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Technical Report

Reference: N&V – R2909

ENVIRONMENTAL NOISE INVESTIGATION AT PULROSS ROAD MID-TUNNEL VENTILATION SHAFT (MTVS)

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1. INTRODUCTION

Pulross Road Mid-Tunnel Ventilation Shaft (MTVS) was upgraded as part of the Cooling the Tube program. This upgrade doubled the airflow rate and increased the resultant noise. The criteria required by Lambeth council for any new permanent plant equipment is that the equipment must produce 10dB below the existing ambient noise level at the nearest sensitive receptor; this is derived from the recommendations in BS 4142:1997. The upgraded tower failed to achieve this criterion but a compromise was reached with Lambeth council's Environmental Health Officer.

Despite the compromise reached with Lambeth council there have been long standing noise complaints from the residents of Pulross Road and the surrounding area related to the MTVS. In response to these complaints the ventilation shaft has been switched off while a resolution is sought.

It has been decided that the MTVS will be operated at different speeds at different times of day. Ambient noise measurements are required to determine the present noise levels throughout a 24-hour period and consequently how fast the ventilation fans can be operated.

2. MEASUREMENT DETAILS

Measurements are required at periods throughout the day as well as at night in order to determine the highest speed at which the ventilation fan can be run throughout a 24-hour period without causing a statutory nuisance. Five daytime periods have been identified: 07:30-09:30 (morning peak), 12:00-14:00 (midday), 17:00-19:00 (evening peak), 21:00-23:00 (late evening) and between 00:00 and 07:00 at night.

Measurements will be conducted in line with BS 4142:2014, with a thirty-minute measurement for each of the daytime measurement periods and a fifteen-minute measurement used for the night-time measurements. Measurements will be conducted using Class 1 sound level meters which will be calibrated before and after each measurement period and the calibration factors noted.

6 measurement locations around the ventilation shaft have been identified. These are listed below and mapped in Figure 1. See Appendix A for images of the equipment setup at each measurement location.

No.	Measurement locations	Distance from ventilation shaft (m)
1	43a Pulross Road	5
2	32 Pulross Road	60
3	64 Pulross Road	235
4	8 Glendall Street	75
5	190 Ferndale Road	100
6	6 Bythorn Street	70

Table 1 – Measurement positions

Figure 1 – Map showing the Victoria line, MTVS and measurement positions

All measurement positions are more than 3.5m away from the nearest building façade.

Measurements were conducted between the dates of 17/03/2021 and 31/03/2021. The weather was dry with wind speeds below 5ms^{-1} during all measurement periods. Measurements were conducted using the below listed equipment. The specific times for each measurement and which equipment set was used are detailed in the table below.

1. Svantek SVAN 958A Sound & Vibration analyser S/N 69835
2. Svantek SVAN 958A Sound & Vibration analyser S/N 69836
3. 01dB Fusion Sound Level Meter S/N 12501

Measurement position		Measurement period				
		07:30-09:30	12:00-14:00	17:00-19:00	21:00-23:00	00:00-07:00
43a Pulross Road	Date/Time	08:45-09:15 23/03/2021	13:08-13:34 24/03/2021	17:08-17:34 24/03/2021	17/03/2021 21:00-21:30	18/03/2021 01:01-01:16
	Equipment	2	2	2	1	1
32 Pulross Road	Date/Time	08:12-08:37 23/03/2021	12:35-13:00 24/03/2021	17:46-18:12 24/03/2021	17/03/2021 21:32-22:02	18/03/2021 00:44-00:59
	Equipment	2	2	2	1	1
64 Pulross Road	Date/Time	07:41-08:01 23/03/2021*	12:05-12:25 24/03/2021*	18:27-18:37 23/03/2021*	17/03/2021 22:05-22:35	18/03/2021 00:26-00:41
	Equipment	2	2	2	1	1
8 Glendall Street	Date/Time	08:54-09:21 31/03/2021	12:03-12:35 24/03/2021**	17:32-18:02 24/03/2021**	29/03/2021 22:03-22:33	30/03/2021 01:01-01:16
	Equipment	2	3	3	1	1
190 Ferndale Road	Date/Time	08:19-08:44 31/03/2021	12:28-13:08 24/03/2021**	16:55-17:25 24/03/2021**	29/03/2021 21:32-22:02	30/03/2021 00:45-01:00
	Equipment	2	3	3	1	1
6 Bythorn Street	Date/Time	07:46-08:11 31/03/2021	13:11-13:41 24/03/2021**	18:04-18:35 24/03/2021**	29/03/2021 21:00-21:30	30/03/2021 00:29-00:44
	Equipment	2	3	3	1	1

Table 2 – Survey details

*Measurement truncated due to the presence of noise sources considered to be unrepresentative.

**Measurement period not continuous.

3. DEFINITIONS

$L_{90, T}$ – The sound level just exceeded for 90% of the measurement period and calculated by statistical analysis, for time period T

$L_{eq, T}$ – The equivalent continuous sound level or average sound level of the measurement period, for time period T

$L_{max, T}$ - The maximum sound level of the measurement period, for time period T

4. RESULTS OF NOISE MEASUREMENTS

Time period	Results, (dB(A))	Measurement Position					
		43a Pulross Road	32 Pulross Road	64 Pulross Road	8 Glendall Street	190 Ferndale Road	6 Bythorn Street
07:30-09:30	$L_{90,\ 30\ min}$	42	41	45	42	47	43
	$L_{eq,\ 30\ min}$	58	52	59	55	62	54
	$L_{max,\ 30\ min}$	73	70	82	78	82	77
12:00-14:00	$L_{90,\ 30\ min}$	39	43	49	39	44	39
	$L_{eq,\ 30\ min}$	54	57	60	45	53	46
	$L_{max,\ 30\ min}$	75	80	89	74	79	74
17:00-19:00	$L_{90,\ 30\ min}$	40	41	53	44	38	39
	$L_{eq,\ 30\ min}$	55	54	64	53	47	47
	$L_{max,\ 30\ min}$	72	79	88	82	73	67
21:00-23:00	$L_{90,\ 30\ min}$	42	40	39	37	41	40
	$L_{eq,\ 30\ min}$	55	49	58	52	59	57
	$L_{max,\ 30\ min}$	74	71	85	72	83	81
00:00-07:00	$L_{90,\ 15\ min}$	36	34	38	32	38	37
	$L_{eq,\ 15\ min}$	38	37	41	38	53	50
	$L_{max,\ 15\ min}$	53	50	72	64	81	69

Table 3 – Measurement results (See Appendix B for graphs)

5. OBSERVATIONS

The principal noise sources at all measurement locations were road and rail traffic.

43a and 64 Pulross Road, 6 Bythorn Street and 8 Glendall Street all had direct line of sight of Network Rail infrastructure. At 32 Pulross Road and 190 Ferndale Road line of site of the railway was obstructed by the residence; noise from the railway was less noticeable and could be heard primarily from either side of the measurement position. Even in the late evening there are frequent passenger rail services which pass through the area. Passenger rail services cease operating shortly after midnight but freight services continue throughout the night.

Road traffic consisted of cars, vans, mopeds, cyclists and pedestrians. 32 and 43a Pulross Road, 6 Bythorn Street and 8 Glendall Street are all located at dead ends which limited the volume of road traffic passing these properties. There was frequent road traffic near and passing 64 Pulross Road and 190 Ferndale Road.

Some of the measurements at 64 Pulross Road were truncated due to construction work which will not be a regular feature of the environment and created a noise environment which is not considered to be representative. 64 Pulross Road is located opposite an outdoor tyre and wheel servicing business.

6. NOISE EMITTED BY THE MTVS

A prior measurement exercise was conducted in February 2020 to determine the level of noise emitted from the MTVS at different fan speeds.

Measurement locations	Ventilation fan condition		
	OFF	Half speed	Full speed
43A Pulross Road	39dB(A)	38dB(A)	46dB(A)
32 Pulross Road	40dB(A)	38dB(A)	38dB(A)
64 Pulross Road	41dB(A)	39dB(A)	40dB(A)
6 Bythorn Street	37dB(A)	36dB(A)	40dB(A)
190 Ferndale Road	38dB(A)	37dB(A)	36dB(A)
8 Glendall Street	37dB(A)	36dB(A)	38dB(A)

Table 3 – Variable speed testing results, $L_{90,\ 5\ min}$

The $L_{90,\ 5\ min}$ with the fan off is 1-2dB(A) higher than the $L_{90,\ 5\ min}$ with the fan running at half-speed at all measurement locations. This indicates that when the fan is running at half-speed the noise emitted from the MTVS is below the ambient noise level at all measurement locations.

With the fan running at full-speed, the $L_{90,\ 5\ min}$ at 32 and 64 Pulross Road and 190 Ferndale Road is also below the $L_{90,\ 5\ min}$ with the fan off; indicating that the noise from the MTVS is below ambient at all fan speeds at these measurement locations.

Comparing the above results with the environmental noise results, running the fan at half-speed should not increase the ambient noise level at any time at any of the measurement locations. The noise from the MTVS will be audible at, at least, some measurement positions but should not be the predominant noise source, rather it should form part of the ambient soundscape.

Increasing the fan to full-speed will exceed the daytime L_{90} at the nearest sensitive receptor (43a Pulross Road), where it will be the predominant noise source. The noise from the MTVS is around the same amplitude as the daytime L_{90} values at 6 Bythorn Street and 8 Glendall Street meaning that it should form part of the ambient soundscape during the day.

Running the ventilation fan at full speed will increase the L_{90} at 43a Pulross Road to 46dB(A) which is an increase of 4-7dB(A) compared with the current daytime L_{90} values. This is below the current daytime L_{eq} levels but these will increase as a result of the higher noise floor.

7. RECOMMENDATIONS

The Night Noise Guideline (NNG) value, published in the World Health Organisation (WHO) Night Noise Guidelines for Europe 2009, is 40dB(A) when measured as an 8-hour L_{eq}. The night-time L_{eq} at 32, 43a and 64 Pulross Road and 8 Glendall Street are all in the region of the NNG value while the night-time L_{eq} at 190 Ferndale and 6 Bythorn Street are both well above it.

The NNG value is published for **guideline purposes only** and has no statutory implications. The definition of night-time for the purpose of this value is between the hours of 23:00 and 07:00.

As it will not be possible to achieve the criterion set by Lambeth council of 10dB below the ambient noise level it is recommended that, between the hours of 23:00 and 07:00, the fans in the MTVS be run at a speed which will produce an equivalent continuous noise level of 40dB(A) or lower, when measured at the nearest sensitive receptor (43a Pulross Road). Running the ventilation fan at half-speed between these hours will achieve this result as the noise generated by the MTVS has been shown to be below the ambient noise level at this speed. No other speed reductions are recommended.

Transitions between different fan speeds should be managed in order to minimise perceived annoyance and maximise perceived benefit. When the fan speed increases speed in the mornings it should do so gradually, with the increase to full speed taking at least 5 minutes. This will minimise the noticeability of the increase in noise. Conversely when the fan speed is decreased in the late evening the change should be rapid in order to maximise the noticeability of the decrease in noise.

APPENDIX A

MEASUREMENT PHOTOS

43a Pulross Road

32 Pulross Road

64 Pulross Road

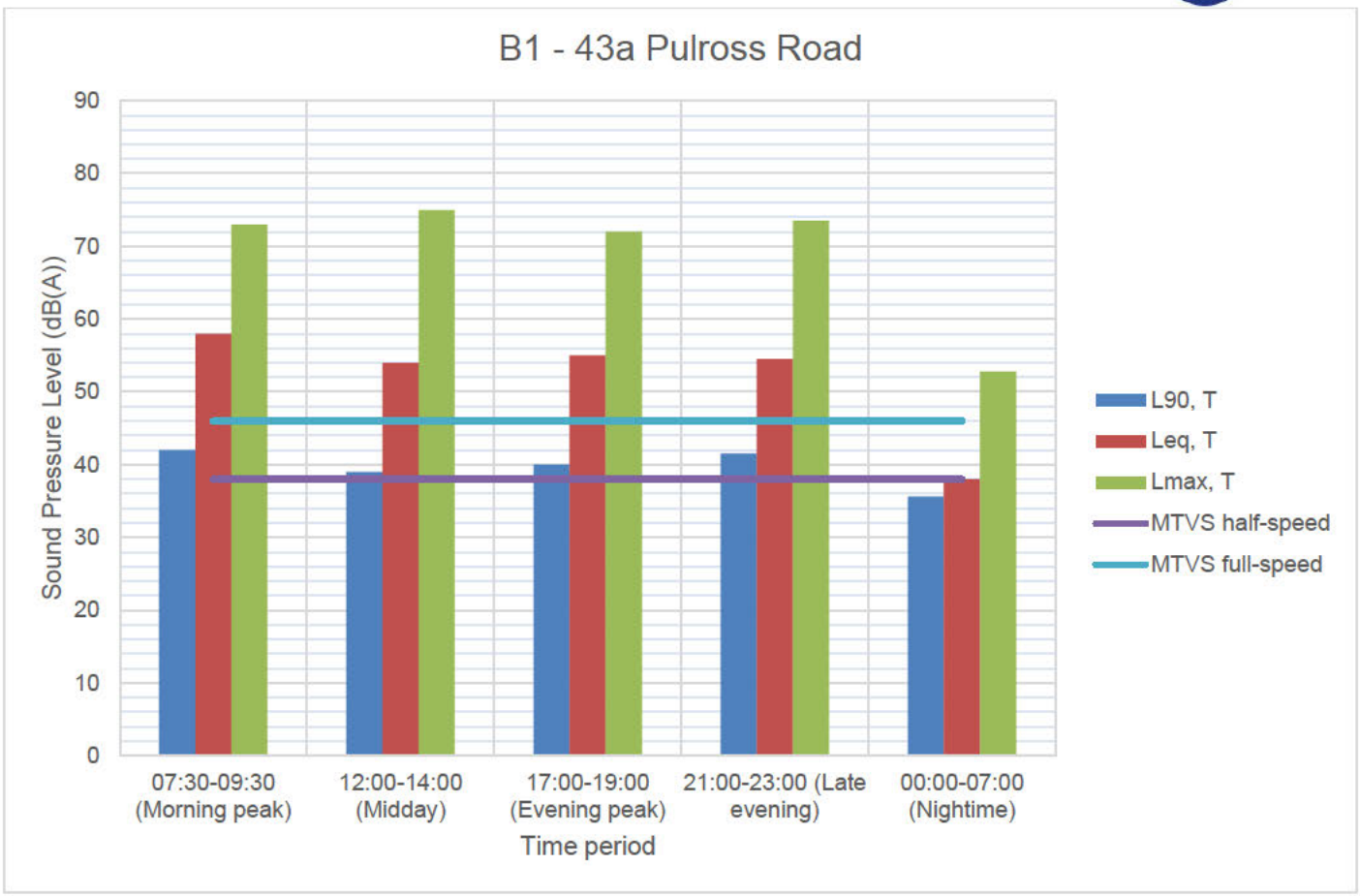
6 Bythorn Street

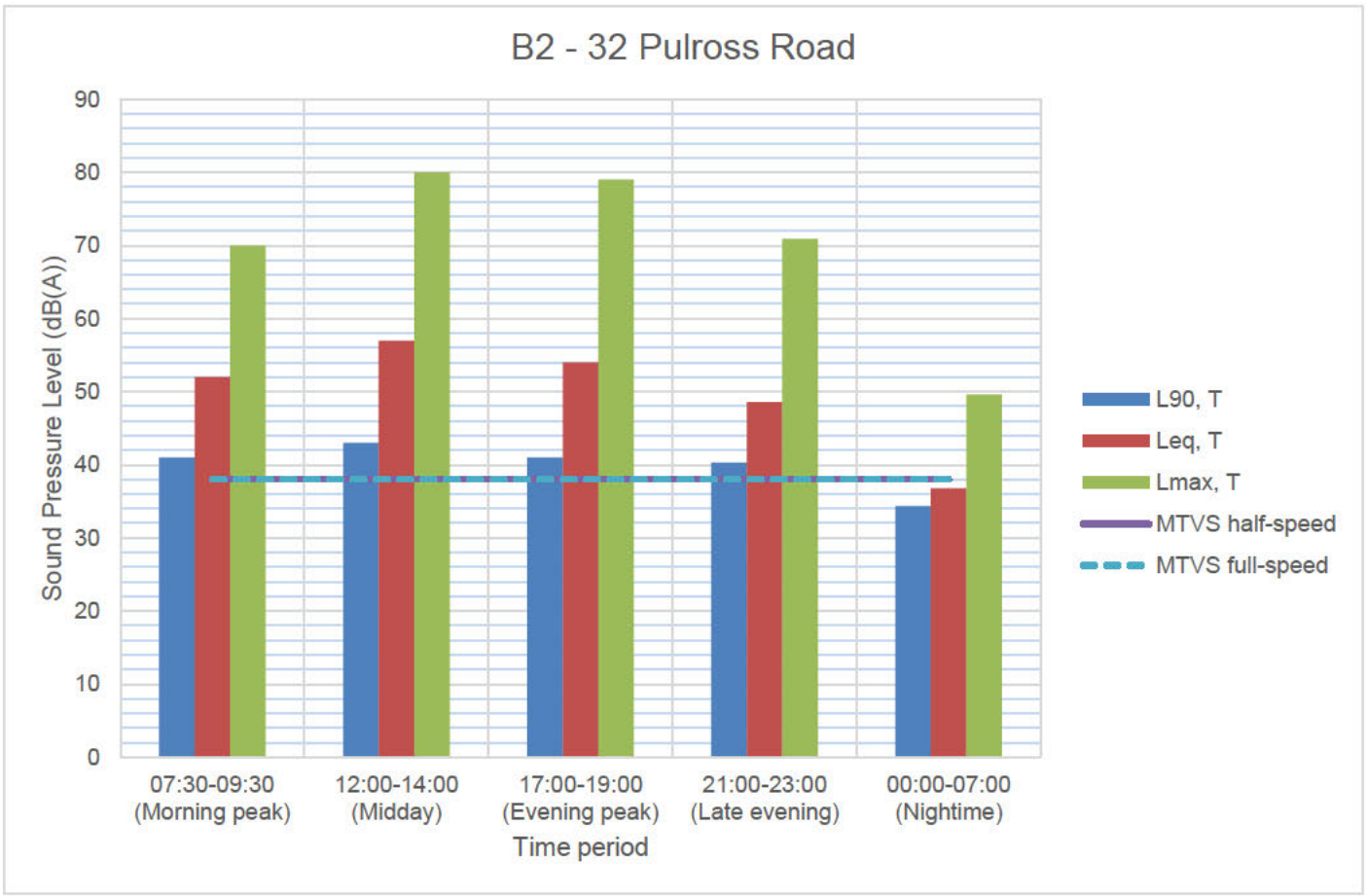
190 Ferndale Road

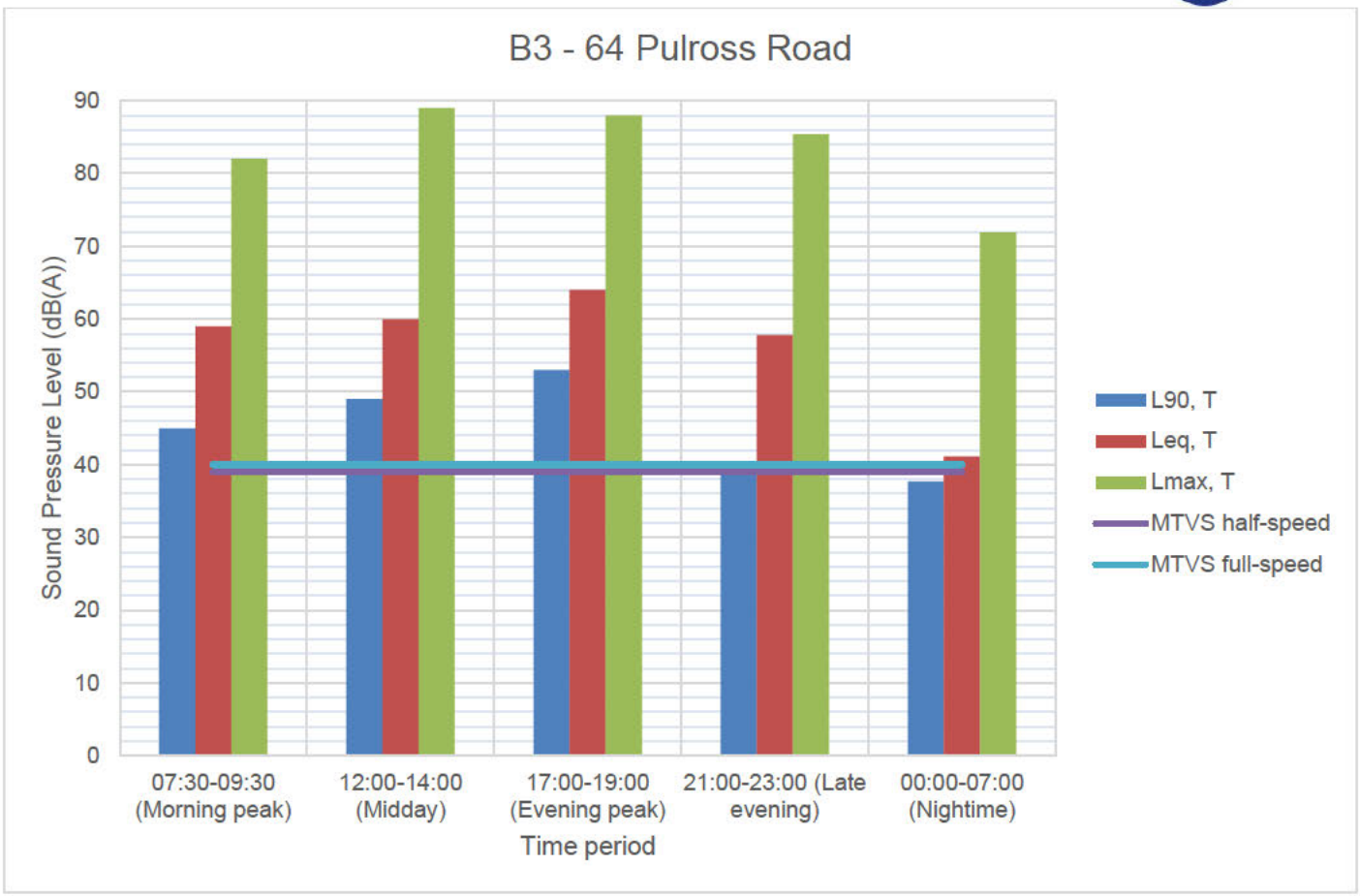
8 Glendall Street

APPENDIX B

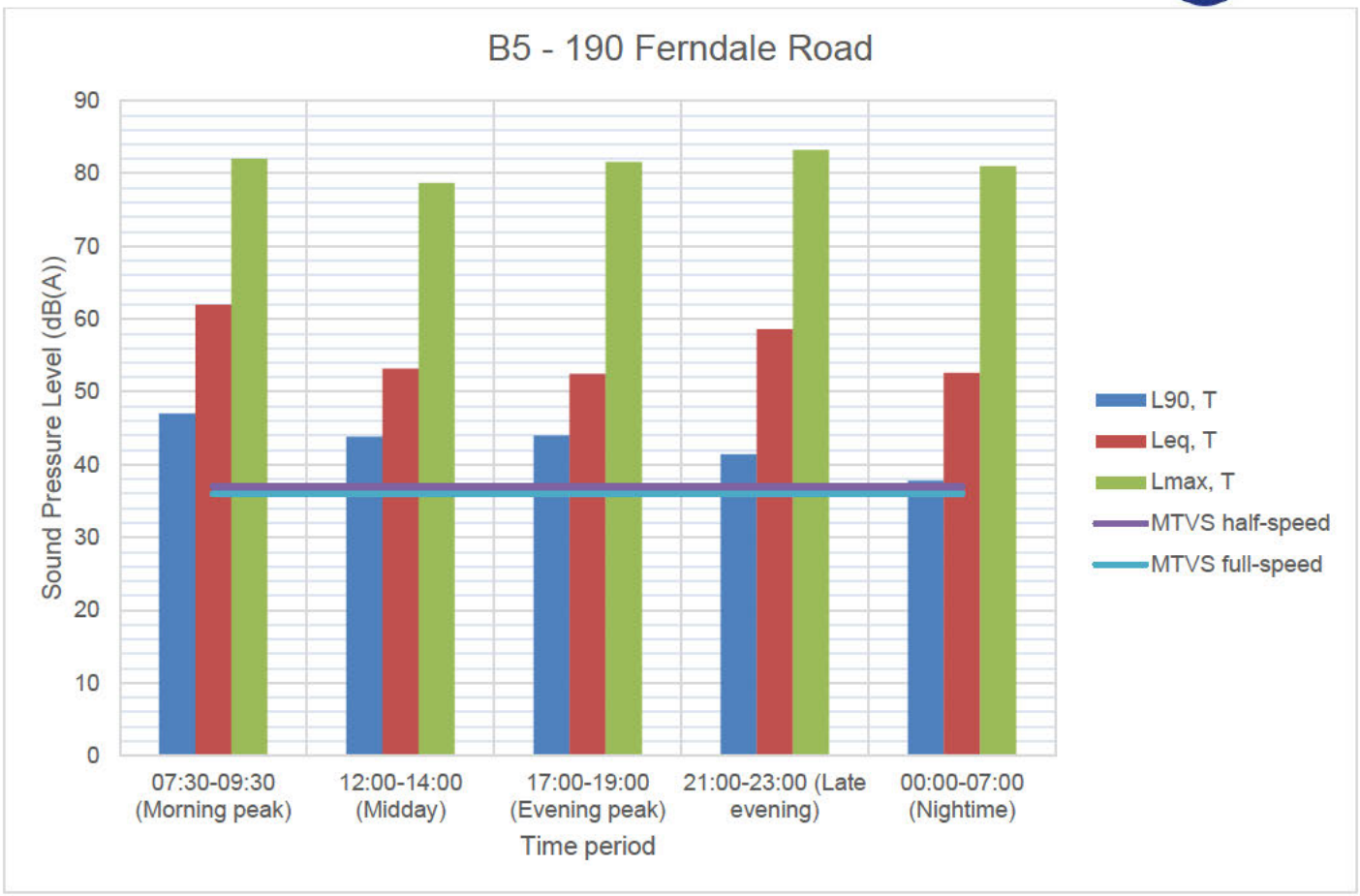
RESULTS GRAPHS

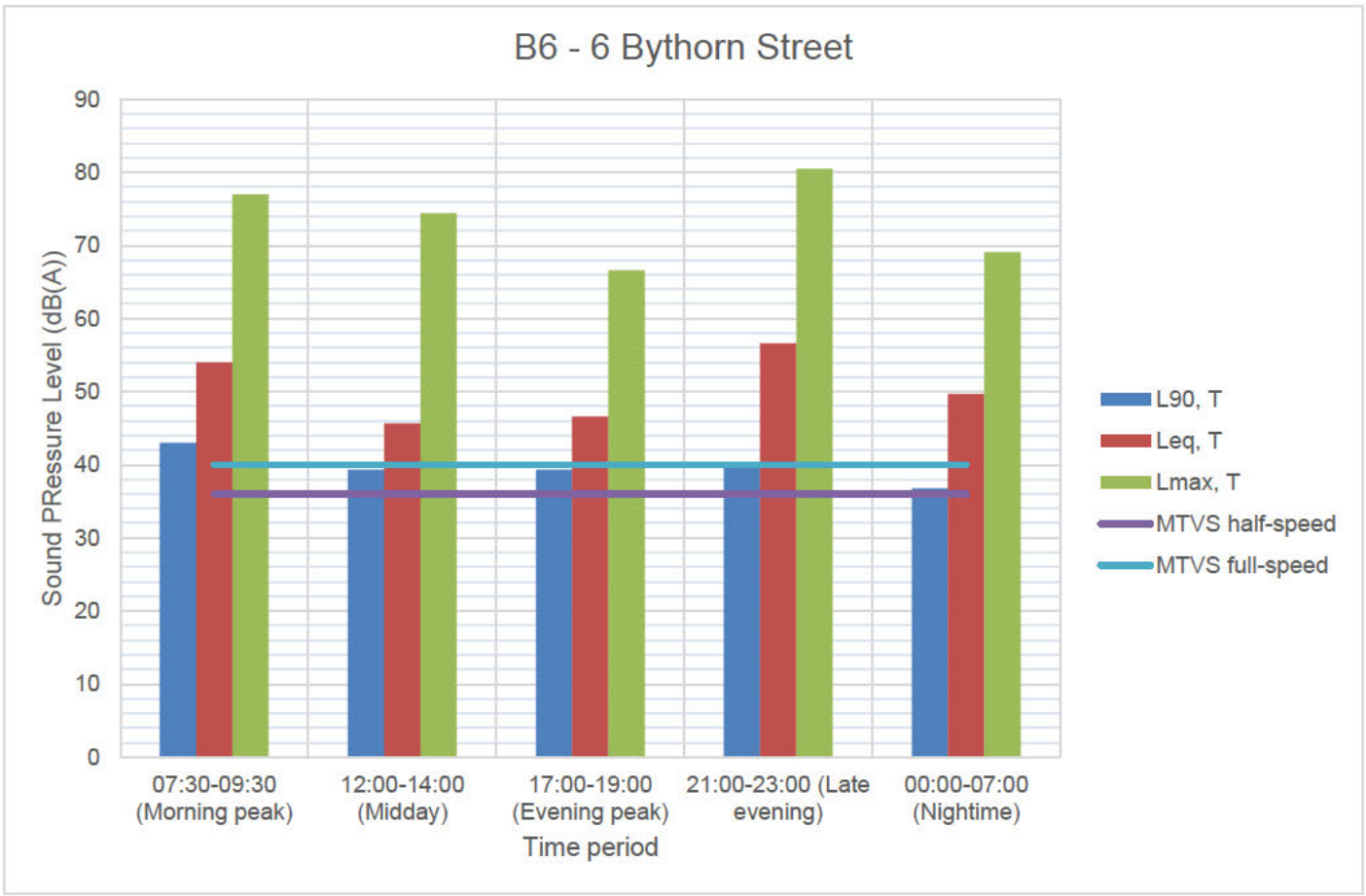

B1 - 43a Pulross Road
Sound Pressure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed


B2 - 32 Pulross Road
Sound Pressure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed


B3 - 64 Pulross Road
Sound Pressure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed


B4 - 8 Glendall Street
Sound Pressure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed


B5 - 190 Ferndale Road
Sound Pressure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed


B6 - 6 Bythorn Street
Sound PRessure Level (dB(A))
90
80
70
60
50
40
30
20
10
0
07:30-09:30 (Morning peak)
12:00-14:00 (Midday)
17:00-19:00 (Evening peak)
21:00-23:00 (Late evening)
00:00-07:00 (Nightime)
Time period
L90, T
Leq, T
Lmax, T
MTVS half-speed
MTVS full-speed