MTR Corporation Limited

Shatin to Central Link - Tai Wai to Hung Hom Section [SCL(TAW – HUH)] and Stabling Sidings at Hung Hom Freight Yard [SCL(HHS)]

Monthly Operational Airborne Rail Noise Monitoring Report (Festival City) No.2

[Period from 14 March to 13 April 2020]

(April 2020)

Verified by: Helen Cochrane

Position: Independent Environmental Checker

Date: 14 April 2020

MTR Corporation Limited

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Certified by: Lisa Poon

Position: Environmental Team Leader

Date: 14 April 2020

AECOM

MTR Corporation Limited

Consultancy Agreement No. C11033

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April 2020

	Name	Signature
Prepared & Checked:	Isaac Chu	
Reviewed & Approved:	Josh Lam	

Version:	A	Date: 14 April 2020

AECOM Asia Co. Ltd.
12/F, Grand Central Plaza, Tower 2, 138 Shatin Rural Committee Road, Shatin, NT, Hong Kong
Tel: (852) 3922 9000 Fax: (852) 3922 9797 www.aecom.com

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1 INTRODUCTION

1.1 Background

1.1.1 The Shatin to Central Link (SCL) is a 17km extension of the existing Ma On Shan Line (MOL) and East Rail Line (EAL) comprising (i) The East-West Corridor which extends the MOL from Tai Wai to Hung Hom via East Kowloon to connect with the West Rail Line (WRL) at Hung Hom Station (HUH) and Stabling Sidings at Hung Hom Freight Yard (HHS); and (ii) The North-South Corridor which is an extension of the EAL at Hung Hom across the harbour to Admiralty Station (ADM).

1.1.2 The SCL Tai Wai to Hung Hom Section [SCL (TAW-HUH)] included a total of 7 stations, including Hin Keng Station (HIK), Diamond Hill Station (DIH), Kai Tak Station (KAT), Sung Wong Toi Station (SUW) (formerly named as To Kwa Wan Station (TKW) in SCL(TAW-HUH) EIA), To Kwa Wan Station (formerly named as Ma Tau Wai Station (MTW) in SCL (TAW-HUH) EIA Report), Ho Man Tin Station (HOM) and Hung Hom Station (HUH).

1.1.3 Following the cessation of the operations of various freight facilities at Hung Hom in April 2011, MTR Corporation Limited started a detailed study to investigate the feasibility and environmental acceptability of utilizing the former freight yard to accommodate the train stabling requirements for SCL (TAW-HUH). To allow Stabling Sidings at Hung Hom Freight Yard (HHS) feasible for the use of stabling, in addition to providing siding tracks underneath the existing podium structure covering the freight yard, and launching/retrieval and emergency tracks and shunt neck extending outside the podium, appropriate changes were made to the design of SCL (TAW-HUH) and SCL Mong Kok East to Hung Hom Section [SCL (MKK-HUH)] at HUH, Kai Tak Station (KAT) and Diamond Hill Station (DIH) and its associated alignment and facilities.

1.1.4 Environmental Impact Assessment (EIA) Reports for SCL – Tai Wai to Hung Hom Section [SCL (TAW-HUH)] (Register No. AEIAR-167/2012), SCL Stabling Sidings at Hung Hom Freight Yard [SCL (HHS)] (Register No. AEIAR-164/2012) and SCL - Mong Kok East to Hung Hom Section [SCL(MKK – HUH)] (Register No. AEIAR-165/2012) (hereinafter referred to as "the EIA Reports") were approved on 17 February 2012 under the Environmental Impact Assessment Ordinance (EIAO). The alignment and associated facilities under SCL (TAW-HUH) at HUH, KAT and DIH, and SCL (MKK-HUH) at HUH were superseded by those proposed and assessed in SCL (HHS) EIA Report.

1.1.5 Following the approval of the EIA Reports, the Environmental Permit EP-438/2012 covering the construction of both SCL (TAW-HUH) and SCL (HHS) (hereinafter referred to as "the Project") was granted on 22 March 2012. Variations of Environmental Permit (VEP) were subsequently applied for EP-438/2012 and the latest Environmental Permit (EP No: EP-438/2012/K) was issued by Director of Environmental Protection (DEP) on 4 October 2016.

1.1.6 In accordance with Section 8.9 of the approved Environmental Monitoring and Audit (EM&A) Manuals for SCL (TAW-HUH) and SCL (HHS), monitoring of $L_{eq,30min}$ airborne rail noise levels will be carried out at the proposed monitoring locations during night-time period, i.e. 2300-0700 hours on a monthly basis after SCL (TAW-HUH) and SCL (HHS) is in operation. The noise monitoring will be conducted for the initial start-up of up to 6 months and can be terminated before the end of this 6-month period with full compliance of the noise limit and agreement from IEC.

1.1.7 An Operational Rail Noise Monitoring Plan (hereinafter referred to as "the Plan"), which was provided in Appendix A of the Monthly Operational Airborne Rail Noise Monitoring Report (Festival City) No. 1 (March 2020), specifying monitoring locations, monitoring methodology and noise criteria was agreed by EPD on 14 February 2020.

1.1.8 The SCL(TAW-HUH) will connect the West Rail Line (WRL) and Ma On Shan Line (MOL) to form Tuen Ma Line (TML). The 1st phase opening of TML, covering three new stations at Hin

Keng, Diamond Hill and Kai Tak commenced on 14 February 2020. As such the 1st phase operational airborne rail noise monitoring has commenced accordingly.

1.1.9 AECOM Asia Co. Ltd (AECOM) was commissioned by MTRC to conduct the operational rail noise monitoring for the phased opening of TML according to the agreed Plan.

1.2 Purpose of the Report

1.2.1 The 1st phase opening of TML commenced on 14 February 2020. This is the second monthly operational noise monitoring report, summarizing the monitoring result obtained between 14 March and 13 April 2020.

2 OPERATIONAL RAIL NOISE MONITORING

2.1 Monitoring Equipment

2.1.1 In accordance with the Plan, sound level meter in compliance with the prevailing International Electrotechnical Commission Publications 60651 (Type 1) and 60804 (Type 1) specifications was used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of sound level meter was checked using an acoustic calibrator generating 94dB at 1000 Hz. Measurement was considered to be valid with the calibration level from before and after the noise measurement within 1.0 dB. **Table 2.1** summarizes the noise monitoring equipment model used for monitoring.

Table 2.1 Noise Monitoring Equipment

Equipment	Model
Integrating Sound Level Meter	• B&K 2250 (Serial No. 3001291)
Calibrator	• B&K 4231 (Serial No. 3006428)

2.2 Monitoring Parameter

2.2.1 A $L_{Aeq\ 30min}$ was obtained during night-time normal train operation on a monthly basis.

2.3 Monitoring Location and Date

2.3.1 As discussed in **Section 1.1.8**, the 1st phase opening of TML, covering three new stations at Hin Keng, Diamond Hill and Kai Tak commenced on 14 February 2020. The 2nd operational airborne noise monitoring at Tower 1, Festival City Phase II (TAW-P1-2) was conducted on 19 March 2020, while the noise monitoring at Wing Fung Building (HUH-1-3) will be conducted in a later stage after full opening of TML.

2.3.2 The corresponding monitoring location during the reporting period was shown in **Figure C11033/C/SCL/ACM/M52/071**.

2.3.3 Summary of the monitoring location and monitoring date during the reporting period are shown in **Table 2.2**.

Table 2.2 Monitoring Location and Schedule of Noise Monitoring

Monitoring ID	NSR ID	Description	Type	Measurement Floor (1)	ASR	Monitoring Date
NMS-OA-1	TAW-P1-2	Tower 1, Festival City Phase II	Residential	Refuge Floor (19/F)	C(2)	19 March 2020

Remarks:
(1) In accordance with Noise Performance Test Report, the predicted noise level (i.e. $L_{Aeq,\ 30min}$ 45dB(A) during night-time period) at the measurement floor (19/F) of TAW-P1-2 is same as those predicted at the worst affected floor (10/F). It is therefore considered that the noise level at the proposed measurement floor would be able to represent the worst affected floor.
(2) Based on latest available information, Annual Traffic Census 2018 (ATC 2018), Tsing Sha Highway located to the immediate south-west of TAW-P1-2, as represented by the annual average daily traffic (AADT) of Eagle's Nest Tunnel, is considered as an Influencing Factor (IF) with the AADT of this road section more than 30,000 (i.e. 60,680 as recorded in ATC 2018). As TAW-P1-2 is located in "Urban Area" and the noise from IF was readily noticeable at the monitoring location during the monitoring, the ASR "C" was assigned to TAW-P1-2.

2.4 Monitoring Procedures

2.4.1 During the noise monitoring, the following procedures were followed:

- All measurements were made in facade type. The microphone of the sound level meter was

positioned 1m exterior of the sensitive receivers and lowered sufficiently so that the external wall of the building acts as a reflecting surface.

- Parameters such as frequency weighting, the time weighting and the duration of measurement were set as follows:
  - Frequency weighting : A
  - Time weighting : Fast
  - Duration of measurement : $L_{Aeq\ 30\ min}$ (with data being logged at every one second)
- Prior to and after each noise measurement, the sound level meter was calibrated using the Calibrator for 94 dB at 1000 Hz. If the difference in the calibration level before and after measurement was more than 1 dB (A), the measurement is considered invalid and repeat of noise measurement should be required after repair or re-calibration of the equipment.
- Details were recorded when intrusive noise was observed. Noise sources and duration were also recorded during the measurement process.
- All the monitoring data within the sound level meter system were downloaded through the computer software. All these data were then checked and reviewed properly.
- The weather condition during the monitoring period was recorded by the monitoring staff.
- Noise monitoring was conducted in the absence of fog, rain, and wind with a steady speed lower than 5 m/s, or wind with gusts lower than 10 m/s.

2.4.2 Calibration certificates for the equipment employed for monitoring (**Table 2.1** refers) are presented in **Appendix A**.

2.5 Data Analysis

2.5.1 Overall noise level, $L_{Aeq\ 30\ min\ (overall)}$, represents the noise level recorded during the 30-mintue Sampling Time Period, including the time periods with and without the TML, EAL and intercity trains passed in front of the monitoring station. Background noise levels, $L_{Aeq\ 30\ min\ (background)}$ was evaluated by discarding logged data for the period when the TML, EAL and intercity trains passed in front of the monitoring station.

2.5.2 The noise level contributed by TML, EAL and intercity trains pass-by, $L_{Aeq\ 30min\ (event)}$, was calculated by subtracting the background noise level $L_{Aeq\ 30min\ (background)}$ from the overall noise level $L_{Aeq\ 30\ mins\ (overall)}$ in accordance with standard acoustical principles. In the event of $L_{Aeq\ 30min\ (overall)}$ is lower than $L_{Aeq\ 30min\ (background)}$, $L_{Aeq\ 30min\ (event)}$ would be evaluated by applying a correction of -12 dB(A) to $L_{Aeq\ 30min\ (overall)}$, following same approach as adopted in MOL 8-car train operation noise monitoring conducted in 2017.

2.5.3 The operation rail noise level is considered in compliance with NCO noise criteria if one of following conditions is satisfied:

- Operation rail noise level, $L_{Aeq\ 30min\ (event)}$, do not exceed ANL; or
- Overall noise level is comparable to background noise level (i.e. $L_{Aeq\ 30min\ (overall)} - L_{Aeq\ 30min\ (background)} < 3$ dB).

2.6 Result and Observation

2.6.1 Night-time operation rail noise monitoring was carried out at TAW-P1-2 during the reporting period. All monitoring data and graphical presentation of the monitoring results are provided in **Appendix B**. **Tables 2.3** summarises the monitoring result obtained.

Table 2.3 Summary of Operation Rail Noise Monitoring Result at Tower 1, Festival City Phase II

Monitoring Date	Time	Noise Level, $L_{Aeq, 30\ min}$,dB(A)					
		$L_{Aeq\ 30min}$ (overall)	$L_{Aeq\ 30min}$ (background)	Difference	$L_{Aeq\ 30min}$ (event)	ANL	Compliance
19 March 2020	23:30 – 00:00	60.7	58.8	1.9	56	60	Yes

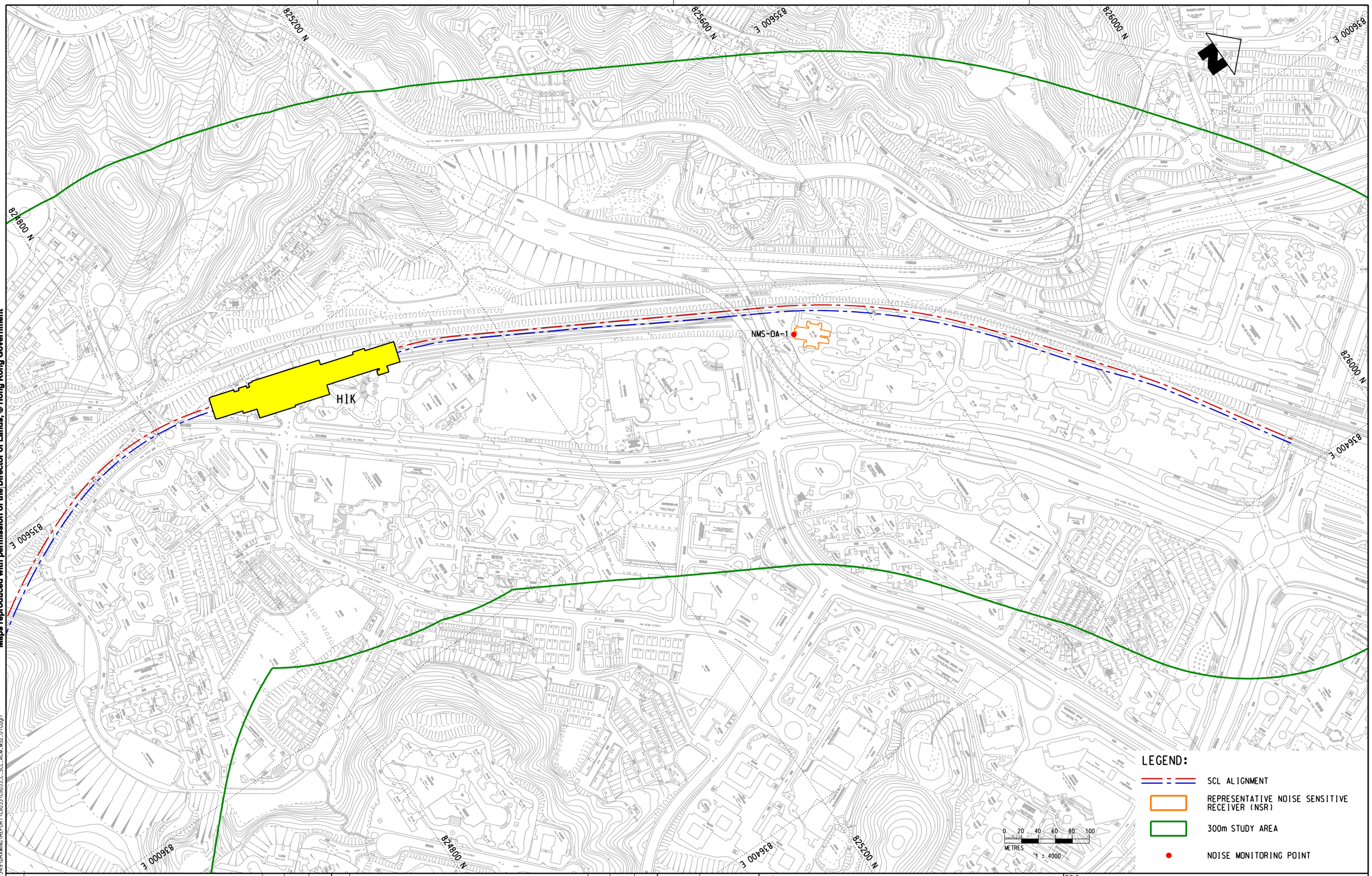
2.6.2 According to site observation, apart from the train noise including TML and EAL trains, the noise source from heavy vehicles (i.e. bus and trucks) travelling along Tsing Sha Highway was readily noticeable.

2.6.3 With the satisfaction of either one of conditions set out in **Section 2.5.3**, the monitoring result indicated the compliance of operation rail noise level with NCO noise criteria.

3 CONCLUSION

3.1.1 The second monthly night-time noise monitoring was conducted on 19 March 2020 at Tower 1, Festival City Phase II for the 1st phase of TML operation. It was observed that noise generated from road traffic along Tsing Sha Highway was readily noticeable during the monitoring period. The monitoring result indicated the operation rail noise level complied with NCO noise criteria.

Figure



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DATE	21/FEB/2020

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

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TITLE

C11033
SCL (TAW - HUH)
LOCATION OF OPERATION RAIL NOISE MONITORING POINT
(TOWER 1, FESTIVAL CITY PHASE I)

SCALE	FIGURE NO.	REV.
1 : 4000 (A3)	C11033/C/SCL/ACM/M52/071	A

Appendix A

Calibration Records of Monitoring Equipment

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

CERTIFICATE OF CALIBRATION

Certificate No.: 19CA1017 01-01 Page 1 of 2

Item tested

		Microphone	Preamp
Description:	Sound Level Meter (Type 1)		
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250	4950	ZC0032
Serial/Equipment No.:	3001291	2665582	17190
Adaptors used:	- (N 01105)	-	-

Item submitted by

Customer Name:	AECOM ASIA CO LIMITED
Address of Customer:	-
Request No.:	-
Date of receipt:	17-Oct-2019

Date of test: 18-Oct-2019

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	20-Aug-2019	CIGISMEC
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

Ambient conditions

Temperature:	22 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1000 ± 5 hPa

Test specifications

1. The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory: Feng Junqi **Date:** 21-Oct-2019 **Company Chop:** SOILS & MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

CERTIFICATE OF CALIBRATION

(Continuation Page)

1, Electrical Tests

The electrical tests were perfomed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Frequency weightings	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100μs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor $1/10^3$ at 4kHz	Pass	0.3	
	1 ms burst duty factor $1/10^4$ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by: Fung Chi Yip Date: 18-Oct-2019

Checked by: Shek Kwong Tai Date: 21-Oct-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

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CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0327 01-02 **Page:** 1 **of** 2

Item tested

Description:	Acoustical Calibrator (Class 1)
Manufacturer:	B & K
Type/Model No.:	4231
Serial/Equipment No.:	3006428 / N004.03
Adaptors used:	-

Item submitted by

Curstomer:	AECOM ASIA CO LIMITED
Address of Customer:	-
Request No.:	-
Date of receipt:	27-Mar-2019

(N.004.03)

Date of test: 27-Mar-2019

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	20-Apr-2019	SCL
Preamplifier	B&K 2673	2743150	27-Apr-2019	CEPREI
Measuring amplifier	B&K 2610	2346941	08-May-2019	CEPREI
Signal generator	DS 360	33873	24-Apr-2019	CEPREI
Digital multi-meter	34401A	US36087050	23-Apr-2019	CEPREI
Audio analyzer	8903B	GB41300350	23-Apr-2019	CEPREI
Universal counter	53132A	MY40003662	24-Apr-2019	CEPREI

Ambient conditions

Temperature:	22 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

Test specifications

1, The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.

2, The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.

3, The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on **page 2** of this certificate.

Approved Signatory: Feng Junqi **Date:** 29-Mar-2019 **Company Chop:**

SOILS & MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

Comments: The results reported in this certificate refer to the conditon of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.

試驗有限公司
...S & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

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CERTIFICATE OF CALIBRATION

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Certificate No.: 19CA0327 01-02 **Page:** 2 **of** 2

1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

(Output level in dB re 20 μPa)

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	Estimated Expanded Uncertainty dB
1000	94.00	94.23	0.10

2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz **STF = 0.014 dB**

Estimated expanded uncertainty 0.005 dB

3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz **Actual Frequency = 1000.0 Hz**

Estimated expanded uncertainty 0.1 Hz Coverage factor k = 2.2

4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz **TND = 0.3 %**

Estimated expanded uncertainty 0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by: Fung Chi Yip **Date:** 27-Mar-2019

Checked by: Fong Chun Wai **Date:** 29-Mar-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

Appendix B

Train Operation Noise Monitoring Results

Appendix B Operation Rail Noise Monitoring Results

Date	Time	$L_{Aeq\ 30min\ (overall)}$	$L_{Aeq\ 30min\ (Background)}$	Difference	$L_{Aeq\ 30min\ (event)}$	ANL	Compliance (Yes/No)
2/17/2020	23:30 - 00:00	60.1	57.8	2.3	56.2	60	Yes
3/19/2020	23:30 - 00:00	60.7	58.8	1.9	56.1	60	Yes

Appendix B Operation Rail Noise Monitoring Results