Civil Engineering & Development Department

Contract No. ST/2013/01

Sha Tin New Town Stage II
Road T3 and Associated Roadworks – Remaining Works, Phase III

Traffic Noise Monitoring Plan (Version 5.0)

May 2016

Certified By _____

(Environmental Team Leader)

REMARKS:

The information supplied and contained within this report is, to the best of our knowledge, correct at the time of printing.

CINOTECH accepts no responsibility for changes made to this report by third parties.

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1. INTRODUCTION

1.1 Cinotech Consultants Limited (hereinafter called the "ET") was commissioned by the Civil Engineering and Development Department (CEDD) (hereinafter called the "Project Proponent") to undertake the Environmental Monitoring and Audit (EM&A) works for "Road T3 and Associated Roadworks – Remaining Works, Phase III" (hereinafter called the Project), which is the remaining works of 'Sha Tin New Town – Stage II, Trunk Road T3 (Tai Wai)' (hereinafter called the Road T3 Project) includes the construction of an outstanding 1-lane slip road in the original Road T3 Scheme. The major construction works of the Project were commenced on 19th June 2014 and tentative completed in July 2015.

1.2 The Road T3 Project forms part of the continuing programme for the development of the Sha Tin New Town. It will provide the essential link between R9-CSWST with the high speed road networks in the north east New Territories and alleviate the traffic congestion at the local roads in Tai Wai, Sha Tin. The Road T3 Project (except the remaining works under the Project) were commenced on 26th March 2003 and completed on 13th May 2010.

1.3 The site layout plan of the Road T3 Project is shown in **Figure 1**.

1.4 The Road T3 Project is a Schedule 2 Designated Project under the Environmental Impact Assessment Ordinance (Cap. 449) and the latest version is Environmental Permit No. EP-135/2002/J (EP) which was issued on 6 February 2014.

1.5 Under the requirements of Conditions 4 of the EP, EM&A programme as set out in the EM&A Manual is required to be implemented. In accordance with Condition 5.1 of the EP and Section 3.21 of the EM&A Manual, traffic noise monitoring plan (TNMP) was submitted to EPD on 27 September 2010. The TNMP version 5.0 was updated to propose alternative monitoring stations (Refer to **Table 2.1**).

1.6 The traffic noise monitoring aims to assess the accuracy of traffic noise predictions by comparing the project 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. TRAFFIC NOISE MONITORING

Monitoring Requirements

2.1 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 points during peak hours twice (once at morning traffic peak hour, i.e. 07:30-09:30, & once at evening traffic peak hour, i.e. 17:30-19:30) on normal weekdays at 6-month intervals within the first year upon completion of the Project.

2.2 Other information such as traffic flow 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.

Monitoring Locations

2.3 In accordance with the EM&A Manual, operational traffic noise monitoring shall be conducted at six designated monitoring stations, N1 to N6. Table 2.1 lists out these stations and **Figures 2.1-2.4** show their locations.

Table 2.1 Noise Monitoring Stations

Monitoring Stations	Location	Floor	Monitoring Stations In accordance with EM&A Manual	Alternative Monitoring Stations (Floor)
N1	Tai Wai New Village – Block 20	1/F	Yes	N/A
		3/F	No	N1(A) - Tai Wai New Village – Block 18 (3/F)
N2	Holford Garden – Fook Hey Court	10/F	No	Holford Garden – Fook Hey Court (1/F)
		20/F	No	Holford Garden –Fook Hey Court, Roof Top (31/F)
N3	38-46 Chik Chuen Street	3/F	No	N3(A) - 60 – 68 Chik Chuen Street – Tai Wai Cambridge Nursing Home (3/F)
		5/F	No	N3(A) - 60 – 68 Chik Chuen Street – Tai Wai Cambridge Nursing Home (5/F)
N4	Mei Fung House	10/F	Yes	N/A
		20/F	Yes	N/A
N5	27 Tung Lo Wan Village	1/F	Yes	N/A
		3/F	Yes	N/A
N6	Scenery Court Block 1	10/F	Yes	N/A
		23/F	No	Scenery Court Block 1, Roof Top (24/F)

Remarks:
- "Yes" - Monitoring station is the same as that stated in EM&A Manual
- No - Monitoring station is not the same as that stated in EM&A Manual. Request for carrying monitoring works at the monitoring stations stated in EM&A Manual was rejected by owner of premise.
- N/A - No alternative monitoring station is required.
- Alternative Monitoring Stations proposed are chosen based on the criteria stated in section 2.4 below.

2.4 The status and locations of these monitoring stations may be reviewed in consultation with EPD, if neccessary, after issuing this plan. In addition, please note that the owners of the premises where the stations are proposed may not grant permission to the monitoring works. When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:-

- alternative location shall be similarly exposed to potential noise impacts;
- it shall be close to the noise sensitive receivers; and
- it shall be located so as to cause minimal disturbance to the occupants.

2.5 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 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 monitoring position and the corrections to be adopted. Care should be taken to avoid disturbance to the occupants during monitoring.

Monitoring Equipment

2.6 Sound level meters, which 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 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 level before and after the noise measurement are accurate to be within 1.0 dB(A).

Monitoring Parameters, Frequency and Duration

2.7 Noise measurements each of 30 minutes duration (3 occasions per monitoring event) shall be carried out by the ET at each of the selected representative noise monitoring points during peak hours twice (once at morning traffic peak hour, i.e. 07:30-09:30, & once at evening traffic peak hour, i.e. 17:30-19:30) on normal weekdays at 6-month intervals within the first year upon completion of the Project.

Monitoring Methodology and QA/QC Procedures

2.8 The Sound Level Meter shall be set on a tripod at a height of 1.2 m above the ground.

2.9 For 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).

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

2.11 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

2.12 Prior to and after each noise measurement, the meter shall be calibrated using a Calibrator for 94 dB at 1000 Hz. If the difference in the calibration level before and after measurement shall be more than 1 dB(A), the measurement would be considered invalid and repeat of noise measurement would be required after re-calibration or repair of the equipment.

2.13 The wind speed shall be frequently checked with the portable wind meter.

2.14 At the end of the monitoring period, the L_{10} shall be recorded. In addition, site conditions and noise sources were recorded on a standard record sh`eet.

2.15 Noise measurement shall be paused during periods of high intrusive noise if possible and observation shall be recorded when intrusive noise is not avoided.

2.16 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.

Maintenance and Calibration

2.17 The microphone head of the sound level meter and calibrator shall be cleaned with soft cloth regularly.

2.18 The meter shall be sent to the supplier to check and calibrate on yearly intervals.

Traffic Counts

2.19 During the noise measurement, a concurrent traffic counts with percentage 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 will be estimated by timing a vehicle to travel a certain distant. A sample of the record sheet is provided in **Appendix A**.

3. ASSESSMENT WORK

3.1 In order to ensure that the measured noise levels are comparable with the predicted in EIA Review Report 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.

3.2 The adjustment to measured noise levels from current situation to Year 2022 (timeframe of EIA Review Report prediction) cannot be directly calculated by desktop CRTN method in complex road networks. Modelling tools is used for adjustments. The measured noise levels from current situation can be adjusted by using the calibrated in house noise model. By using the EIA traffic data in the calibrated model, the predicted noise levels of Year 2022 can be calculated and adjusted when the differences between measured and calculated noise levels for current traffic data are added.

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

3.4 The procedures of CRTN assume typical traffic and noise propagation conditions which are consistent with moderately adverse wind velocities and direction. All noise levels will be expressed in terms of L_{10}(1-hr) dB(A). The calculations will be worked out to 0.1 dB(A) keeping within the quoted range of the validity charts. For comparison with the specified noise level or the EIA-TM standards, the relevant noise level from traffic expected to use the highway will be rounded to the nearest whole number (0.5 being rounded up). Details of the methods have been given in the CRTN.

3.5 The predicted noise levels from the EIA Review Report (ERR) will be compared with the measured values, which will be adjusted by the model from current situation to Year 2022, to check the effectiveness of the installed noise mitigation measures. The detailed methodology of this comparison will be given in section 3.6. A summary of the predicted noise levels of the monitoring location from the ERR is provided in **Table 3.1** for reference.

Table 3.1 Summary of Predicted Noise Levels (Unmitigated and Mitigated) at the Monitoring Stations based on the EIA Review Report (March 2002)

Monitoring Stations	Location	Floor	Predicted Unmitigated Noise Levels, dB(A)	Predicted Mitigated Noise Levels, dB(A)
N1 (TWV4)[(a)(b)]	Tai Wai New Village – Block 20	1/F	76.4	61.9
		3/F[(e)]	82.3	65.1
N2 (HG4)[(a)(b)(c)]	Holford Garden – Fook Hey Court	1/F	74.7	60.2
		20/F[(e)]	81.0	69.5
N3 (CCS3)[(a)(b)(c)(d)]	38-46 Chik Chuen Street	3/F[(e)]	76.7	72.2
		5/F[(e)]	80.4	72.3
N4 (MFH2)[(a)(b)(c)(d)]	Mei Fung House	10/F	78.4	68.1
		20/F	79.1	68.0
N5 (TLW3)[(a)]	27 Tung Lo Wan Village	1/F	75.6	72.7
		3/F	77.8	68.5
N6 (SC2)[(a)(b)]	Scenery Court Block 1	10/F	80.5	77.7
		23/F[(e)]	79.1	77.0

Remarks:

Relevant Noise Mitigation Measure involved-

(a) Plain barriers
(b) Inverted-L barriers
(c) Partial Enclosure
(d) Full Enclosure

(e) No predicted noise levels are presented in the EIA Review Report (March 2002) for the alternative monitoring stations Tai Wai New Village – Block 18 (3/F) and 60 – 68 Chik Chuen Street – Tai Wai Cambridge Nursing Home (3/F & 5/F). Therefore, for stations N1(A) and N3(A), the predicted noise level at the original monitoring stations N1 and N3, which are the nearest locations to these alternative monitoring stations respectively, will be adopted.

Similarly, the predicted noise level at Holford Garden – Fook Hey Court (20/F) and Scenery Court Block 1 (23/F) in the EIA Review Report will be adopted for alternative monitoring stations Holford Garden – Fook Hey Court, Roof Top (31/F) and Scenery Court Block 1, Roof Top (24/F) respectively.

3.6 The actual noise impact by the Project will be compared to the predicted traffic noise levels in the ER Report by the following procedures:

(i) A calibration process of the in-house noise modelling tool will be carried out by comparing ER Report predictions and the results from the in-house noise modelling tool by inputting an identical set of traffic flow data, which is the Predicted traffic data in Year 2022 from ER Report.

(ii) After the calibration of the in-house noise model, the difference between the measured noise levels and the calculated noise levels using current traffic data will be checked and recorded.

(iii) The above difference between the measured noise levels and the calculated noise levels using current traffic data will be added to the calculated traffic noise levels using the traffic data in the ER Report. A calibrated predicted traffic noise level in 2022 will then be obtained.

(iv) This calibrated predicted traffic noise level in 2022 will then be compared to the predicted traffic noise levels in the ER Report to check the effectiveness of the installed noise mitigation measures.

3.7 For the calibration process in section 3.6 (i), as both models in the ERR and our in-house noise modelling tool are based on the same methods described in the CRTN, the difference between ER Report predictions and results from the in-house noise modelling tool is expected to be very small. In case there is a significant difference between the two noise levels, it should be due to minor different settings and options of the in-house noise modelling tool. The options in the in-house tool (such as gradient, texture and segments of roads) will be adjusted to fit the scenarios of the model in ER Report, so that the two noise levels are comparable thus completing the calibration process.

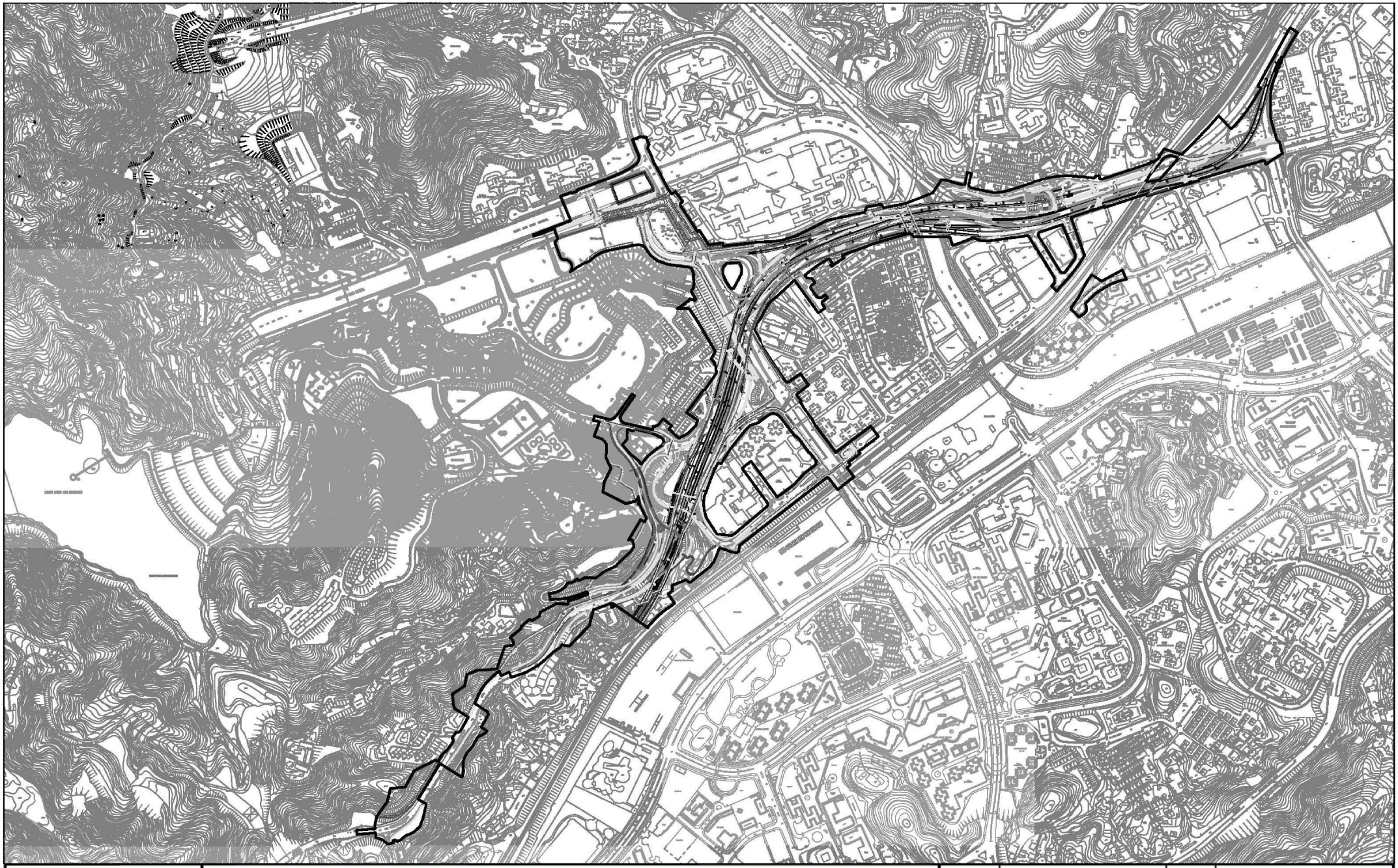
3.8 The above procedures are also show in a flow chart in **Appendix B**.

4. PROGRAMMING AND REPORTING

4.1 The first operational traffic noise monitoring is scheduled to be conducted before or within August 2016 while the second operational traffic noise monitoring is proposed to be conducted before or within February 2017.

4.2 An Interim Traffic Noise Monitoring Report (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.

FIGURE(S)



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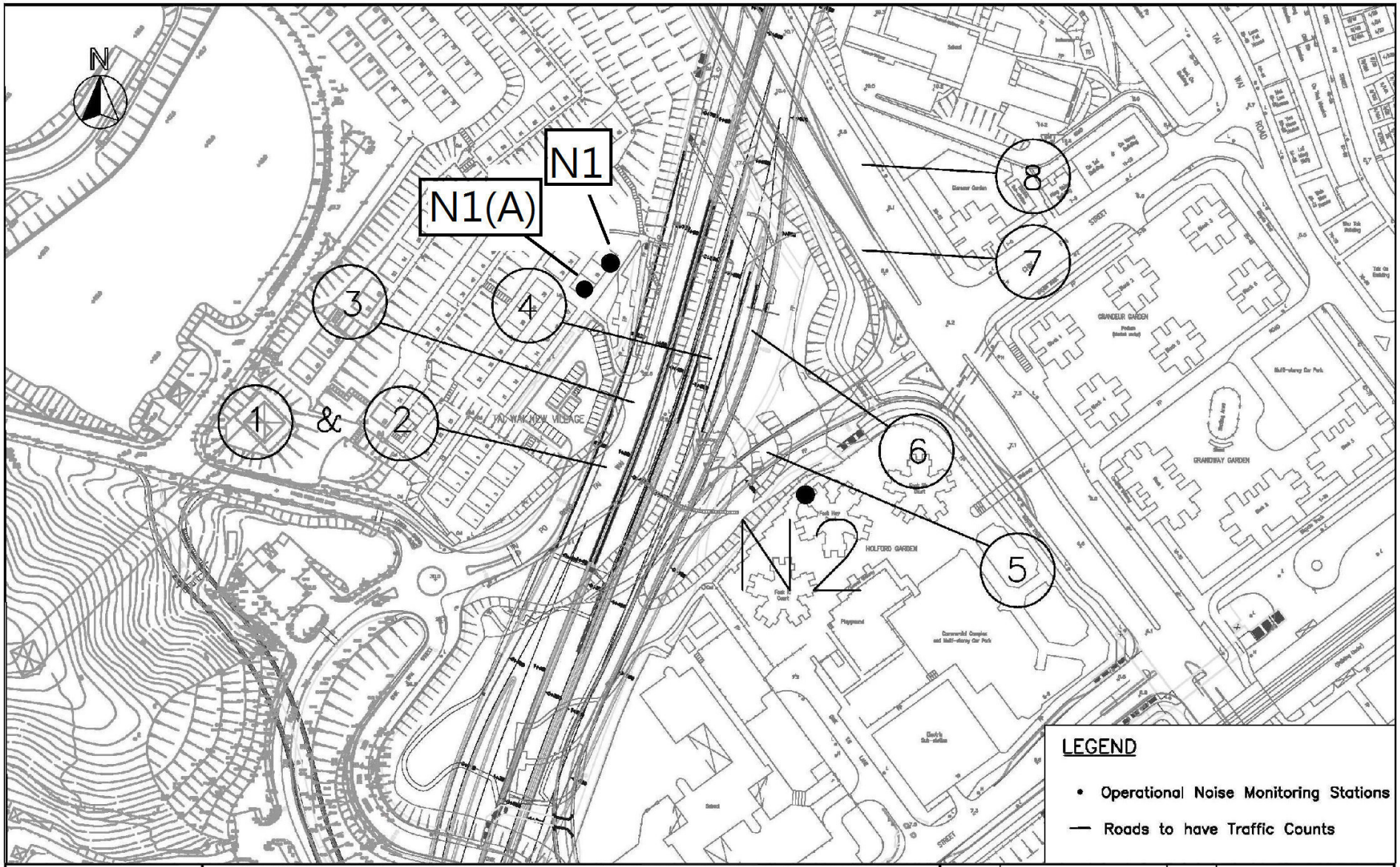
SHA TIN NEW TOWN STAGE II ROAD T3 AND ASSOCIATED ROADWORKS – REMAINING WORKS, PHASE III

THE SITE LAYOUT PLAN OF ROAD T3 PROJECT

SCALE	NTS	DATE	FEB 2015
CHECK	IT	DRAWN	HW
Project No.	MA13058	FIGURE NO. 1	REV –



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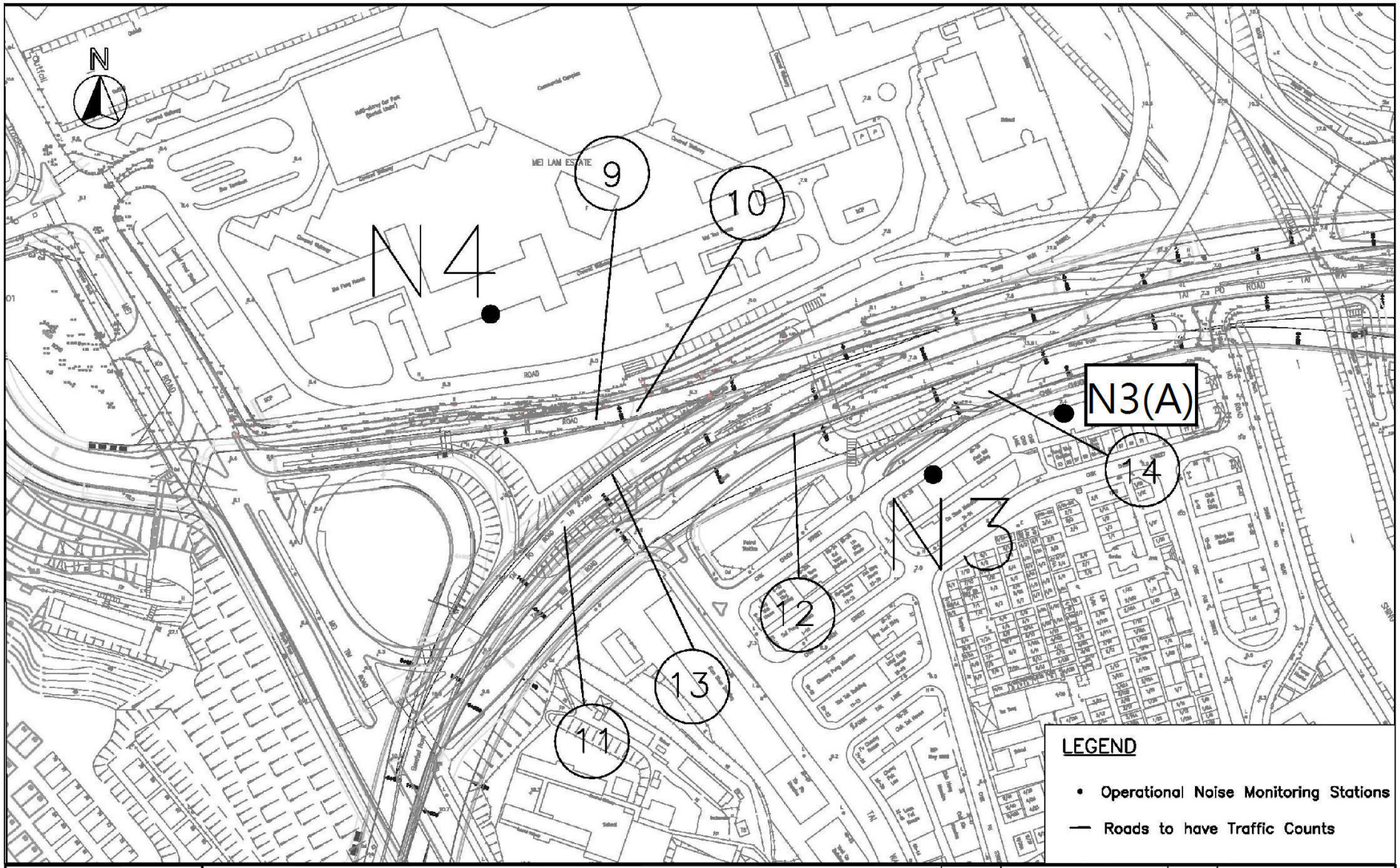
SHA TIN NEW TOWN STAGE II ROAD T3 AND ASSOCIATED ROADWORKS - REMAINING WORKS, PHASE III

LOCATIONS OF THE OPERATIONAL NOISE MONITORING STATIONS (N1 & N2)

SCALE	1:50	DATE	FEB 2015
CHECK	IT	DRAWN	HW
Project No.	MA13058	FIGURE NO.	2.1
		REV	–



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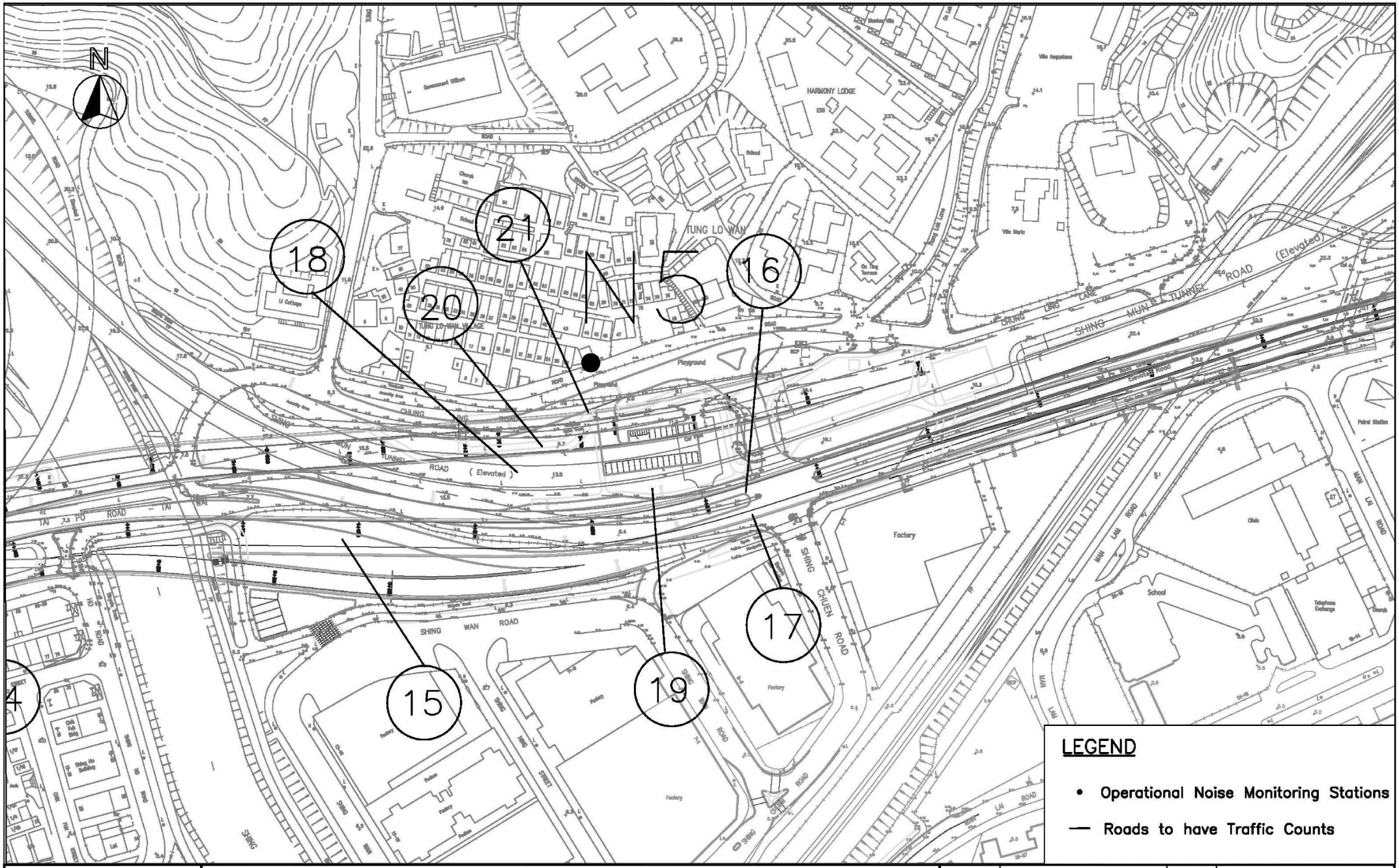
LOCATIONS OF THE OPERATIONAL NOISE MONITORING STATIONS (N3 & N4)

SCALE	1:50	DATE	FEB 2015
CHECK	IT	DRAWN	HW
Project No.	MA13058	FIGURE NO. 2.2	REV –



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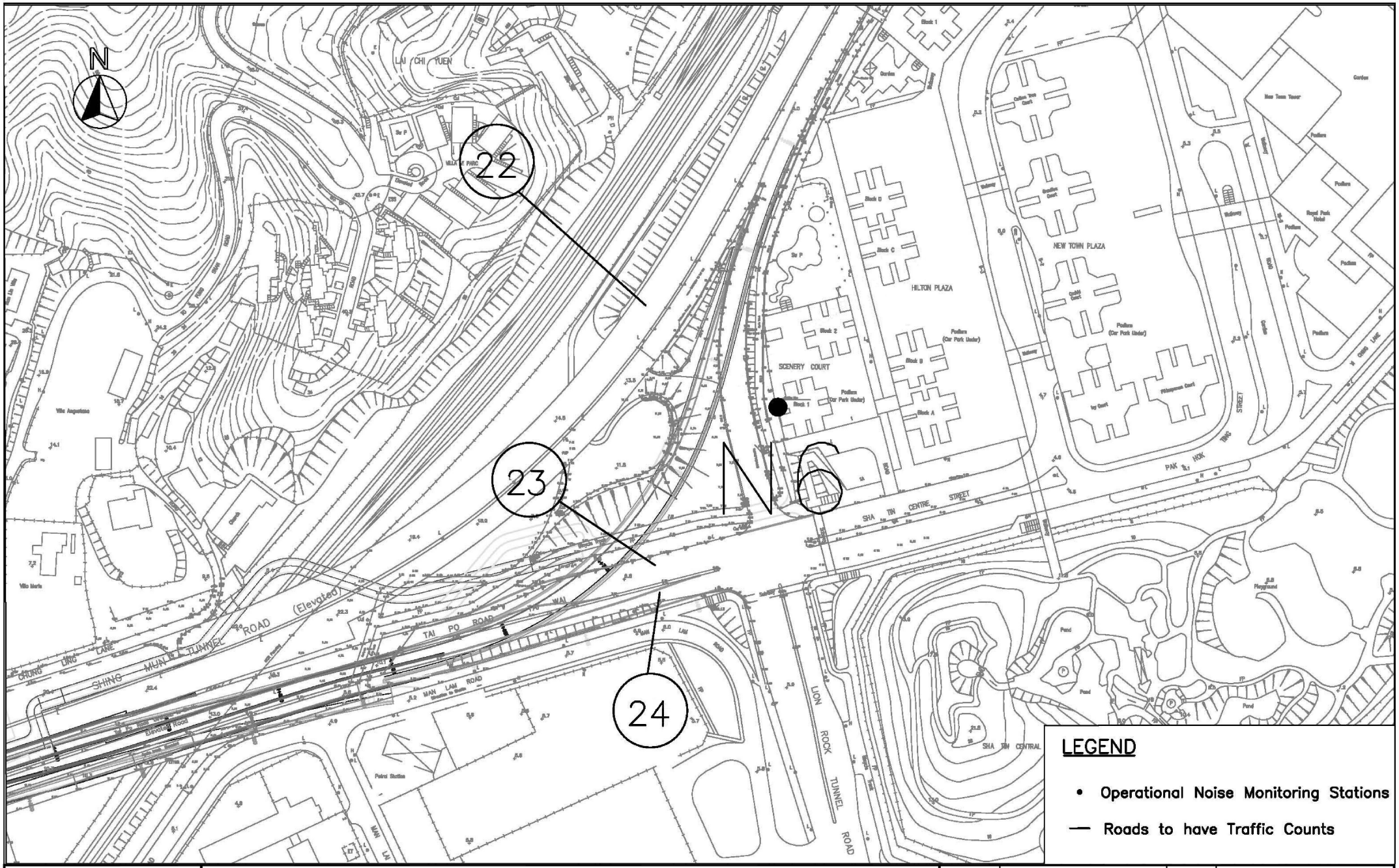
SHA TIN NEW TOWN STAGE II ROAD T3 AND ASSOCIATED ROADWORKS - REMAINING WORKS, PHASE III

LOCATIONS OF THE OPERATIONAL NOISE MONITORING STATIONS (N5)

SCALE	1:50	DATE	FEB 2015
CHECK	IT	DRAWN	HW
Project No.	MA13058	FIGURE NO. 2.3	REV –



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SHA TIN NEW TOWN STAGE II ROAD T3 AND ASSOCIATED ROADWORKS – REMAINING WORKS, PHASE III

LOCATIONS OF THE OPERATIONAL NOISE MONITORING STATIONS (N6)

SCALE	1:50	DATE	FEB 2015
CHECK	IT	DRAWN	HW
Project No.	MA13058	FIGURE NO.	2.4
		REV	–

APPENDIX A
SAMPLE RECORD SHEET

Traffic Noise Monitoring
Field Record Sheet

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General

Location		
Date of Monitoring		
Measurement time	(Morning traffic peak hour / Evening traffic peak hour)	
Weather conditions		
Temperature (^{o}C)		
Wind speed (ms^{-1})		

Equipment

Instrument	Type	Equipment No.	Setting
Sound level meter			
Calibrator			

Calibration

Before measurement:	After measurement:

Raw Data

Noise Measurements

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

Remarks: Monitoring should be cancelled if steady wind speed exceeds 5m/s or with gusts exceeding 10m/s.
Note: LV - light vehicle (i.e., private car, motorcycle and taxies)
HV - heavy vehicle (i.e., other than LV)
* - traffic count for a duration of 15 minutes
# - a/b|c/d=near side LV/ near side HV | far side LV/far side HV

…../2

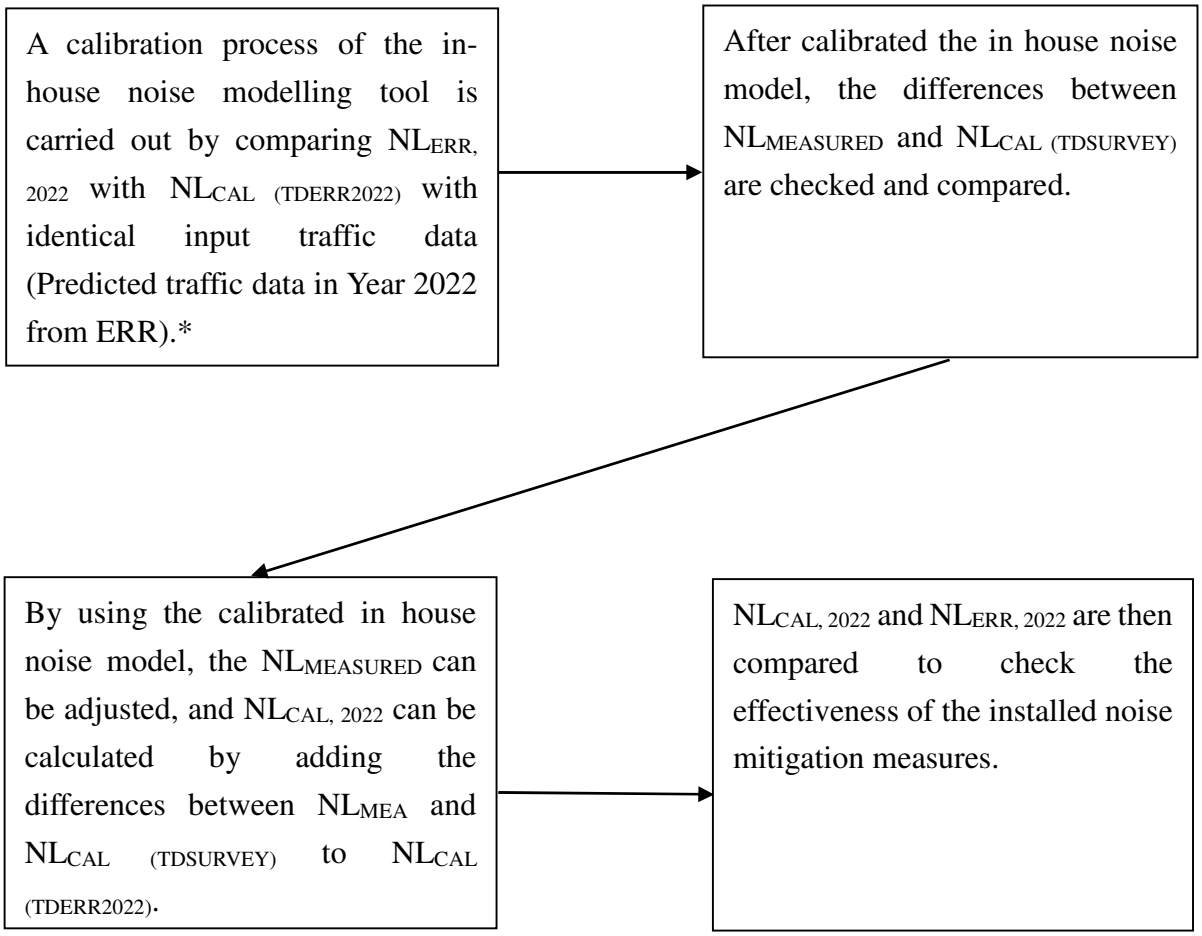
Traffic Noise Monitoring
Field Record Sheet

Traffic Counts

Road Segments	Time (15 min each)	Traffic data*				Average traveling time			
		Near side		Far side		Near side		Far side	
		HV	LV	HV	LV	HV	LV	HV	LV
T3									

APPENDIX B
FLOWCHART OF NOISE ASSESSMENT WORK

Appendix B – Methodology of Comparison of the Predicted Traffic Noise Levels in ERR with the Predicted Traffic Noise Levels by the In-house Noise Model



*Different noise model tools using in ERR and in this plan are no contradiction to correct the measured noise levels for the comparison with predicted noise levels in ERR as they are based on same acoustic theory according to CRTN.

$NL_{CAL, 2022}$: Calibrated Predicted Traffic Noise Level in 2022 using the traffic data in Year 2022 from ERR by the in-house noise model

$NL_{ERR, 2022}$: Predicted Traffic Noise Level in 2022 in ERR

$NL_{CAL\ (TDERR2022)}$: Calculated Traffic Noise Level in 2022 with the traffic data in Year 2022 from ERR by the in-house noise model

$NL_{MEASURED}$: Measured Traffic Noise Level

$NL_{CAL\ (TDSURVEY)}$: Calculated Traffic Noise Level based on surveyed traffic data by the calibrated in-house noise model

Sample assessment using hypothetical measured noise data at Station N1

(i) A calibration process of the in-house noise modelling tool will be carried out by comparing ER Report predictions and the results from the in-house noise modelling tool by inputting an identical set of traffic flow data

- Predicted traffic data in Year 2022 from ER Report (Figure 2-4 of ER Report) will be the input into our in-house noise modelling tool to obtain **$NL_{CAL\ (TDERR2022)}$**
- Comparison to be made between **$NL_{ERR,\ 2022}$** and **$NL_{CAL\ (TDERR2022)}$**

Monitoring Station	**Location**	**Floor**	**$NL_{ERR,\ 2022}$ ER Report Predicted Mitigated Noise Levels, dB(A)**	**$NL_{CAL\ (TDERR2022)}$ Calculated Noise Level $L_{10(1\text{-}hour)}$ dB(A) (Based on ER Report Traffic Data) (Hypothetical)**
N1 (TWV4)	Tai Wai New Village – Block 20	1/F	61.9	62.0
		3/F	65.1	65.0

- The difference is expected to be small and acceptable as they are based on the same acoustic theory according to the Calculation of Road Traffic Noise (CRTN).

(ii) After the calibration of the in-house noise model, the difference between the **$NL_{MEASURED}$** and the **$NL_{CAL\ (TDSURVEY)}$** will be checked and recorded.

Measurement Date	**Monitoring Stations**	**Floor**	**$NL_{MEASURED}$** **Measured Traffic Noise Levels, $L_{10(1\text{-}hour)}$ dB(A) (Hypothetical)**	**In-house Noise Modelling Tool** **$NL_{CAL\ (TDSURVEY)}$** **Calculated Traffic Noise Levels, $L_{10(1\text{-}hour)}$ dB(A) (Surveyed Traffic Data) (Hypothetical)**	**Difference between Calculated Traffic Noise Levels, dB(A)**
1st monitoring	N1 (TWV4)	1/F	65.3	65.6	-0.3
		3/F	63.7	64.2	-0.5
2nd monitoring	N1 (TWV4)	1/F	64.0	64.8	-0.8
		3/F	64.6	64.0	0.6

(iii) The above difference between **$NL_{MEASURED}$** and **$NL_{CAL\ (TDSURVEY)}$** will be added to **$NL_{CAL\ (TDERR2022)}$** to obtain the **$NL_{CAL,\ 2022}$**.

Measurement Date	**Monitoring Stations**	**Floor**	**$NL_{CAL\ (TDERR2022)}$ Calculated Traffic Noise Levels, $L_{10(1\text{-}hour)}$ dB(A) (ER Report Traffic Data) (Hypothetical)**	**Differences between Measured and Calculated Traffic Noise Levels, dB(A)**	**$NL_{CAL,\ 2022}$ Calibrated Predicted Traffic Noise Levels, $L_{10(1\text{-}hour)}$ dB(A) (ER Report Traffic Data) (Hypothetical)**
1st monitoring	N1 (TWV4)	1/F	62.0	-0.3	61.7
		3/F	65.0	-0.5	64.5
2nd monitoring	N1 (TWV4)	1/F	62.0	-0.8	61.2
		3/F	65.0	0.6	65.6

(iv) This **$NL_{CAL,\ 2022}$** will then be compared to the **$NL_{ERR,\ 2022}$** to check the effectiveness of the installed noise mitigation measures.

Measurement Date	**Monitoring Stations (NSR ID in the EIA Report)**	**Floor**	**$NL_{CAL,\ 2022}$ Calibrated Predicted Traffic Noise Levels, $L_{10(1\text{-}hour)}$ dB(A) (ER Report Traffic Data) (Hypothetical)**	**$NL_{ERR,\ 2022}$ ER Report Predicted Mitigated Noise Levels, dB(A)**
1st monitoring	N1 (TWV4)	1/F	61.7	61.9
		3/F	64.5	65.1
2nd monitoring	N1 (TWV4)	1/F	61.2	61.9
		3/F	65.6	65.1