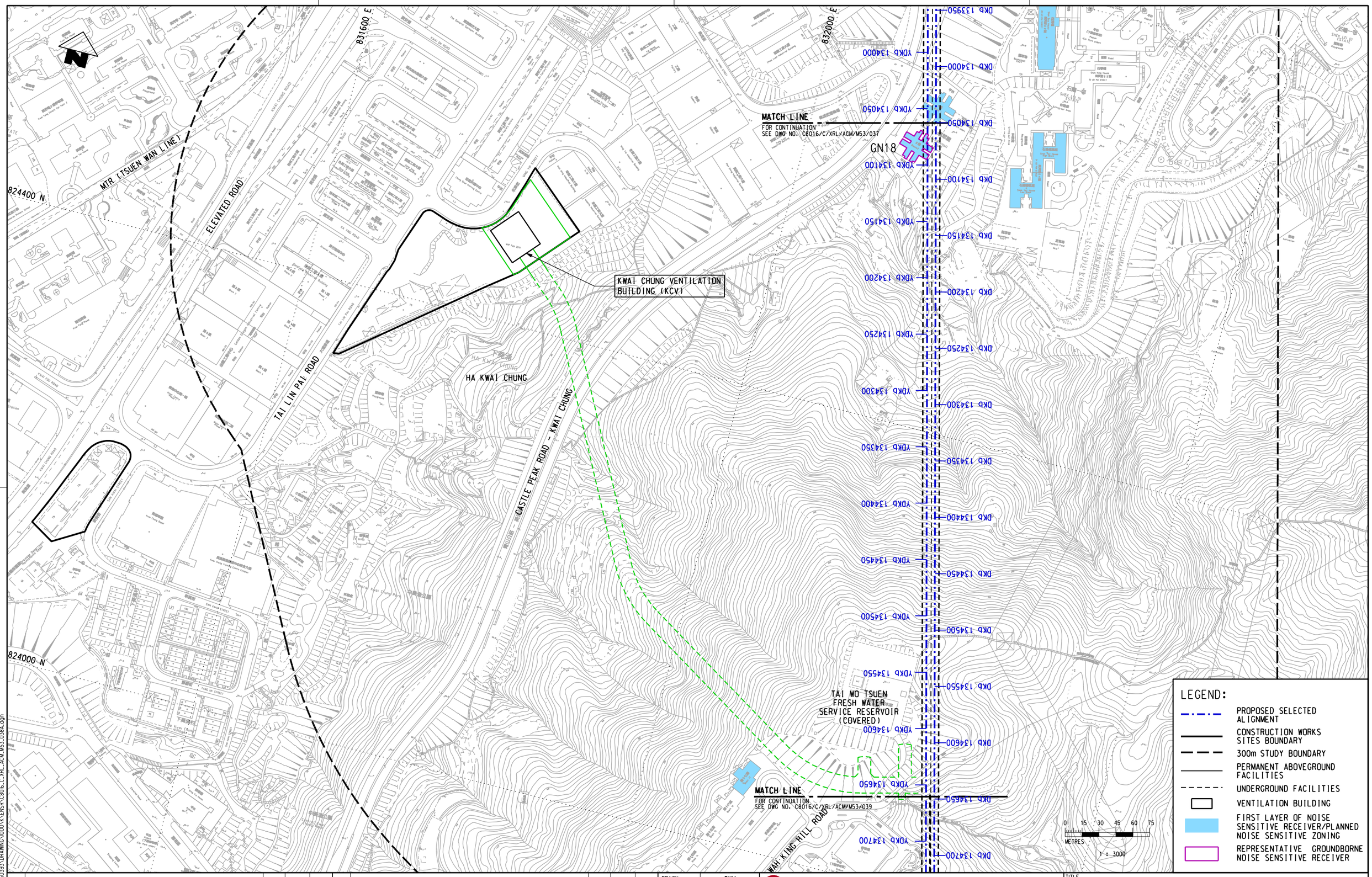

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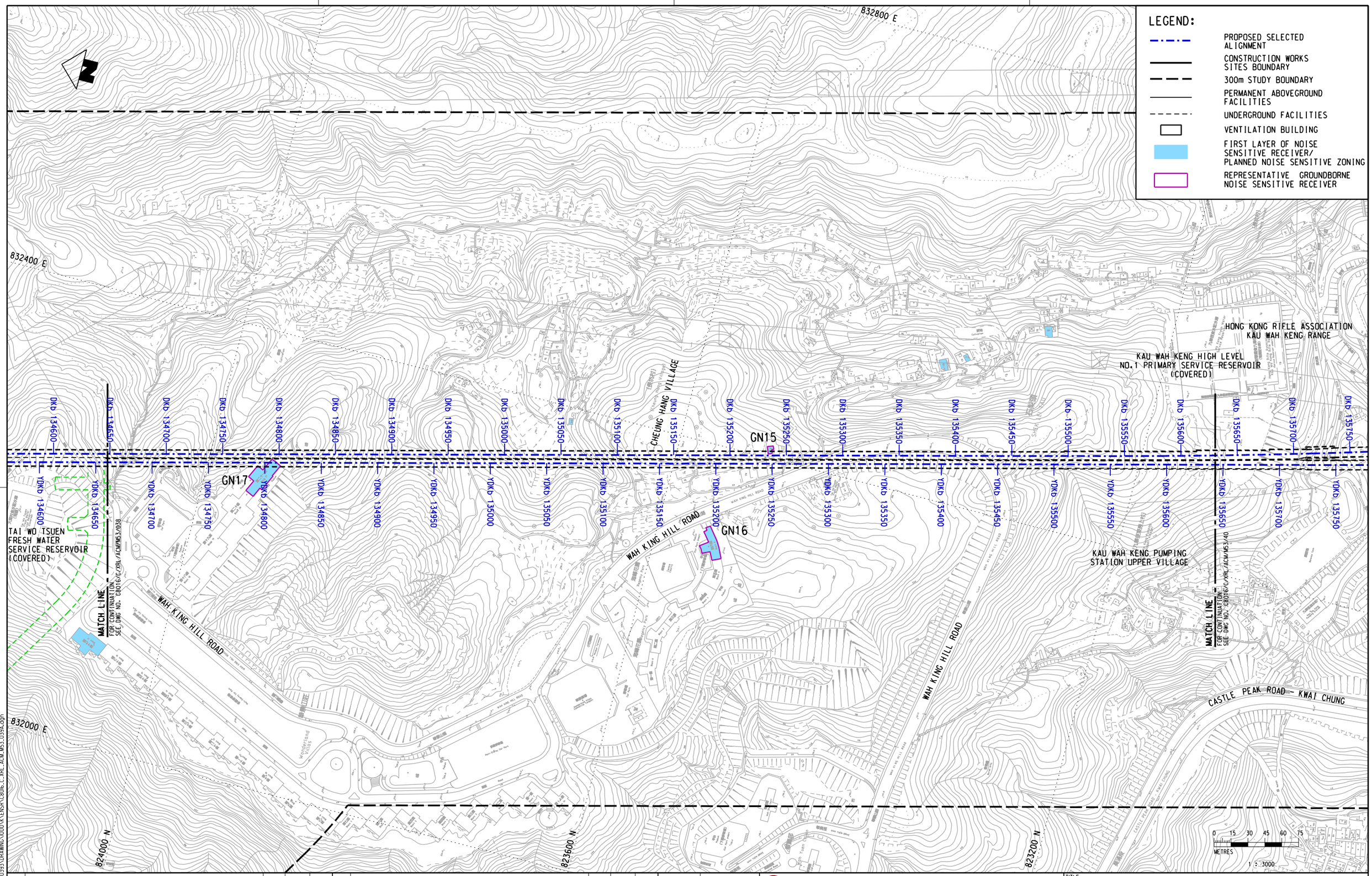
C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/038

REV. A



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C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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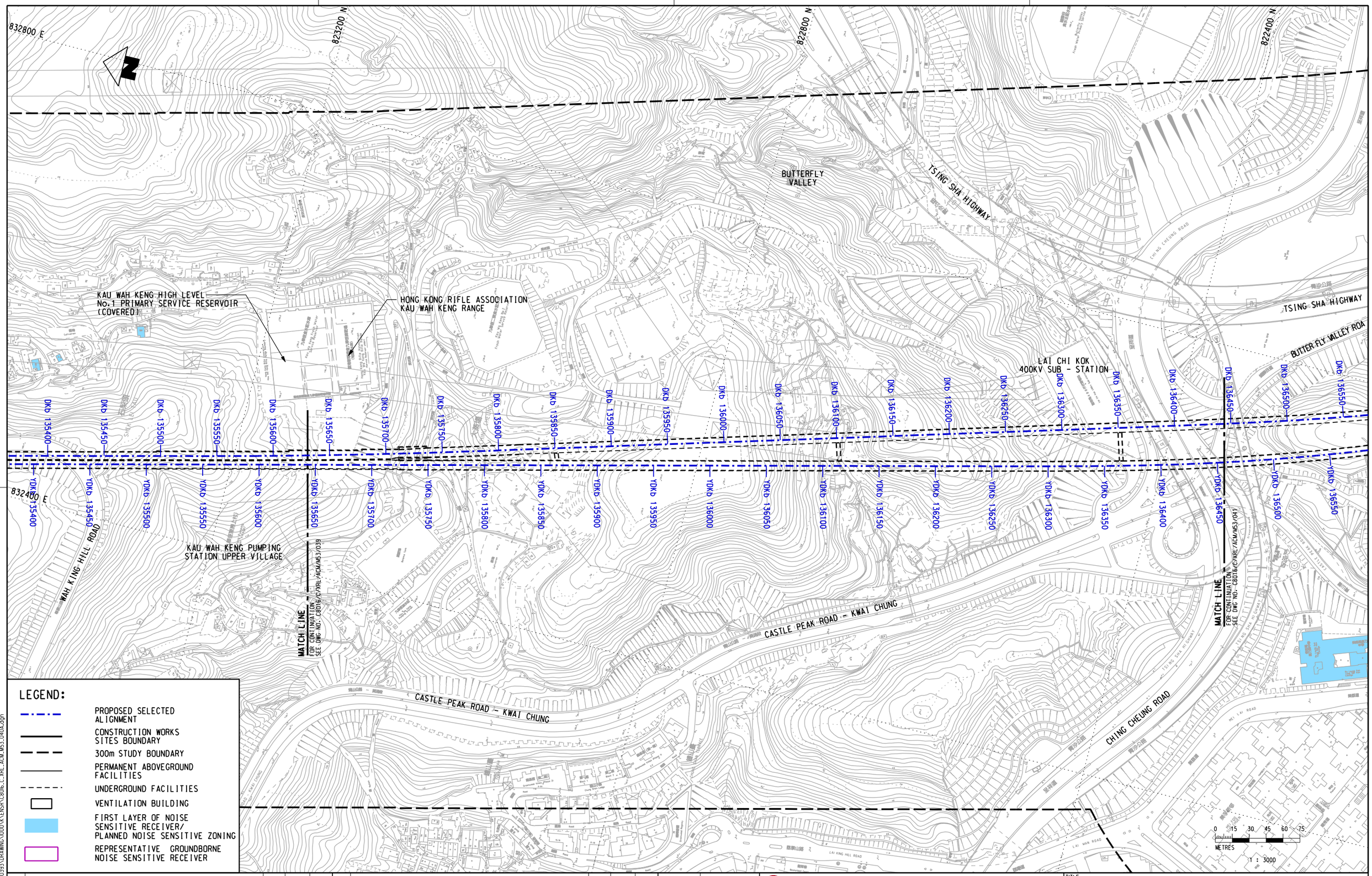

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/040

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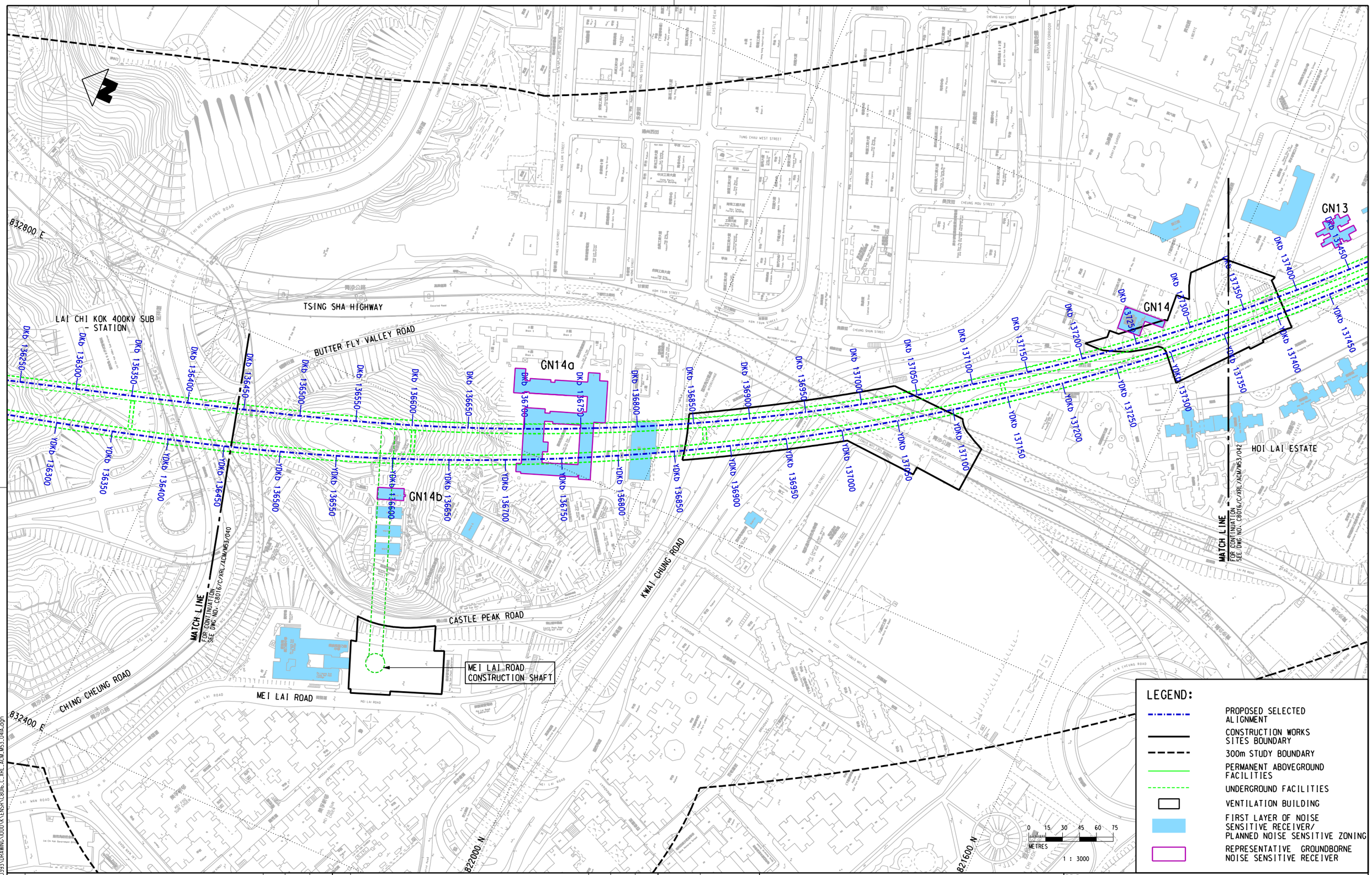

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/041

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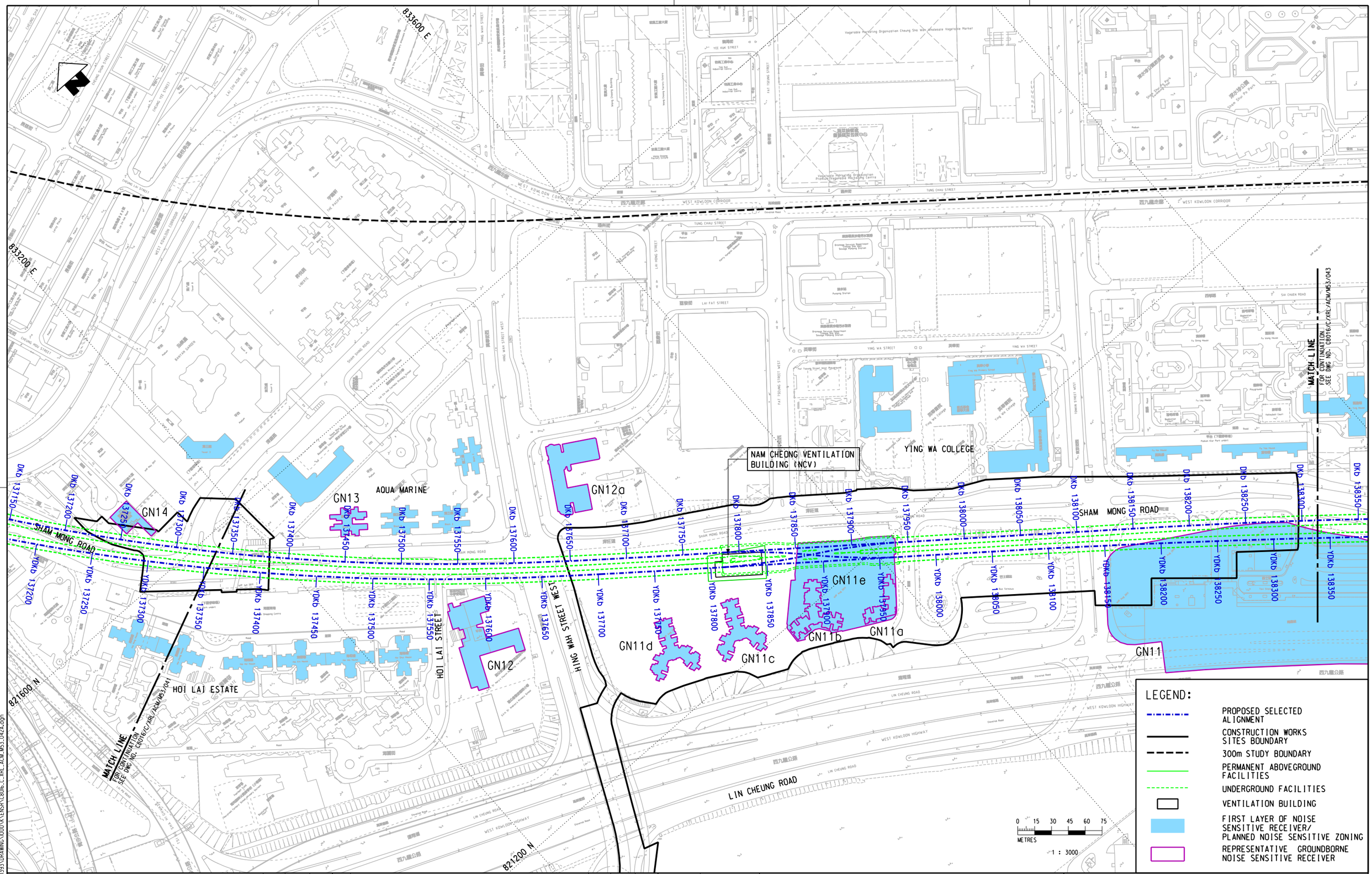

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C8016

ENVIRONMENTAL TERM CONSULTANCY FOR XRL

LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE	FIGURE NO.	REV.
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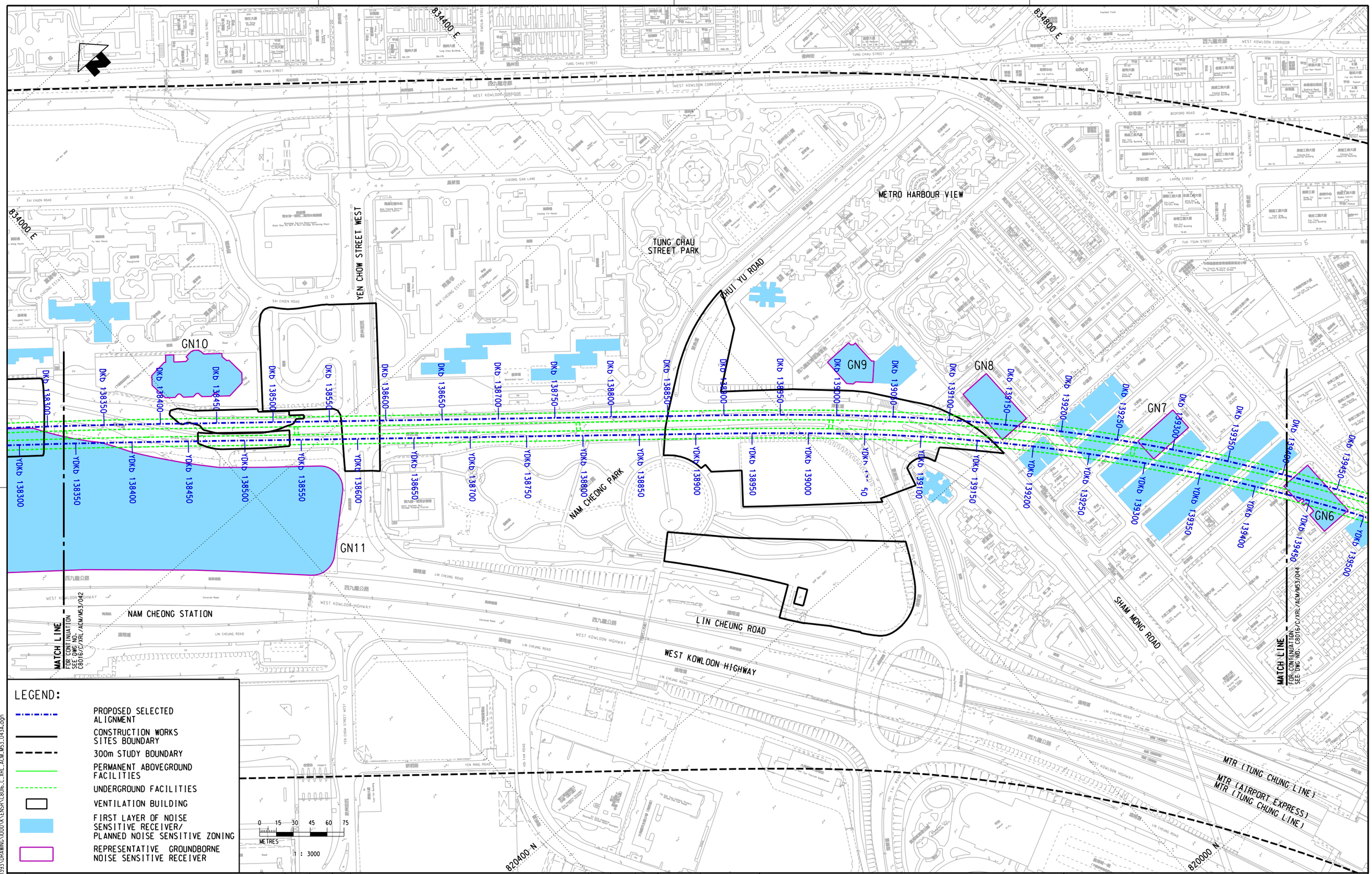

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/043

REV. A

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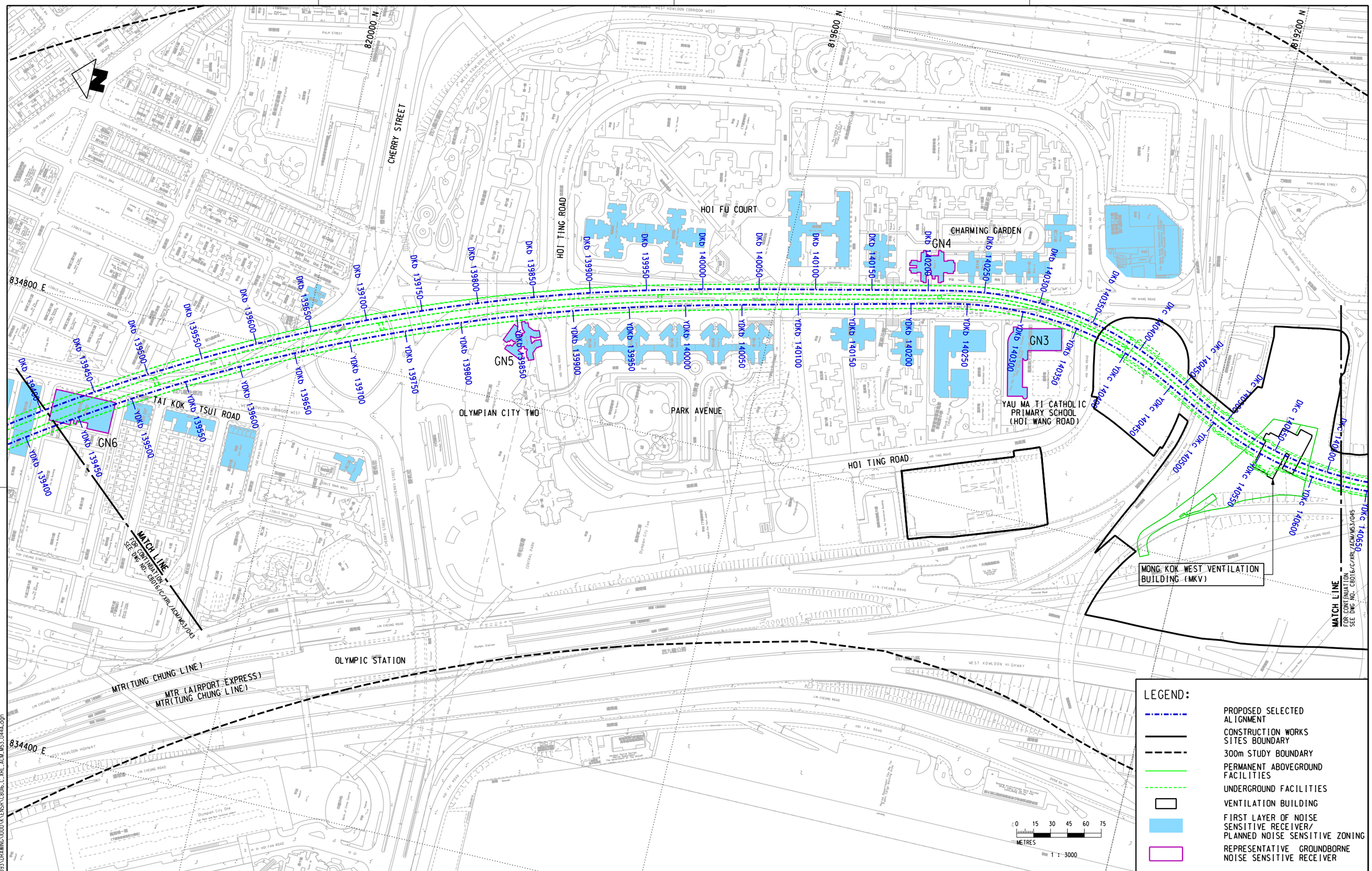

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ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/044

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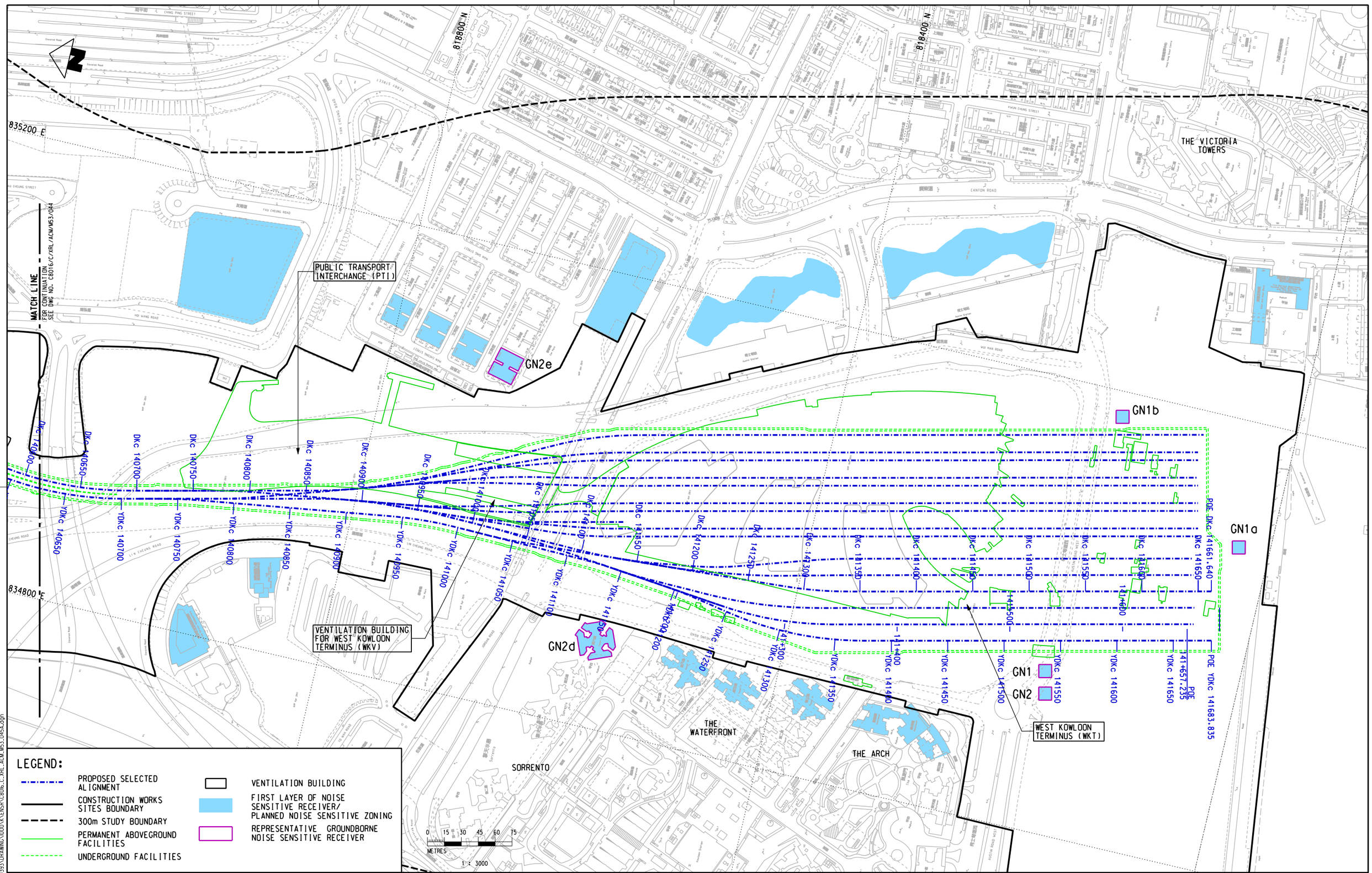

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C8016
ENVIRONMENTAL TERM CONSULTANCY FOR XRL
LOCATIONS OF REPRESENTATIVE
GROUNDBORNE NOISE SENSITIVE RECEIVERS

SCALE 1 : 3000 (A3)

FIGURE NO. C8016/C/XRL/ACM/M53/045

REV. A

APPENDIX 2.1A

FORCE DENSITY LEVEL MEASUREMENT AND PREDICTION REPORT (CRH 380B)

AECOM

MTR Corporation Limited

Consultancy Agreement No. C8016

Environmental Term Consultancy for Express Rail Link

Force Density Level Measurement and Prediction Report

December 2011

	Name	Signature
Prepared & Checked:	Angela Tong	
Reviewed & Approved:	Josh Lam	

Version:	B	Date:	15 December 2011

AECOM Asia Co. Ltd.
8/F, Grand Central Plaza, Tower 2, 138 Shatin Rural Committee Road, Shatin, NT, Hong Kong
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Executive Summary

Pursuant to EP Condition 2.24, the Permit Holder, MTR Corporation Ltd (MTR), conducted vibration and transfer mobility measurements in July 2011 to obtain the data for the prediction of Force Density Levels (FDL) of the China Railway High-Speed (CRH) trains.

The measurement section selected is an at-grade and tangent up track section adjoining Shiziyang Tunnel, which is the Guangzhou-Shenzhen section of Guangzhou-Shenzhen-Hong Kong Express Rail Link. The trackform at measurement section is CRTS-I non-ballast track, baseplate WJ-7B, with prestressed frame plate (PF). This type of baseplate is similar to, but not as stiff as, the baseplate proposed for Rheda. Rails were grinded a few days before the measurement and transverse marks from the grinding process were observed during inspection.

Measurements were conducted according to FDL Test Plan which specified the requirements and methodology of the vibration and transfer mobility measurements. Based on the measurement results, the FDL values were calculated at different speed. The FDL results obtained for the speed ranged from 160km/h to 270km/h show a typical increase in FDL with speed, except for at 160km/h where the accuracy of the 95th percentile vibration level was affected by only two train movements available for measurement.

The measured FDL values at 250km/h were used to compare with the FDL values (at 240km/h), which were referenced from Final Report of High-Speed Ground Transportation Noise and Vibration Impact Assessment (HMMH Report No. 293630-4), adopted in the EIA Report. The measured FDL result was found to be similar to, but lower at some frequencies than, the values adopted in the EIA Report. The measured FDL is expected to give similar ground-borne noise levels to those in the EIA, but possibly lower, subject to the findings of updated ground-borne noise assessment.

1 INTRODUCTION

1.1 Background

1.1.1 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 emergency rescue sidings.

1.1.2 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.

1.1.3 The EIA Report (Register No.: AEIA-143/2009) was approved on 28 September 2009 under the *Environmental Impact Assessment Ordinance (EIAO).* Following the approval of the EIA Report, an Environmental Permit (EP) was granted on 16 October 2009 (EP No: EP-349/2009) for the construction and operation of the Project. Variations of environmental permit (VEP) were subsequently applied and the latest Environmental Permit (EP No: EP-349/2009/C) was issued by Director of Environmental Protection (DEP) on 11 November 2011.

1.1.4 Pursuant to EP Condition 2.24, the Permit Holder, MTR Corporation Ltd (MTR), shall arrange testing of the Force Density Levels (FDL) of the trains for the Project as soon as possible, but in no case later than six months before the commencement of operation of the Project.

1.1.5 The train vibration and transfer mobility measurements at the XRL Mainland section was conducted by Chinese Academy of Railway Sciences (CARS) and was witnessed by MTR and AECOM Asia Co. Ltd.

1.1.6 AECOM Asia Co. Ltd has been commissioned by MTR to predict the FDL values, based on the vibration and transfer mobility measurement data provided by the CARS.

1.2 Purpose of This Report

1.2.1 This Report presents the FDL analysis based on the results of the vibration and transfer mobility measurements conducted at the XRL Mainland section for the verification of the FDL assumed in the EIA Report.

1.3 Report Structure

1.3.1 The remainder of the report is organized as follows:

- Section 2 presents the background information of the train vibration and transfer mobility Measurement.
- Section 3 presents the prediction of FDL and verification of FDL assumptions in the EIA study.
- Section 4 presents the conclusion of verification.

2 TRAIN VIBRATION AND TRANSFER MOBILITY MEASUREMENT

2.1 Background

2.1.1 A FDL Test Plan was prepared to specify the requirements and methodology of the vibration and transfer mobility measurement in order to obtain the data for the prediction of FDL. The Test Plan has been provided to CARS before commencement of the measurement.

2.1.2 The vibration and transfer mobility measurement commenced on 7 July and was completed on 9 July 2011. The FDL Test Measurement Report was prepared by CARS in Chinese and a summary of the measurement information is presented in the following sections.

2.2 Train Vibration and Transfer Mobility Measurement

Measurement Section

2.2.1 The vibration and transfer mobility measurement has been conducted at suitable testing location which is an at-grade section with trackforms similar to that proposed for the Project (i.e. Rheda) to obtain representative information for FDL determination.

2.2.2 The measurement section was selected in the Guangzhou-Shenzhen section of Guangzhou-Shenzhen-Hong Kong Express Rail Link. This section is a two-way passenger line with spacing of 5m between up and down tracks and maximum slope of 20%. Maximum design speed at this section is 350km/h.

2.2.3 Measurement section was selected at the at-grade and tangent up track section which adjoins Shiziyang Tunnel. There were no turnouts in the vicinity of the measurement locations in order to obtain data under normal operational situations. Given that there was a speed restriction for the rail section at Shiziyang Tunnel, the maximum design speed at the measurement location was 270kph.

Trackform at Measurement Section

2.2.4 Trackform at measurement section is CRTS-I non-ballast track, baseplate WJ-7B, with prestressed frame plate (PF). This type of baseplate is similar to, but not as stiff as, the baseplate proposed for Rheda, and thus a correction for stiffness has been made in the analysis (details refer to **Section 3.3.1**). Major component of frame type slab track includes rail, elastic splitting fastener, filling plate, rail plate, cement asphalt (CA) mortar adjustment layer, convex shift-resisting poles and concrete block base. Thickness of each component of frame type slab track is given in **Table 2.1**. Stiffness of base plate under elastic splitting fastener is 25kN/mm (± 5kN/mm). Measurement was conducted a few days after rail grinding and transverse marks from the grinding process were observed during inspection. Otherwise, the rails were smooth with no sign of corrugation.

Table 2.1 Thickness of Frame Type Slab Track Structure

Type	Rail (mm)	Fastener (mm)	Slab (mm)	CA Mortar (mm)	Concrete Base (mm)	Overall Track Structure (mm)
At-grade Non-ballast track	176	41	190	50	299	756

Information of High-speed Train Passby During Measurement

2.2.5 The China Railway High-Speed (CRH) trains running on the measurement section were CRH380B-002 high-speed electric multiple unit (EMU), comprising 8 subgroups (6M2T) with a total train length of 200m. This type of train had been running for the commissioning tests for about 6 months and the wheels had not been ground or replaced. During the measurement,

the train was unloaded, nonetheless, the loading/unloading condition would only have an insignificant effect on the dynamic load and on FDL.

Instrumentation

2.2.6 The vibration and transfer mobility measurement was conducted using the instruments as listed in **Table 2.2.**

Table 2.2 Instruments Used in the Measurement

Instrument	Manufacturer / Model No.	Purpose
Multi Channel Vibration Analyser	Bruel & Kjaer Model LANXI	Spectrum analyser for data acquisition
Accelerometer with compatible charge amplifier	Bruel & Kjaer Type 4370V	Vibration transducer to measure vibration levels
Large modal Hammer (peak force at least 60kN) or larger impact rig (peak force at least 200kN) with Force Transducer	Bruel & Kjaer Model 2304	For applying a known impact force at the test location
Charge to DeltaTron® Converters	Bruel & Kjaer Model 2647A	Pre-amplifier for LANXI
Accelerometer calibrator	Bruel & Kjaer Type 4294	For checking the calibration of the instrument
Train passage sensor	Motion detector	Magnetic sensor on rails to detect wheels and to trigger LANXI recording, and also to measure train speed

Measurement Procedures

2.2.7 The measurement was conducted according to the FDL Test Plan with the procedures summarised as below.

<u>Measurement of Train Vibration Levels</u>

2.2.8 Train vibration levels have been measured according to procedures provided below:

- The accelerometers were fixed into position with bees wax in preparation for measurement ensuring good coupling to the ground.
- The vibration analyser was set to fast weighting and one-third octave bands from 6.3Hz to 500Hz. The sampling rate was set to 10 samples per second. The calibrator was applied to set the system levels.
- The one third octave band vibration levels were recorded during the train movements (see **Table 2.3**) on the nearest track. During the vibration measurement, the train speed was also measured. Details of train type, train length, train speed and track form were recorded for each measurement.
- The recordings were later analysed by passing a window of length 2s along the signal to obtain the 5s sample with the highest energy average vibration level (Leq in dB re 10^{-9} m/s) for each train movement.
- The 90th percentile vibration levels (normally vibration levels from the train movement generating the highest vibration when fewer than ten movements) were determined in one third octave bands for the train at each speed.

Measurement of Transfer Mobility

2.2.9 Mobility measurement has been conducted according to the steps provided below:

- The accelerometer was set at the same locations as for measurement of train vibration levels. Mobility measurement was conducted in the absence of train movements.
- The measurement system was set up for fast Fourier transform (FFT) analysis, with a window length (typically 500-1000ms) and a sampling rate to give at least 1Hz resolution. A trigger was set up to allow 100ms pre-trigger. A transient window was set in the measurement system, suitable for FFT analysis.
- Using the modal hammer, an impact force was applied at a series of impact points, on the invert as close as practicable to under the nearest rail, and the level of impact force was measured with the spectrum analyser. The impact points were at 10m intervals along the track for a length representing half a train length (100m) for a total of 10 points. The modal hammer was operated in a way to give a single impulse, and a double bounce was avoided. The force energy spectrum (dB re 1 N) was measured using the force transducer on the modal hammer which was connected to the measurement system. Ten such impacts shall be applied at each point.
- The vibration energy spectrum (dB re 10^{-9} m/s) at the accelerometer location was recorded during each impact.
- Using the measurement system, the narrow band transfer mobility (point source response, PSR) was determined from each impact to the accelerometer location [dB re 10^{-9} (m/s)/N] by deducting the dB force energy spectrum from the dB vibration energy spectrum. The coherence and the logarithmic average of the PSR from each point were also determined.

Measurement Results

Train Vibration Measurement

2.2.10 Measurements were conducted in the absence of extraneous factors that could affect the results. A summary of train movement during the train vibration measurement is presented in **Table 2.3**.

Table 2.3 Details of Train Movements During Train Vibration Measurement

No.	Time	Track	Train Direction	Train Type	Actual Speed (km/h)	Passing Duration (s)
Measurement Date: 7 July 2011						
1	10:35	Up track	Down	CRH380B-002	174	4.14
2	11:38		Up		200	3.60
3	12:20		Down		200	3.60
4	13:15		Up		206	3.50
5	13:53		Down		219	3.29
6	14:40		Up		238	3.03
7	15:20		Down		160	4.50
8	17:35		Up		249	2.89
9	18:25		Down		250	2.88
10	19:10		Up		251	2.87
11	19:50		Down		259	2.78
Measurement Date: 8 July 2011						
1	8:42	Up track	Down	CRH380B-002	257	2.80

No.	Time	Track	Train Direction	Train Type	Actual Speed (km/h)	Passing Duration (s)
2	9:31		Up		270	2.67
3	10:10		Down		262	2.75
4	11:35		Down		267	2.70
5	12:20		Up		260	2.77
6	12:56		Down		265	2.72
7	13:50		Up		268	2.69
8	14:38		Down		270	2.67
9	15:15		Up		261	2.76
10	15:58		Down		260	2.77
11	16:38		Up		268	2.69
12	17:20		Down		264	2.73
13	18:08		Up		270	2.67

2.2.11 The measured 90th percentile vibration levels in 1/3 octave bands at different speeds are presented in **Appendix A**.

Transfer Mobility Measurement

2.2.12 The PSR was determined for a number of distances along with the coherence of the measurements. The coherence indicates the effect of background vibration (if any) during the measurements. The PSR values are shown in **Appendix B.** Even though the coherence shows that the PSR values, and hence the LSR values discussed later, are affected by background noise levels in the low frequencies, this is not expected to affect the prediction of ground-borne noise levels from this information. A-weighted ground-borne noise mostly results from the mid and high frequency vibration.

2.2.13 Using the PSR results, the line source transfer mobility (or line source response, LSR) for the train was determined by numerical integration. These are shown in **Appendix C**.

3 PREDICTION AND VERIFICATION OF FORCE DENSITY LEVEL

3.1 Prediction Methodology

3.1.1 The LSR is a measure of the conversion from FDL on the track to the vibration level at the test location. The FDL could be obtained when the vibration level and the LSR are known by using the following formula:

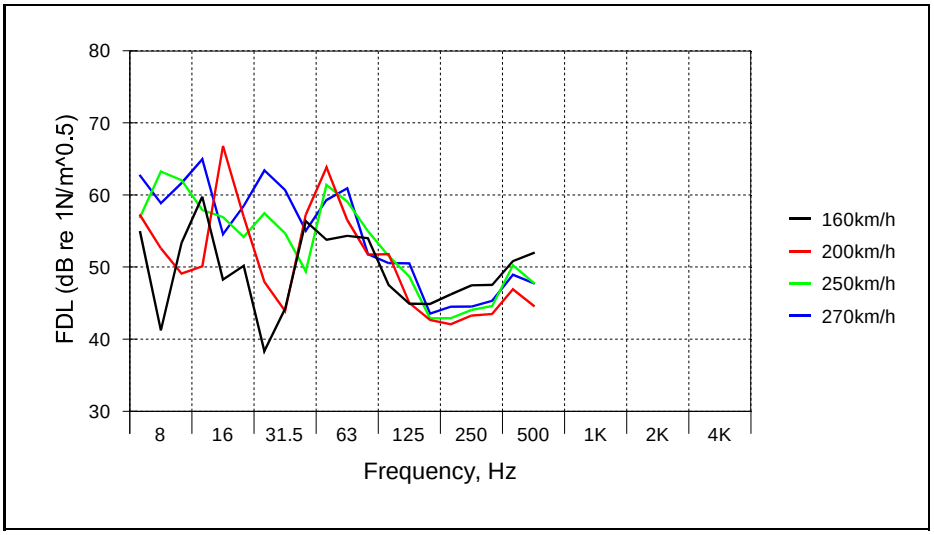
$$FDL = V + LSR$$

Where
FDL = force density level of train;
V = vibration level at test location; and
LSR = line source response to test location

3.2 Predicted FDL

3.2.1 The FDL determined for the CRH train is shown in **Drawing 3-1**. These results show a typical increase of FDL with speed (above and below 50-100Hz), except for at 160km/h where the accuracy of the 95th percentile vibration level was affected by the small sample of two train movements.

Drawing 3-1 Measured FDL Values

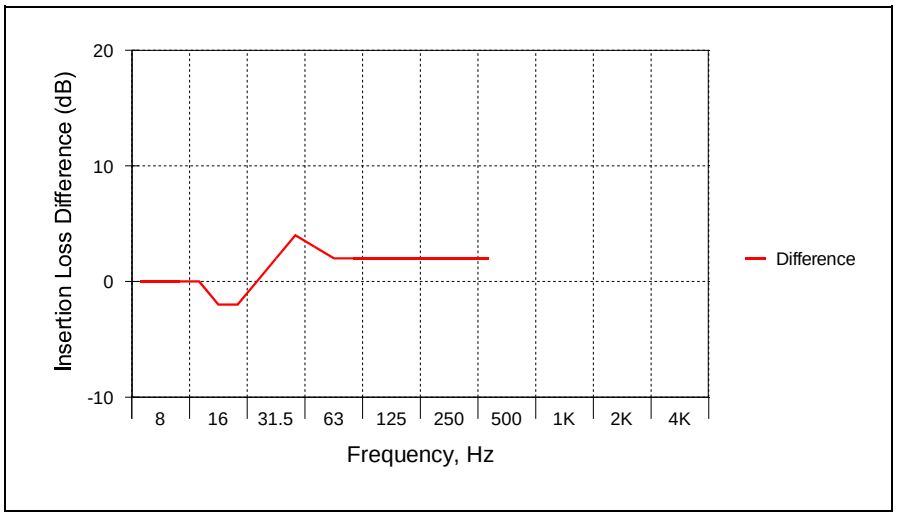


3.3 Verification of FDL

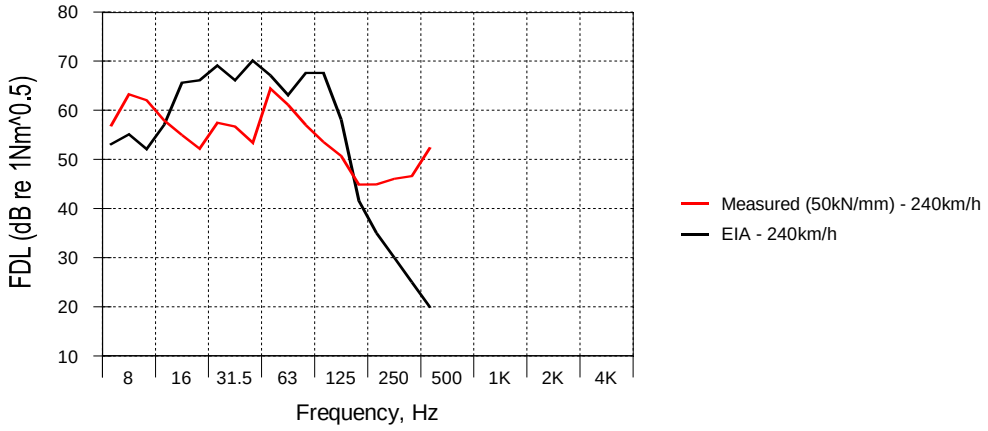
3.3.1 The FDL values determined by the measurement process are compared with the values adopted in the EIA Report. The EIA value was taken as the highest level in any one-third octave band from the levels given in the High-Speed Ground Transportation Noise and Vibration Impact[1] (FRA High-Speed Guidance Manual) for four typical high speed trains. The EIA value was for a speed of 240km/h and for a track fastener stiffness of 50kN/mm. The measured FDL values at 250km/h were compared with the EIA level (240km/h) because the difference in FDL between these two speeds is insignificant. A small adjustment to convert the measured level from 25N/mm to 50kN/mm was applied for direct comparison. This was based on the difference in insertion loss between a baseplate of 25kN/mm stiffness and the proposed fastner of 50kN/mm stiffness, both of which had previously been measured with the insertion loss difference shown in **Drawing 3-2**. The comparison between the EIA adopted and measured FDL values is then shown in **Drawing 3-3**.

[1] Final Report of High-Speed Ground Transportation Noise and Vibration Impact Assessment, HMMH Report No. 293630-4

Drawing 3-2 Insertion Loss Difference between 25kN/mm and 50kN/mm Fasteners



Drawing 3-3 Comparison of EIA and Measured FDL Values (240km/h and 50kN/mm)



3.3.2 The comparison indicates that the measured levels are very similar to, but lower than at some frequencies, those assumed in the EIA.

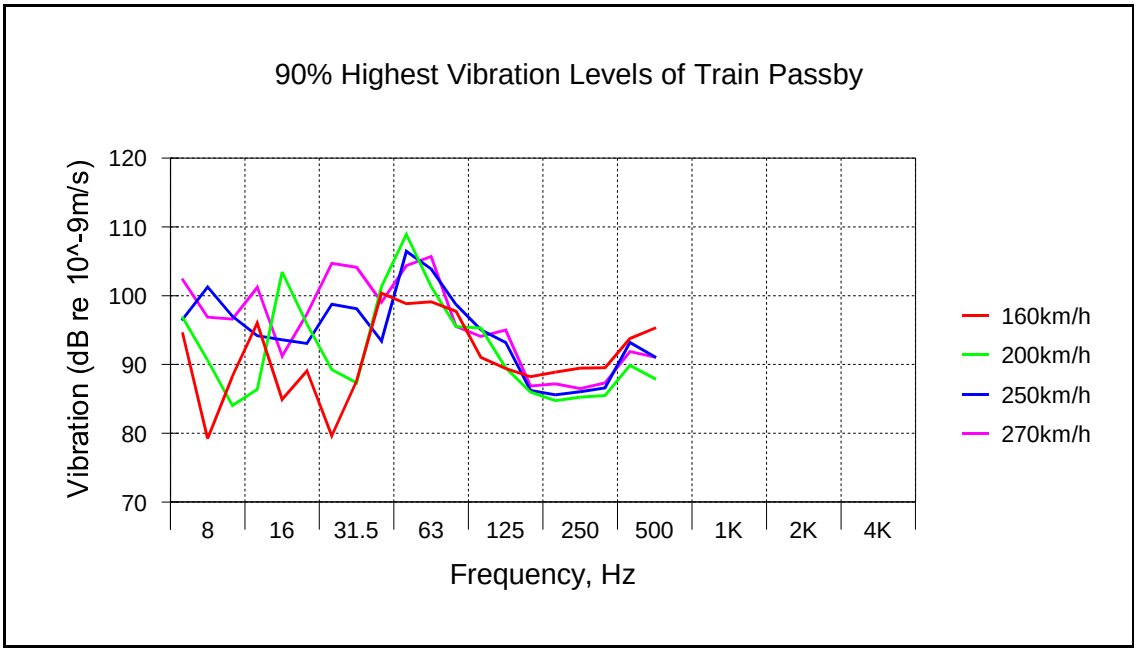
4 CONCLUSION

4.1.1 Measurements have been carried out to determine the force density level (FDL) generated by the high speed train proposed to be operated on the Express Rail Link (CRH). The tests involved the measurement of the vibration levels generated by train movements and the line source response at the test site. Based on the measurement results, the FDL was calculated.

4.1.2 The FDL result obtained was found to be similar to, but lower at some frequencies than, the values adopted in the EIA Report, as shown in **Figure 3.2** above. The use of the measured FDL is expected to give similar ground-borne noise levels to those in the EIA, but possibly lower, subject to the findings of updated ground-borne noise assessment.

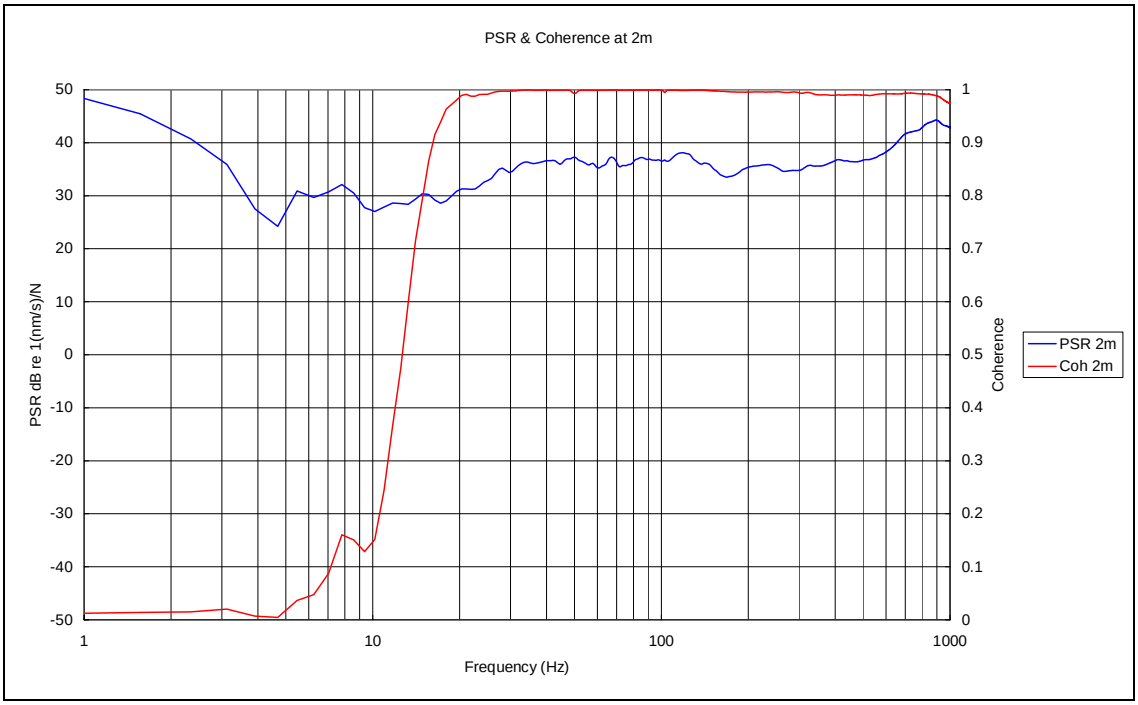
APPENDIX A

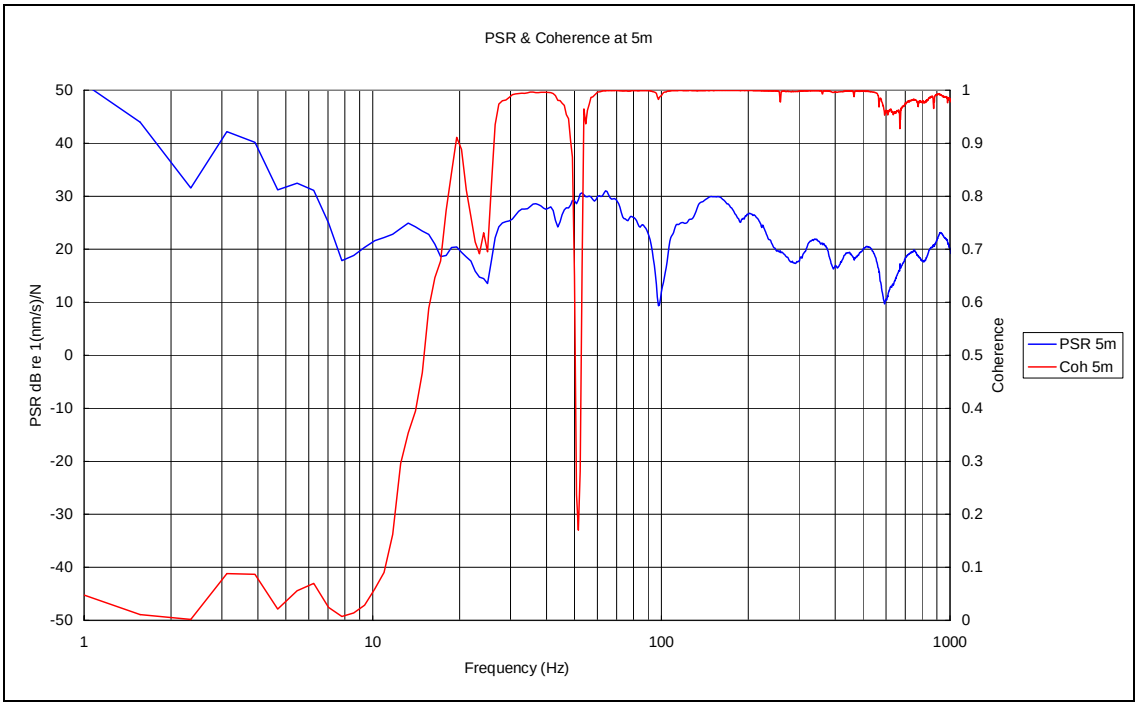
Measured Vibration Levels on 1/3 Octave Band Spectrum

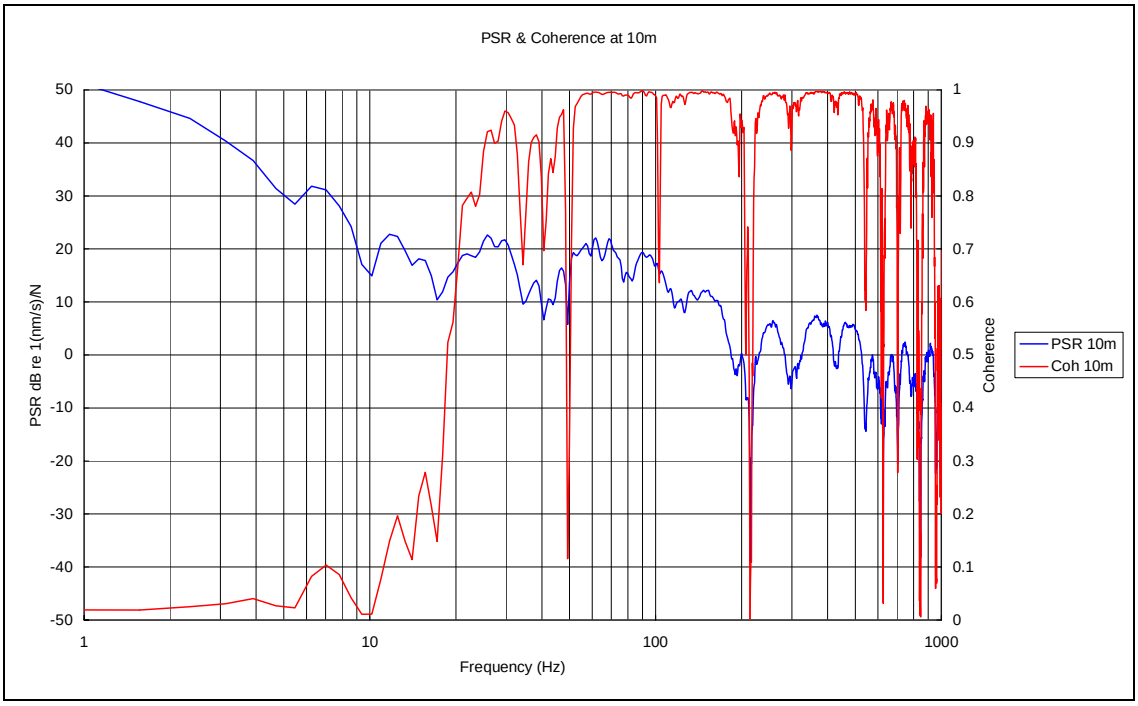

90% Highest Vibration Levels of Train Passby
Vibration (dB re 10^-9m/s)
120
110
100
90
80
70
8
16
31.5
63
125
250
500
1K
2K
4K
Frequency, Hz
160km/h
200km/h
250km/h
270km/h

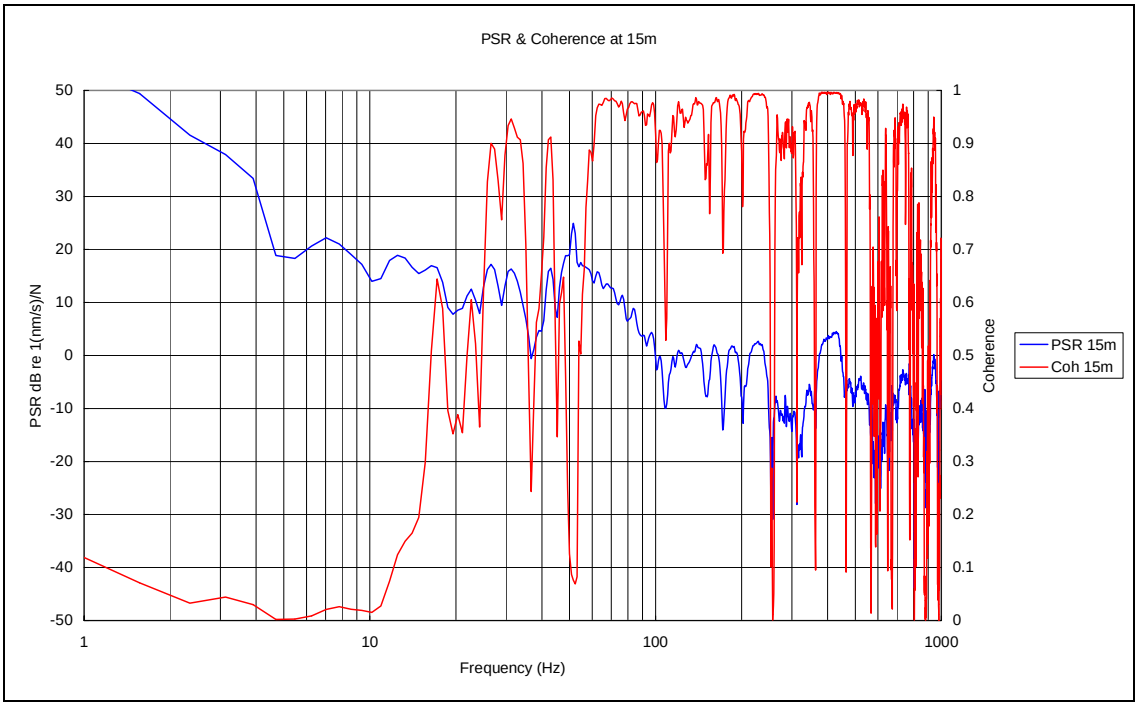
APPENDIX B

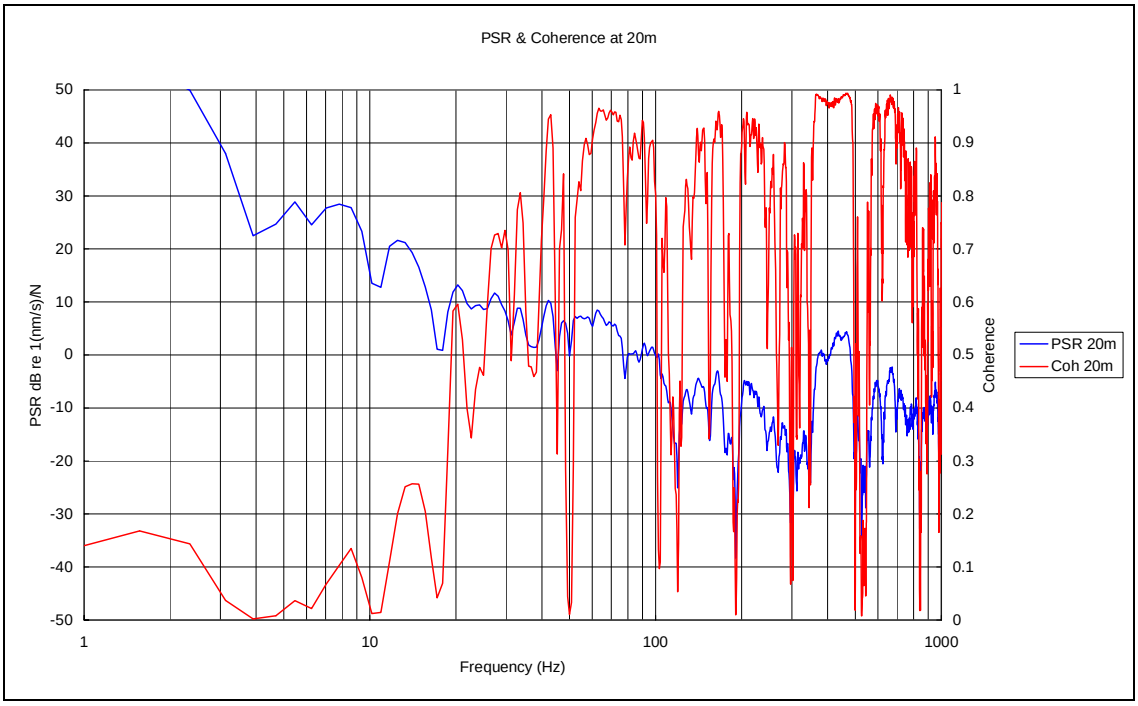
Graphical Presentation of Transfer Mobility Data

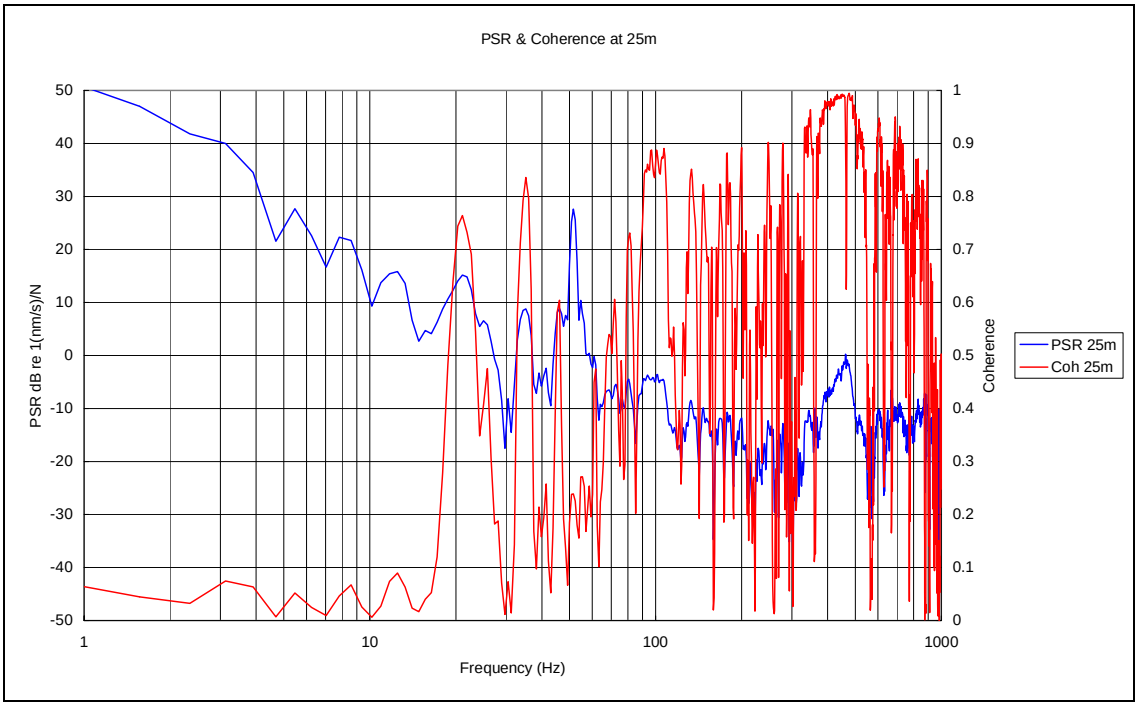

PSR & Coherence at 2m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 2m
Coh 2m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

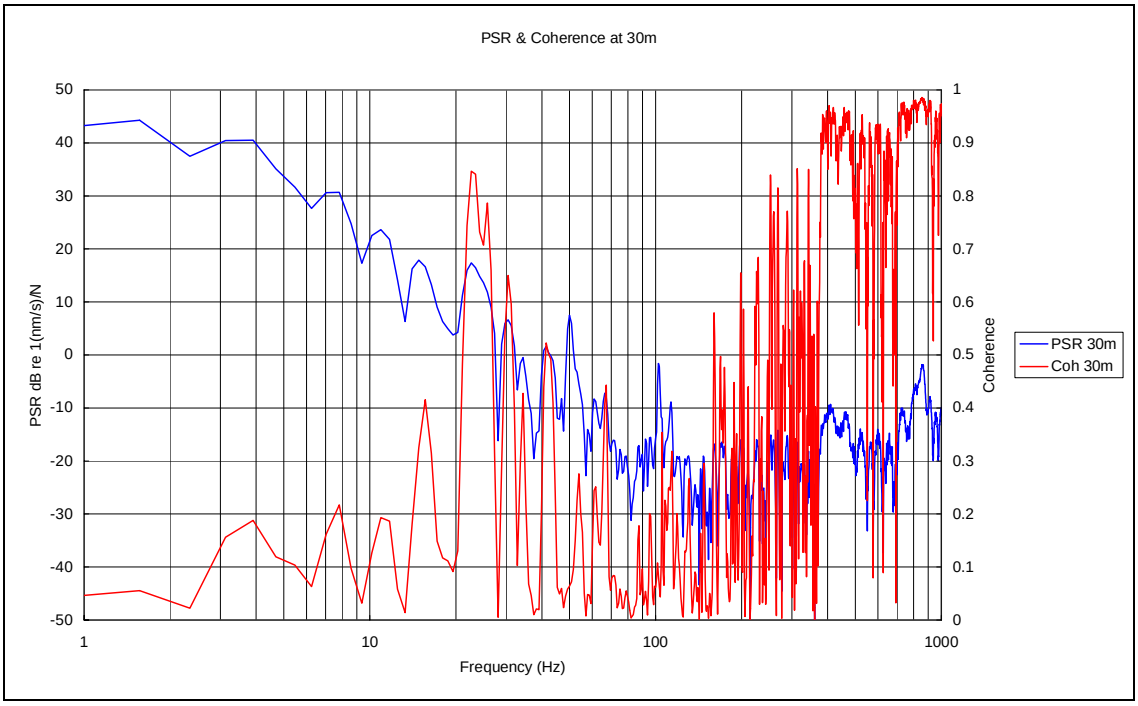

PSR & Coherence at 5m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 5m
Coh 5m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

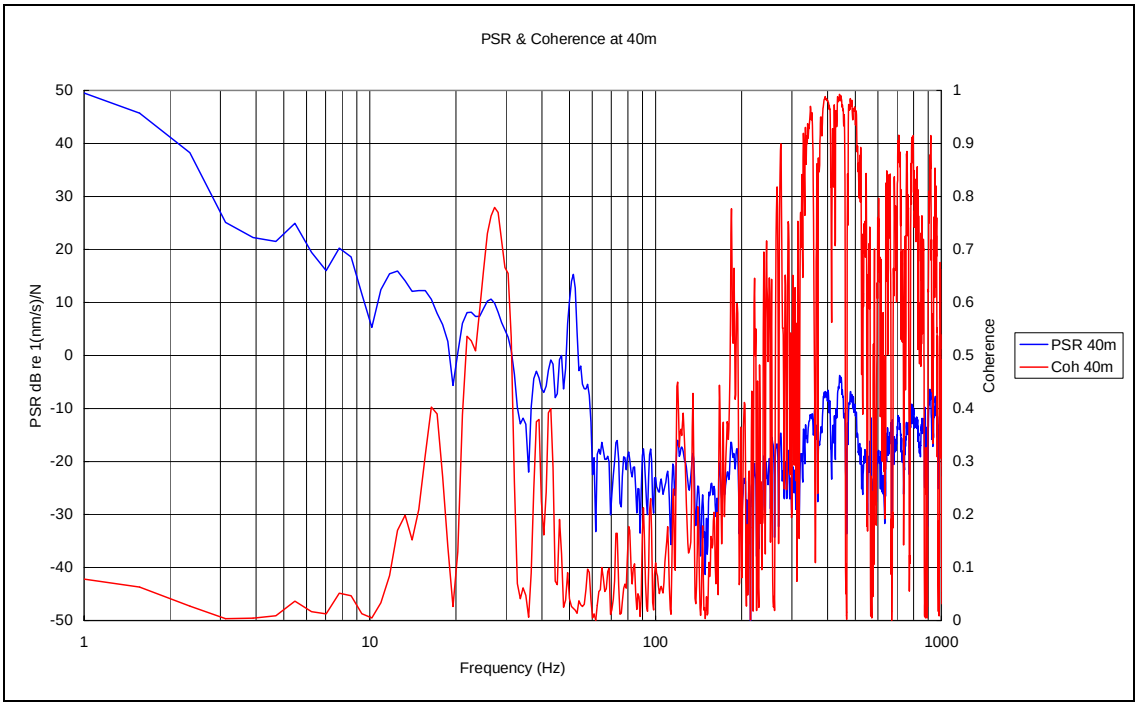

PSR & Coherence at 10m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 10m
Coh 10m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

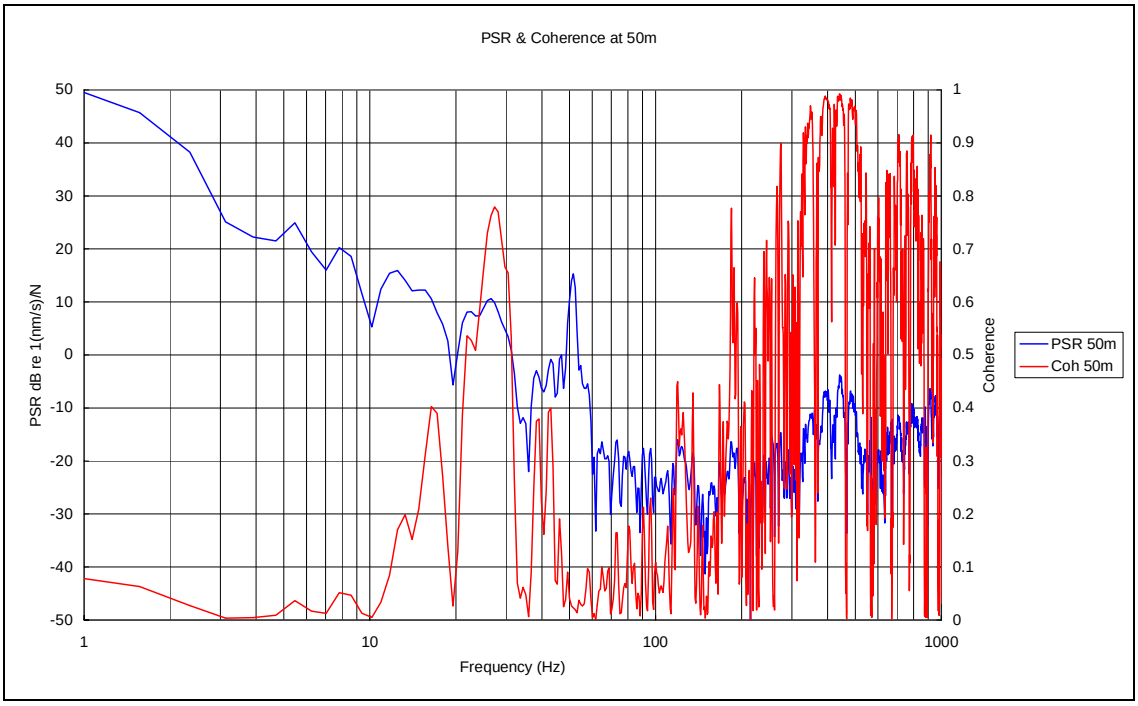

PSR & Coherence at 15m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 15m
Coh 15m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

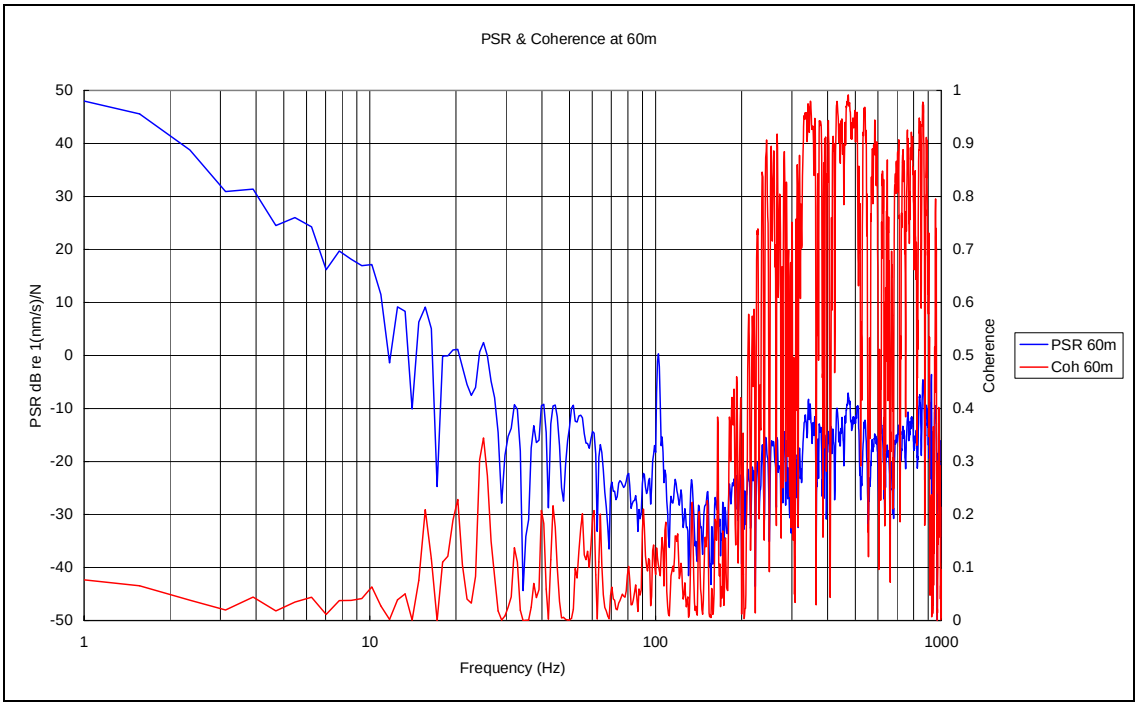

PSR & Coherence at 20m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 20m
Coh 20m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

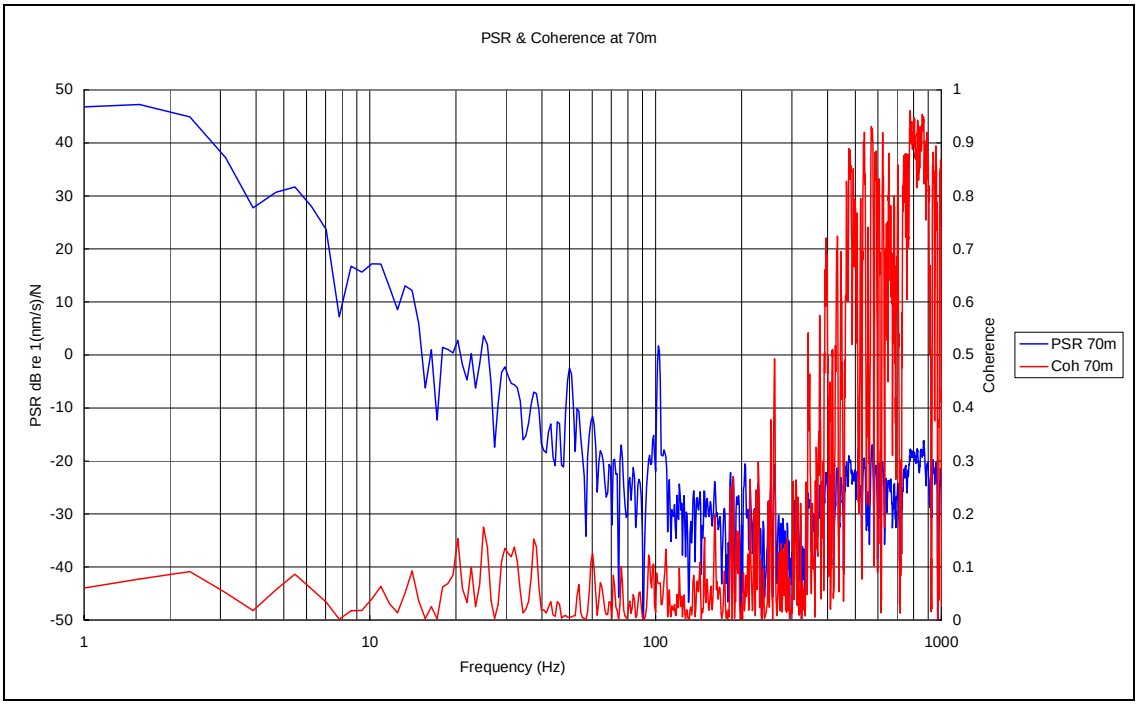

PSR & Coherence at 25m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 25m
Coh 25m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

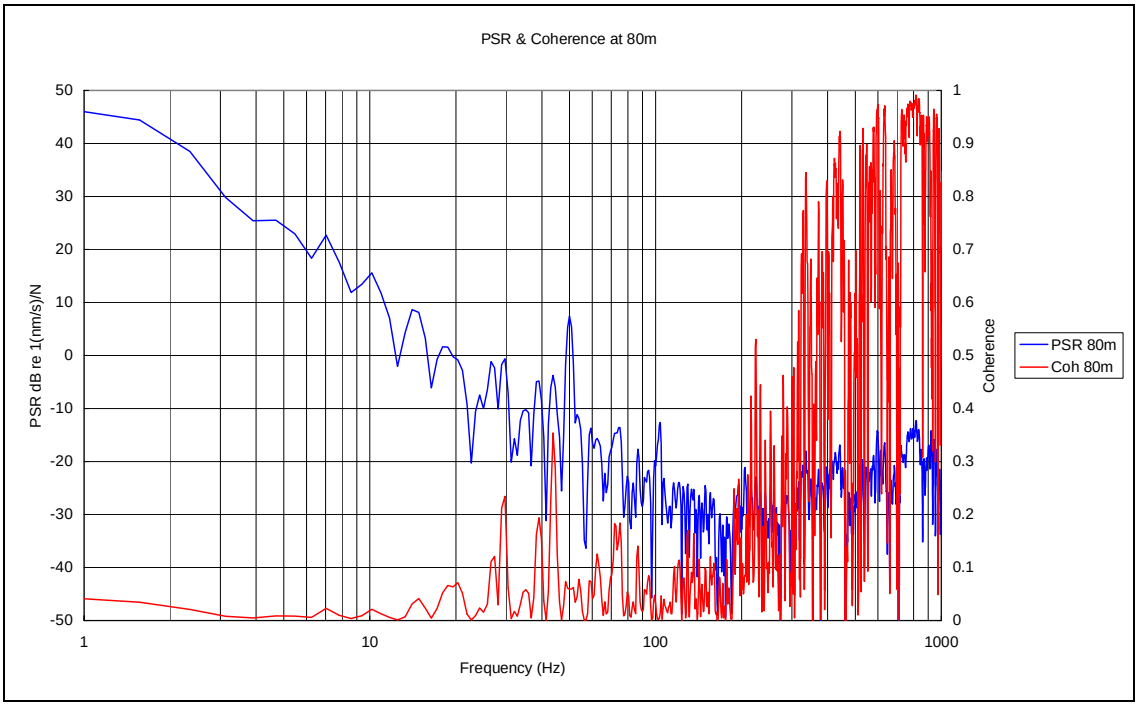

PSR & Coherence at 30m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 30m
Coh 30m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

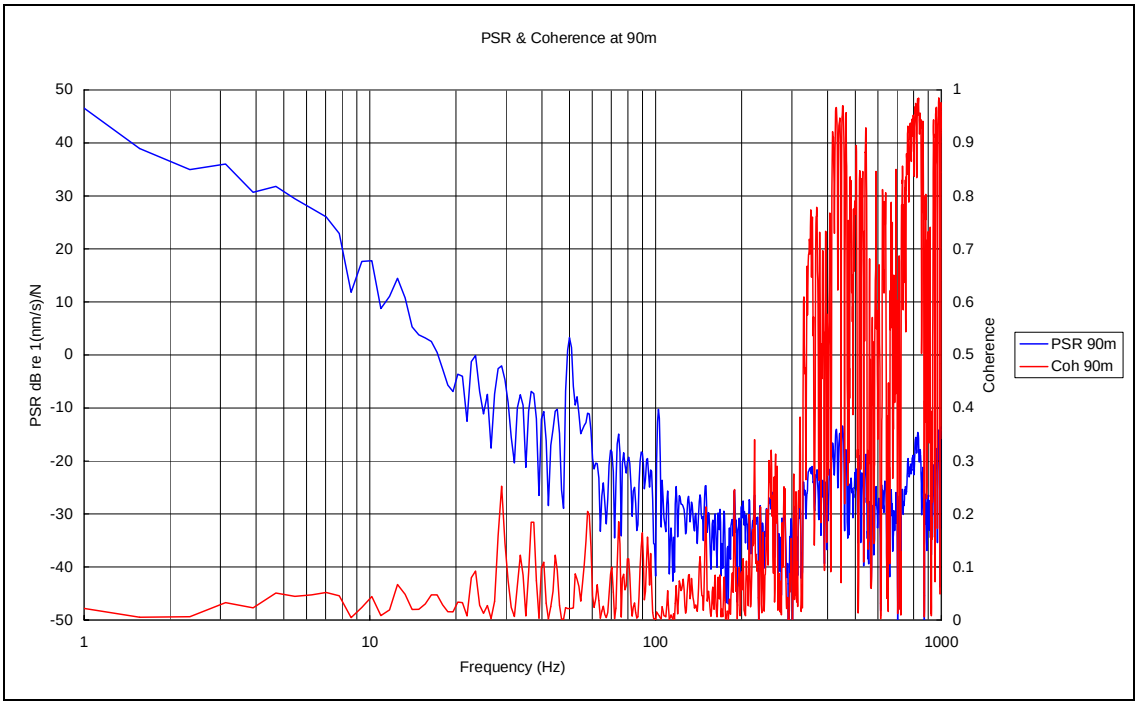

PSR & Coherence at 40m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 40m
Coh 40m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

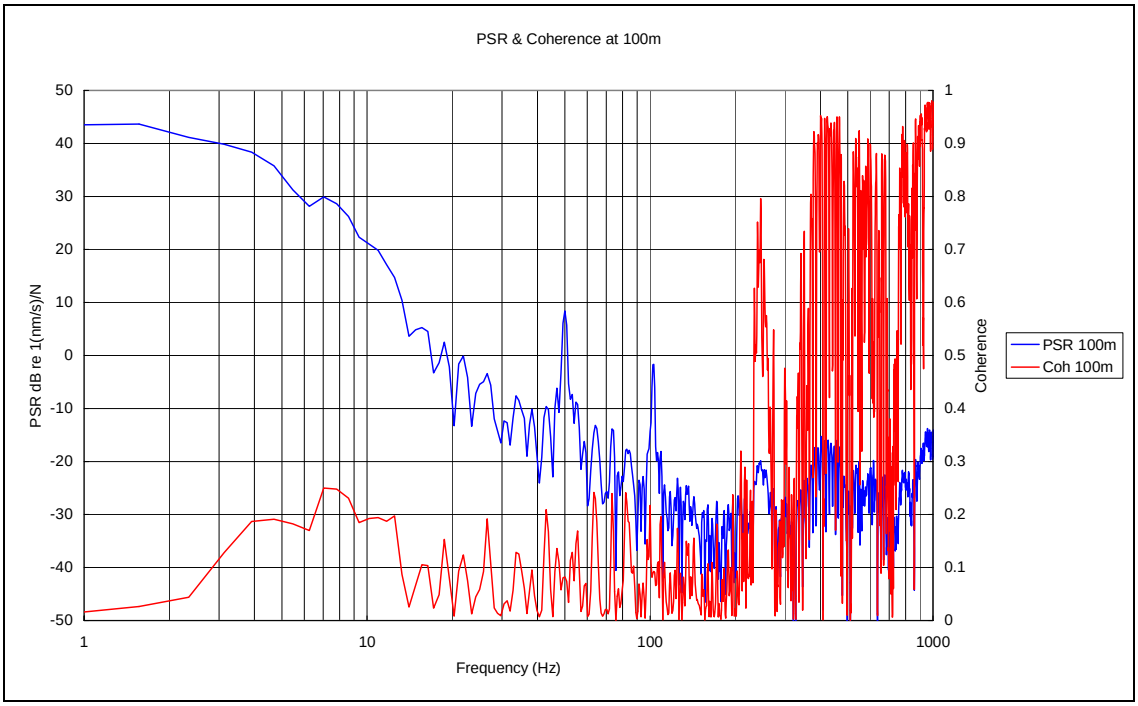

PSR & Coherence at 50m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 50m
Coh 50m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 60m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 60m
Coh 60m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 70m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 70m
Coh 70m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

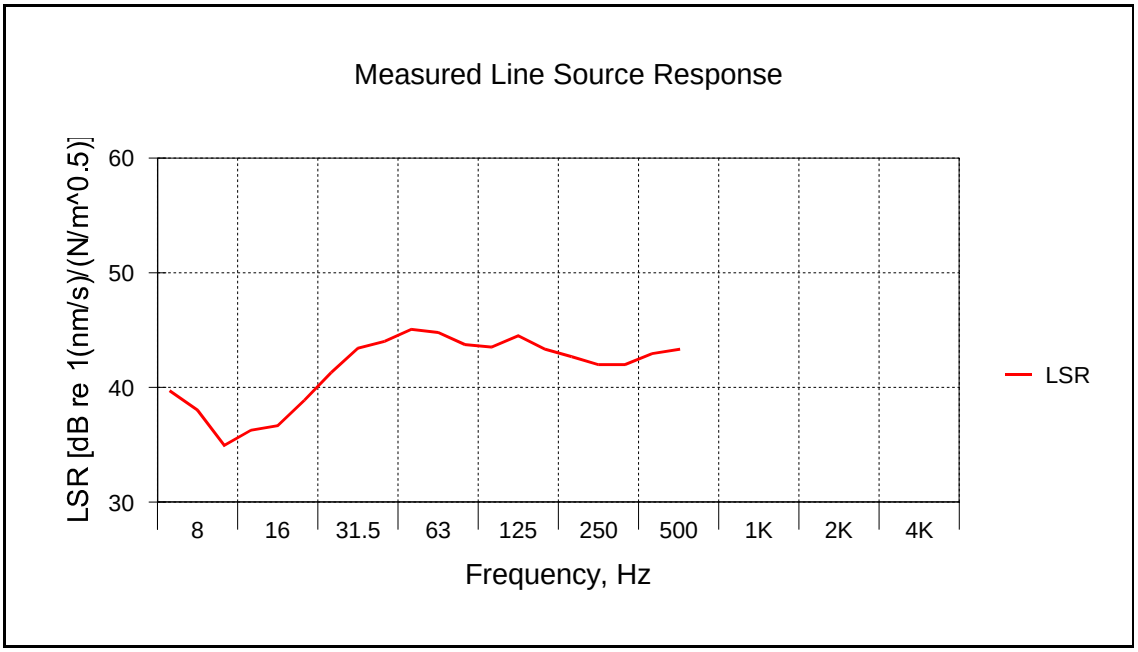

PSR & Coherence at 80m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 80m
Coh 80m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 90m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 90m
Coh 90m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 100m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 100m
Coh 100m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

APPENDIX C

Measured Line Source Response


Measured Line Source Response
LSR [dB re 1(nm/s)/(N/m^0.5)]
60
50
40
30
8
16
31.5
63
125
250
500
1K
2K
4K
Frequency, Hz
LSR

APPENDIX 2.1B

FORCE DENSITY LEVEL MEASUREMENT AND PREDICTION REPORT (CRH 2)

AECOM

MTR Corporation Limited

Consultancy Agreement No. C8016

Environmental Term Consultancy for Express Rail Link

Force Density Level Measurement in 2012 and Prediction Report

March 2013

	Name	Signature
Prepared & Checked:	Angela Tong	Angela
Reviewed & Approved:	Josh Lam	pp. Angela

Version:	A	Date:	28 March 2013

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Executive Summary

Pursuant to EP Condition 2.24, the Permit Holder, MTR Corporation Ltd (MTR), conducted vibration and transfer mobility measurements in July 2011 to obtain the data for the prediction of Force Density Levels (FDL) of the China Railway High-Speed (CRH) trains (CRH 380B). In order to obtain FDL of other type of CRH trains (i.e. CRH 2), additional vibration and transfer mobility measurements were conducted in November 2012.

The measurement section selected is an at-grade and tangent up track section adjoining Phoenix Mountain Tunnel, which is the section between Zhuhai North and Zhuhai (Macau) of Guangzhou-Zhuhai Intercity Railway. The trackform at measurement section is CRTS-I non-ballast track, baseplate WJ-7B, with prestressed frame plate (PF). This type of baseplate is similar to, but not as stiff as, the baseplate proposed for Rheda. Rails were grinded a month before the measurement.

Measurements were conducted according to FDL Test Plan which specified the requirements and methodology of the vibration and transfer mobility measurements. Based on the measurement results, the FDL values were calculated at different speed. The accuracy of the 95th percentile vibration level was affected by the small sample size of train movements running at 160km/h and 220km/h. Due to limited number of train measured between 160km/h and 220km/h, in particular at 160km/h and 220km/h, these results show unclear trend of increase but with slightly increase of FDL with speed in certain range of frequency. Nevertheless, results indicate that the measured FDL at 180km/h and 200km/h are in similar pattern.

The measured FDL values adjusted at speed of 240km/h were used to compare with the FDL values (at 240km/h) in the EIA report, which were referenced from Final Report of High-Speed Ground Transportation Noise and Vibration Impact Assessment (HMMH Report No. 293630-4), adopted in the EIA Report. The measured FDL result for both CRH 380B and CRH 2 test were found to be similar to, but lower at some frequencies than, the values adopted in the EIA Report. The measured FDL is expected to give similar ground-borne noise levels to those in the EIA, but possibly lower, subject to the findings of updated ground-borne noise assessment.

1 INTRODUCTION

1.1 Background

1.1.1 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 emergency rescue sidings.

1.1.2 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.

1.1.3 The EIA Report (Register No.: AEIA-143/2009) was approved on 28 September 2009 under the *Environmental Impact Assessment Ordinance (EIAO).* Following the approval of the EIA Report, an Environmental Permit (EP) was granted on 16 October 2009 (EP No: EP-349/2009) for the construction and operation of the Project. Variations of environmental permit (VEP) were subsequently applied and the latest Environmental Permit (EP No: EP-349/2009/I) was issued by Director of Environmental Protection (DEP) on 26 October 2012.

1.1.4 Pursuant to EP Condition 2.24, the Permit Holder, MTR Corporation Ltd (MTR), shall arrange testing of the Force Density Levels (FDL) of the trains for the Project as soon as possible, but in no case later than six months before the commencement of operation of the Project.

1.1.5 The 1st train vibration and transfer mobility measurements at the XRL Mainland section for CRH 380B was conducted at Guangzhou-Shenzhen section of XRL by Chinese Academy of Railway Sciences (CARS) and was witnessed by MTR and AECOM Asia Co. Ltd.

1.1.6 In order to obtain FDL of other type of CRH trains (i.e. CRH 2), 2nd vibration and transfer mobility measurements were conducted in Zhuhai in November 2012. The measurements were conducted by Chinese Academy of Railway Sciences (CARS) and were witnessed by MTR and AECOM Asia Co. Ltd.

1.1.7 AECOM Asia Co. Ltd has been commissioned by MTR to predict the FDL values, based on the vibration and transfer mobility measurement data provided by the CARS.

1.2 Purpose of This Report

1.2.1 This Report presents the FDL analysis based on the results of the vibration and transfer mobility measurements conducted in 2012 for the verification of the FDL assumed in the EIA Report.

1.3 Report Structure

1.3.1 The remainder of the report is organized as follows:

- Section 2 presents the background information of the train vibration and transfer mobility Measurement.
- Section 3 presents the prediction of FDL and verification of FDL assumptions in the EIA study.
- Section 4 presents the conclusion of verification.

2 TRAIN VIBRATION AND TRANSFER MOBILITY MEASUREMENT

2.1 Background

2.1.1 A FDL Test Plan was prepared to specify the requirements and methodology of the vibration and transfer mobility measurement in order to obtain the data for the prediction of FDL. The Test Plan has been provided to CARS before commencement of the measurement.

2.1.2 The 1st vibration and transfer mobility measurement commenced on 7 July and was completed on 9 July 2011. Based on the information provided by CARS, the FDL Measurement and Prediction Report (Version B) was prepared and submitted by AECOM in December 2011 (Sharepoint Ref: C8016-DED-ACM-ENV-000150).

2.1.3 The 2nd vibration and transfer mobility measurement commenced on 21 November and was completed on 29 November 2012. A summary of the measurement information as provided by CARS is presented in the following sections.

2.2 Train Vibration and Transfer Mobility Measurement

Measurement Section

2.2.1 The vibration and transfer mobility measurement has been conducted at suitable testing location which is an at-grade section with trackforms similar to that proposed for the Project (i.e. Rheda) to obtain representative information for FDL determination.

2.2.2 The measurement section was selected in the section between Zhuhai North and Zhuhai (Macau) of Guangzhou-Zhuhai Intercity Railway. This section is a two-way passenger line with spacing of about 4m between up and down tracks and maximum slope upto 12%. Maximum design speed at this section is 200km/h.

2.2.3 Measurement section was selected at the at-grade and tangent up track section which adjoins Phoenix Mountain Tunnel. There were no turnouts in the vicinity of the measurement locations in order to obtain data under normal operational situations. Given that there was a speed restriction for the rail section at Phoenix Mountain Tunnel, the maximum design speed at the measurement location was 220kph.

Trackform at Measurement Section

2.2.4 Trackform at measurement section is CRTS I non-ballast track, baseplate WJ-7B, with prestressed frame plate (PF). This type of baseplate is similar to, but not as stiff as, the baseplate proposed for Rheda, and thus a correction for stiffness has been made in the analysis (details refer to **Section 3.3.1**). Major component of frame type slab track includes rail, elastic splitting fastener, filling plate, rail plate, cement asphalt (CA) mortar adjustment layer, convex shift-resisting poles and concrete block base. Thickness of each component of frame type slab track is given in **Table 2.1**. Stiffness of base plate under elastic splitting fastener is 25kN/mm (± 5kN/mm). Measurement was conducted about a month after rail grinding carried out from 18 to 20 Oct 2012, according to the information provided by CARS.

Table 2.1 Thickness of Frame Type Slab Track Structure

Type	Rail (mm)	Fastener (mm)	Slab (mm)	CA Mortar (mm)	Concrete Base (mm)	Overall Track Structure (mm)
At-grade Non-ballast track	176	41	190	50	299	756

Information of High-speed Train Passby During Measurement

2.2.5 The China Railway High-Speed (CRH) trains running on the measurement section were CRH2 -068C high-speed electric multiple unit (EMU) (CRH2-300), comprising 8 subgroups (6M2T) with a total train length of about 201m. This series of train had been running for the commissioning tests and the wheels had not been replaced except the first front axle wheel at the first front car (car number 00) which was replaced once on 26 May 2012 for replacement of detective test wheel. During the measurement, the train was unloaded, nonetheless, the loading/unloading condition would only have an insignificant effect on the dynamic load and on FDL.

Instrumentation

2.2.6 The vibration and transfer mobility measurement was conducted using the instruments as listed in **Table 2.2.**

Table 2.2 Instruments Used in the Measurement

Instrument	Manufacturer / Model No.	Purpose
Multi Channel Vibration Analyser	Bruel & Kjaer Model LANXI	Spectrum analyser for data acquisition
Accelerometer with compatible charge amplifier	Wilcoxon Model 731-207	Vibration transducer to measure vibration levels
Impact Hammer (peak force at around 15kN) with Force Transducer	Bruel & Kjaer Model 2304	For applying a known impact force at the test location
Charge to DeltaTron® Converters	Bruel & Kjaer Model 2647A	Pre-amplifier for LANXI
Accelerometer calibrator	Bruel & Kjaer Type 4294	For checking the calibration of the instrument
Train passage sensor	Motion detector	Magnetic sensor on rails to detect wheels and to trigger LANXI recording, and also to measure train speed

Measurement Procedures

2.2.7 The measurement was conducted according to the FDL Test Plan with the procedures summarised as below.

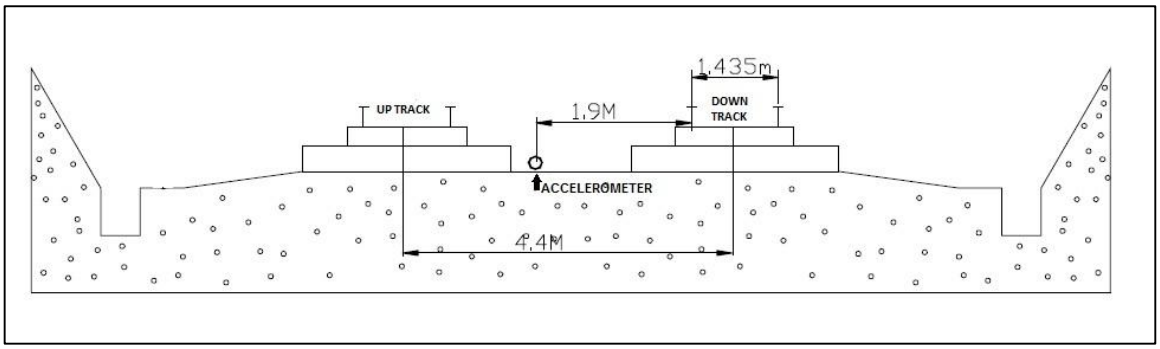
<u>Measurement of Train Vibration Levels</u>

2.2.8 Train vibration levels have been measured according to procedures provided below:

- The accelerometer were fixed into position with bees wax in preparation for measurement ensuring good coupling to the ground (Drawing 2-1).
- The vibration analyser was set to fast weighting and one-third octave bands from 6.3Hz to 500Hz. The sampling rate was set to 10 samples per second. The calibrator was applied to set the system levels.
- The one third octave band vibration levels were recorded during the train movements (see **Table 2.3**) on the nearest track. During the vibration measurement, the train speed was also measured. Details of train type, train length, train speed and track form were recorded for each measurement.

- The recordings were later analysed by passing a window of length 2s along the signal to obtain the 5s sample with the highest energy average vibration level (Leq in dB re 10^{-9} m/s) for each train movement.
- The 90th percentile vibration levels (normally vibration levels from the train movement generating the highest vibration when fewer than ten movements) were determined in one third octave bands for the train at each speed.

Drawing 2-1 Location of Accelerometer



Measurement of Transfer Mobility

2.2.9 Mobility measurement has been conducted according to the steps provided below:

- The accelerometer was set at the same locations as for measurement of train vibration levels (Drawing 2-1). Mobility measurement was conducted in the absence of train movements.
- The measurement system was set up for fast Fourier transform (FFT) analysis, with a window length (typically 500-1000ms) and a sampling rate to give at least 1Hz resolution. A trigger was set up to allow 100ms pre-trigger. A transient window was set in the measurement system, suitable for FFT analysis.
- Using the modal hammer, an impact force was applied at a series of impact points, on the invert as close as practicable to under the nearest rail, and the level of impact force was measured with the spectrum analyser. The impact points were at 10m intervals along the track for a length representing half a train length (100m) for a total of 10 points. The modal hammer was operated in a way to give a single impulse, and a double bounce was avoided. The force energy spectrum (dB re 1 N) was measured using the force transducer on the modal hammer which was connected to the measurement system. Ten such impacts shall be applied at each point.
- The vibration energy spectrum (dB re 10^{-9} m/s) at the accelerometer location was recorded during each impact.
- Using the measurement system, the narrow band transfer mobility (point source response, PSR) was determined from each impact to the accelerometer location [dB re 10^{-9} (m/s)/N] by deducting the dB force energy spectrum from the dB vibration energy spectrum. The coherence and the logarithmic average of the PSR from each point were also determined.

Measurement Results

Train Vibration Measurement

2.2.10 Measurements were conducted between 21 and 29 November 2012. A summary of train movement during the train vibration measurement is presented in **Table 2.3**.

Table 2.3 Details of Train Movements During Train Vibration Measurement

No.	Time	Track	Train Direction	Train Type	Actual Speed (km/h)	Passing Duration (s)
Measurement Date: 21 November 2012						
1	03:30	Down track	Up	CRH2-068C	156	4.64
2	04:05		Down		169	4.29
Measurement Date: 22 November 2012						
1	02:15	Down track	Down	CRH2-068C	175	4.13
2	03:45		Down		186	3.88
3	05:00		Down		193	3.75
Measurement Date: 23 November 2012						
1	02:47	Down track	Down	CRH2-068C	185	3.91
2	04:08		Down		181	4.00
3	05:27		Down		179	4.04
Measurement Date: 25 November 2012						
1	02:47	Down track	Down	CRH2-068C	187	3.87
2	04:08		Down		178	4.07
Measurement Date: 26 November 2012						
1	02:36	Down track	Down	CRH2-068C	172	4.20
Measurement Date: 28 November 2012						
1	01:15	Down track	Up	CRH2-068C linked with CRH2-067C in series	179	8.07
2	01:43		Down		176	8.21
3	02:20		Up		189	7.67
4	02:40		Down		187	7.76
5	03:16		Up		192	7.55
6	03:36		Down		189	7.65
7	04:10		Up		199	7.27
8	04:30		Down		191	7.57
Measurement Date: 29 November 2012						
1	04:18	Down track	Down	CRH2-068C	182	3.98
2	04:51		Up		217	3.33
3	05:11		Down		192	3.77
4	05:40		Up		220	3.30
5	05:58		Down		183	3.96

Note:
Measurement data was only taken for train movement on down track.

2.2.11 The measured 90th percentile vibration levels in 1/3 octave bands at different speeds are presented in **Appendix A**.

Transfer Mobility Measurement

2.2.12 The PSR was determined for a number of distances along with the coherence of the measurements. The coherence indicates the effect of background vibration (if any) during the measurements. The PSR values are shown in **Appendix B.** Even though the coherence shows that the PSR values, and hence the LSR values discussed later, are affected by background noise levels in the low frequencies, this is not expected to affect the prediction of ground-borne noise levels from this information. A-weighted ground-borne noise mostly results from the mid and high frequency vibration.

2.2.13 Using the PSR results, the line source transfer mobility (or line source response, LSR) for the train was determined by numerical integration. These are shown in **Appendix C**.

3 PREDICTION AND VERIFICATION OF FORCE DENSITY LEVEL

3.1 Prediction Methodology

3.1.1 The LSR is a measure of the conversion from FDL on the track to the vibration level at the test location. The FDL could be obtained when the vibration level and the LSR are known by using the following formula:

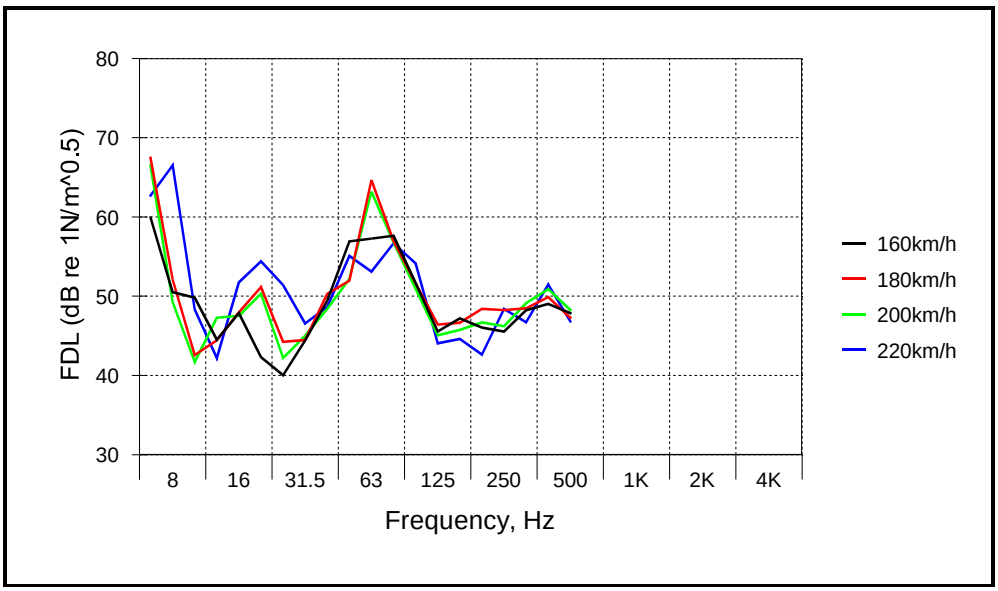
$$FDL = V - LSR$$

Where
FDL = force density level of train;
V = vibration level at test location; and
LSR = line source response to test location

3.2 Predicted FDL

3.2.1 The FDL determined for the CRH2 train is shown in **Drawing 3-1**. The accuracy of the 95th percentile vibration level was affected by the small sample size of train movements running at 160km/h and at 220km/h. Due to limited number of train measured between 160km/h and 220km/h, in particular at 160km/h and 220km/h, these results show unclear trend of increase but with slightly increase of FDL with speed in certain range of frequency. Nevertheless, **Drawing 3-1** indicates that the measured FDL at 180km/h and 200km/h are in similar pattern.

Drawing 3-1 Measured FDL Values



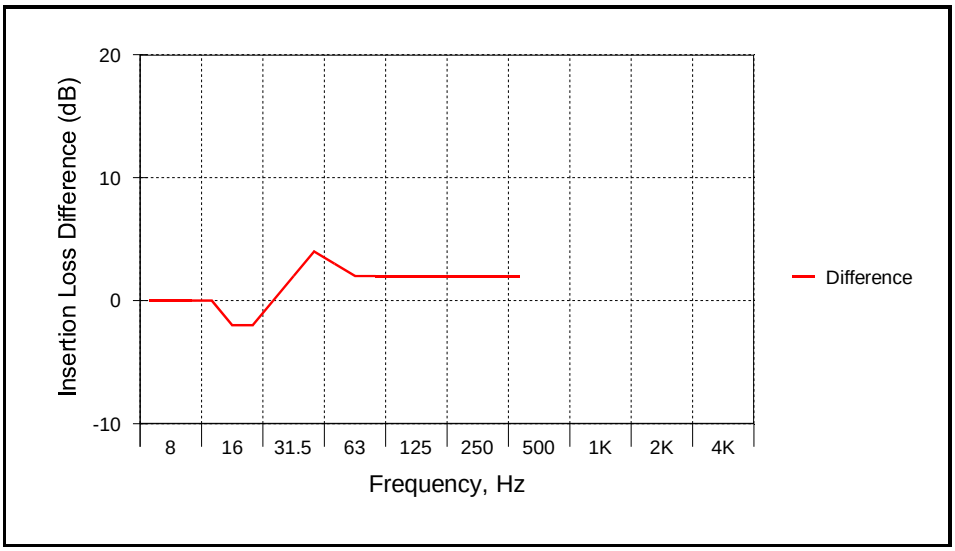
3.3 Verification of FDL

3.3.1 The FDL values determined by the measurement process are compared with the values adopted in the EIA Report. The EIA values adopted in EIA Report was taken as the highest level among the high speed trains (i.e. Acela) given in the High-Speed Ground Transportation Noise and Vibration Impact[1] (FRA High-Speed Guidance Manual) for four typical high speed trains. The EIA value was for a speed of 240km/h and for a track fastener stiffness of 50kN/mm. The measured FDL values at 200km/h were compared with the EIA level (240km/h). For direct comparison, speed correction of the measured FDL was applied to adjust from 200km/h to 240km/h. A small adjustment to convert the measured level from

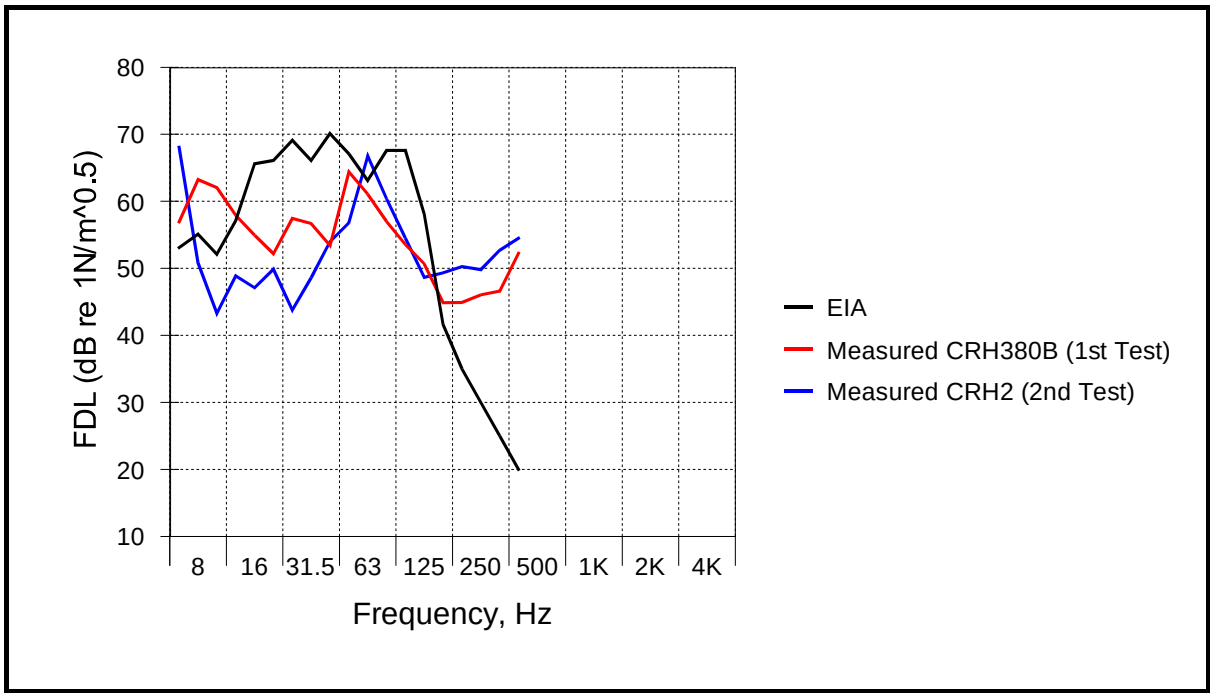
[1] Final Report of High-Speed Ground Transportation Noise and Vibration Impact Assessment, HMMH Report No. 293630-4

25N/mm to 50kN/mm was applied as well. This was based on the difference in insertion loss between a baseplate of 25kN/mm stiffness and the proposed fastner of 50kN/mm stiffness, both of which had previously been measured with the insertion loss difference shown in **Drawing 3-2**. The comparison between the EIA adopted and measured FDL values is then shown in **Drawing 3-3**. The measured FDL of CRH380B obtained from the first test on July 2011 was also included in the same figure for reference.

Drawing 3-2 Insertion Loss Difference between 25kN/mm and 50kN/mm Fasteners



Drawing 3-3 Comparison of EIA and Measured FDL Values (240km/h and 50kN/mm)



3.3.2 The comparison indicates that the measured levels of CRH2 are very similar to, but lower than at some frequencies, those assumed in the EIA. Typically with the effect of ground property

and correction of A-weighting, the ground-borne noise level would be dominant in the vicinity of frequency between 63Hz and 125Hz, it is therefore anticipated that the predicted ground-borne noise levels taking consideration of CRH 2 FDL would be higher than those considering CRH 380B FDL, while the predicted noise levels would be highest with consideration of EIA FDL.

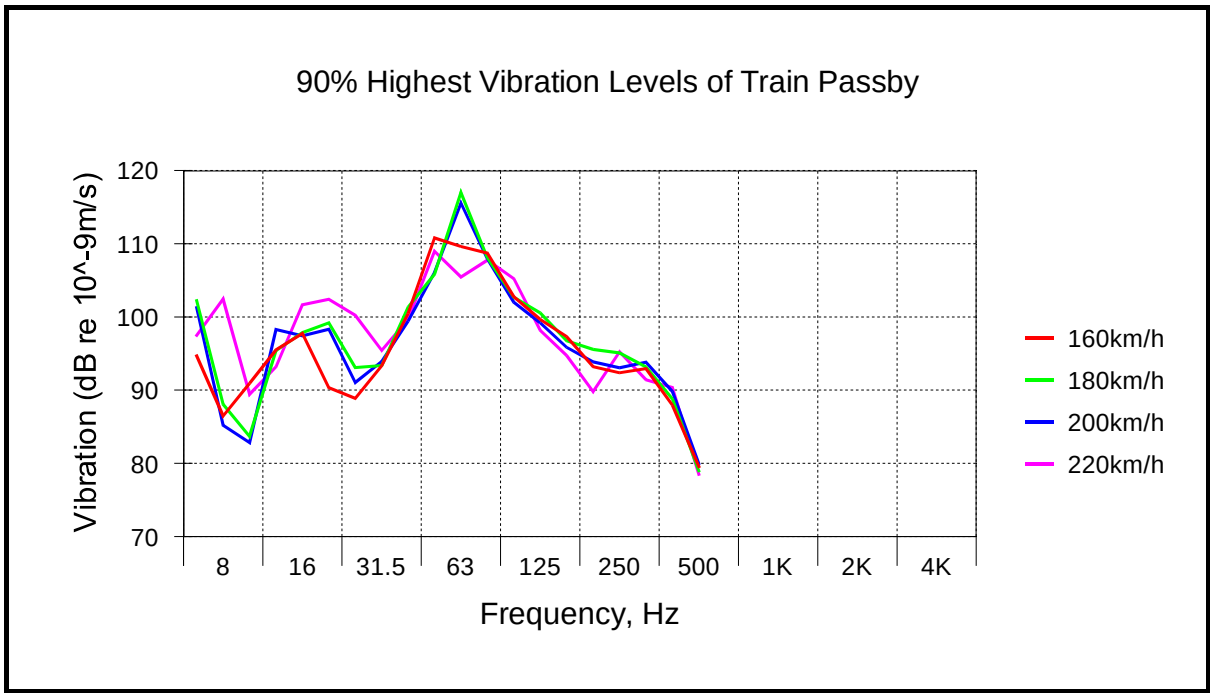
4 CONCLUSION

4.1.1 Measurements have been carried out to determine the force density level (FDL) generated by the high speed train proposed to be operated on the Express Rail Link (CRH). The tests involved the measurement of the vibration levels generated by train movements and the line source response at the test site. Based on the measurement results, the FDL was calculated.

4.1.2 The FDL results of both CRH380B and CRH2 test were found to be similar to, but lower at some frequencies than, the values adopted in the EIA Report, as shown in **Drawing 3-3** above. The use of the measured FDL is expected to give similar ground-borne noise levels to those in the EIA, but possibly lower, subject to the findings of updated ground-borne noise assessment.

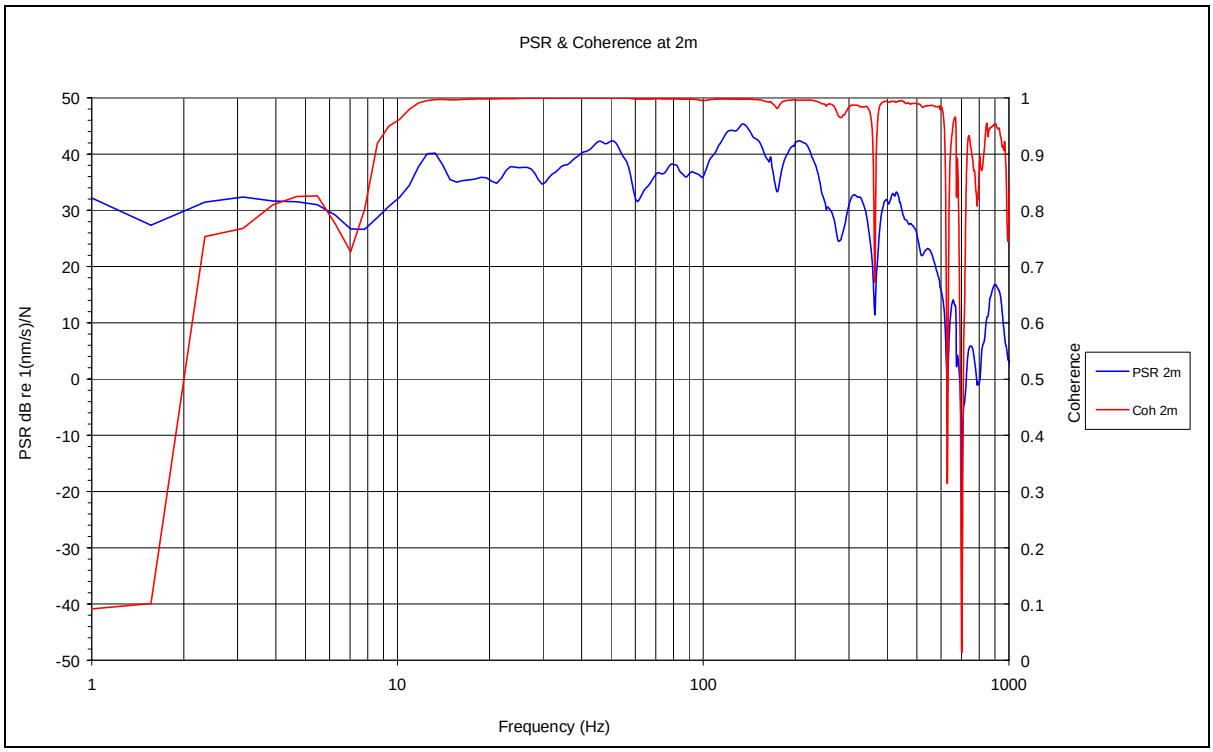
APPENDIX A

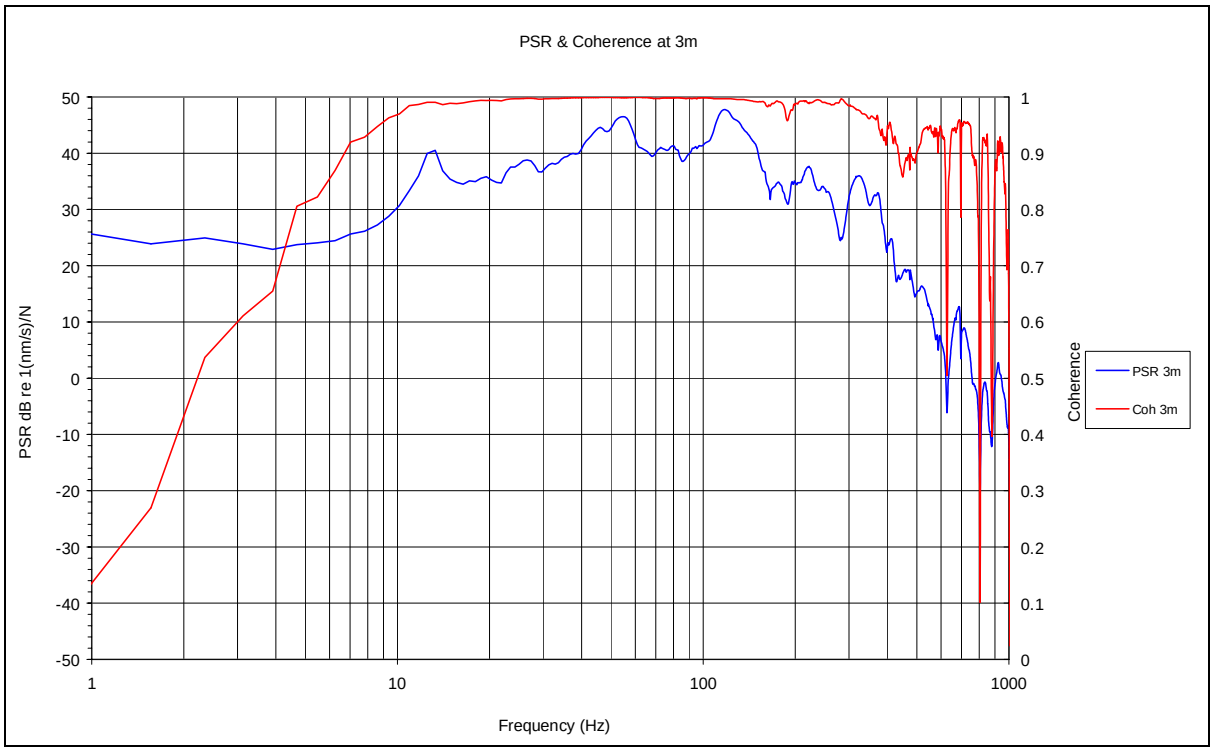
Measured Vibration Levels on 1/3 Octave Band Spectrum

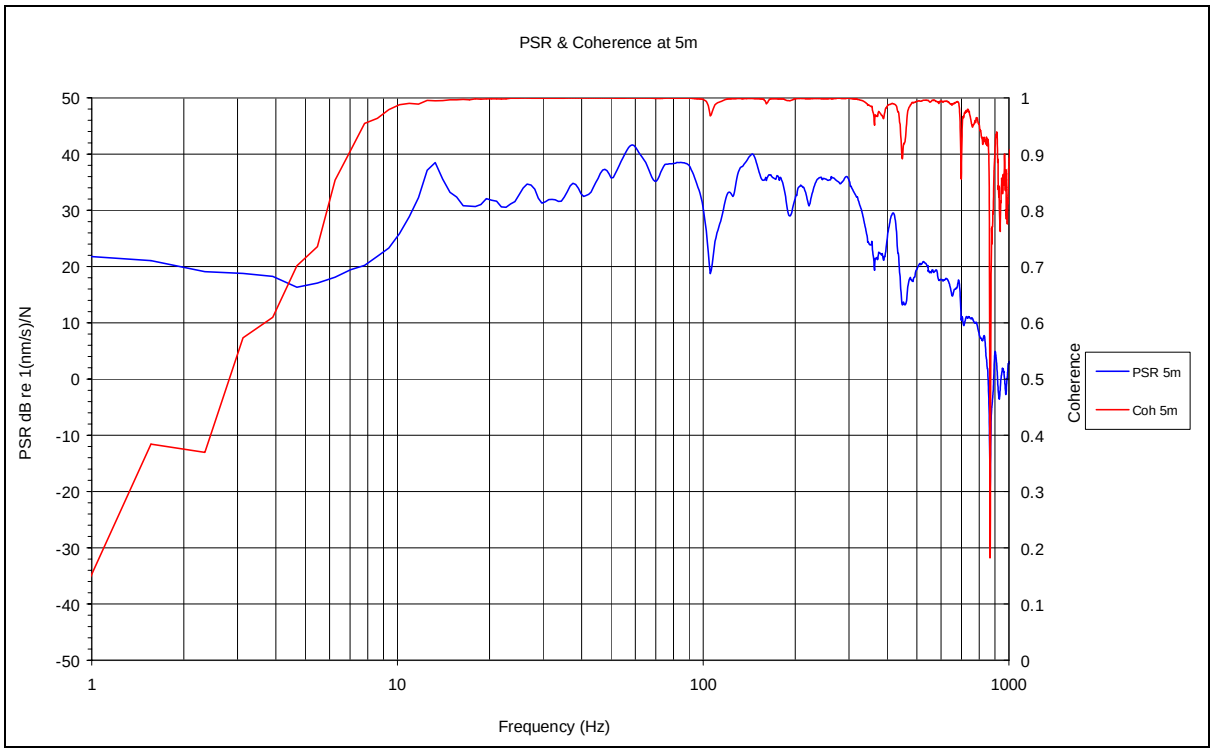

90% Highest Vibration Levels of Train Passby
Vibration (dB re 10^-9m/s)
120
110
100
90
80
70
8
16
31.5
63
125
250
500
1K
2K
4K
Frequency, Hz
160km/h
180km/h
200km/h
220km/h

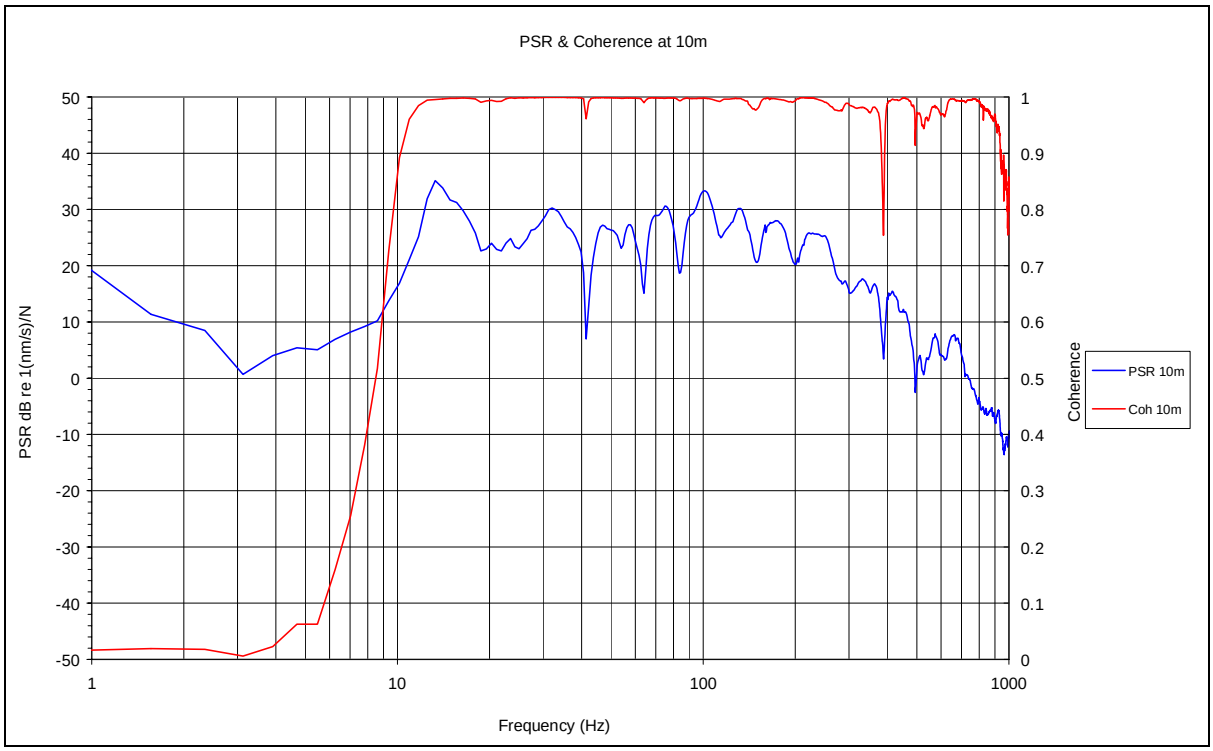
APPENDIX B

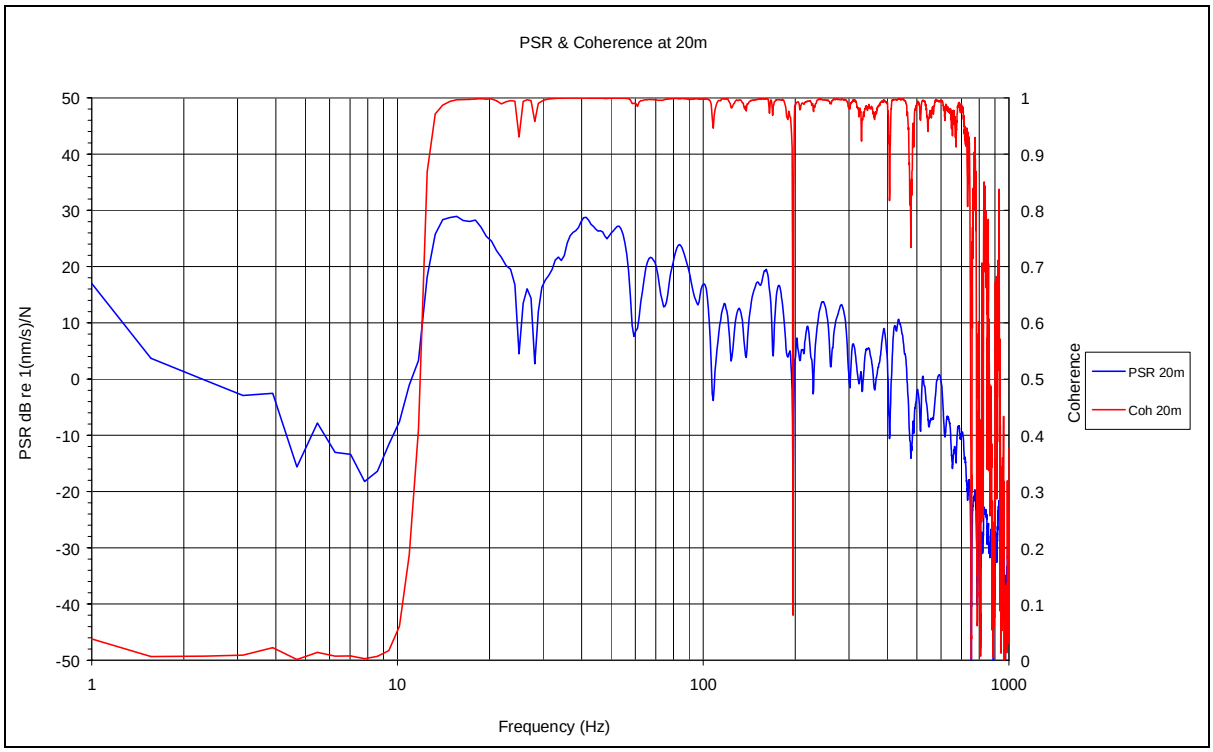
Graphical Presentation of Transfer Mobility Data

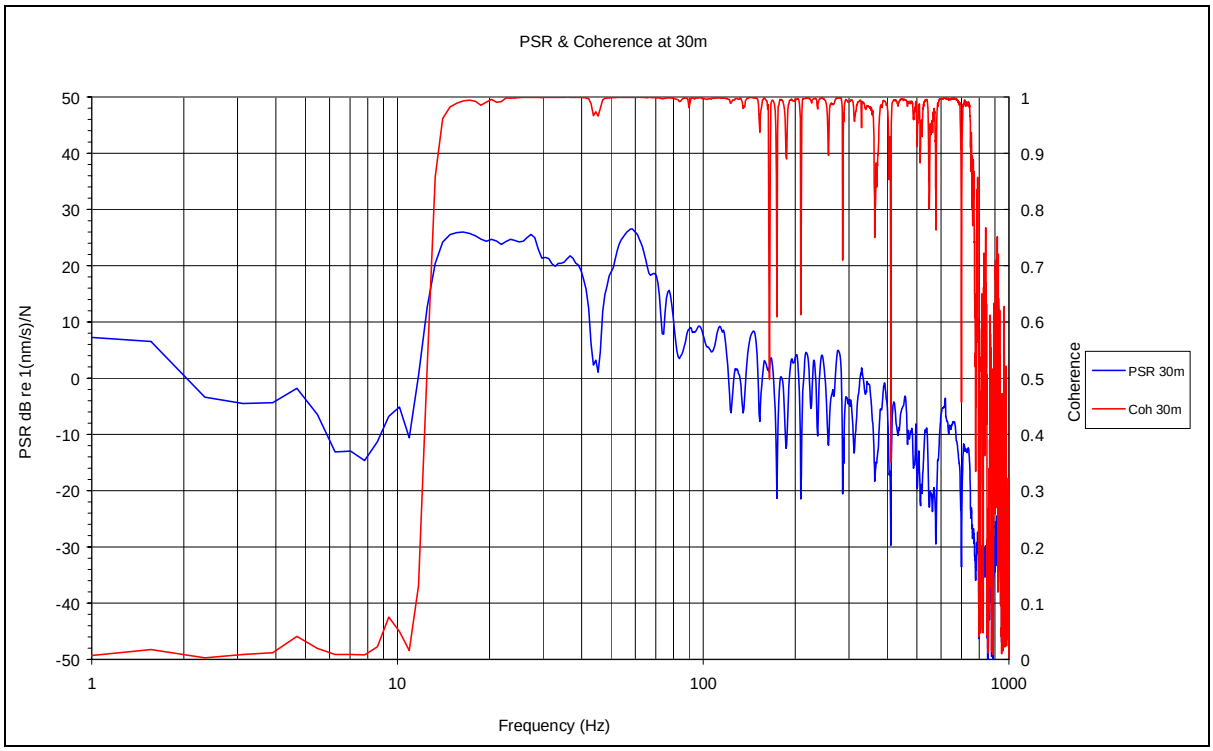

PSR & Coherence at 2m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 2m
Coh 2m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

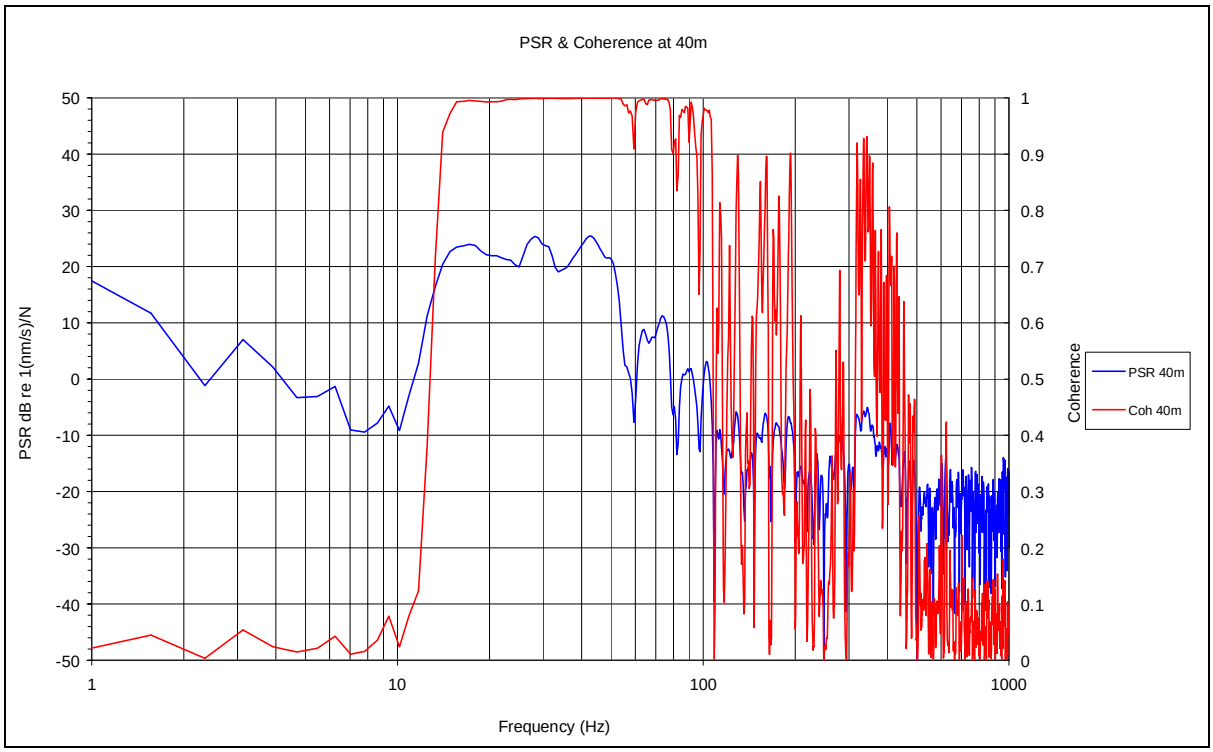

PSR & Coherence at 3m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 3m
Coh 3m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

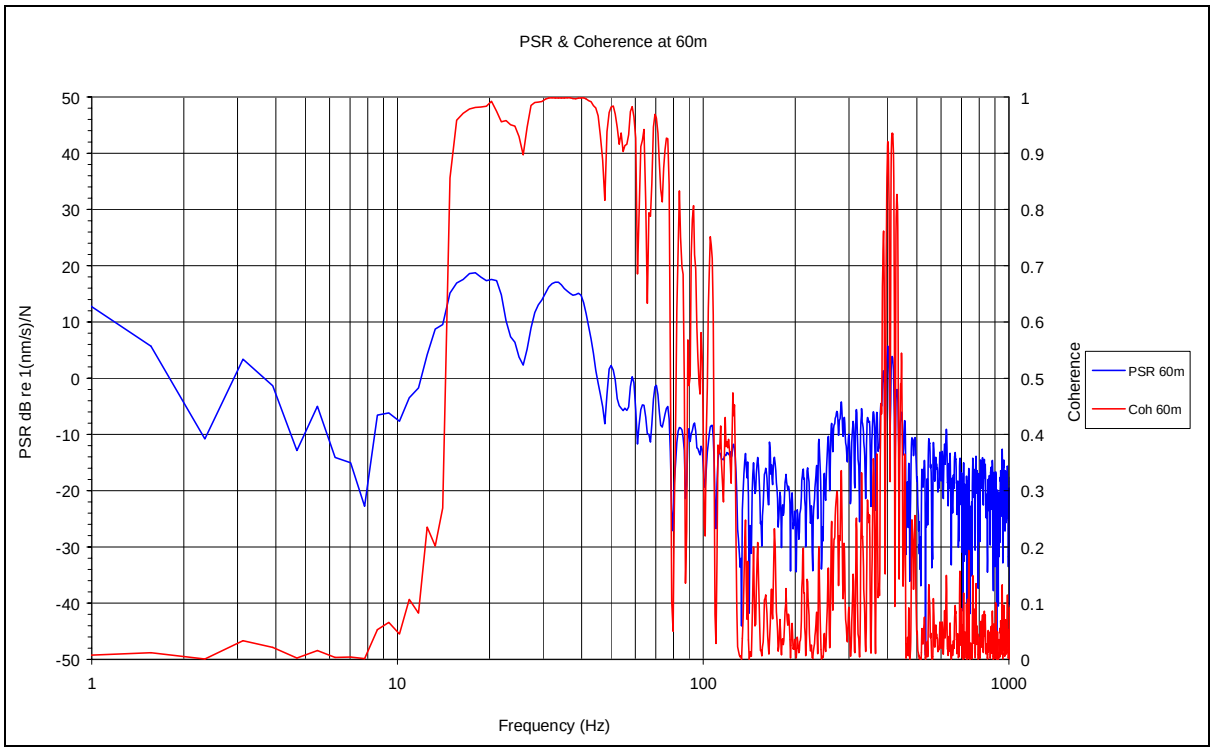

PSR & Coherence at 5m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 5m
Coh 5m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

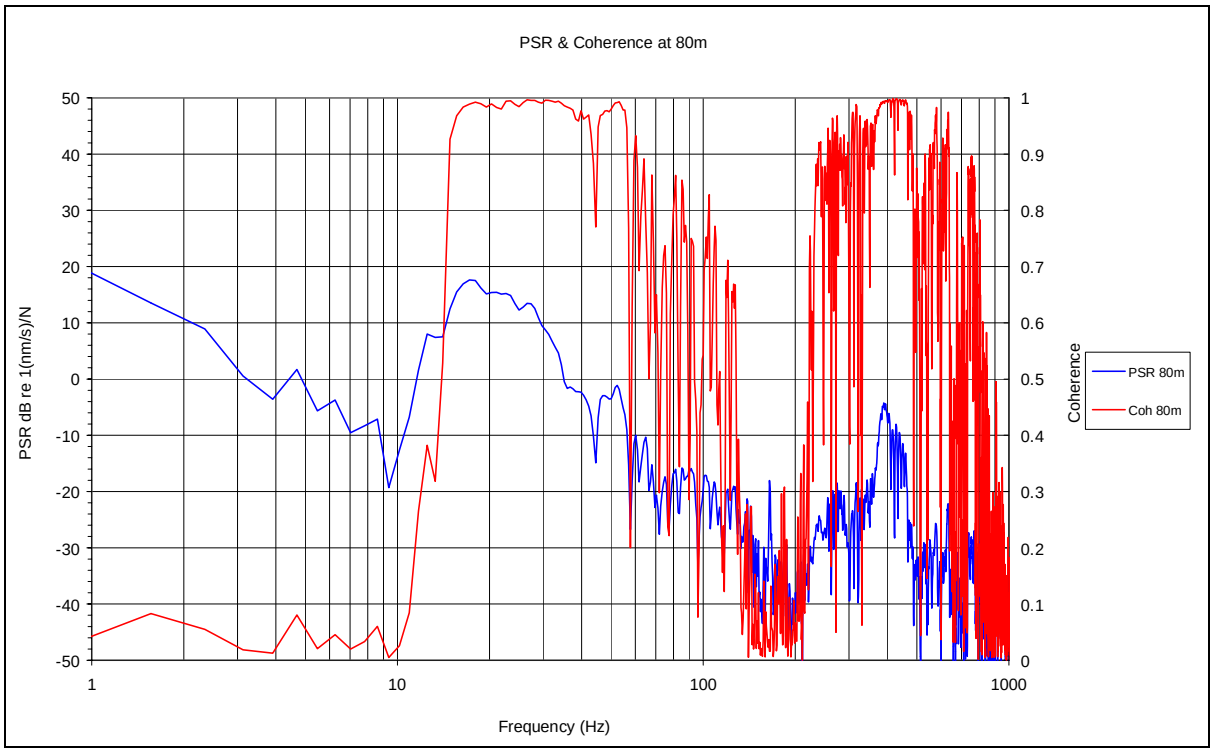

PSR & Coherence at 10m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 10m
Coh 10m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

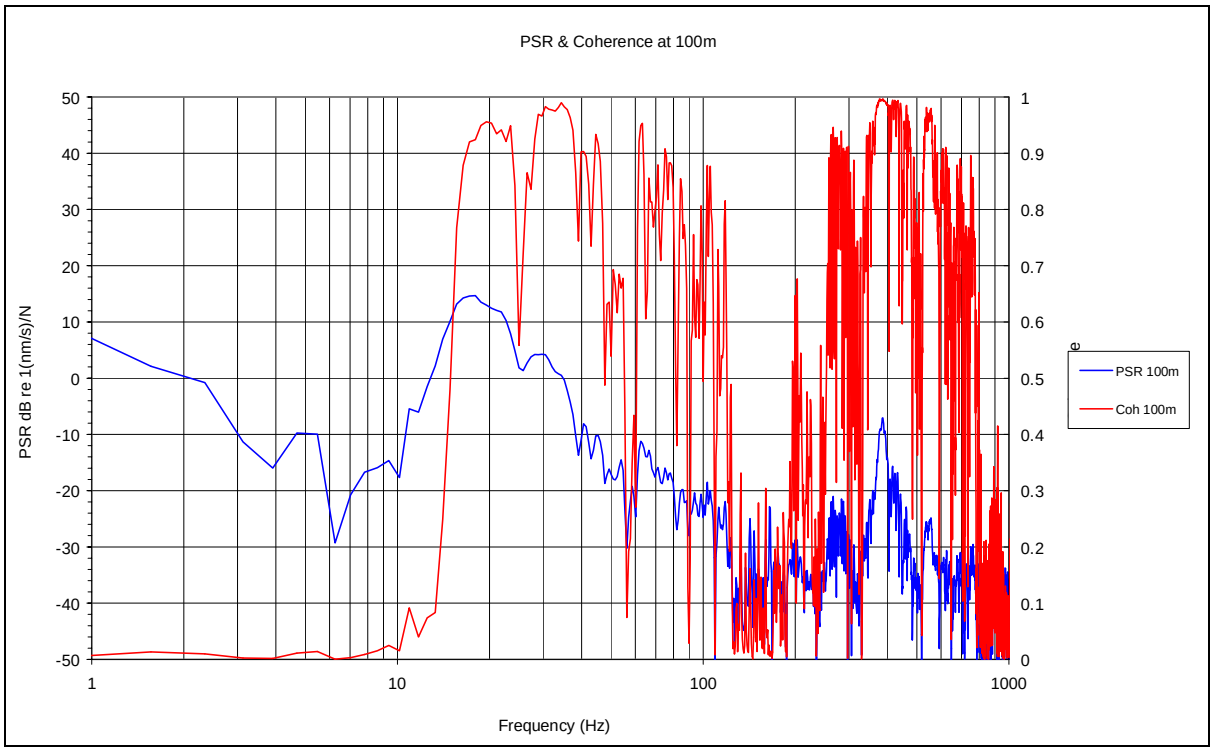

PSR & Coherence at 20m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 20m
Coh 20m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 30m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 30m
Coh 30m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 40m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 40m
Coh 40m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

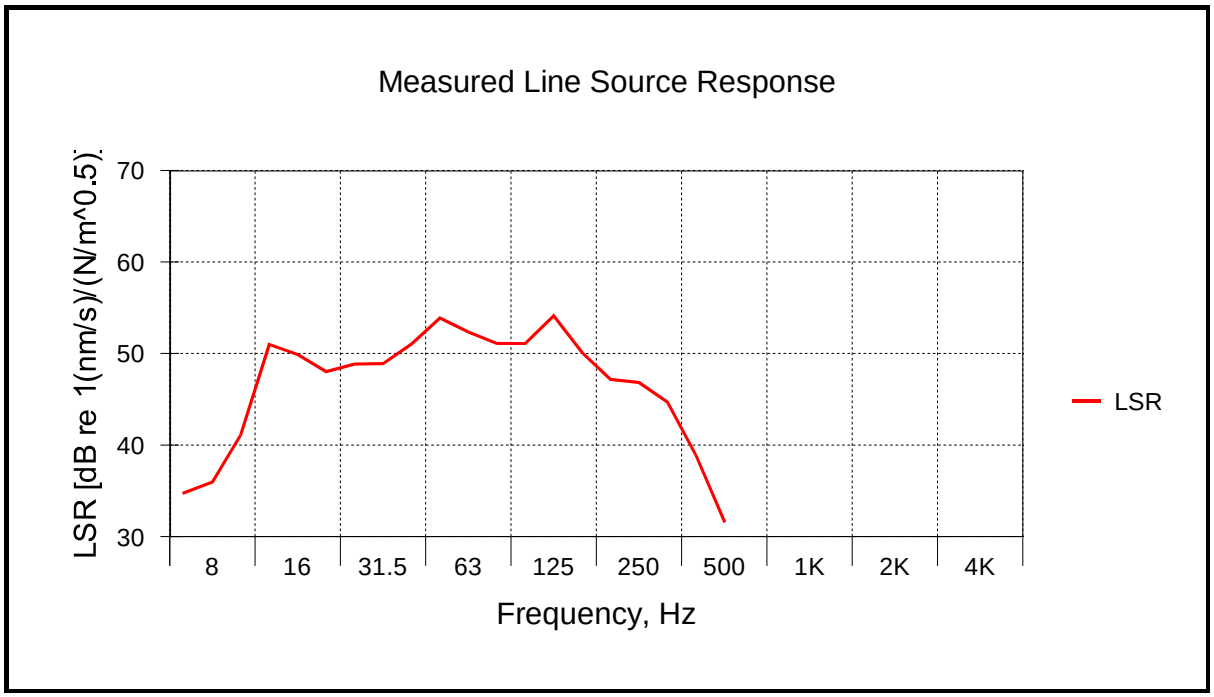

PSR & Coherence at 60m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 60m
Coh 60m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 80m
PSR dB re 1(nm/s)/N
Coherence
Frequency (Hz)
PSR 80m
Coh 80m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000


PSR & Coherence at 100m
PSR dB re 1(nm/s)/N
Frequency (Hz)
PSR 100m
Coh 100m
50
40
30
20
10
0
-10
-20
-30
-40
-50
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1000

APPENDIX C

Measured Line Source Response

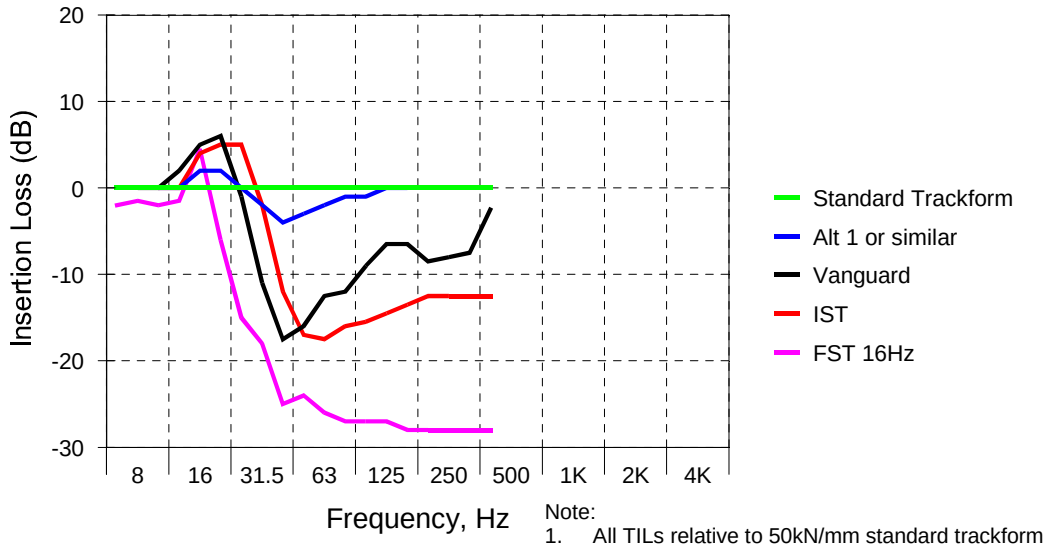

Measured Line Source Response
LSR [dB re 1(nm/s)/(N/m^0.5)]
70
60
50
40
30
8
16
31.5
63
125
250
500
1K
2K
4K
Frequency, Hz
LSR

APPENDIX 2.2

EXAMPLE OF LOW NOISE TRACKFORM AND INSERTION LOSS

Appendix 2-2 Insertion Loss of Low Noise Trackform

Trackform Insertion Loss



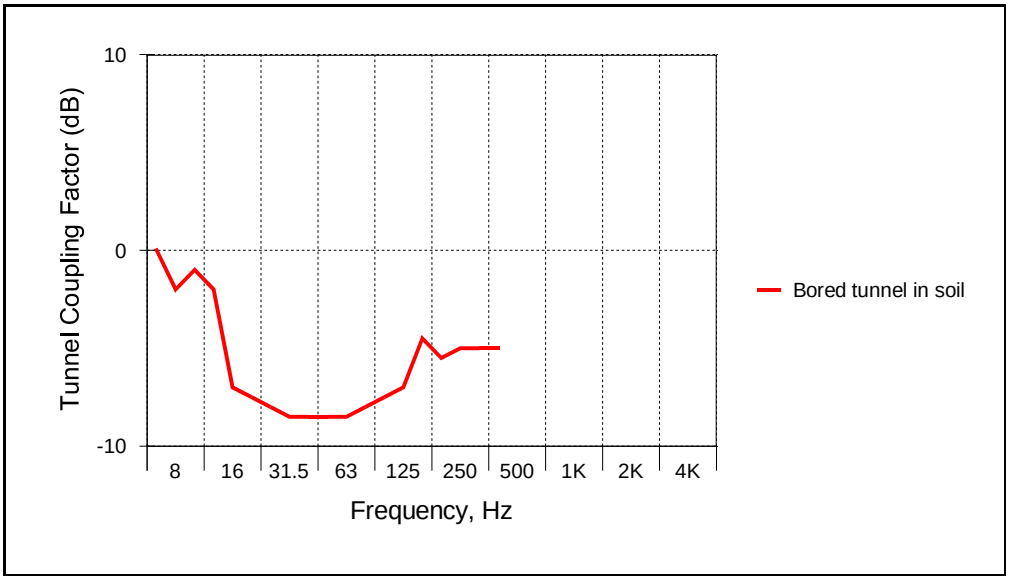
Note:
1. All TILs relative to 50kN/mm standard trackform
2. Alt 1 or similar (i.e. LVT, Vossloh 300-1U)

APPENDIX 2.3

TUNNEL COUPLING FACTOR FOR BORED TUNNEL IN SOIL

Appendix 2-3 Tunnel Coupling Factor for Bored Tunnel in Soil

Tunnel Coupling Factor for Bored Tunnel in Soil



Reference: Hong Kong measurements, 27 October 2005, reported in WIL EIA Appendix 4.7

APPENDIX 2.4

LINE SOURCE RESPONSE VALUES OBTAINED FROM WEST ISLAND LINE EIA STUDY AND PERFORMANCE TEST PLAN

Appendix 2.4 Line Source Response Values Obtained from West Island Line EIA Study and Performance Test Plan

Figure A LSR from WIL Borehole D002 (Rock Head Depth 24m, Hole Depth 20m)

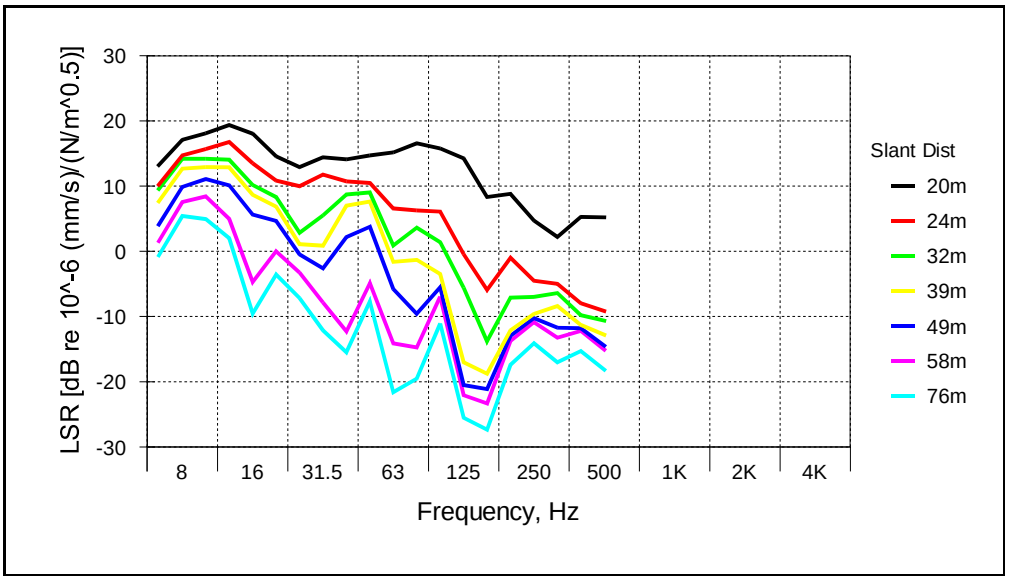


Figure B LSR from WIL Borehole D002 (Rock Head Depth 24m, Hole Depth 34m)

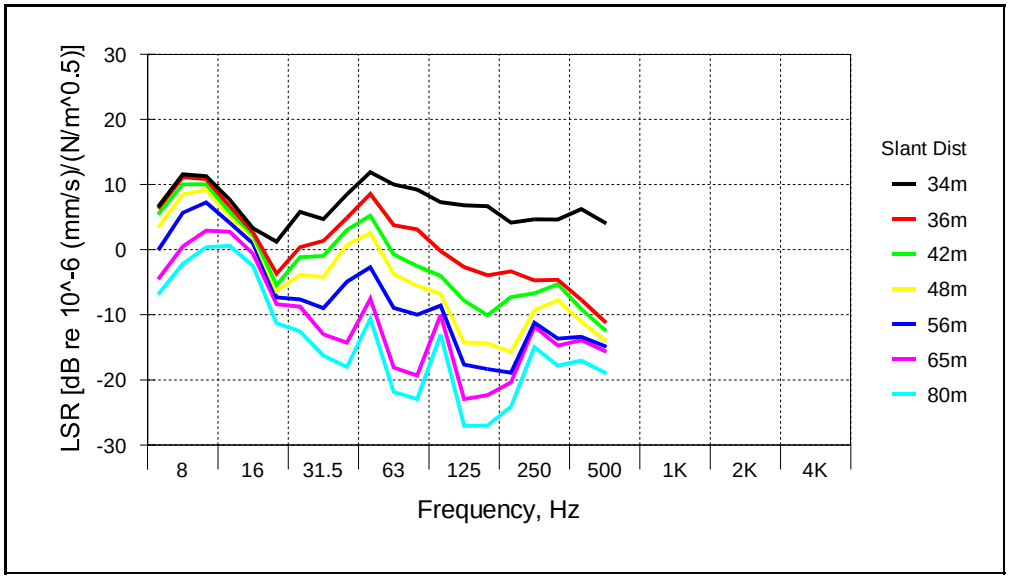


Figure C **LSR from WIL Borehole D012 (Rock Head Depth 34m, Hole Depth 18m)**

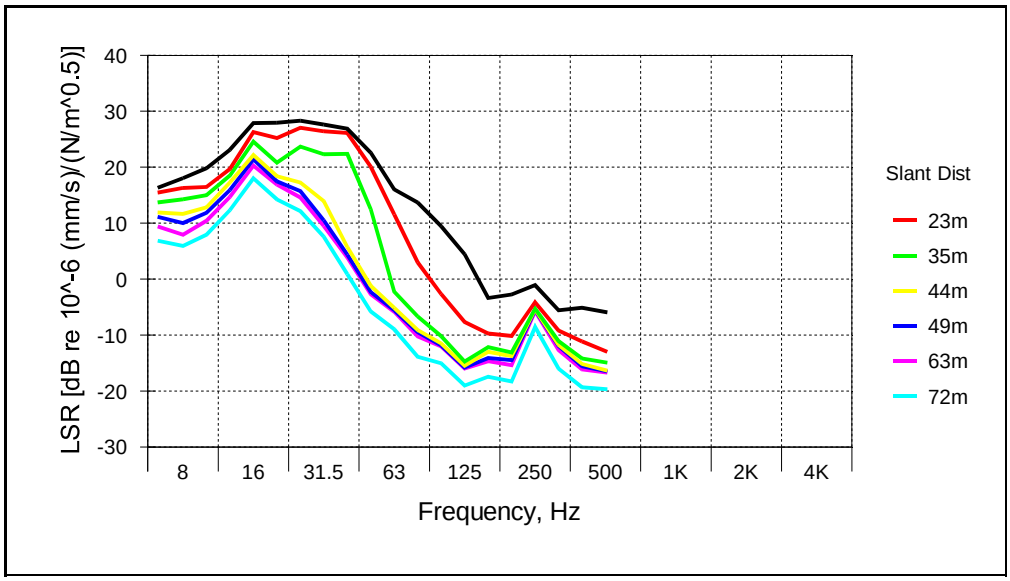


Figure D **LSR from WIL Borehole D012 (Rock Head Depth 34m, Hole Depth 41m)**

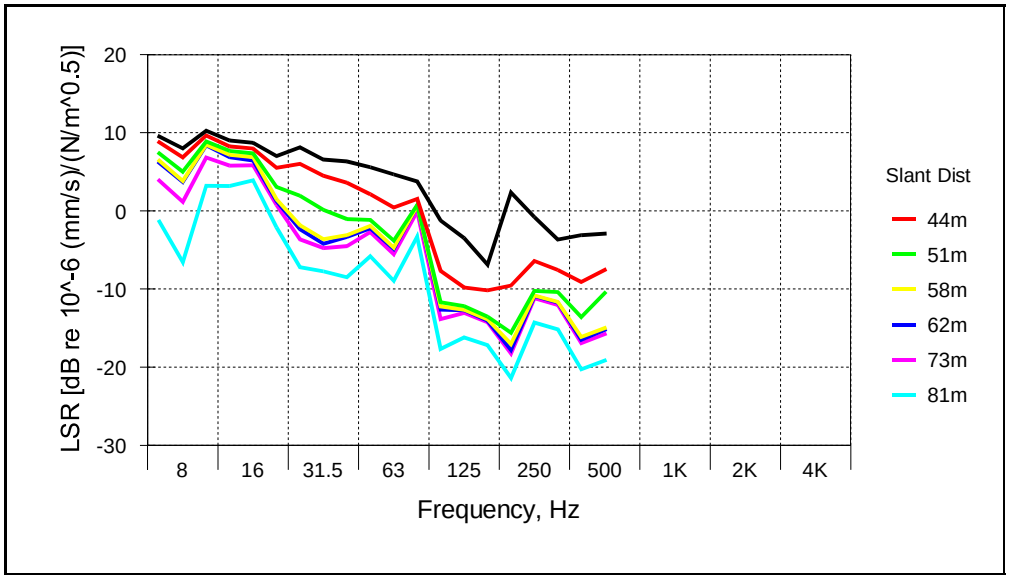


Figure E **LSR from WIL Borehole D018 (Rock Head Depth 28m, Hole Depth 15m)**

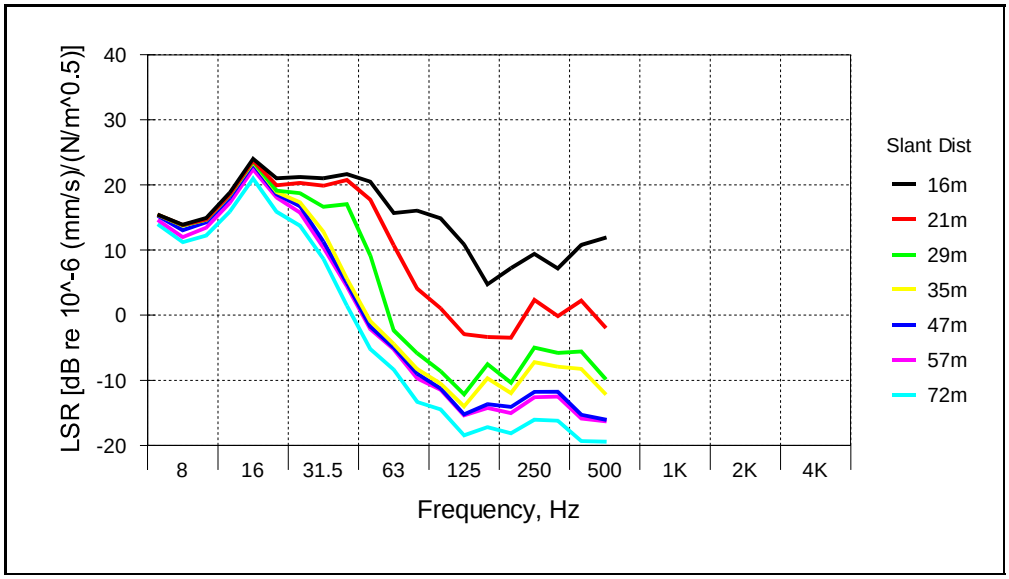


Figure F **LSR from WIL Borehole D018 (Rock Head Depth 28m, Hole Depth 40m)**

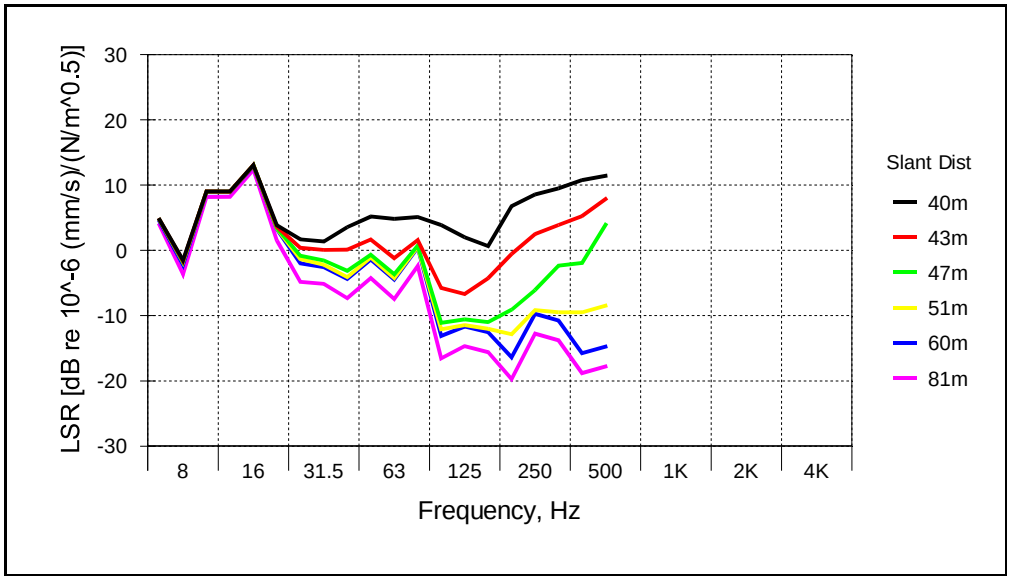


Figure G **LSR from WIL Borehole D028 (Rock Head Depth 22m, Hole Depth 44m)**

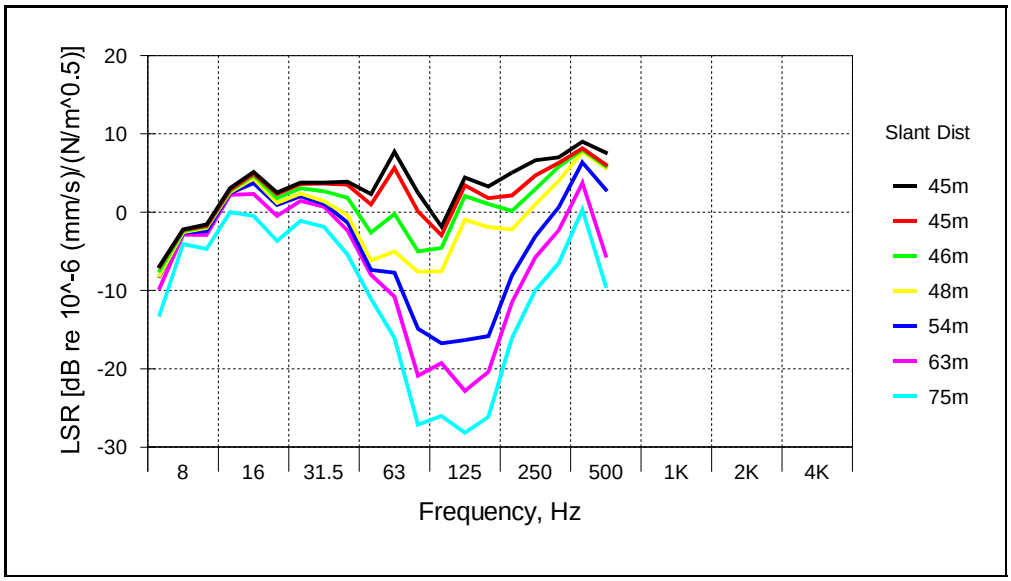


Figure H **LSR from WIL Borehole D032 (Rock Head Depth 28m, Hole Depth 57m)**

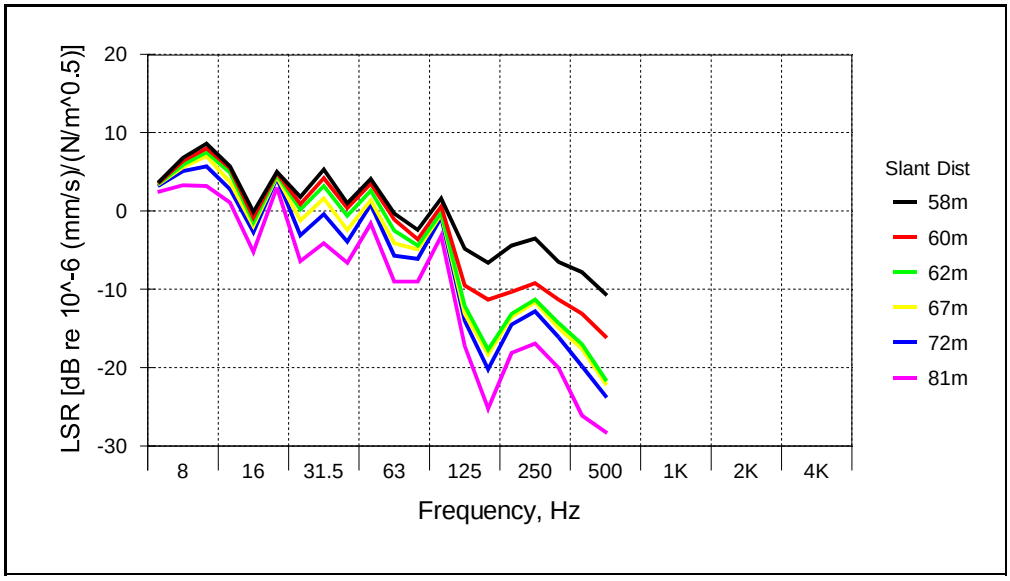


Figure I **LSR from WIL Borehole D047 (Rock Head Depth 37m, Hole Depth 96m)**

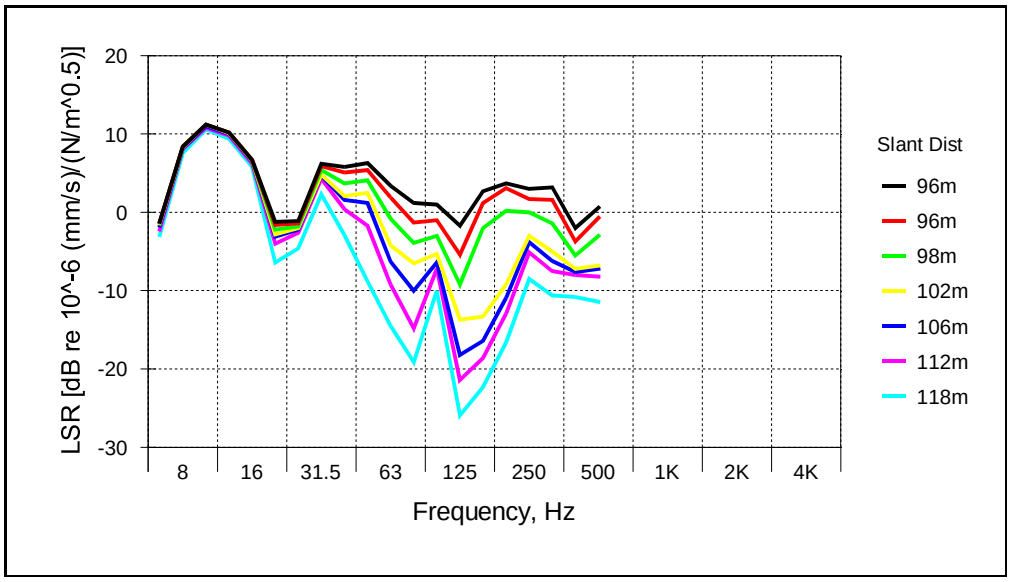


Figure J **LSR from WIL Borehole D049 (Rock Head Depth 19m, Hole Depth 60m)**

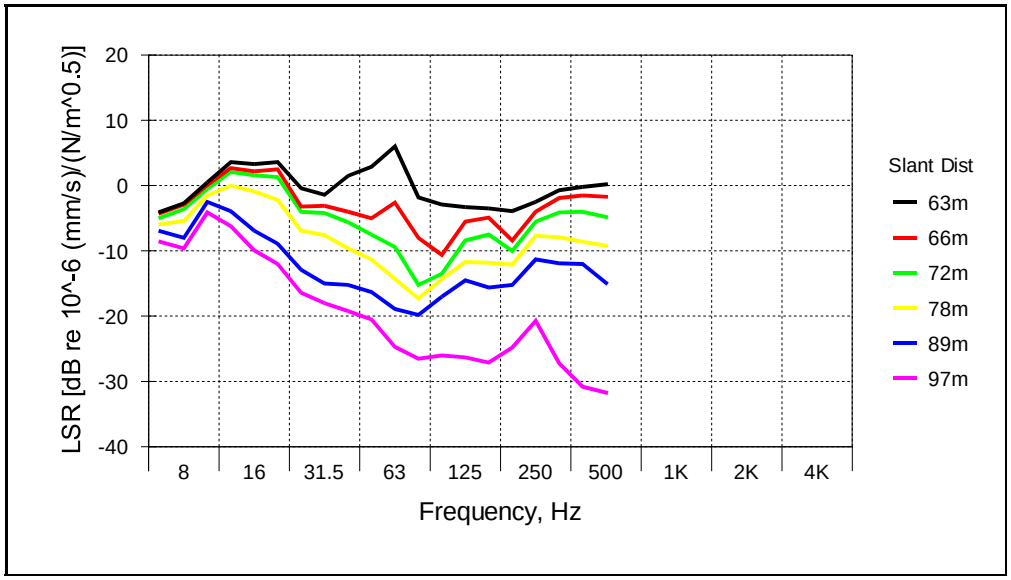


Figure K **LSR from WIL Borehole D049 (Rock Head Depth 19m, Hole Depth 88m)**

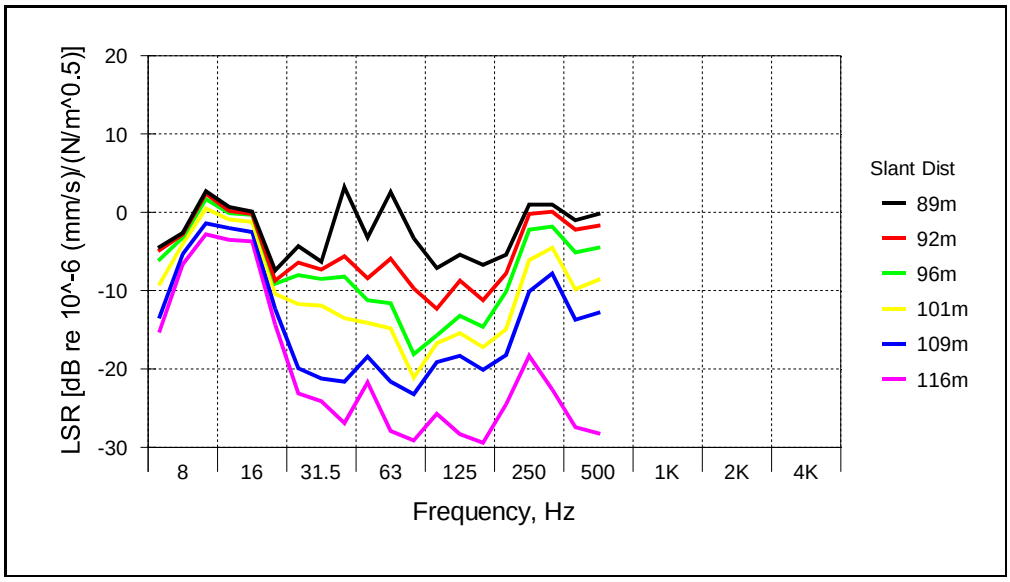


Figure L **LSR from WIL Borehole D064 (Rock Head Depth 15m, Hole Depth 55m)**

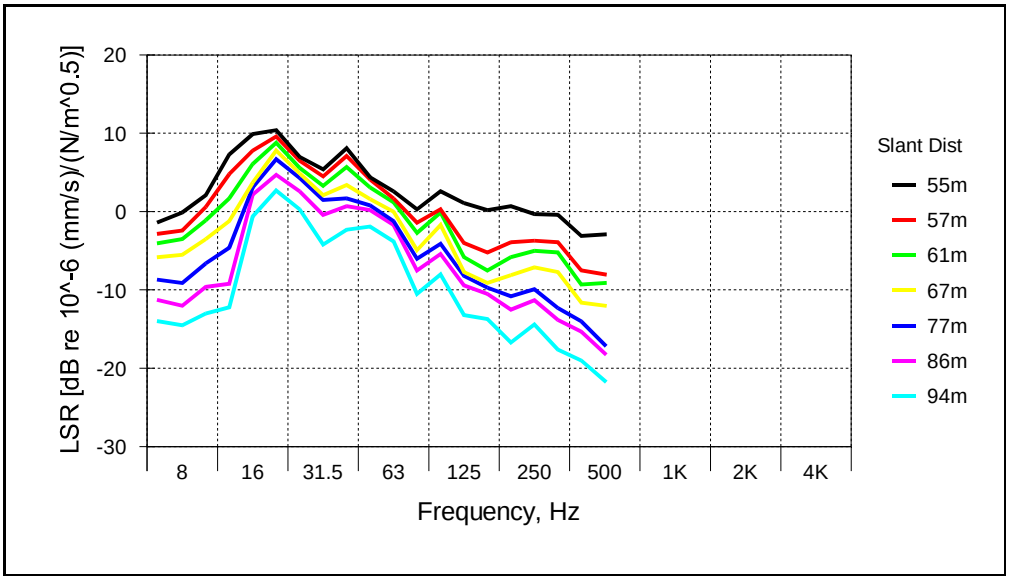


Figure M **LSR from WIL Borehole D064 (Rock Head Depth 15m, Hole Depth 67m)**

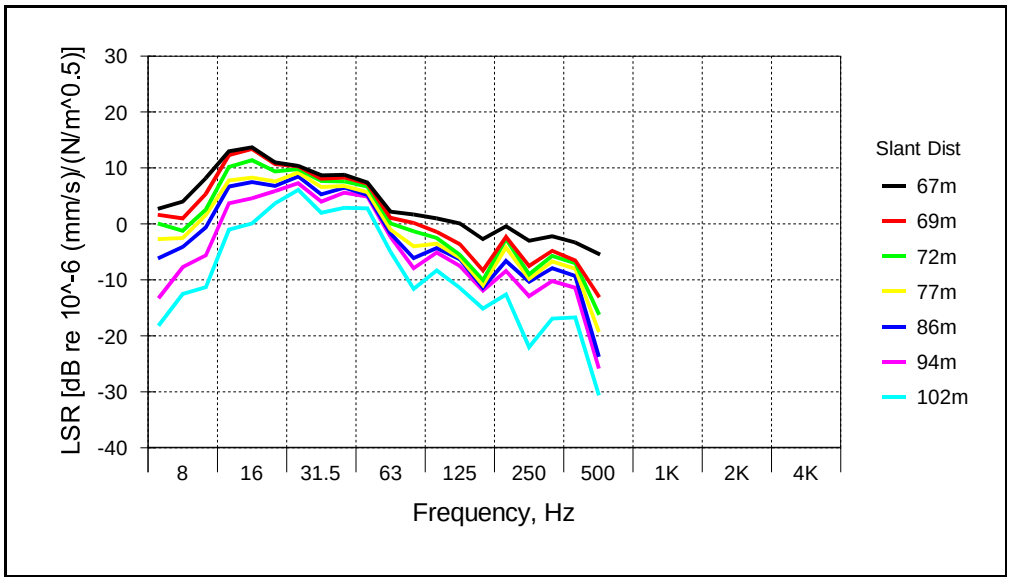


Figure N **Measured LSR at Kwai Chung (Performance Test Plan)**

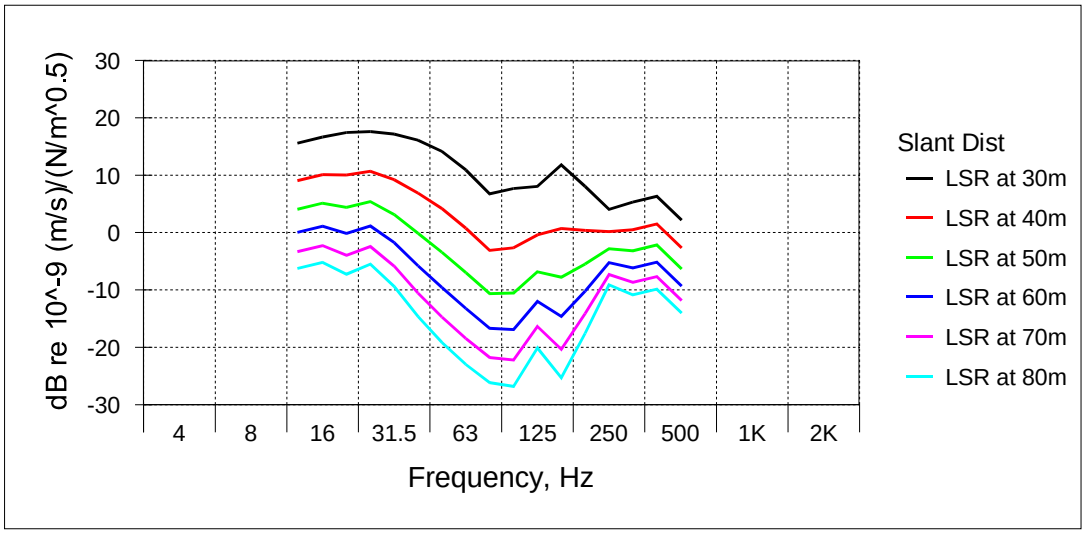
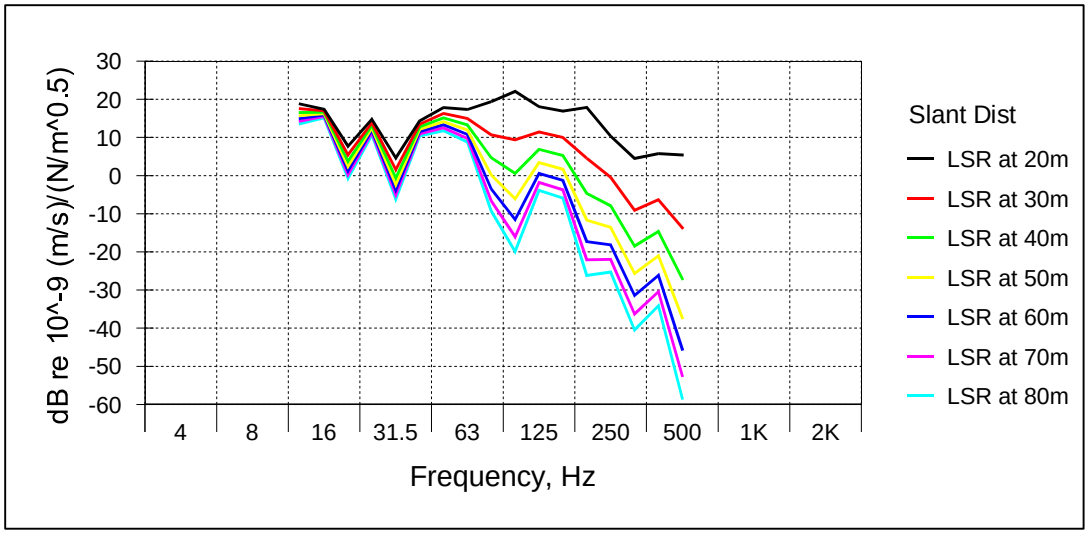


Figure O **Measured LSR at Shek Kong (Performance Test Plan)**

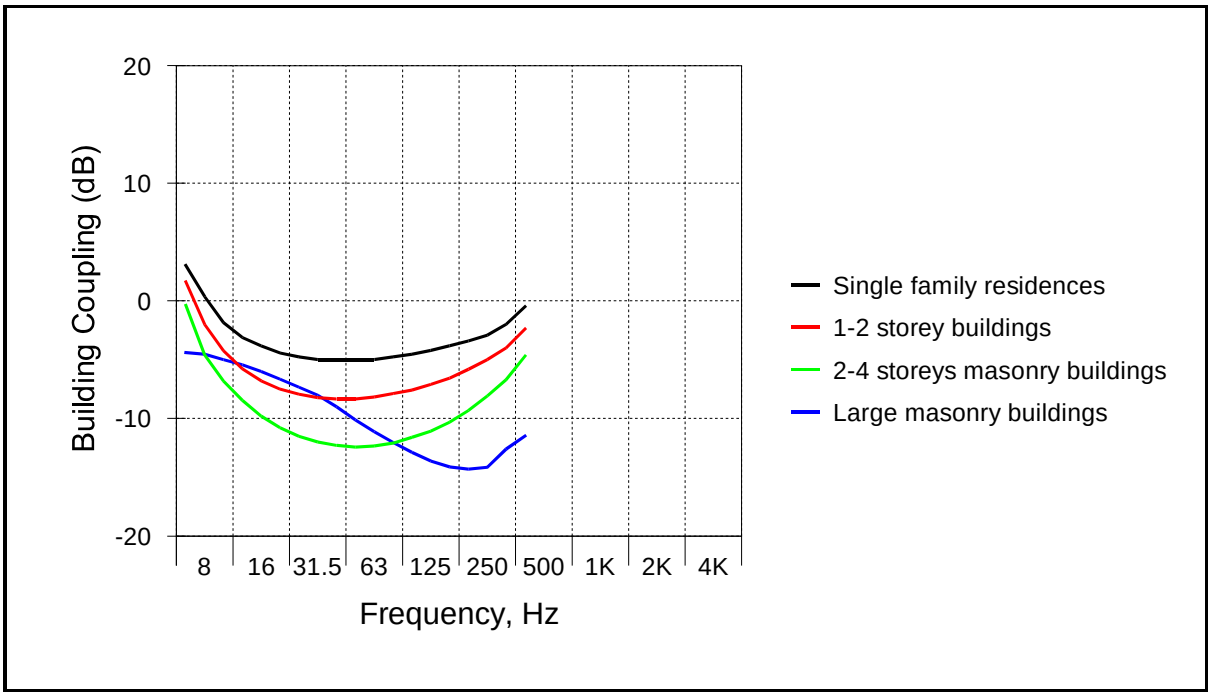


APPENDIX 2.5

BUILDING COUPLING FACTOR

Appendix 2.5 Building Coupling Factor

Building Coupling Factor – Type 0 to Type 3 Structures



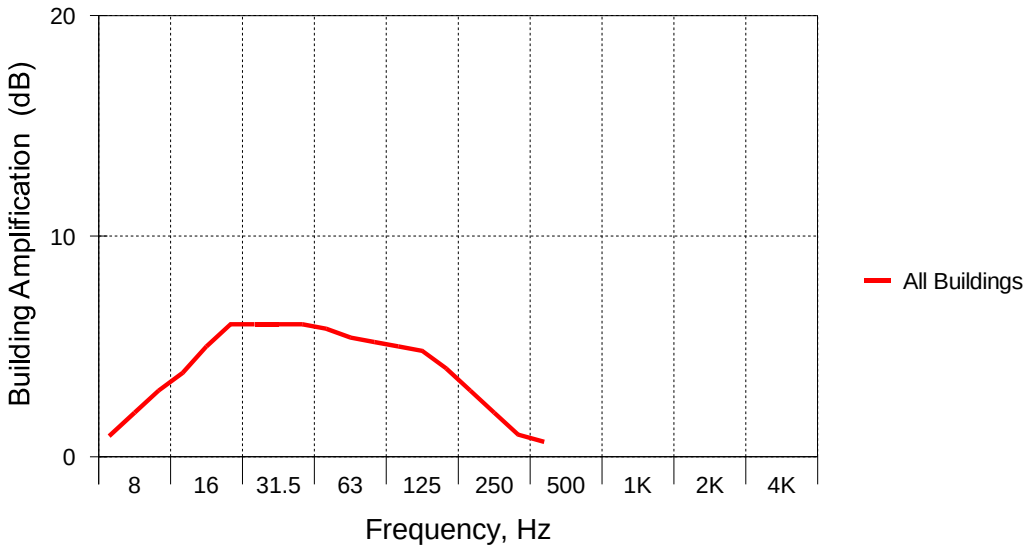
Reference: Figure 11-5 of FTA Guidance Manual

APPENDIX 2.6

BUILDING VIBRATION RESPONSE

Appendix 2.6 Building Vibration Response

Building Vibration Response



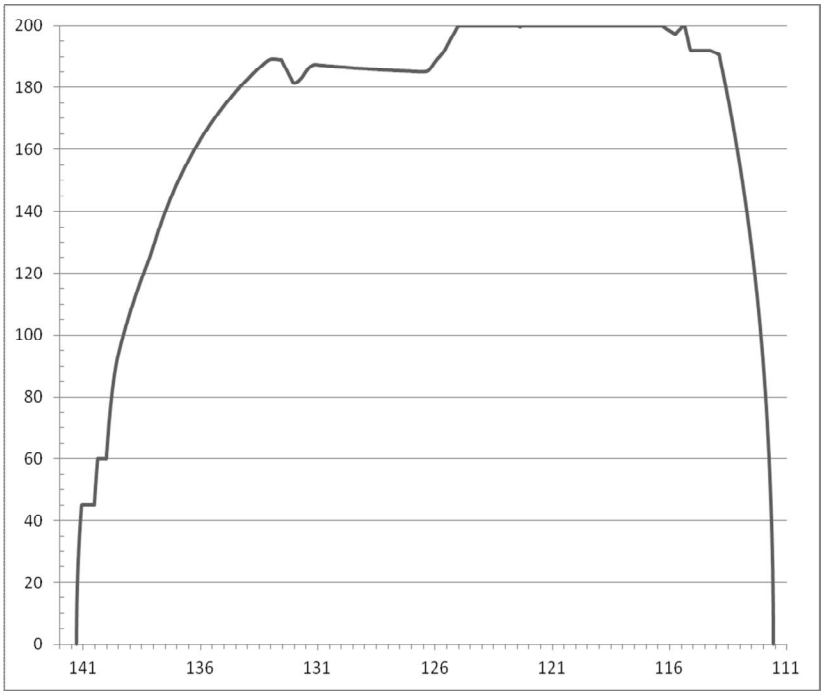
Reference: FTA manual with adjustments made across the frequency range

APPENDIX 2.7

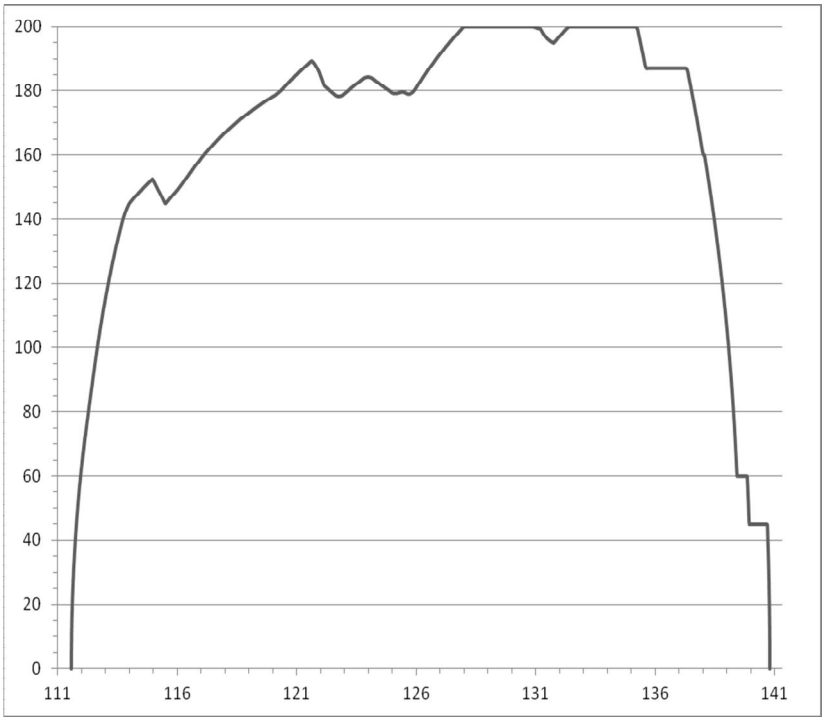
SPEED PROFILE OF THE PROJECT

Appendix 2.7 Speed Profile of the Project

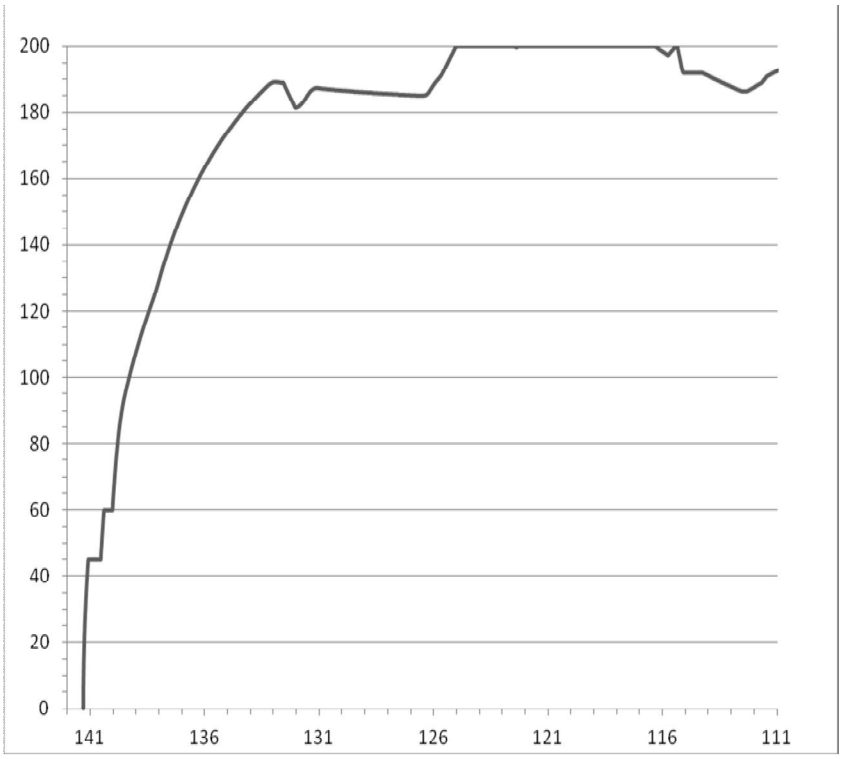
Train Speed from West Kowloon Terminus to Futian, Shenzhen



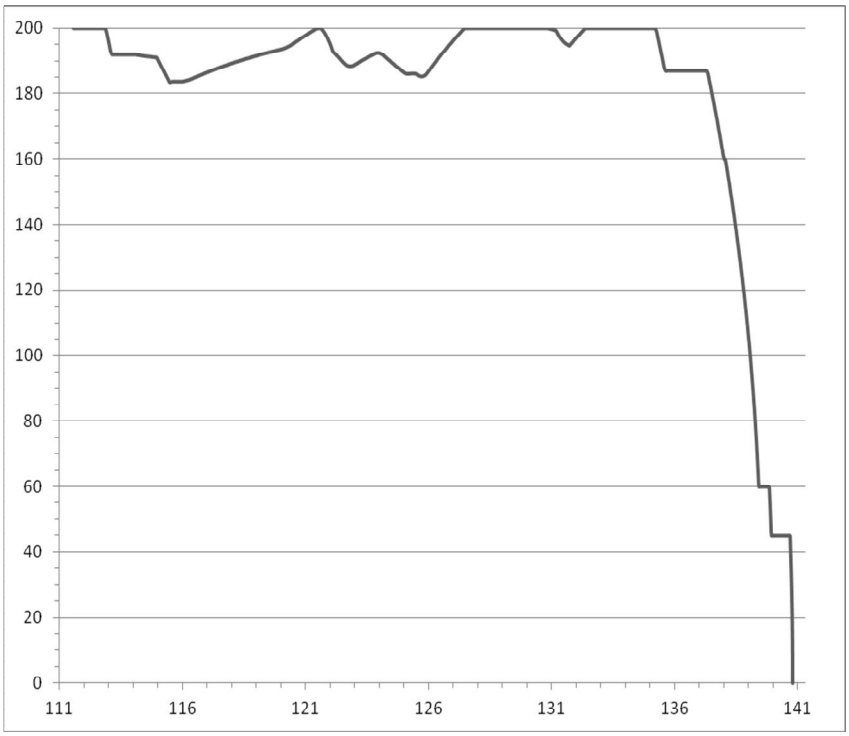
Train Speed from Futian, Shenzhen to West Kowloon Terminus



Train Speed from West Kowloon Terminus to Futian, Shenzhen (Non-Stop at Futian)



Train Speed from Futian, Shenzhen to West Kowloon Terminus (Non-Stop at Futian)



APPENDIX 2.8

SAMPLE CALCULATION OF OPERATIONAL GROUND-BORNE NOISE ASSESSMENT (UNMITIGATED SCENARIO)

NSR No.	GN1							Down Track Chainage			141+486		Calculated Distance (m)			20	Calculated speed (km/h)			45
Location	**Future Development at West Kowloon Cultural District**							Up Track Chainage			141+496		Calculated Distance (m)			20	Calculated speed (km/h)			33
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	37.1	39.1	36.1	41.1	49.6	50.1	53.1	50.1	54.1	51.1	47.1	51.6	51.6	42.1	25.6	19.0	14.0	-16.0	-16.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	10.8	11.5	11.9	15.2	21.6	19.5	21.8	20.8	20.7	13.2	2.3	-4.7	-9.5	-14.4	-14.6	-15.3	-8.6	-13.9	-16.3
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	30.3	34.0	32.4	41.5	55.6	55.0	62.2	60.3	66.2	54.5	38.5	35.9	32.5	21.3	4.9	-7.3	-8.9	-42.3	-37.3
Lmax (Long Train)	dB	30.4	34.1	32.5	41.6	55.6	55.0	62.3	60.3	66.2	54.6	40.1	39.7	38.1	28.5	12.3	-1.0	-3.9	-35.7	-29.7
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	34.4	36.4	33.4	38.4	46.9	47.4	50.4	47.4	51.4	48.4	44.4	48.9	48.9	39.4	22.9	16.3	11.3	-18.7	-18.7
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	12.2	13.6	14.9	18.2	23.5	23.2	24.0	23.3	22.7	17.9	10.8	6.8	2.2	-2.8	-9.1	-8.7	-5.9	-10.5	-10.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	29.3	33.7	33.0	42.1	55.1	56.3	62.1	60.4	65.8	56.8	44.4	43.7	38.9	23.7	2.0	-7.0	-10.2	-44.9	-42.0
Lmax (Long Train)	dB	27.9	32.3	31.7	40.7	53.7	54.9	60.7	59.0	64.4	55.5	43.2	42.8	38.8	26.1	8.4	-3.9	-7.3	-39.4	-33.7
Total Predicted Noise Level																				
Lmax	dBA	34	Highest A-weighted level																	
Leq (day)	dBA	24																		
Leq (night)	dBA	20																		
Leq (24hr)	dBA	21																		

NSR No.	GN2							Down Track Chainage			141+486		Calculated Distance (m)			40	Calculated speed (km/h)			45
Location	**Future Development at West Kowloon Cultural District**							Up Track Chainage			141+496		Calculated Distance (m)			40	Calculated speed (km/h)			33
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	37.7	39.7	36.7	41.7	50.2	50.7	53.7	50.7	54.7	51.7	47.7	52.2	52.2	42.7	26.2	19.6	14.6	-15.4	-15.4
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	7.4	6.6	8.2	12.5	17.7	13.8	12.3	7.8	0.9	-5.9	-9.4	-13.3	-15.7	-19.7	-17.7	-18.2	-9.5	-15.9	-19.4
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	26.2	28.5	28.0	38.0	51.0	48.6	52.1	46.6	45.7	34.9	25.9	25.3	22.8	8.0	-7.4	-15.5	-12.8	-50.0	-53.9
Lmax (Long Train)	dB	26.2	28.7	28.2	38.1	51.0	48.6	52.1	46.6	45.8	35.7	26.4	26.1	23.7	8.5	-7.0	-15.2	-12.6	-49.2	-53.0
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	34.9	36.9	33.9	38.9	47.4	47.9	50.9	47.9	51.9	48.9	44.9	49.4	49.4	39.9	23.4	16.8	11.8	-18.2	-18.2
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	8.7	8.7	9.7	13.8	19.2	15.4	15.9	13.4	8.7	0.5	-7.9	-12.1	-15.0	-19.2	-16.6	-17.5	-9.4	-15.5	-18.8
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	24.9	28.0	27.0	36.8	49.9	47.6	53.1	49.6	50.9	38.6	24.8	24.1	21.1	6.3	-8.8	-17.1	-15.2	-52.1	-55.7
Lmax (Long Train)	dB	23.5	26.8	25.7	35.4	48.5	46.2	51.7	48.2	49.5	38.2	27.8	29.3	28.0	18.2	2.0	-10.7	-12.8	-45.5	-40.2
Total Predicted Noise Level																				
Lmax	dBA	19	Highest A-weighted level																	
Leq (day)	dBA	11																		
Leq (night)	dBA	6																		
Leq (24hr)	dBA	8																		

NSR No.	GN3																			
								Down Track Chainage			140+324		Calculated Distance (m)			16	Calculated speed (km/h)			60
Location	Yaumati Catholic Primary School (Hoi Wang Road)							Up Track Chainage			140+334		Calculated Distance (m)			5	Calculated speed (km/h)			60
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	17.4	19.9	23.3	26.7	29.6	30.9	29.6	28.9	27.7	25.2	20.8	25.0	22.2	17.2	3.3	5.1	2.2	-1.7	1.2
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	37.6	40.8	42.3	50.1	55.8	57.4	60.2	57.7	61.3	52.7	41.3	47.6	44.1	28.2	-0.3	-7.5	-15.0	-48.5	-45.2
Lmax (Long Train)	dB	37.8	40.9	42.4	50.2	56.0	57.5	60.4	58.0	61.6	52.9	41.5	47.8	44.3	28.3	-0.2	-7.4	-14.9	-48.3	-45.1
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	22.6	25.2	29.0	32.4	34.9	36.4	34.9	34.1	32.9	30.7	26.6	31.9	29.4	24.4	9.5	11.4	7.7	4.0	7.3
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	43.1	46.6	48.9	56.7	61.4	63.7	65.7	63.2	66.5	59.0	48.5	56.6	53.5	37.6	7.3	0.5	-8.6	-41.8	-37.6
Lmax (Long Train)	dB	45.2	48.6	50.9	58.7	63.3	65.6	67.5	65.1	68.3	60.8	50.3	58.5	55.4	39.5	9.3	2.4	-6.6	-39.8	-35.7
Total Predicted Noise Level																				
Lmax	dBA	41	Highest A-weighted level																	
Leq (day)	dBA	29																		
Leq (night)	dBA	23																		
Leq (24hr)	dBA	26																		

NSR No.	GN4							Down Track Chainage	140+194			Calculated Distance (m)	5			Calculated speed (km/h)	64		
Location	**Block 9, Charming Garden**							Up Track Chainage	140+204			Calculated Distance (m)	17			Calculated speed (km/h)	73		
		1/3 Octave Band Center Frequency (Hz)																	
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																			
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	22.3	24.9	28.6	32.0	34.5	36.0	34.5	33.8	32.5	30.4	26.2	31.6	29.1	24.1	9.2	11.1	7.4	3.6	7.0
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	40.8	44.3	46.5	54.4	59.0	61.3	63.1	60.7	63.9	56.5	46.0	54.2	51.1	35.2	5.0	-1.9	-11.0	-44.2	-40.0
Lmax (Long Train)	dB	40.8	44.3	46.6	54.4	59.0	61.3	63.2	60.8	64.0	56.5	46.0	54.2	51.2	35.2	5.0	-1.9	-10.9	-44.1	-40.0
Up Track Calculation																			
FDL	dB re 1N/m$^{1/2}$	42.2	44.2	41.2	46.2	54.7	55.2	58.2	55.2	59.2	56.2	52.2	56.7	56.7	47.2	30.7	24.1	19.1	-10.9	-10.9
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	17.0	19.1	21.9	25.2	28.9	29.6	29.1	28.4	27.3	24.1	18.8	20.2	16.8	11.8	0.5	1.8	0.8	-3.3	-1.5
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	36.0	39.0	40.4	48.1	53.8	55.4	58.1	55.7	59.2	50.8	39.2	44.2	40.4	24.5	-2.8	-10.3	-17.0	-50.5	-47.6
Lmax (Long Train)	dB	38.0	41.0	42.4	50.2	55.8	57.4	60.1	57.7	61.2	52.8	41.3	46.5	42.8	26.9	-0.7	-7.4	-14.9	-48.4	-45.4
Total Predicted Noise Level																			
Lmax	dBA	37	Highest A-weighted level																
Leq (day)	dBA	26																	
Leq (night)	dBA	21																	
Leq (24hr)	dBA	23																	

NSR No.	GN8							Down Track Chainage			139+153		Calculated Distance (m)			18	Calculated speed (km/h)			146
Location	**Chung Yew Building**							Up Track Chainage			139+174		Calculated Distance (m)			21	Calculated speed (km/h)			111
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	48.7	50.7	47.7	52.7	61.2	61.7	64.7	61.7	65.7	62.7	58.7	63.2	63.2	53.7	37.2	30.6	25.6	-4.4	-4.4
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	19.0	17.5	8.2	14.9	5.3	14.5	18.2	17.8	21.3	24.9	19.5	18.4	20.8	12.7	7.5	8.4
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	32.4	34.8	34.6	50.3	56.0	51.3	59.1	52.3	61.6	59.1	52.2	58.0	60.5	43.7	24.9	19.4	5.5	-29.2	-27.4
Lmax (Long Train)	dB	33.1	35.4	35.1	50.4	56.1	51.7	59.3	52.9	61.8	59.1	52.2	58.0	60.5	43.7	24.9	19.4	5.5	-29.2	-27.4
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	46.3	48.3	45.3	50.3	58.8	59.3	62.3	59.3	63.3	60.3	56.3	60.8	60.8	51.3	34.8	28.2	23.2	-6.8	-6.8
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	18.7	17.4	7.6	14.7	4.4	14.3	17.7	17.2	18.8	21.2	17.6	16.4	17.0	9.6	3.6	5.0
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	26.6	29.0	28.0	47.4	53.0	45.9	55.6	46.5	58.4	56.2	49.2	53.4	54.9	39.7	20.9	13.7	0.4	-34.9	-32.8
Lmax (Long Train)	dB	30.2	32.7	32.6	48.2	53.9	49.1	56.9	49.9	59.4	56.7	49.6	53.9	55.4	40.1	21.3	14.2	0.9	-34.4	-32.3
Total Predicted Noise Level																				
Lmax	dBA	43	Highest A-weighted level																	
Leq (day)	dBA	29																		
Leq (night)	dBA	24																		
Leq (24hr)	dBA	26																		

NSR No.	GN11a																			
								Down Track Chainage			137+923		Calculated Distance (m)			28	Calculated speed (km/h)			187
Location	**Planned Residential Development in Site 6**							Up Track Chainage			137+954		Calculated Distance (m)			15	Calculated speed (km/h)			137
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.9	52.9	49.9	54.9	63.4	63.9	66.9	63.9	67.9	64.9	60.9	65.4	65.4	55.9	39.4	32.8	27.8	-2.2	-2.2
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	3.6	8.5	8.2	5.2	0.4	2.9	8.0	4.7	8.8	11.9	13.1	12.2	11.7	13.3	14.4	8.5	11.0	10.9	17.4
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.3	48.7	47.0	55.0	68.4	67.6	75.0	73.0	79.0	69.4	62.0	64.2	63.5	54.4	38.2	24.7	21.3	-9.9	-3.7
Lmax (Long Train)	dB	45.1	49.1	47.6	55.6	68.6	67.9	75.2	73.1	79.1	69.5	62.0	64.2	63.5	54.4	38.2	24.7	21.3	-9.9	-3.7
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	48.1	50.1	47.1	52.1	60.6	61.1	64.1	61.1	65.1	62.1	58.1	62.6	62.6	53.1	36.6	30.0	25.0	-5.0	-5.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
TCF	dB	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	13.1	15.3	18.3	21.6	25.1	26.0	25.2	24.5	23.4	20.4	15.3	17.5	14.3	9.3	-2.7	-1.3	-2.8	-6.9	-4.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.4	49.6	51.2	59.9	69.1	72.1	75.5	73.8	78.6	72.7	64.4	71.7	69.4	55.7	36.4	23.5	19.5	-11.7	-5.5
Lmax (Long Train)	dB	44.9	50.1	51.8	60.4	69.5	72.4	75.9	74.1	78.9	73.0	64.7	72.1	69.7	56.0	36.7	23.8	19.8	-11.4	-5.2
Total Predicted Noise Level																				
Lmax	dBA	54	Highest A-weighted level																	
Leq (day)	dBA	40																		
Leq (night)	dBA	35																		
Leq (24hr)	dBA	37																		

NSR No.	GN18	Down Track Chainage	134+073	Calculated Distance (m)	90	Calculated speed (km/h)	200
Location	Block 2 Greenknoll Court	Up Track Chainage	134+084	Calculated Distance (m)	90	Calculated speed (km/h)	185

		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-4.6	-2.7	2.5	0.4	-0.1	-8.1	-5.5	-6.9	-1.7	-6.1	-2.1	-6.9	-10.0	-7.2	-9.2	-6.7	0.3	0.5	-1.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	20.4	25.3	28.6	32.3	39.5	33.1	40.8	38.3	50.7	41.5	40.6	38.8	35.3	27.1	8.0	2.5	3.4	-27.5	-29.9
Lmax (Long Train)	dB	21.7	26.5	29.8	33.5	40.7	34.3	42.1	39.5	52.0	42.8	41.9	40.1	36.6	28.3	9.2	3.8	4.6	-26.2	-28.7
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.8	52.8	49.8	54.8	63.3	63.8	66.8	63.8	67.8	64.8	60.8	65.3	65.3	55.8	39.3	32.7	27.7	-2.3	-2.3
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-4.6	-2.7	2.5	0.4	-0.1	-8.1	-5.4	-6.8	-1.5	-6.0	-1.9	-6.7	-9.9	-7.2	-9.1	-6.7	0.3	0.5	-1.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	19.7	24.6	27.8	31.5	38.7	32.3	40.0	37.5	49.7	40.6	39.6	37.9	34.4	26.2	7.1	1.7	2.6	-28.3	-30.7
Lmax (Long Train)	dB	20.9	25.8	29.1	32.8	40.0	33.6	41.3	38.8	51.0	41.9	41.0	39.2	35.7	27.5	8.4	3.0	3.9	-27.0	-29.4
Total Predicted Noise Level																				
Lmax	dBA	24	Highest A-weighted level																	
Leq (day)	dBA	12																		
Leq (night)	dBA	7																		
Leq (24hr)	dBA	9																		

NSR No.	GN28	Down Track Chainage	125+003	Calculated Distance (m)	26	Calculated speed (km/h)	192
Location	510B Nam Hing Lei	Up Track Chainage	125+014	Calculated Distance (m)	29	Calculated speed (km/h)	200

		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.1	53.1	50.1	55.1	63.6	64.1	67.1	64.1	68.1	65.1	61.1	65.6	65.6	56.1	39.6	33.0	28.0	-2.0	-2.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	10.0	14.6	15.2	16.0	12.6	10.1	7.9	10.0	10.2	10.1	5.0	5.5	4.7	-1.9	-8.2	-2.7	-5.2	-5.4	-8.5
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.0	45.4	42.8	46.7	45.0	43.1	44.4	44.9	50.3	45.9	35.6	40.0	40.0	23.6	3.1	1.0	-5.9	-35.6	-37.0
Lmax (Long Train)	dB	44.2	45.7	43.1	47.0	45.5	43.6	45.0	45.5	50.9	46.5	36.2	40.6	40.5	24.1	3.5	1.4	-5.4	-35.2	-36.6
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.8	14.4	14.8	15.1	11.5	9.3	5.7	8.0	9.5	9.6	3.1	4.7	3.2	-3.5	-10.7	-4.7	-6.0	-5.9	-9.1
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.1	45.5	42.7	46.1	44.4	42.7	42.5	43.3	50.2	46.0	34.1	39.6	38.9	22.3	0.9	-0.6	-6.3	-35.7	-37.2
Lmax (Long Train)	dB	44.4	45.9	43.0	46.5	44.9	43.3	43.1	43.9	50.8	46.6	34.8	40.2	39.5	22.9	1.3	-0.1	-5.8	-35.2	-36.8
Total Predicted Noise Level																				
Lmax	dBA	25	Highest A-weighted level																	
Leq (day)	dBA	14																		
Leq (night)	dBA	9																		
Leq (24hr)	dBA	11																		

NSR No.	GN31																				
								Down Track Chainage			123+473			Calculated Distance (m)		35		Calculated speed (km/h)			189
Location	DD110 LOT 482, Wang Toi Shan Choi Yuen Tsuen							Up Track Chainage			123+494			Calculated Distance (m)		19		Calculated speed (km/h)			200
		1/3 Octave Band Center Frequency (Hz)																			
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Down Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.0	53.0	50.0	55.0	63.5	64.0	67.0	64.0	68.0	65.0	61.0	65.5	65.5	56.0	39.5	32.9	27.9	-2.1	-2.1	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	17.0	16.8	4.6	13.5	0.4	13.1	15.7	14.1	7.6	4.8	9.1	7.5	-0.2	-4.3	-14.0	-10.7	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	34.6	33.6	29.5	50.6	56.5	45.1	58.5	44.2	62.6	61.0	54.2	51.3	48.7	42.8	24.7	10.0	0.8	-38.9	-34.3	
Lmax (Long Train)	dB	40.7	42.6	39.2	51.2	56.7	46.4	58.6	45.4	62.9	61.2	54.3	51.6	49.0	42.9	24.7	10.2	1.2	-35.8	-33.3	
Up Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	18.8	17.4	7.9	14.8	4.8	14.4	17.9	17.5	19.9	22.9	18.5	17.3	18.7	11.0	5.4	6.5	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	40.0	40.1	37.2	54.9	59.1	50.5	61.7	50.8	65.8	65.1	59.4	65.6	68.7	54.1	36.5	31.0	18.2	-17.4	-14.9	
Lmax (Long Train)	dB	43.3	44.3	41.6	55.3	59.4	51.6	61.9	52.5	66.0	65.2	59.6	65.8	68.8	54.3	36.6	31.1	18.3	-17.2	-14.6	
Total Predicted Noise Level																					
Lmax	dBA	51	Highest A-weighted level																		
Leq (day)	dBA	35																			
Leq (night)	dBA	30																			
Leq (24hr)	dBA	32																			

NSR No.	GN33																				
								Down Track Chainage			122+833		Calculated Distance (m)		29		Calculated speed (km/h)		195		
Location	348 Tsat Sing Kong							Up Track Chainage			122+854		Calculated Distance (m)		27		Calculated speed (km/h)		200		
		1/3 Octave Band Center Frequency (Hz)																			
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Down Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.2	53.2	50.2	55.2	63.7	64.2	67.2	64.2	68.2	65.2	61.2	65.7	65.7	56.2	39.7	33.1	28.1	-1.9	-1.9	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.6	14.2	14.3	14.2	10.4	8.5	3.3	5.9	8.8	9.1	1.2	3.8	1.7	-5.3	-13.3	-6.7	-6.8	-6.3	-9.7	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	45.8	48.3	45.0	49.0	50.4	49.0	50.9	50.9	57.9	53.2	41.2	46.6	45.3	28.4	5.3	4.2	-1.9	-31.7	-33.6	
Lmax (Long Train)	dB	45.9	48.6	45.2	49.4	50.8	48.7	50.7	50.0	58.2	54.7	45.0	48.2	47.0	34.2	15.0	6.7	-0.7	-31.3	-32.8	
Up Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.5	14.1	14.1	14.0	10.1	8.2	2.8	5.3	8.6	8.9	0.8	3.3	1.1	-6.2	-14.1	-7.4	-7.1	-6.5	-9.9	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	46.4	48.7	45.7	50.0	51.1	49.6	52.3	52.3	58.3	53.4	42.7	47.2	46.6	29.9	7.8	6.0	-1.1	-31.2	-33.0	
Lmax (Long Train)	dB	46.5	49.0	46.0	50.5	51.6	49.3	52.3	51.8	58.6	55.0	46.0	49.1	48.6	35.5	16.6	8.8	0.4	-30.7	-32.0	
Total Predicted Noise Level																					
Lmax	dBA	33	Highest A-weighted level																		
Leq (day)	dBA	21																			
Leq (night)	dBA	16																			
Leq (24hr)	dBA	18																			

NSR No.	GN37																			
								Down Track Chainage			119+163		Calculated Distance (m)			30	Calculated speed (km/h)			190
Location	DD104 LOT 1396, Yau Tam Mei Tsuen, Chuk Yau Road							Up Track Chainage			119+174		Calculated Distance (m)			29	Calculated speed (km/h)			200
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.1	53.1	50.1	55.1	63.6	64.1	67.1	64.1	68.1	65.1	61.1	65.6	65.6	56.1	39.6	33.0	28.0	-2.0	-2.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	14.4	15.0	15.6	19.0	25.2	22.5	25.0	23.9	23.8	15.4	3.0	-3.0	-7.3	-12.0	-11.2	-12.0	-4.8	-10.4	-13.0
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	50.3	48.3	45.5	52.3	60.2	58.3	64.3	61.9	67.2	54.6	37.0	35.1	31.4	16.9	3.5	-5.1	-2.7	-38.2	-39.5
Lmax (Long Train)	dB	50.7	48.7	46.0	52.7	60.6	58.7	64.8	62.4	67.6	55.0	37.4	35.5	31.8	17.4	3.9	-4.7	-2.3	-37.8	-39.1
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	14.5	15.2	15.7	19.1	25.3	22.8	25.2	24.1	24.0	15.9	4.0	-2.3	-6.8	-11.6	-11.1	-11.8	-4.8	-10.2	-12.8
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	50.9	48.9	46.1	52.8	60.8	59.0	65.0	62.7	67.9	55.5	38.4	36.2	32.3	17.9	4.1	-4.4	-2.1	-37.6	-38.9
Lmax (Long Train)	dB	51.3	49.3	46.5	53.2	61.2	59.4	65.4	63.1	68.3	55.9	38.7	36.6	32.7	18.3	4.5	-4.1	-1.7	-37.2	-38.5
Total Predicted Noise Level																				
Lmax	dBA	35	Highest A-weighted level																	
Leq (day)	dBA	21																		
Leq (night)	dBA	16																		
Leq (24hr)	dBA	19																		

NSR No.	GN42																			
								Down Track Chainage			117+893		Calculated Distance (m)			38	Calculated speed (km/h)			187
Location	House A78 Maple Gardens							Up Track Chainage			117+904		Calculated Distance (m)			40	Calculated speed (km/h)			200
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.9	52.9	49.9	54.9	63.4	63.9	66.9	63.9	67.9	64.9	60.9	65.4	65.4	55.9	39.4	32.8	27.8	-2.2	-2.2
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	5.9	5.2	7.1	11.5	17.2	13.3	11.3	6.9	-0.1	-6.8	-10.0	-15.1	-16.1	-20.1	-18.4	-19.3	-9.5	-17.2	-20.4
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	46.0	43.3	40.8	47.8	55.9	52.7	57.8	54.2	56.8	45.1	35.4	35.8	35.2	22.5	1.7	10.9	-1.9	-36.6	-33.1
Lmax (Long Train)	dB	46.9	44.1	41.7	48.6	56.5	53.3	58.4	54.8	57.5	46.2	37.4	37.8	37.3	24.6	3.3	13.1	-0.1	-34.8	-31.0
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	5.6	5.0	6.8	11.2	17.0	13.0	11.0	6.7	-0.5	-7.2	-10.4	-15.6	-16.5	-20.5	-18.7	-19.7	-9.9	-17.6	-20.8
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	45.9	43.1	40.7	47.9	56.0	52.8	57.2	53.3	54.6	43.8	35.1	35.6	34.7	22.0	1.6	10.0	-2.1	-36.8	-33.6
Lmax (Long Train)	dB	47.1	44.2	41.9	49.0	56.8	53.6	58.0	54.1	55.4	45.0	36.9	37.5	36.6	23.9	3.2	11.9	-0.5	-35.1	-31.7
Total Predicted Noise Level																				
Lmax	dBA	26	Highest A-weighted level																	
Leq (day)	dBA	12																		
Leq (night)	dBA	7																		
Leq (24hr)	dBA	9																		

APPENDIX 2.9

SAMPLE CALCULATION OF OPERATIONAL GROUND-BORNE NOISE ASSESSMENT (WITH LOW NOISE TRACKFORM)

NSR No.	GN1							Down Track Chainage			141+486		Calculated Distance (m)			20	Calculated speed (km/h)			45
Location	**Future Development at West Kowloon Cultural District**							Up Track Chainage			141+496		Calculated Distance (m)			20	Calculated speed (km/h)			33
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	37.7	39.7	36.7	41.7	50.2	50.7	53.7	50.7	54.7	51.7	47.7	52.2	52.2	42.7	26.2	19.6	14.6	-15.4	-15.4
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-5.1	-4.3	-3.9	0.9	6.9	1.9	0.4	-2.5	-12.5	-19.5	-22.8	-29.3	-28.5	-32.6	-30.1	-31.4	-21.5	-30.5	-33.4
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	12.4	18.3	16.3	22.8	37.7	37.3	42.8	38.6	43.0	36.9	32.4	35.7	35.0	26.9	10.7	-2.7	-6.2	-37.4	-31.1
Lmax (Long Train)	dB	20.2	24.6	22.8	31.1	48.6	48.9	56.0	47.7	47.1	38.1	32.6	35.9	35.2	27.1	10.9	-2.6	-6.0	-37.2	-30.9
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	34.9	36.9	33.9	38.9	47.4	47.9	50.9	47.9	51.9	48.9	44.9	49.4	49.4	39.9	23.4	16.8	11.8	-18.2	-18.2
TIL	dB	-2.0	-1.5	-2.0	-1.5	2.5	-8.0	-15.0	-16.0	-21.0	-21.0	-24.0	-26.0	-26.0	-27.0	-28.0	-28.0	-28.0	-28.0	-28.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	12.2	13.6	14.9	18.2	23.5	23.2	24.0	23.3	22.7	17.9	10.8	6.8	2.2	-2.8	-9.1	-8.7	-5.9	-10.5	-10.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	12.9	18.6	16.7	23.7	38.7	39.5	44.2	40.4	44.4	38.1	32.4	35.4	34.7	26.6	10.4	-3.1	-6.6	-37.7	-31.5
Lmax (Long Train)	dB	18.8	23.9	22.6	30.9	47.3	49.4	55.0	47.3	47.1	39.2	32.6	35.5	34.7	26.5	10.3	-3.1	-6.5	-37.7	-31.5
Total Predicted Noise Level																				
Lmax	dBA	21	Highest A-weighted level																	
Leq (day)	dBA	15																		
Leq (night)	dBA	10																		
Leq (24hr)	dBA	12																		

NSR No.	GN2							Down Track Chainage			141+486		Calculated Distance (m)			40	Calculated speed (km/h)			45
Location	**Future Development at West Kowloon Cultural District**							Up Track Chainage			141+496		Calculated Distance (m)			40	Calculated speed (km/h)			33
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	37.7	39.7	36.7	41.7	50.2	50.7	53.7	50.7	54.7	51.7	47.7	52.2	52.2	42.7	26.2	19.6	14.6	-15.4	-15.4
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-6.2	-5.2	-5.0	-0.1	5.9	0.8	-0.7	-3.3	-13.8	-20.8	-24.2	-30.9	-29.8	-34.0	-31.3	-32.7	-22.8	-31.9	-34.8
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	24.0	26.8	26.0	36.3	54.9	46.3	48.4	36.3	26.2	13.5	2.8	3.5	1.7	-13.1	-28.2	-35.5	-33.2	-68.9	-72.7
Lmax (Long Train)	dB	24.2	27.2	26.3	36.4	54.9	46.5	48.5	36.7	30.1	25.3	14.8	17.0	15.5	-0.8	-18.0	-26.2	-25.6	-57.0	-60.7
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	34.9	36.9	33.9	38.9	47.4	47.9	50.9	47.9	51.9	48.9	44.9	49.4	49.4	39.9	23.4	16.8	11.8	-18.2	-18.2
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-7.3	-6.1	-6.1	-1.2	4.9	-0.4	-1.8	-4.2	-15.1	-22.2	-25.6	-32.5	-31.2	-35.3	-32.6	-34.0	-24.0	-33.4	-36.2
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	17.7	21.9	20.5	29.2	46.0	44.8	50.3	39.9	34.5	31.7	27.8	31.2	30.5	22.3	6.0	-7.3	-10.8	-42.0	-35.9
Lmax (Long Train)	dB	17.7	22.0	20.6	29.2	45.2	43.7	48.8	39.3	35.9	32.5	28.1	31.4	30.6	22.3	6.1	-7.2	-10.7	-41.9	-35.9
Total Predicted Noise Level																				
Lmax	dBA	15	Highest A-weighted level																	
Leq (day)	dBA	7																		
Leq (night)	dBA	2																		
Leq (24hr)	dBA	3																		

NSR No.	GN3																			
								Down Track Chainage			140+324		Calculated Distance (m)			16	Calculated speed (km/h)			60
Location	Yaumati Catholic Primary School (Hoi Wang Road)							Up Track Chainage			140+334		Calculated Distance (m)			5	Calculated speed (km/h)			60
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	17.4	19.9	23.3	26.7	29.6	30.9	29.6	28.9	27.7	25.2	20.8	25.0	22.2	17.2	3.3	5.1	2.2	-1.7	1.2
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	37.6	40.8	42.3	50.1	57.5	59.2	60.2	56.1	58.3	50.1	39.4	46.6	43.1	28.2	-0.3	-7.5	-15.0	-48.5	-45.2
Lmax (Long Train)	dB	37.8	40.9	42.4	50.2	57.7	59.4	60.4	56.5	59.0	50.4	39.7	46.8	43.3	28.3	-0.2	-7.4	-14.9	-48.3	-45.1
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	22.6	25.2	29.0	32.4	34.9	36.4	34.9	34.1	32.9	30.7	26.6	31.9	29.4	24.4	9.5	11.4	7.7	4.0	7.3
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	43.1	46.6	48.9	56.7	63.4	65.6	65.7	61.4	62.9	56.3	46.6	55.7	52.6	37.6	7.3	0.5	-8.6	-41.8	-37.6
Lmax (Long Train)	dB	45.2	48.6	50.9	58.7	65.3	67.6	67.5	63.1	64.5	57.9	48.3	57.5	54.4	39.5	9.3	2.4	-6.6	-39.8	-35.7
Total Predicted Noise Level																				
Lmax	dBA	40	Highest A-weighted level																	
Leq (day)	dBA	27																		
Leq (night)	dBA	22																		
Leq (24hr)	dBA	24																		

NSR No.	GN4							Down Track Chainage			140+194		Calculated Distance (m)			5	Calculated speed (km/h)			64
Location	**Block 9, Charming Garden**							Up Track Chainage			140+204		Calculated Distance (m)			17	Calculated speed (km/h)			73
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	41.1	43.1	40.1	45.1	53.6	54.1	57.1	54.1	58.1	55.1	51.1	55.6	55.6	46.1	29.6	23.0	18.0	-12.0	-12.0
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	22.3	24.9	28.6	32.0	34.5	36.0	34.5	33.8	32.5	30.4	26.2	31.6	29.1	24.1	9.2	11.1	7.4	3.6	7.0
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	40.8	44.3	46.5	54.3	59.0	61.3	63.1	60.7	63.9	56.5	46.0	54.2	51.1	35.2	5.0	-1.9	-11.0	-44.2	-40.0
Lmax (Long Train)	dB	40.8	44.3	46.6	54.4	59.0	61.3	63.2	60.7	64.0	56.5	46.0	54.2	51.1	35.3	5.0	-1.9	-10.9	-44.1	-40.0
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	42.2	44.2	41.2	46.2	54.7	55.2	58.2	55.2	59.2	56.2	52.2	56.7	56.7	47.2	30.7	24.1	19.1	-10.9	-10.9
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	17.0	19.1	21.9	25.2	28.9	29.6	29.1	28.4	27.3	24.1	18.8	20.2	16.8	11.8	0.5	1.8	0.8	-3.3	-1.5
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	36.0	39.0	40.4	48.1	53.8	55.4	58.1	55.7	59.2	50.8	39.2	44.2	40.4	24.5	-2.8	-10.3	-17.0	-50.5	-47.6
Lmax (Long Train)	dB	38.0	41.0	42.4	50.2	55.8	57.5	60.2	57.8	61.2	52.8	41.3	46.4	42.7	26.8	-0.7	-7.2	-14.8	-48.3	-45.4
Total Predicted Noise Level																				
Lmax	dBA	37	Highest A-weighted level																	
Leq (day)	dBA	26																		
Leq (night)	dBA	21																		
Leq (24hr)	dBA	23																		

NSR No.	GN8							Down Track Chainage			139+153		Calculated Distance (m)			18	Calculated speed (km/h)			146
Location	**Chung Yew Building**							Up Track Chainage			139+174		Calculated Distance (m)			21	Calculated speed (km/h)			111
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	48.7	50.7	47.7	52.7	61.2	61.7	64.7	61.7	65.7	62.7	58.7	63.2	63.2	53.7	37.2	30.6	25.6	-4.4	-4.4
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	19.0	17.5	8.2	14.9	5.3	14.5	18.2	17.8	21.3	24.9	19.5	18.4	20.8	12.7	7.5	8.4
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	32.4	34.8	34.6	50.3	60.0	56.3	64.1	50.3	49.6	42.1	34.7	42.0	45.0	29.2	11.4	6.9	-7.0	-41.7	-39.9
Lmax (Long Train)	dB	33.1	35.4	35.1	50.4	60.0	56.5	64.2	51.1	51.6	42.9	34.8	42.0	45.0	29.2	11.4	6.9	-7.0	-41.7	-39.9
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	46.3	48.3	45.3	50.3	58.8	59.3	62.3	59.3	63.3	60.3	56.3	60.8	60.8	51.3	34.8	28.2	23.2	-6.8	-6.8
TIL	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	18.7	17.4	7.6	14.7	4.4	14.3	17.7	17.2	18.8	21.2	17.6	16.4	17.0	9.6	3.6	5.0
BCF	dB	-4.4	-4.5	-5.0	-5.4	-6.0	-6.7	-7.3	-8.0	-9.0	-10.1	-11.1	-12.0	-12.9	-13.6	-14.1	-14.3	-14.2	-12.6	-11.5
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	22.9	25.6	23.2	47.2	54.6	45.7	55.1	41.2	54.0	53.2	47.2	52.4	53.9	39.7	20.9	13.8	0.4	-34.9	-32.8
Lmax (Long Train)	dB	30.2	32.7	32.6	48.2	55.9	51.0	56.9	48.0	55.5	53.7	47.6	52.9	54.4	40.1	21.3	14.2	0.9	-34.4	-32.3
Total Predicted Noise Level																				
Lmax	dBA	37	Highest A-weighted level																	
Leq (day)	dBA	24																		
Leq (night)	dBA	18																		
Leq (24hr)	dBA	21																		

NSR No.	GN11a																			
								Down Track Chainage			137+923		Calculated Distance (m)			28	Calculated speed (km/h)			187
Location	**Planned Residential Development in Site 6**							Up Track Chainage			137+954		Calculated Distance (m)			15	Calculated speed (km/h)			137
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.9	52.9	49.9	54.9	63.4	63.9	66.9	63.9	67.9	64.9	60.9	65.4	65.4	55.9	39.4	32.8	27.8	-2.2	-2.2
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
TCF	dB	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	10.7	11.4	11.8	15.2	21.5	19.2	21.5	20.5	20.4	12.6	1.2	-5.5	-10.1	-14.9	-14.8	-15.5	-8.7	-14.1	-16.5
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.3	48.7	47.0	55.0	72.4	72.6	80.0	71.0	67.0	52.4	44.5	48.2	48.0	39.9	24.7	12.2	8.8	-22.4	-16.2
Lmax (Long Train)	dB	44.0	48.6	46.8	54.8	72.3	72.6	79.9	70.9	67.0	52.7	45.5	50.0	49.5	42.1	25.4	12.8	8.9	-22.4	-16.1
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	48.1	50.1	47.1	52.1	60.6	61.1	64.1	61.1	65.1	62.1	58.1	62.6	62.6	53.1	36.6	30.0	25.0	-5.0	-5.0
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
TCF	dB	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	13.1	15.3	18.3	21.6	25.1	26.0	25.2	24.5	23.4	20.4	15.3	17.5	14.3	9.3	-2.7	-1.3	-2.8	-6.9	-4.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	44.4	49.6	51.2	59.9	73.1	77.1	80.5	71.8	66.6	55.7	46.9	55.7	53.9	41.2	22.9	11.0	7.0	-24.2	-18.0
Lmax (Long Train)	dB	44.6	49.9	51.5	60.1	73.4	77.4	80.8	72.1	67.0	56.3	47.7	56.4	54.5	42.5	23.7	11.7	7.4	-23.9	-17.6
Total Predicted Noise Level																				
Lmax	dBA	42	Highest A-weighted level																	
Leq (day)	dBA	29																		
Leq (night)	dBA	24																		
Leq (24hr)	dBA	26																		

NSR No.	GN18	Down Track Chainage	134+073	Calculated Distance (m)	90	Calculated speed (km/h)	200
Location	Block 2 Greenknoll Court	Up Track Chainage	134+084	Calculated Distance (m)	90	Calculated speed (km/h)	185

		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-4.6	-2.7	2.5	0.4	-0.1	-8.1	-5.5	-6.9	-1.7	-6.1	-2.1	-6.9	-10.0	-7.2	-9.2	-6.7	0.3	0.5	-1.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	20.4	25.3	28.6	32.3	39.5	33.1	40.8	38.3	50.7	41.5	40.6	38.8	35.3	27.1	8.0	2.5	3.4	-27.5	-29.9
Lmax (Long Train)	dB	21.7	26.5	29.8	33.5	40.7	34.3	42.1	39.5	52.0	42.8	41.9	40.1	36.6	28.3	9.2	3.8	4.6	-26.2	-28.7
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.8	52.8	49.8	54.8	63.3	63.8	66.8	63.8	67.8	64.8	60.8	65.3	65.3	55.8	39.3	32.7	27.7	-2.3	-2.3
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	-4.6	-2.7	2.5	0.4	-0.1	-8.1	-5.4	-6.8	-1.5	-6.0	-1.9	-6.7	-9.9	-7.2	-9.1	-6.7	0.3	0.5	-1.7
BCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	19.7	24.6	27.8	31.5	38.7	32.3	40.0	37.5	49.7	40.6	39.6	37.9	34.4	26.2	7.1	1.7	2.6	-28.3	-30.7
Lmax (Long Train)	dB	20.9	25.8	29.1	32.8	40.0	33.6	41.3	38.8	51.0	41.9	41.0	39.2	35.7	27.5	8.4	3.0	3.9	-27.0	-29.4
Total Predicted Noise Level																				
Lmax	dBA	24	Highest A-weighted level																	
Leq (day)	dBA	12																		
Leq (night)	dBA	7																		
Leq (24hr)	dBA	9																		

NSR No.	GN28																				
								Down Track Chainage			125+003			Calculated Distance (m)		26		Calculated speed (km/h)		192	
Location	510B Nam Hing Lei							Up Track Chainage			125+014			Calculated Distance (m)		29		Calculated speed (km/h)		200	
		1/3 Octave Band Center Frequency (Hz)																			
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Down Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.1	53.1	50.1	55.1	63.6	64.1	67.1	64.1	68.1	65.1	61.1	65.6	65.6	56.1	39.6	33.0	28.0	-2.0	-2.0	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	10.0	14.6	15.2	16.0	12.6	10.1	7.9	10.0	10.2	10.1	5.0	5.5	4.7	-1.9	-8.2	-2.7	-5.2	-5.4	-8.5	
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	44.0	45.4	42.8	46.7	45.0	43.1	44.4	44.9	50.3	45.9	35.6	40.0	40.0	23.6	3.1	1.0	-5.9	-35.6	-37.0	
Lmax (Long Train)	dB	44.2	45.7	43.1	47.0	45.5	43.6	45.0	45.5	50.9	46.5	36.2	40.6	40.5	24.1	3.5	1.4	-5.4	-35.2	-36.6	
Up Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.8	14.4	14.8	15.1	11.5	9.3	5.7	8.0	9.5	9.6	3.1	4.7	3.2	-3.5	-10.7	-4.7	-6.0	-5.9	-9.1	
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	44.1	45.5	42.7	46.1	44.4	42.7	42.5	43.3	50.2	46.0	34.1	39.6	38.9	22.3	0.9	-0.6	-6.3	-35.7	-37.2	
Lmax (Long Train)	dB	44.4	45.9	43.0	46.5	44.9	43.3	43.1	43.9	50.8	46.6	34.8	40.2	39.5	22.9	1.3	-0.1	-5.8	-35.2	-36.8	
Total Predicted Noise Level																					
Lmax	dBA	25	Highest A-weighted level																		
Leq (day)	dBA	14																			
Leq (night)	dBA	9																			
Leq (24hr)	dBA	11																			

NSR No.	GN31																			
								Down Track Chainage			123+473		Calculated Distance (m)			35	Calculated speed (km/h)			189
Location	DD110 LOT 482, Wang Toi Shan Choi Yuen Tsuen							Up Track Chainage			123+494		Calculated Distance (m)			19	Calculated speed (km/h)			200
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.0	53.0	50.0	55.0	63.5	64.0	67.0	64.0	68.0	65.0	61.0	65.5	65.5	56.0	39.5	32.9	27.9	-2.1	-2.1
TIL	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	17.0	16.8	4.6	13.5	0.4	13.1	15.7	14.1	7.6	4.8	9.1	7.5	-0.2	-4.3	-14.0	-10.7
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	34.6	33.6	29.5	50.6	58.5	47.1	58.5	42.2	58.6	58.0	52.2	50.3	47.7	42.8	24.7	10.0	0.8	-38.9	-34.3
Lmax (Long Train)	dB	40.7	42.6	39.1	51.2	58.7	48.4	58.6	43.5	58.9	58.2	52.3	50.6	48.0	42.9	24.7	10.2	1.2	-35.8	-33.3
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	-8.0	-14.0	-15.5	-15.0	-14.5	-14.5	-13.5	-12.5	-12.5	-12.5	-12.5
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	0.0	0.0	0.0	18.8	17.4	7.9	14.8	4.8	14.4	17.9	17.5	19.9	22.9	18.5	17.3	18.7	11.0	5.4	6.5
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	40.0	40.1	37.2	54.9	63.1	55.5	66.7	48.8	53.8	48.1	41.9	49.6	53.2	39.6	23.0	18.5	5.7	-29.9	-27.4
Lmax (Long Train)	dB	43.4	44.5	41.8	55.2	63.3	56.4	66.8	50.8	54.7	49.5	44.0	50.9	53.6	40.5	23.2	18.5	5.9	-29.4	-26.4
Total Predicted Noise Level																				
Lmax	dBA	36	Highest A-weighted level																	
Leq (day)	dBA	24																		
Leq (night)	dBA	18																		
Leq (24hr)	dBA	21																		

NSR No.	GN33																			
								Down Track Chainage			122+833		Calculated Distance (m)		29		Calculated speed (km/h)		195	
Location	348 Tsat Sing Kong							Up Track Chainage			122+854		Calculated Distance (m)		27		Calculated speed (km/h)		200	
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.2	53.2	50.2	55.2	63.7	64.2	67.2	64.2	68.2	65.2	61.2	65.7	65.7	56.2	39.7	33.1	28.1	-1.9	-1.9
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.6	14.2	14.3	14.2	10.4	8.5	3.3	5.9	8.8	9.1	1.2	3.8	1.7	-5.3	-13.3	-6.7	-6.8	-6.3	-9.7
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	45.8	48.3	45.0	49.0	50.4	49.0	50.9	50.9	57.9	53.2	41.2	46.6	45.3	28.4	5.3	4.2	-1.9	-31.7	-33.6
Lmax (Long Train)	dB	45.9	48.6	45.2	49.4	50.8	48.7	50.7	50.0	58.2	54.7	45.0	48.2	47.0	34.2	15.0	6.7	-0.7	-31.3	-32.8
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	9.5	14.1	14.1	14.0	10.1	8.2	2.8	5.3	8.6	8.9	0.8	3.3	1.1	-6.2	-14.1	-7.4	-7.1	-6.5	-9.9
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	46.4	48.7	45.7	50.0	51.1	49.6	52.3	52.3	58.3	53.4	42.7	47.2	46.6	29.9	7.8	6.0	-1.1	-31.2	-33.0
Lmax (Long Train)	dB	46.5	49.0	46.0	50.5	51.6	49.3	52.3	51.8	58.6	55.0	46.0	49.1	48.6	35.5	16.6	8.8	0.4	-30.7	-32.0
Total Predicted Noise Level																				
Lmax	dBA	33	Highest A-weighted level																	
Leq (day)	dBA	21																		
Leq (night)	dBA	15																		
Leq (24hr)	dBA	18																		

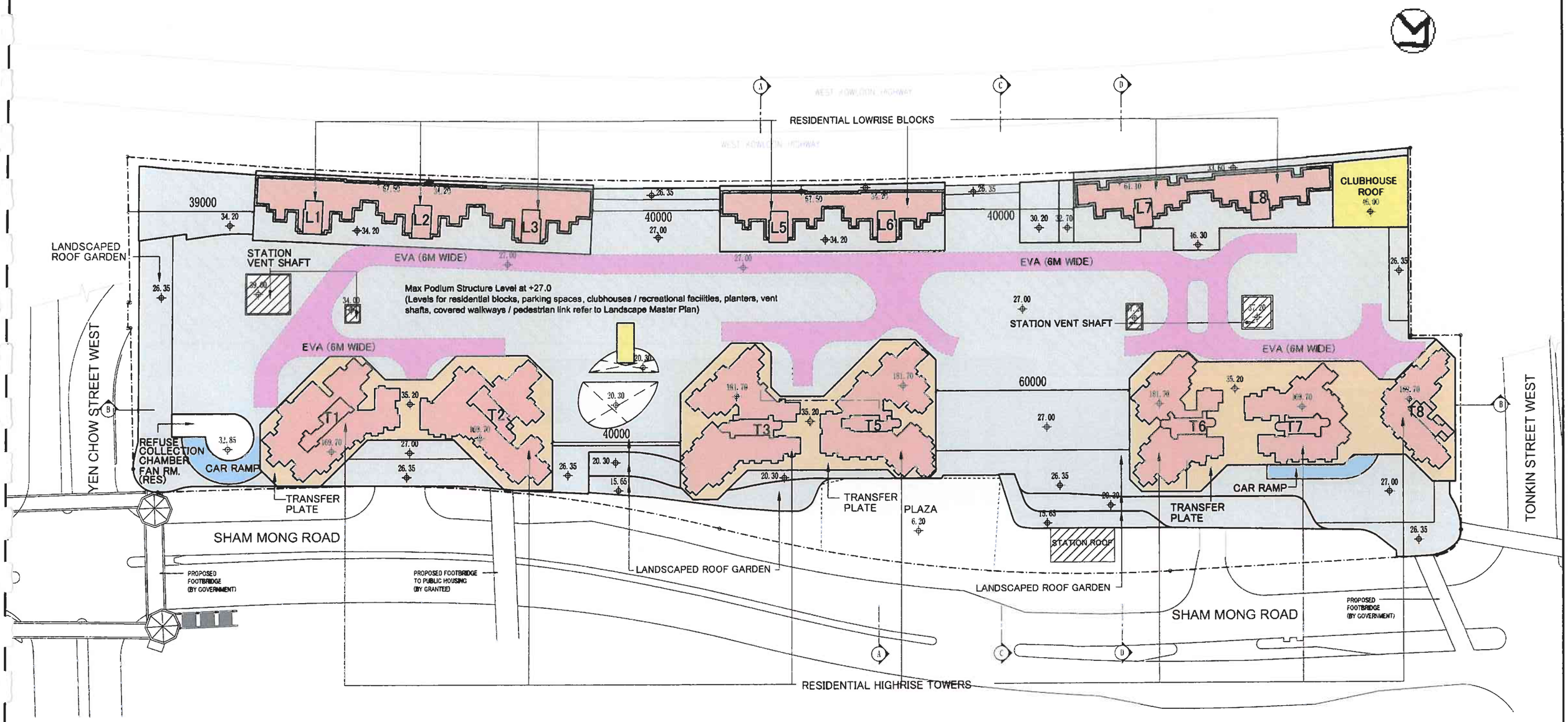
NSR No.	GN37																				
								Down Track Chainage			119+163			Calculated Distance (m)		30		Calculated speed (km/h)		190	
Location	DD104 LOT 1396, Yau Tam Mei Tsuen, Chuk Yau Road							Up Track Chainage			119+174			Calculated Distance (m)		29		Calculated speed (km/h)		200	
		1/3 Octave Band Center Frequency (Hz)																			
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	
Down Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.1	53.1	50.1	55.1	63.6	64.1	67.1	64.1	68.1	65.1	61.1	65.6	65.6	56.1	39.6	33.0	28.0	-2.0	-2.0	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	14.4	15.0	15.6	19.0	25.2	22.5	25.0	23.9	23.8	15.4	3.0	-3.0	-7.3	-12.0	-11.2	-12.0	-4.8	-10.4	-13.0	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	50.3	48.3	45.5	52.3	60.2	58.3	64.3	61.9	67.2	54.6	37.0	35.1	31.4	16.9	3.5	-5.1	-2.7	-38.2	-39.5	
Lmax (Long Train)	dB	50.7	48.7	46.0	52.7	60.6	58.7	64.8	62.4	67.6	55.0	37.4	35.5	31.8	17.4	3.9	-4.7	-2.3	-37.8	-39.1	
Up Track Calculation																					
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6	
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TCF	dB	0.0	-2.0	-1.0	-2.0	-7.0	-7.0	-8.0	-8.0	-8.5	-8.5	-8.5	-8.0	-7.5	-7.0	-4.5	-5.5	-5.0	-5.0	-5.0	
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	14.5	15.2	15.7	19.1	25.3	22.8	25.2	24.1	24.0	15.9	4.0	-2.3	-6.8	-11.6	-11.1	-11.8	-4.8	-10.2	-12.8	
BCF	dB	1.6	-2.0	-4.3	-5.8	-6.8	-7.5	-7.9	-8.2	-8.4	-8.4	-8.2	-7.9	-7.6	-7.1	-6.6	-5.8	-5.0	-4.0	-2.4	
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7	
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Lmax (Short Train)	dB	50.9	48.9	46.1	52.8	60.8	59.0	65.0	62.7	67.9	55.5	38.4	36.2	32.3	17.9	4.1	-4.4	-2.1	-37.6	-38.9	
Lmax (Long Train)	dB	51.3	49.3	46.5	53.2	61.2	59.4	65.4	63.1	68.3	55.9	38.7	36.6	32.7	18.3	4.5	-4.1	-1.7	-37.2	-38.5	
Total Predicted Noise Level																					
Lmax	dBA	35	Highest A-weighted level																		
Leq (day)	dBA	21																			
Leq (night)	dBA	16																			
Leq (24hr)	dBA	19																			

NSR No.	GN42																			
								Down Track Chainage			117+893		Calculated Distance (m)			38	Calculated speed (km/h)			187
Location	House A78 Maple Gardens							Up Track Chainage			117+904		Calculated Distance (m)			40	Calculated speed (km/h)			200
		1/3 Octave Band Center Frequency (Hz)																		
		6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400
Down Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	50.9	52.9	49.9	54.9	63.4	63.9	66.9	63.9	67.9	64.9	60.9	65.4	65.4	55.9	39.4	32.8	27.8	-2.2	-2.2
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	5.9	5.2	7.1	11.5	17.2	13.3	11.3	6.9	-0.1	-6.8	-10.0	-15.1	-16.1	-20.1	-18.4	-19.3	-9.5	-17.2	-20.4
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	46.0	43.3	40.8	47.8	55.9	52.7	57.8	54.2	56.8	45.1	35.4	35.8	35.2	22.5	1.7	10.9	-1.9	-36.6	-33.1
Lmax (Long Train)	dB	46.9	44.1	41.7	48.6	56.5	53.3	58.4	54.8	57.5	46.2	37.4	37.8	37.3	24.6	3.3	13.1	-0.1	-34.8	-31.0
Up Track Calculation																				
FDL	dB re 1N/m$^{1/2}$	51.5	53.5	50.5	55.5	64.0	64.5	67.5	64.5	68.5	65.5	61.5	66.0	66.0	56.5	40.0	33.4	28.4	-1.6	-1.6
TIL	dB	0.0	0.0	0.0	0.0	-2.0	-2.0	0.0	2.0	4.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
TOC	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCF	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSR	dB re 1(nm/s)/(N/m$^{1/2}$)	5.6	5.0	6.8	11.2	17.0	13.0	11.0	6.7	-0.5	-7.2	-10.4	-15.6	-16.5	-20.5	-18.7	-19.7	-9.9	-17.6	-20.8
BCF	dB	-0.4	-4.6	-6.8	-8.5	-9.8	-10.8	-11.5	-12.0	-12.3	-12.4	-12.3	-12.1	-11.6	-11.1	-10.3	-9.3	-8.1	-6.7	-4.7
BVR - Amplification	dB	1.0	2.0	3.0	3.8	5.0	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0	4.8	4.0	3.0	2.0	1.0	0.7
BVR - Floor Attenuation	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CTN	dB	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0	-27.0
SAF	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Lmax (Short Train)	dB	45.9	43.1	40.7	47.9	56.0	52.8	57.2	53.3	54.6	43.8	35.1	35.6	34.7	22.0	1.6	10.0	-2.1	-36.8	-33.6
Lmax (Long Train)	dB	47.1	44.2	41.9	49.0	56.8	53.6	58.0	54.1	55.4	45.0	36.9	37.5	36.6	23.9	3.2	11.9	-0.5	-35.1	-31.7
Total Predicted Noise Level																				
Lmax	dBA	26	Highest A-weighted level																	
Leq (day)	dBA	12																		
Leq (night)	dBA	7																		
Leq (24hr)	dBA	9																		

APPENDIX 2.10

LATEST AVAILABLE LAYOUT OF PLANNED NAM CHEONG PROPERTY DEVELOPMENT

申請編號 Application No. : A/K20/119
此頁摘自申請人提交的文件。
This page is extracted from applicant's submitted documents.



Max Podium Structure Level at +27.0
(Levels for residential blocks, parking spaces, clubhouses / recreational facilities, planters, vent shafts, covered walkways / pedestrian link refer to Landscape Master Plan)

SITE BOUNDARY

STATION AND ASSOCIATED FACILITIES

EACH FUNCTIONAL AREA SHALL CONTAIN SOME ANCILLARY E&M FACILITIES, SUBJECT TO DETAILED DESIGN

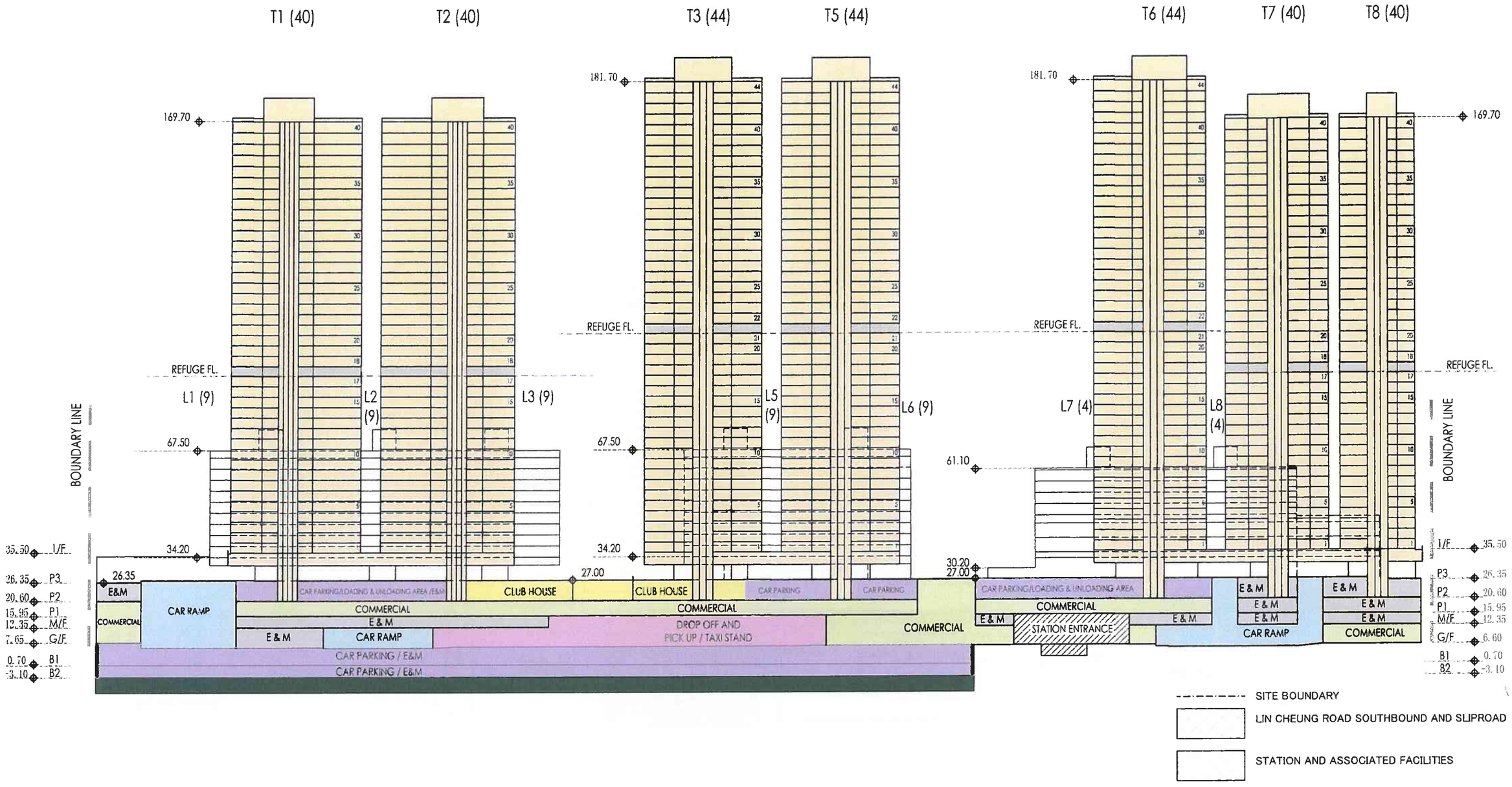
MTR

Title

MASTER LAYOUT PLAN

Checked		Drawn	
Rev		Date	
Scale 1 : 1200		Figure	

申請編號 Application No. : A/K20/119
此頁摘自申請人提交的文件。
This page is extracted from applicant's submitted documents.



EACH FUNCTIONAL AREA SHALL CONTAIN SOME ANCILLARY E&M FACILITIES, SUBJECT TO DETAILED DESIGN

MTR

Title

SECTION B-B

Checked		Drawn	
Rev		Date	
Scale 1 : 1200		Figure	