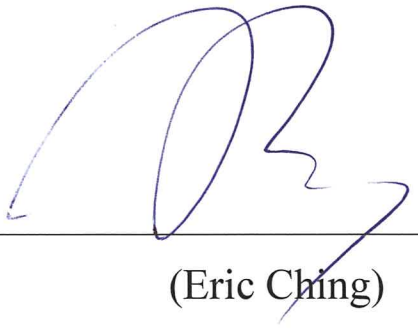
MTR Corporation Limited

ROAD WORKS at WEST KOWLOON

(No. EP-366/2009/A)

Operational Noise Monitoring Plan

Verified by : 

(Eric Ching)

Position : Independent Environmental Checker

Date : 26 - March - 2018

MTR Corporation Limited

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Certified by : _____

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Position : Environmental Team Leader

Date : 26 MAR 2018

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Roadworks at West Kowloon

MTR Corporation Ltd.

26/03/2018

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1 Introduction

1.1 Project Background

1.1.1.1 MTR Corporation Ltd. (hereinafter called the "ET") was required to undertake the Environmental Monitoring and Audit (EM&A) works for "Road Works at West Kowloon" (hereinafter called the Project). The major construction works of the Project were commenced in July 2011 and tentatively scheduled to be completed in Q3 2018.

1.1.1.2 The site layout plan of the Project is shown in **Figure 1.1**.

1.1.1.3 The Project is a Schedule 2 Designated Project under the Environmental Impact Assessment Ordinance (Cap. 449) and the latest version is Environmental Permit No. EP-366/2009/A (EP) which was issued on 18 June 2012.

1.1.1.4 Under EP Condition 3.1, during operation phase, road traffic noise levels shall be monitored at representative noise sensitive receivers as described in the approved EIA Report (AEIAR-141/2009) during the first year after the road opening. And in accordance with Section 2.22 of the EM&A Manual, a traffic noise monitoring plan (TNMP) should be prepared.

1.1.1.5 Traffic noise impacts at representative NSRs were assessed in the EIA Report, and following the report approval in the Review Report (RR) to incorporate the latest site conditions and design at the time. Various mitigation measures such as noise barriers and semi-enclosures were recommended to alleviate traffic noise impacts for some of the NSRs. The traffic noise monitoring aims to verify the traffic noise predictions from the RR by comparing the noise impact predictions with the actual impacts. This monitoring plan presents the monitoring locations, monitoring schedules, methodology of noise monitoring including noise measurement procedures, traffic counts and speed checks, and methodology of comparison with the predicted levels.

2 Measurement Methodology

2.1 Measurement Requirements

2.1.1.1 Traffic noise levels shall be measured in terms of $L_{10\ (30min)}$ dB(A) over three half hour periods at each of the selected representative noise monitoring locations during both morning peak hours (i.e. 07:30 – 09:30) and evening peak hours (i.e. 17:30 - 19:30) on normal weekdays. The morning and evening peak hours should be checked with the latest Annual Traffic Census. The traffic noise levels shall be measured at a 6-month interval within the first year upon completion of the Project.

2.1.1.2 Other information such as traffic counts, percentage of heavy vehicles (all vehicles with an unladen weight exceeding 1525 kg) and average speed shall also be obtained during the same measurement period for both far-side and near-side of the road. Noise monitoring should be arranged during morning and evening peaks in accordance with the latest Annual Traffic Census.

2.2 Noise Monitoring Locations

2.2.1.1 In accordance with the EM&A Manual, three designated monitoring stations are proposed for operational traffic noise monitoring, TNM-1 to TNM-3. TNM-4 and TNM-5 have been added to collect more traffic noise data. **Table 2.1** lists out these stations and their respective range of predicted noise levels from the RR, and **Figure 2.1** show their locations.

2.2.1.2 A high floor and a medium floor should be selected for each noise monitoring location as far as practicable. Locations, such as podium, refuge floor and/or roof of the building would be considered when access to the other floors is not allowed. Monitoring points at suitable levels would be selected at each noise monitoring location depending on the site suitability and accessibility at the time of monitoring.

Table 2.1 Operational noise monitoring stations and respective range of predicted noise levels

Monitoring Stations	Location	Floor	Predicted Noise Level, $L_{10(1\ hr)}$ in Year 2030, dB(A)		Noise Criteria, dB(A)
			Unmitigated	Mitigated	
TNM-1	Man King Building	A high floor and a medium floor	73.8 - 75.0	65.3 - 69.7	70
TNM-2	Tower 6, Sorrento		72.1 – 76.0	68.8 - 69.9	
TNM-3	Tower III, The Waterfront		72.7 – 75.8	69.5 - 70.4	
TNM-4	Sun Tower,		65.7 – 69.0	62.6 - 65.4	

Monitoring Stations	Location	Floor	Predicted Noise Level, $L_{10(1\ hr)}$ in Year 2030, dB(A)		Noise Criteria, dB(A)
	The Arch				
TNM-5	Tower 2, The Harborside		67.1 – 72.5	65.4 – 70.4	

2.2.1.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position of 1.2m above the floor level. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET Leader shall agree with the IEC the alternative monitoring position and the corrections to be adopted. Care should be taken to avoid disturbance to the occupants during monitoring.

2.3 Noise Monitoring Equipment

2.3.1.1 Sound level meters that comply with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications and acoustic calibrators shall be used for the monitoring. The sound level meters and calibrator(s) should be calibrated by accredited laboratories annually to ensure reliable performance. The accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency, immediately prior to and following each noise measurement. Measurements may be accepted as valid only if the calibration levels before and after the noise measurement agree to within 1.0 dB(A). Calibration certificates for the sound level meters and calibrator shall be appended in the operational noise monitoring report.

2.4 Noise Measurement and Monitoring Methodology

2.4.1.1 The noise measurements shall be conducted to obtain two sets of A-weighted $L_{10(1\ hour)}$ sound pressure level during the AM and PM peak traffic hours over 3 half hour periods at each designated noise monitoring location.

2.4.1.2 The noise measurement point shall be set at a point 1m from the exterior of the sensitive receiver building façade and at a height of 1.2 m above the ground.

2.4.1.3 If there is free field measurement, the meter shall be positioned away from any nearby reflective surfaces. All records for free field noise levels shall be adjusted with a correction of +3 dB(A).

2.4.1.4 The battery condition shall be checked to ensure the correct functioning of the meter.

2.4.1.5 Parameters such as frequency weighting, the time weighting and the measurement time shall be set as follows:

- frequency weighting : A
- time weighting : Fast
- time measurement : 30 minutes

2.4.1.6 Statistical results such as L_{max}, L_{min}, L_{eq}, L_{10}, and L_{90} shall be obtained for reference purpose.

2.4.1.7 The wind speed shall be checked with the portable wind meter.

2.4.1.8 At the end of the monitoring period, the L_{10} shall be recorded. In addition, site conditions and noise sources were recorded.

2.4.1.9 Noise measurement shall be paused during periods of high intrusive noise or extraneous noise (e.g. noise from construction activities and honking sounds) if possible and observation shall be recorded when intrusive noise is not avoided.

2.4.1.10 Noise monitoring shall be cancelled in the presence of fog, rain, and wind with a steady speed exceeding 5 m/s, or wind with gusts exceeding 10 m/s.

2.5 Traffic Survey

2.5.1.1 During the noise measurement, a concurrent traffic survey with percentage of heavy vehicles shall be conducted for the far-side and near-side of the road carriageways and the nearby existing road network. The average vehicle speed for the far-side and the near-side of the road and the nearby existing road network will be estimated by timing a vehicle to travel a certain distance. The vehicle speed will be recorded for at least 5 vehicles to obtain the average speed.

2.5.1.2 Traffic survey shall be conducted with the noise measurement for the sections of Road D1A(N), Lin Cheung Road (LCR), Austin Road West (ARW), Austin Road West Underpass (ARWU) and Jordan Road (JR) that are faced by and near the respective monitoring stations. The locations of these roads are shown in **Figure 2.1**. The road sections for each monitoring point of which traffic would be counted concurrently are shown in **Appendix 2.1**.

2.5.1.3 Background information, including weather conditions and noise sources other than traffic shall be recorded for each sensitive receiver. The record sheet in **Appendix 2.1** shall be used to record the traffic.

3 Measurement Results and Observations

3.1.1.1 Noise data shall be continuously recorded by sound level meter at an interval of 1 second. Other sources (e.g. construction noise and honking noise) and noisy activities shall be recorded during the monitoring events and extraneous noise shall not be taken into calculation of the traffic noise level.

3.1.1.2 Traffic noise monitoring results should be summarized with date, weather condition for each monitoring station and monitoring period.

3.1.1.3 Comparison of the noise measurement results should be made against the RR predicted noise level and the noise standard of 70dB(A) for each monitoring station and monitoring period.

3.1.1.4 Road traffic condition during the monitoring period should be briefly summarized. Details of the measured and RR predicted traffic flow and the percentage of heavy vehicles should be provided.

3.1.1.5 Traffic speed monitoring results should be summarized and compared against design speed in RR.

4 Assessment

4.1.1.1 To compare the measured noise levels with the predicted noise levels in the RR under the full provision of the mitigation measures recommended, the conversion correction will be applied into the measured noise levels for the adjustment to the traffic condition.

4.1.1.2 The adjustment to measured noise levels from current situation to Year 2030 (timeframe of EIA and RR prediction) cannot be directly calculated by desktop CRTN method in complex road networks. Modelling tools should be used for adjustments. The measured noise levels from current situation can be adjusted by using the calibrated noise model. By using the RR traffic data in the calibrated model, the predicted noise levels of Year 2030 can be calculated and adjusted when the differences between measured and calculated noise levels for current traffic data are added.

4.1.1.3 Based on the surveyed traffic counts, percentage heavy vehicles and average vehicle speed, the $L_{10(1\text{-}hr)}$ at the selected monitoring locations will be calculated using a noise model according to the methods described in the U.K. Department of Transport's "Calculation of Road Traffic Noise (CRTN)" (1988). The topographical terrain will also be considered in the model based on the field observations.

4.1.1.4 The predicted noise levels from the RR will be compared with the measured values, which will be adjusted by the model from current situation to Year 2030, to check the effectiveness of the installed noise mitigation measures. The detailed methodology is given in **Section 4.1.1.5**.

4.1.1.5 The actual noise impact by the Project will be compared to the predicted traffic noise levels in the RR by the following procedures and shown in the flow chart in **Appendix 3.1**:

i. Calibration of the in-house noise model - A calibration process will be carried out by comparing RR predictions **[A]** and the results from the in-house noise model with the estimated RR Year 2030 traffic data **[B]**. The model parameters (such as gradient, texture and road segments) will match the scenarios of the model in RR to avoid large discrepancies. The in-house noise model would then be calibrated.

ii. Comparison of measured noise level **[C]** and calculated noise level in Year 2018 **[D]** – The calibrated model will be used to obtain results with the surveyed Year 2018 traffic data. The difference between the measured noise levels and the calculated noise levels will be recorded.

iii. Calibration of predicted noise level in Year 2030 - By adding the difference in (ii) to the results from the in-house noise model with the estimated RR Year 2030 traffic data **[B]**, a calibrated predicted traffic noise level in Year 2030 **[E]** will be obtained.

iv. Comparison of noise levels in Year 2030 - This calibrated predicted traffic noise level in Year 2030 **[E]** would then be compared to the predicted traffic noise levels from the RR **[A]**.

Note:
[A]: Predicted Year 2030 traffic noise levels from the RR
[B]: Calculated traffic noise levels in Year 2030 (Using the in-house model and RR Year 2030 traffic data)

[C]: Measured noise level
[D]: Calculated noise level in Year 2018 (Using the in-house developed model and surveyed traffic data)
[E]: Calibrated predicted traffic noise level in Year 2030

5 Reporting

5.1.1.1 The first operational traffic noise monitoring would be conducted within the 6th month of full operation while the second operational traffic noise monitoring is proposed to be conducted between the 7th and the 12th month of full operation.

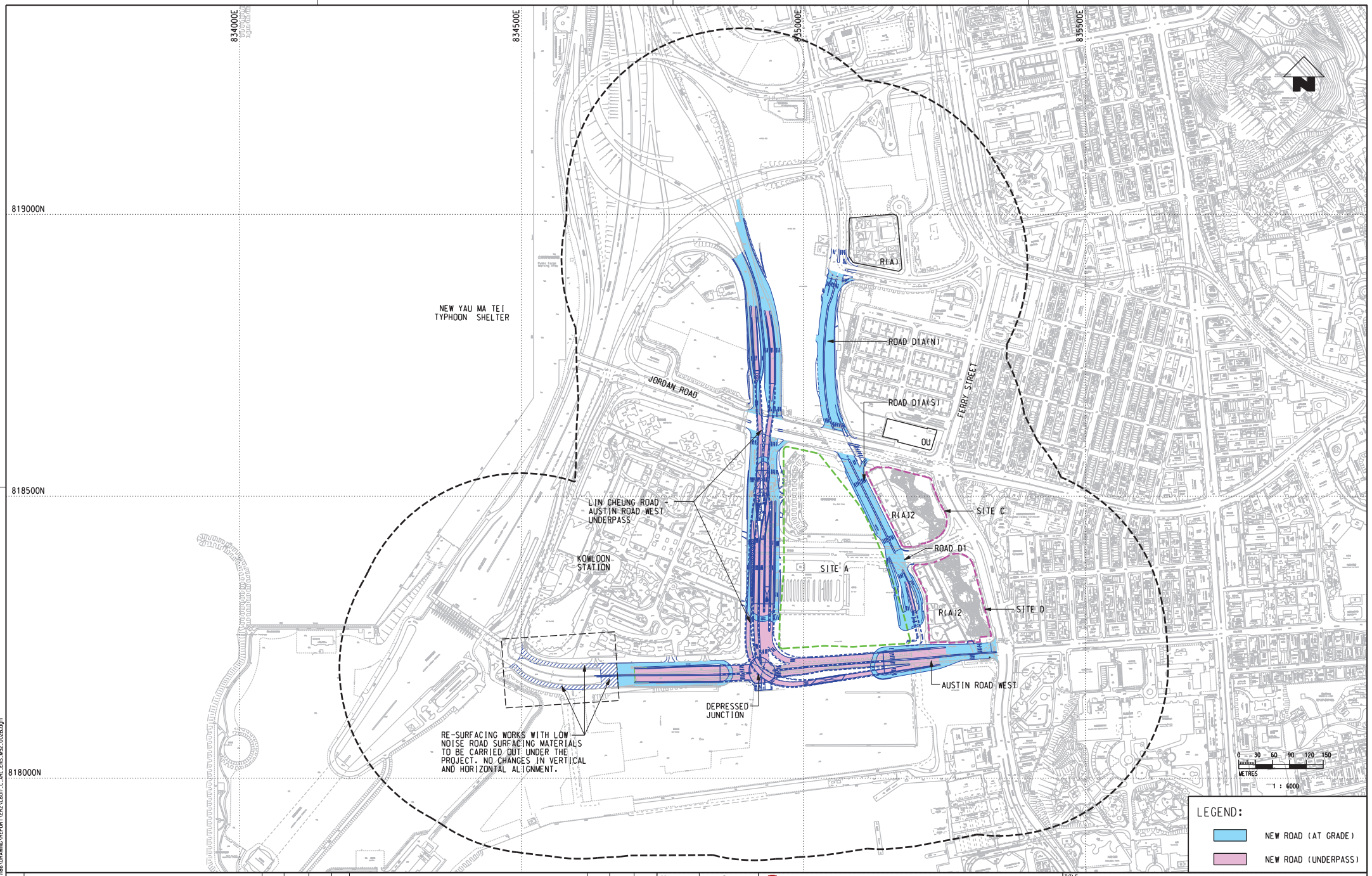
5.1.1.2 Monitoring details and results including the comparison between the measured noise levels and the predicted levels shall be recorded in a Traffic Noise Monitoring Report (TNMR) to be deposited with EPD within one month of the completion of the monitoring. The report shall be certified by the ET Leader before deposit with EPD.

5.1.1.3 An Interim TNMR will be prepared and submitted within one month after the completion of the noise monitoring for each occasion. A Final TNMR will be issued by compiling the approved 1st and 2nd Interim TNMRs.

6 Reference

- Approved EIA Report of *Road Works at West Kowloon*, AEIAR-141/2009, EPD
- "Calculation of Road Traffic Noise", Department of Transport, UK, 1988

Figure



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A	REVIEW REPORT - FIRST ISSUE	_	_	_

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DATE	26/SEP/2011

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FIGURE NO. Figure 1.1

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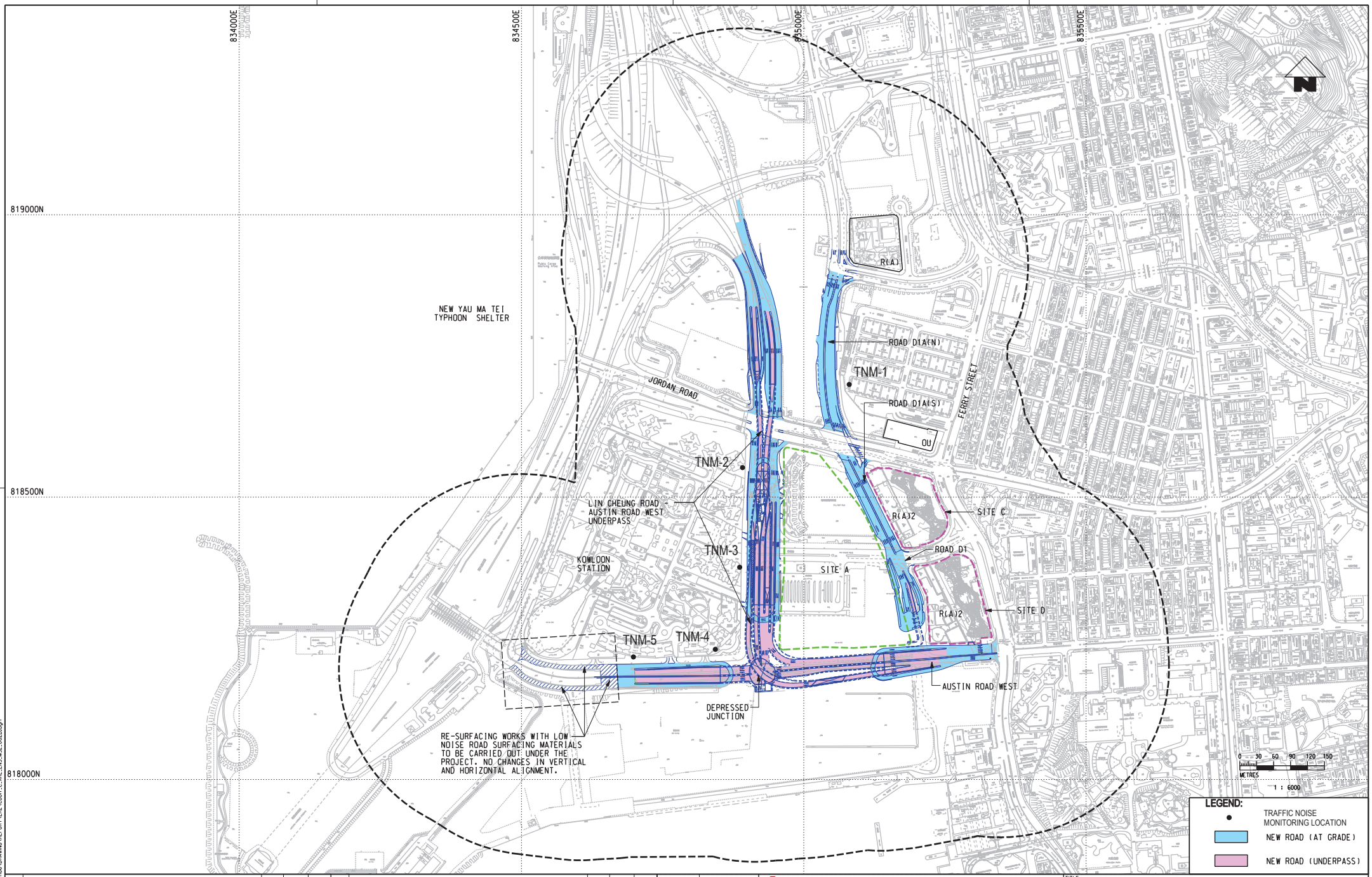

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TITLE
Operational Noise Monitoring Locations

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FIGURE NO. Figure 2.1
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Appendix

Traffic Noise Monitoring
Field Record Sheet

General Conditions

Location		
Date of Monitoring		
Measurement time	Morning peak hour / Evening peak hour	
Weather condition		
Temperature (^{o}C)		
Wind speed (m/s)		

Equipment

Instrument	Type	Equipment No.	Setting
Sound level meter			
Calibrator			

Calibration

Before measurement:	After measurment:

Raw Data

Noise Measurements

	Parameter	Measured
Measurement Results (1st 30 mins), dB(A)	L_{eq}	
	L_{10}	
	L_{90}	
Measurement Results (2nd 30 mins), dB(A)	L_{eq}	
	L_{10}	
	L_{90}	
Measurement Results (3rd 30 mins), dB(A)	L_{eq}	
	L_{10}	
	L_{90}	

Remarks: Monitoring should be cancelled if steady wind speed exceeds 5m/s or with gusts exceeding 10m/s

Traffic Noise Monitoring
Field Record Sheet

Traffic Counts

Monitoring Location (Road)	Time (15 min each)	Traffic data*				Average travelling time and distance			
		Near side		Far side		Near side		Far side	
		HV	LV	HV	LV	HV	LV	HV	LV
TNM-1 (D1A(N))									
TNM-1 (JR)									
TNM-2 (JR)									
TNM-2 (LCR)									
TNM-3 (LCR)									
TNM-4 (LCR)									
TNM-4 (ARW)									
TNM-4 (ARWU)									

Traffic Noise Monitoring
Field Record Sheet

Traffic Counts

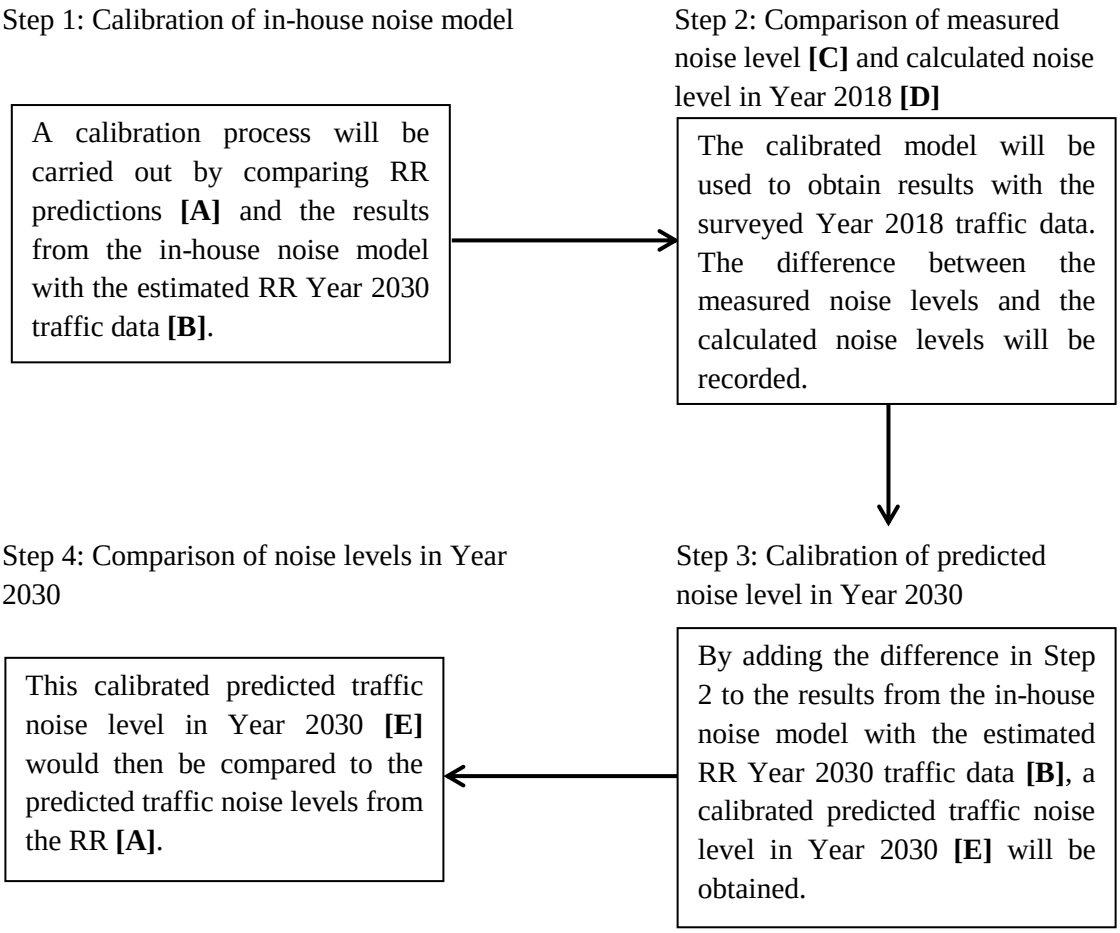
Monitoring Location (Road)	Time (15 min each)	Traffic data*				Average travelling time and distance			
		Near side		Far side		Near side		Far side	
		HV	LV	HV	LV	HV	LV	HV	LV
TNM-5 (ARW)									
TNM-5 (ARWU)									

Note:

LV- Light vehicle (i.e. private car, taxi and motorcycle)

HV - heavy vehicle (i.e. vehicles other than LV)

* - Traffic count for a duration of 15 min



Note:
[A]: Predicted Year 2030 traffic noise levels from the RR
[B]: Calculated traffic noise levels in Year 2030 (Using the in-house model and RR Year 2030 traffic data)
[C]: Measured noise level
[D]: Calculated noise level in Year 2018 (Using the in-house model and surveyed traffic data)
[E]: Calibrated predicted traffic noise level in Year 2030