CLIENT: LONDON UNDERGROUND LIMITED

CONTRACT REF: TLL 7917

NORTHERN LINE EXTENSION

MAIN WORKS CONTRACT

Kennington Park Unattended Noise Monitoring

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CONTENTS

1 INTRODUCTION

Ferrovial Laing O'Rourke (FLO) is currently undertaking works as part of the London Underground Extension of the Northern Line (NLE) running from Kennington to Battersea (Charing Cross branch).

Unattended noise monitoring stations have been set up in order to assess construction noise levels of the current activities at the nearest sensitive receptors located around the site boundary.

This report provides a summary of the unattended noise monitoring. The analysed monitoring period spanned hours between Sunday 17th September 2017 and Saturday 14th October 2017.

2 MONITORING PROGRAMME

2.1 Receptors

The unattended monitoring positions are representative of the following sensitive receptors:

- Kennington Park Place residents (R1)
- Bishops House Children's Centre (R2)
- St. Agnes Place residents (R3)

2.2 Monitoring Locations

Two monitoring units were installed on Thursday 1st October 2015. The measurement positions are located within the NLE construction site at a height of approx. 2.9m and are considered to be free field measurements. They are illustrated in the layout plan presented in **Appendix I** and are as follows:

Table 1

MONITORING LOCATIONS		
Location	**Coordinates**	**Representative sensitive receptor**
NLE site – North West (MP1)	531522, 177956	R1, R2
NLE site – West (MP2)	531561, 177929	R3

2.3 Equipment

The measurement equipment used is detailed in **Table 2**. The measurement system was field calibrated before the start of the unattended monitoring and on-site calibrations are conducted monthly. All the measurement equipment is subject to current certificates of periodic validation traceable to national and international standards. Copies of calibration certificates are available upon request.

Table 2

SURVEY EQUIPMENT				
Manufacture	**Item**	**Type**	**Serial Number**	**Dates Monitor Active**
Sigicom	Sound Level Meter	INFRA S50	9039	17/09/17 – 29/09/17
Sigicom	Sound Level Meter	INFRA S50	8695	17/09/17 – 29/09/17
Sigicom	Sound Level Meter	INFRA S50	7479	29/09/17 – 14/10/17
Sigicom	Sound Level Meter	INFRA S50	4846	29/09/17 – 14/10/17

3 NOISE MONITORING RESULTS

The results of the monthly noise monitoring are presented below in **Table 3** and **Table 4**. The measured noise levels have been corrected in order to predict noise levels from site activities at associated sensitive receptors. In addition, a façade correction which takes into account the reflections from the building façade of 3 dB(A) has been applied to the corrected noise levels.

The descriptions of the assessment periods are outlined in **Appendix IV**.

Table 3

Monthly Noise Levels at R1 & R2							
		L_{morn}	L_{day}	L_{eve}	Max LEN	Max LLN	Typical LLN
Sun	17/09/17	-	57.3	-	59.0	58.4	53.1
Mon	18/09/17	60.1	62.0	58.5	57.0	58.7	54.6
Tue	19/09/17	60.1	61.2	59.3	57.4	**66.2**	55.2
Wed	20/09/17	59.1	61.8	59.0	57.7	59.1	52.9
Thu	21/09/17	61.4	61.4	59.2	58.7	58.4	54.3
Fri	22/09/17	61.6	61.0	59.7	57.6	56.8	54.0
Sat	23/09/17	57.2	58.7	57.8	59.4	56.3	53.4
Sun	24/09/17	-	62.1	-	72.7	57.8	52.7
Mon	25/09/17	59.8	62.1	59.4	56.3	57.8	52.3
Tue	26/09/17	60.4	61.4	58.4	56.9	57.6	52.5
Wed	27/09/17	60.5	60.6	59.0	59.6	61.3	55.6
Thu	28/09/17	59.2	61.1	59.8	58.1	59.0	54.3
Fri	29/09/17	59.7	61.0	60.0	58.9	58.0	55.0
Sat	30/09/17	57.2	58.6	59.3	60.0	57.9	57.7
Sun	01/10/17	-	57.7	-	59.1	58.3	53.6
Mon	02/10/17	59.8	61.7	59.2	58.5	58.5	53.4
Tue	03/10/17	60.8	62.4	59.2	57.6	59.1	53.4
Wed	04/10/17	60.6	61.5	60.0	57.9	59.0	54.3
Thu	05/10/17	59.7	61.7	60.8	60.3	58.6	53.9
Fri	06/10/17	62.0	62.3	59.4	57.9	60.6	55.2
Sat	07/10/17	57.9	59.5	58.4	59.0	56.7	54.7
Sun	08/10/17	-	58.1	-	60.0	58.1	53.5
Mon	09/10/17	59.9	61.2	59.0	57.4	59.4	53.0
Tue	10/10/17	62.1	63.1	60.5	58.2	61.4	55.1
Wed	11/10/17	62.6	61.8	61.0	58.6	59.0	55.1
Thu	12/10/17	60.7	61.2	60.0	58.6	58.2	55.0
Fri	13/10/17	59.6	61.6	60.9	58.7	57.3	54.0

Sat	14/10/17	56.1	58.3	58.0	58.7	61.6	58.3

Table 4

Monthly Noise Levels at R3

		L_{morn}	L_{day}	L_{eve}	Max LEN	Max LLN	Typical LLN
Sun	17/09/17	-	57.8	-	58.9	58.3	53.2
Mon	18/09/17	60.2	62.1	58.2	56.4	58.7	53.5
Tue	19/09/17	60.0	60.6	58.4	56.6	**64.9**	54.0
Wed	20/09/17	58.8	63.1	58.5	57.0	58.6	51.4
Thu	21/09/17	60.5	66.4	58.7	62.7	58.3	52.7
Fri	22/09/17	60.4	60.4	59.4	57.2	56.6	53.0
Sat	23/09/17	57.1	58.7	58.1	59.2	56.3	52.5
Sun	24/09/17	-	61.6	-	72.1	57.7	51.5
Mon	25/09/17	60.5	61.5	59.2	56.1	57.6	50.9
Tue	26/09/17	59.6	**78.4**	57.9	56.1	57.2	50.9
Wed	27/09/17	59.3	73.3	58.4	58.3	58.7	53.3
Thu	28/09/17	59.4	72.3	58.4	57.0	58.2	52.6
Fri	29/09/17	59.7	69.4	59.3	58.1	56.8	53.5
Sat	30/09/17	57.0	58.3	58.7	58.8	56.8	55.8
Sun	01/10/17	-	57.8	-	61.9	58.5	52.8
Mon	02/10/17	62.9	70.2	58.7	57.8	58.3	51.7
Tue	03/10/17	59.6	68.7	58.4	56.5	58.8	51.6
Wed	04/10/17	59.9	65.7	60.3	57.3	59.3	53.6
Thu	05/10/17	60.5	61.0	58.2	59.6	58.3	52.3
Fri	06/10/17	60.6	63.6	59.1	57.1	57.5	53.5
Sat	07/10/17	57.5	59.1	58.1	59.1	55.3	53.3
Sun	08/10/17	-	57.9	-	61.1	57.8	51.8
Mon	09/10/17	59.9	60.5	58.3	56.7	58.9	51.1
Tue	10/10/17	60.7	63.7	59.4	57.3	61.6	53.2
Wed	11/10/17	61.0	64.1	61.2	58.0	58.8	52.1
Thu	12/10/17	59.7	61.5	59.3	58.2	57.2	52.6
Fri	13/10/17	59.4	62.7	60.1	58.1	56.1	52.3
Sat	14/10/17	54.9	60.0	57.4	58.1	62.9	58.4

4 TRIGGER RESPONSE LOG

Exceedances above the limits set out in the Noise and Vibration Mitigation Scheme, included as **Appendix II** are identified along with the action taken in **Table 5** below:

Table 5

NOISE TRIGGER LOG					
Date	**Receptor**	**Time period**	**Noise Level $L_{Aeq,T}$, dB (exceedance above trigger level)**	**Cause**	**Best Practicable Means check**
19/09/2017	R1/R2	LLN	66.2 (+2.4)	1 emergency police siren.	n/a
19/09/2017	R3	LLN	64.9 (+0.7)	1 emergency police siren. Same event as R1/R2	n/a
26/09/2017	R3	Core hours	78.4 (+3.4)	External muck bin removal	✓

One exceedance occurred during the monitoring period due to the NLE activities.

APPENDIX I – SITE PLAN

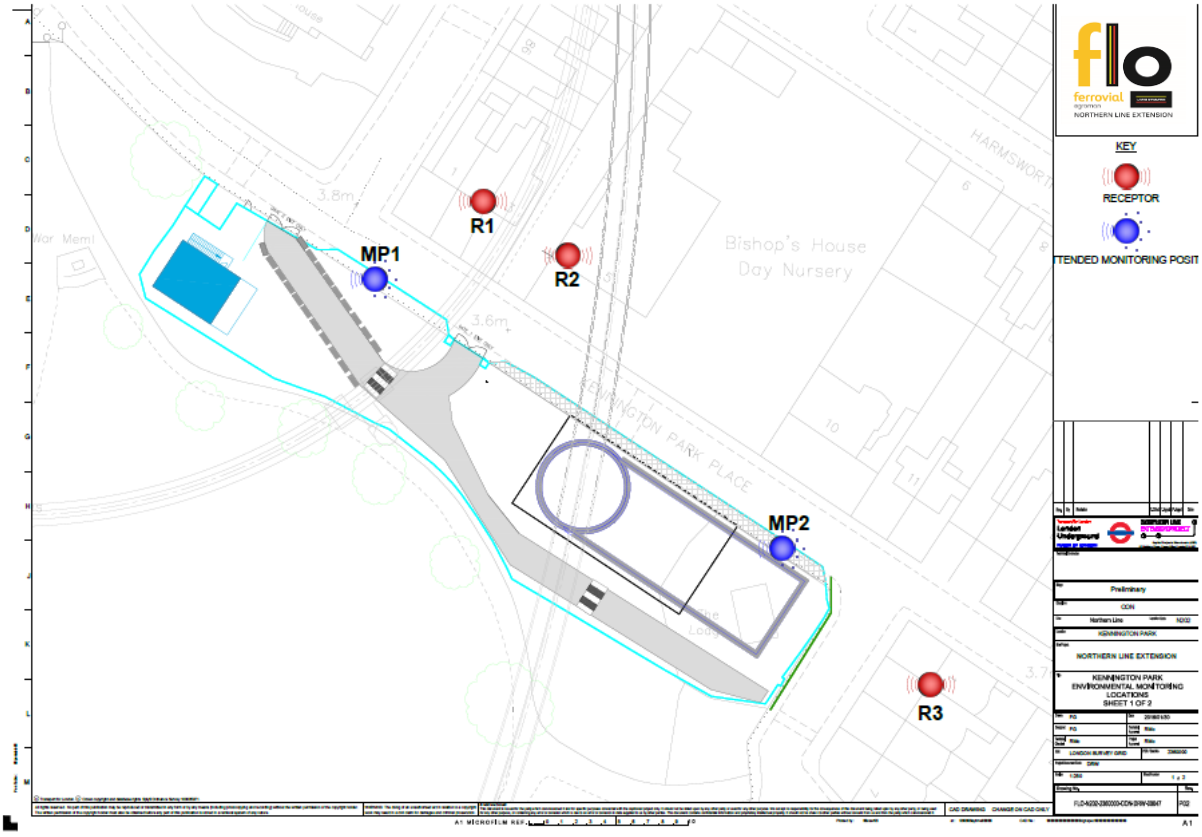

Figure 1 – NLE site plan and sensitive receptor locations

APPENDIX II – NORTHERN LINE EXTENSION: CONSTRUCTION NOISE AND VIBRATION MITIGATION SCHEME

Noise Insulation

A dwelling will be eligible for noise insulation where the total noise level due to construction of the railway (pre-existing ambient plus airborne NLE construction noise), measured or predicted at a point one metre in front of the most exposed of any windows and doors in any façade of a building which is an eligible dwelling, exceeds whichever is the higher of either: a) any of the following criteria in **Table 6**.

Table 6

NOISE INSULATION TRIGGER LEVEL TABLE

Time	Relevant Time Period	Averaging Time Period	Noise Insulation Trigger Level ($L_{Aeq,\ T}$) dB
Monday to Friday	07:00 – 08:00	1 hr	70
	08:00 – 18:00	10 hr	75
	18:00 – 19:00	1 hr	70
	19:00 – 22:00	3 hr	65
	22:00 – 07:00	1 hr	55
Saturday	07:00 – 08:00	1 hr	70
	08:00 – 13:00	5 hr	75
	13:00 – 14:00	1 hr	70
	14:00 – 22:00	3 hr	65
	22:00 – 07:00	1 hr	55
Sunday and Public Holidays	07:00 – 22:00	1 hr	65
	22:00 – 07:00	1 hr	55

Or
(b) 5 dB above the pre-existing airborne noise level for the corresponding times of day (i.e. the Relevant Time Periods presented in column 2 of Table 6);
And
for a period of 10 or more days of working in any 15 consecutive days or for a period of 3 or more nights (22:00-07:00) of working in any 7 consecutive nights or for a total of days exceeding 40 in any six consecutive months.

APPENDIX III – BASELINE SURVEY

Attended Survey

Baseline noise measurements were taken in the area surrounding Kennington Park in October 2014. Measurement locations and results can be seen below; locations were chosen in order to cover the closest sensitive receptors around the ventilation shaft site. Further details related to the exercise are documented in the report *'T2385.1 – Northern Line Extension: Pre-construction Noise and Vibration Baseline Report'*.

Table 7

ATTENDED BASELINE RESULTS			
ID	**Address**	**Time Period**	**Typical $L_{Aeq,T}$ dB**
KP1	Kennington Park Road (A3)	Daytime	72.2
		Evening	69.7
		Night-time	67.5
KP2	De Laune Street	Daytime	56.6
		Evening	54.6
		Night-time	47.9
KP3	Kennington Park Place	Daytime	65.3
		Evening	59.1
		Night-time	52.3
KP4	St Agnes Place	Daytime	57.3
		Evening	58.2
		Night-time	49.3

Unattended Survey

In order to assess typical ambient noise levels outside core hours, data has been gathered by the monitoring system in place at the Kennington Park worksite. These levels have been taken from the period between 11th January 2016 and 3rd April 2016.

Table 8

UNATTENDED BASELINE RESULTS						
	M-F 1900-2200 (LEN) $L_{Aeq,T}$ dB	**M-F 2200-0700 (LLN) $L_{Aeq,T}$ dB**	**Sat 1400-2200 (LEN) $L_{Aeq,T}$ dB**	**Sat 2200-0700 (LLN) $L_{Aeq,T}$ dB**	**Sun 0700-2200 (LEN) $L_{Aeq,T}$ dB**	**Sun 2200-0700 (LLN) $L_{Aeq,T}$ dB**
R1/R2	63.0	58.8	63.0	57.5	61.0	55.9
R3	62.8	59.2	63.0	58.3	61.1	56.8

Trigger Levels

Trigger levels for each receptor, as stated in the Northern Line Extension: Construction Noise and Vibration Mitigation Scheme (Appendix II) can be seen in **Table 9** below:

Table 9

TRIGGER LEVELS								
	Core Hours, $L_{Aeq,T}$ dB	**M-F 07:00-08:00 18:00-19:00 (Lmorn, Leve) $L_{Aeq,T}$ dB**	**M-F 19:00-22:00 (LEN) $L_{Aeq,T}$ dB**	**M-F 22:00-07:00 (LLN) $L_{Aeq,T}$ dB**	**Sat 14:00-22:00 (LEN) $L_{Aeq,T}$ dB**	**Sat 22:00-07:00 (LLN) $L_{Aeq,T}$ dB**	**Sun 07:00-22:00 (LEN) $L_{Aeq,T}$ dB**	**Sun 22:00-07:00 (LLN) $L_{Aeq,T}$ dB**
R1/R2	75.0*	70*	68.0	63.8	68.0	62.5	66.0	60.9
R3	75.0*	70*	67.8	64.2	68.0	63.3	66.1	61.8

* based on the NI trigger level from **Table 6**

APPENDIX IV – GLOSSARY

Table 10

ABBREVIATIONS	
L_{morn}	Morning values from 07:00 to 08:00 Monday to Saturday.
L_{day}	Core hours from 08:00 to 18:00 Monday to Friday, 08:00 to 13:00 Saturday. 07:00 to 21:00 on Sunday is included but not considered to be Core hours.
L_{eve}	Evening values from 18:00 to 19:00 Monday to Friday and from 13:00 to 14:00 Saturday.
Max LEN	Maximum early night values from 19:00 to 22:00 Monday to Friday, 14:00 to 22:00 Saturday and from 0700 to 2200 Sun.
Max LLN	Maximum late night values from 22:00 to 07:00 Monday to Sunday.
Typical LLN	Arithmetic average of the intervals for the late night time period.