

Report No: Neal Street plant noise impact 20150227

For: DSDHA

DRAFT

41-45 NEAL STREET

BACKGROUND NOISE SURVEY AND PLANT NOISE IMPACT ASSESSMENT

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February 2015

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TABLE OF CONTENTS

Introduction.....	3
1.0 Summary.....	3
2.0 Plant noise assessment criteria	3
3.0 Survey details	4
4.0 Survey results	4
5.0 Plant noise design criteria	4
6.0 Plant Assessment	5
APPENDIX A: Site overview	7
APPENDIX B: Existing plant in lightwell area	8
APPENDIX C: Survey results graph	9
APPENDIX D: Acoustic screening.....	10
APPENDIX E: Equipment and Procedure.....	11
APPENDIX F: Survey Results	12
APPENDIX G: Glossary of acoustic terms	16

Introduction

Proposals are being submitted to the London Borough of Camden Council to install items of external air conditioning plant to be installed at 41-45 Neal Street, Covent Garden.

Gillieron Scott Acoustic Design have been commissioned to undertake a background noise survey and plant impact assessment.

The findings of the plant noise impact assessment are presented in the following sections of this report together with the supporting Figures and Appendices.

1.0 Summary

An environmental noise survey was undertaken over a 4-day period at a position representative of the immediate noise environment at the neighbouring properties to the rear of 41-45 Neal Street. The measurement position is shown in Appendix A.

The survey results show that the lowest background noise level measured over the survey period was 42 dB $L_{A90,5min}$ at the measurement location.

GSAD's recommended noise limits for the proposed plant locations have been outlined in this report so that noise from plant items does not exceed 32 dB(A) at the nearest noise sensitive windows. The nearest noise sensitive windows were identified as the rooflights at the rear of 16 Neal's Yard.

2.0 Plant noise assessment criteria

The following table is taken from the London Borough of Camden Council Development Policy DP28 - Noise and Vibration and sets out limits for noise levels from plant and machinery.

Table 1 - Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90

Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB _{LAeq}
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3.0 Survey details

Background noise levels have been measured over a 4-day period at the rear of 41-45 Neal Street at third floor level. The measurement position is shown in Appendix A.

The noise environment during daytime hours was dominated by several items of existing plant items in the lightwell area that is formed at the rear of Neal Street and Neal's Yard. Some of the units are shown in the photographs in the appendix.

The equipment was set up to record sound levels over 5-minute intervals between 14:05 on Thursday 19th February 2015 and 16:45 on Monday 23rd February 2015.

The weather conditions did not adversely affect the measurement.

Details of equipment and procedure used are shown in Appendix E.

4.0 Survey results

Period	Lowest <i>L</i> _{A90} (dB)	Average <i>L</i> _{Aeq} (dB)
Day (07:00 - 19:00)	44	58
Evening (19:00 - 23:00)	47	55
Night (23:00 – 07:00)	42	47

The minimum LA90 was 42 dB at 05:45 on Friday 20th February.

The full survey results (to one decimal place) are available on request however a sample of the results is shown in Appendix F.

5.0 Plant noise design criteria

The proposed units will have the facility to operate 24 hours a day. Therefore based on the local authority noise limits set out in section 2.0 and the survey results summarised in section 4.0, the cumulative noise from all new items of plant should not exceed 32 dB(A) at 1m from the nearest noise sensitive windows: 10 dB less than the lowest measured *L*_{A90} background level during the measurement period.

6.0 Plant Assessment

The proposed plant items are three Daikin ERLQ011C outdoor units. The manufacturer's published sound pressure level for one of these units is 53 dB L_{Aeq} at 1m in heating mode measured in a semi-anechoic room, which is taken here as worst case.

The units will be situated on the rear terrace at 4th floor as indicated in Appendix D.

The nearest noise sensitive windows to the proposed units were identified as the rooflights of 16 Neal's Yard at a distance of approximately 6 metres in a straight line. The height difference of those windows with the top edge of the terrace is estimated to be 3m. As such the units will be visually and acoustically screened by the terrace to the rear of 16 Neal's Yard and 21-23 Shorts gardens.

Element	Level	Comments
Unit sound pressure level	58 dB L_{Aeq}	3x Daikin ERLQ011C at 1m
Directivity	0 dB	Terrace walls acoustically treated
Distance	- 14 dB	Approx. 5 m to 1m from nearest windows
Screening effect	- 15 dB	Screening from terrace
Cumulative noise at receiver	29 dB(A)	Meets night time criteria of 32 dB(A)

The acoustic treatment of the walls could be achieved by lining the walls with a sound absorbing, flame retardant mineral wool or acoustic foam infill min 50mm thick with absorption coefficient of 0.8 at 500Hz. (ISO 11654, CLASS B) e.g. perforated galvanised steel panels with minimum 50mm thick 45 kg/m³ mineral wool infill. The area to be treated should be at least the height of the units and be located on at least the longest 2 walls of the terrace. See Appendix D.

APPENDICES

APPENDIX A: Site overview

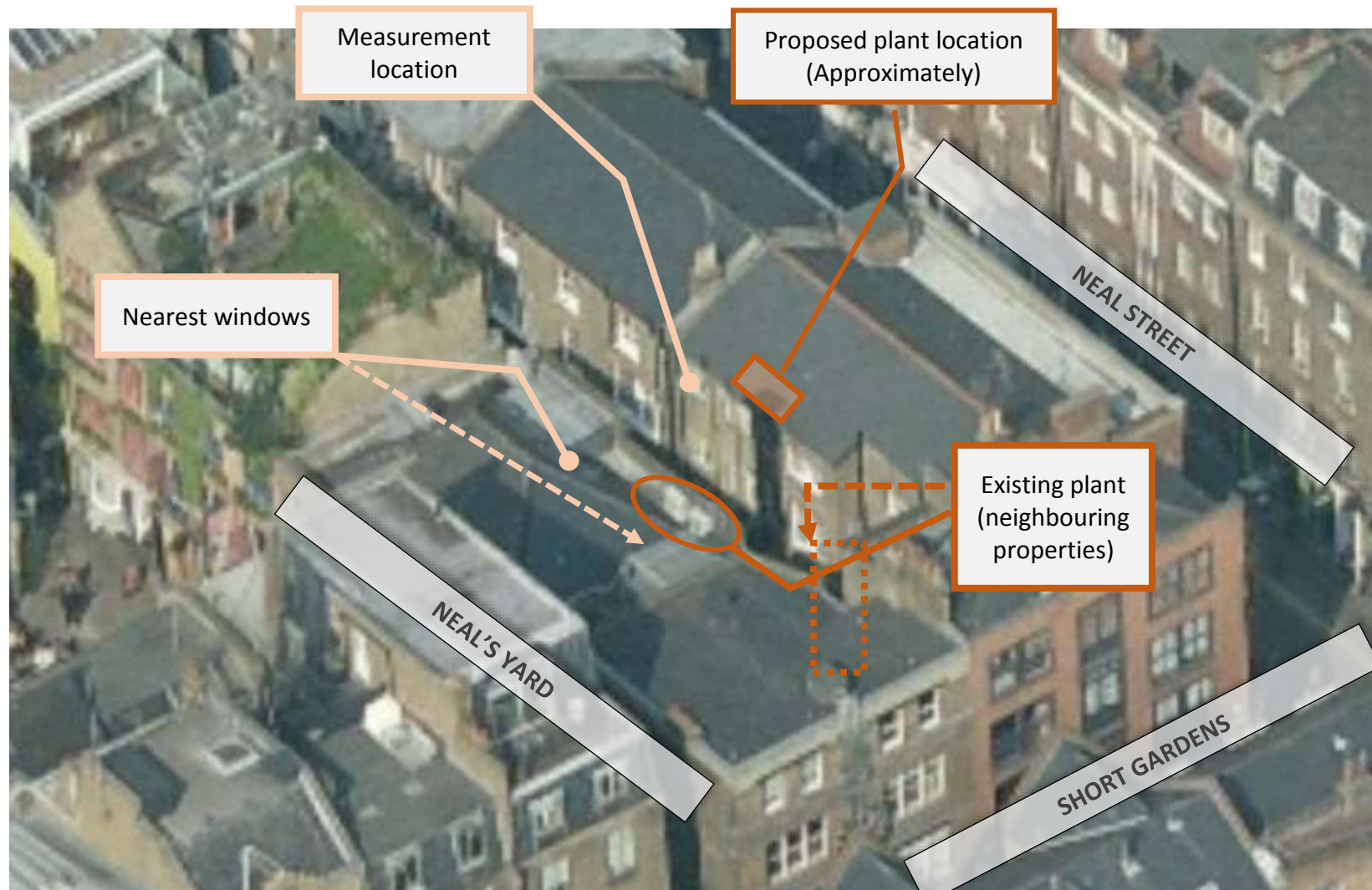


Photo 1 - Aerial photograph courtesy of Bing maps

APPENDIX B: Existing plant in lightwell area



Existing plant
(neighbouring
properties)

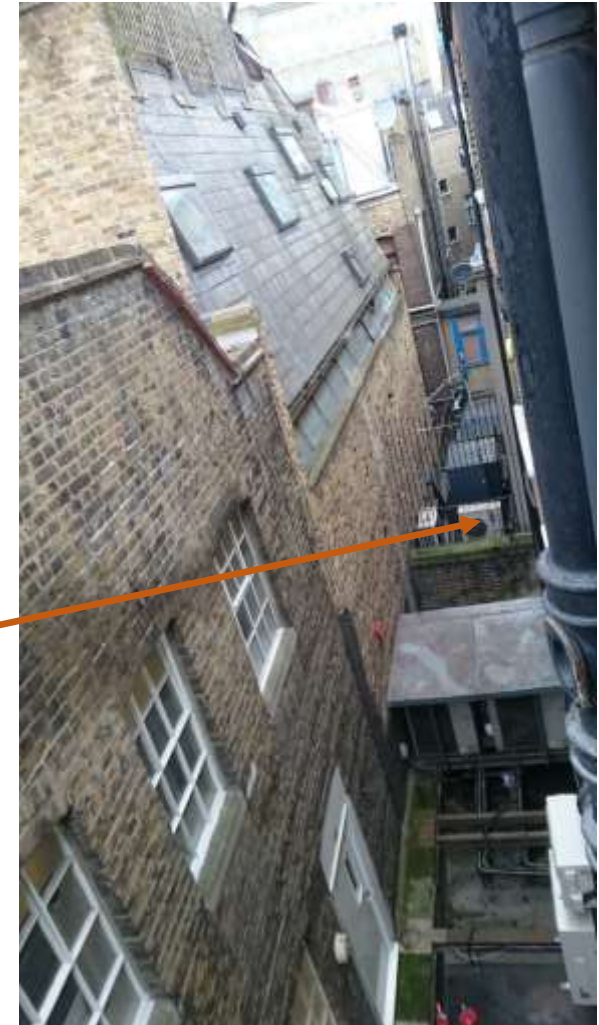


Photo 3 - Looking South
Photo 2 - Looking North

APPENDIX C: Survey results graph

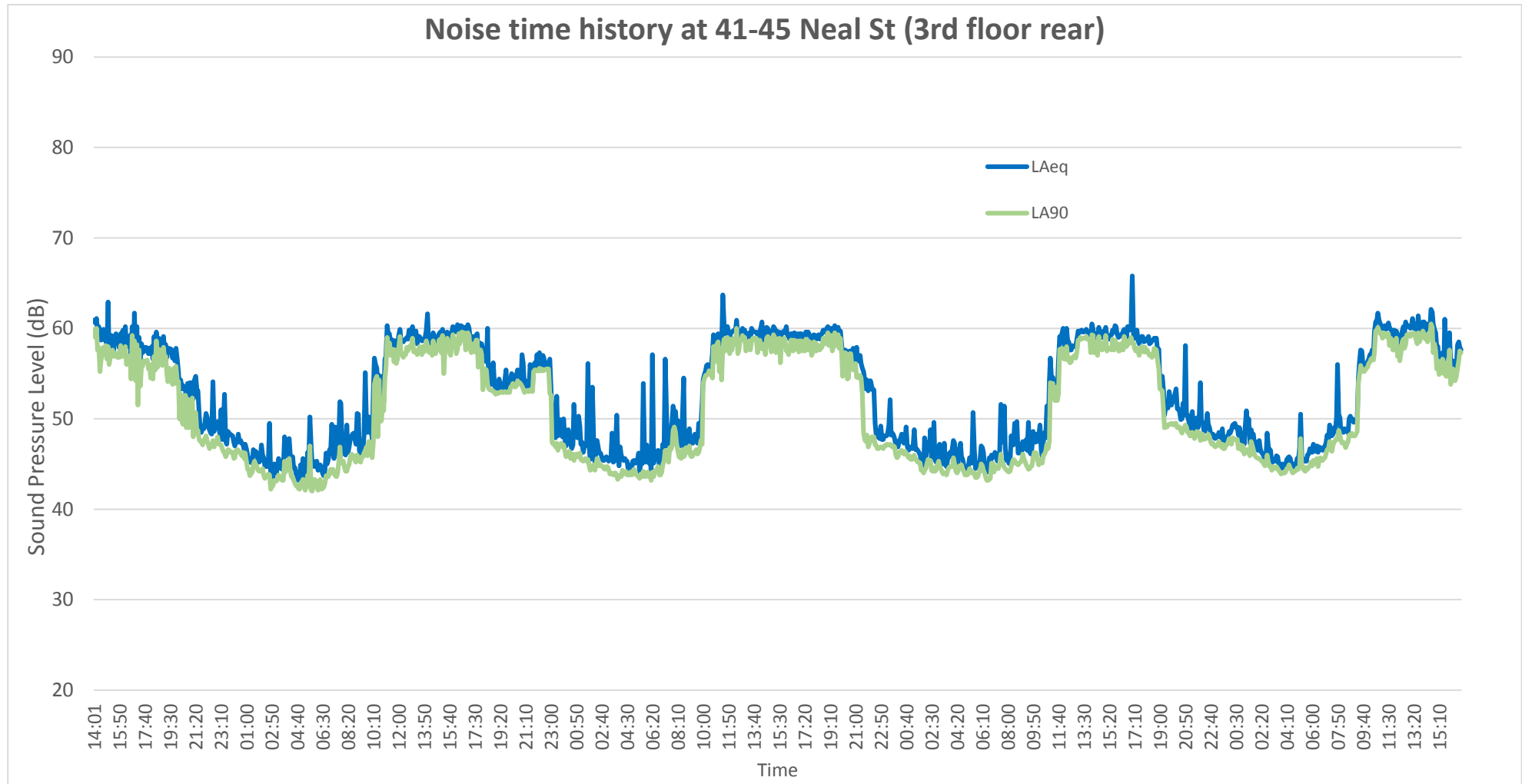


Figure 1 - Vertical lines indicate midnight approximately

APPENDIX D: Acoustic screening

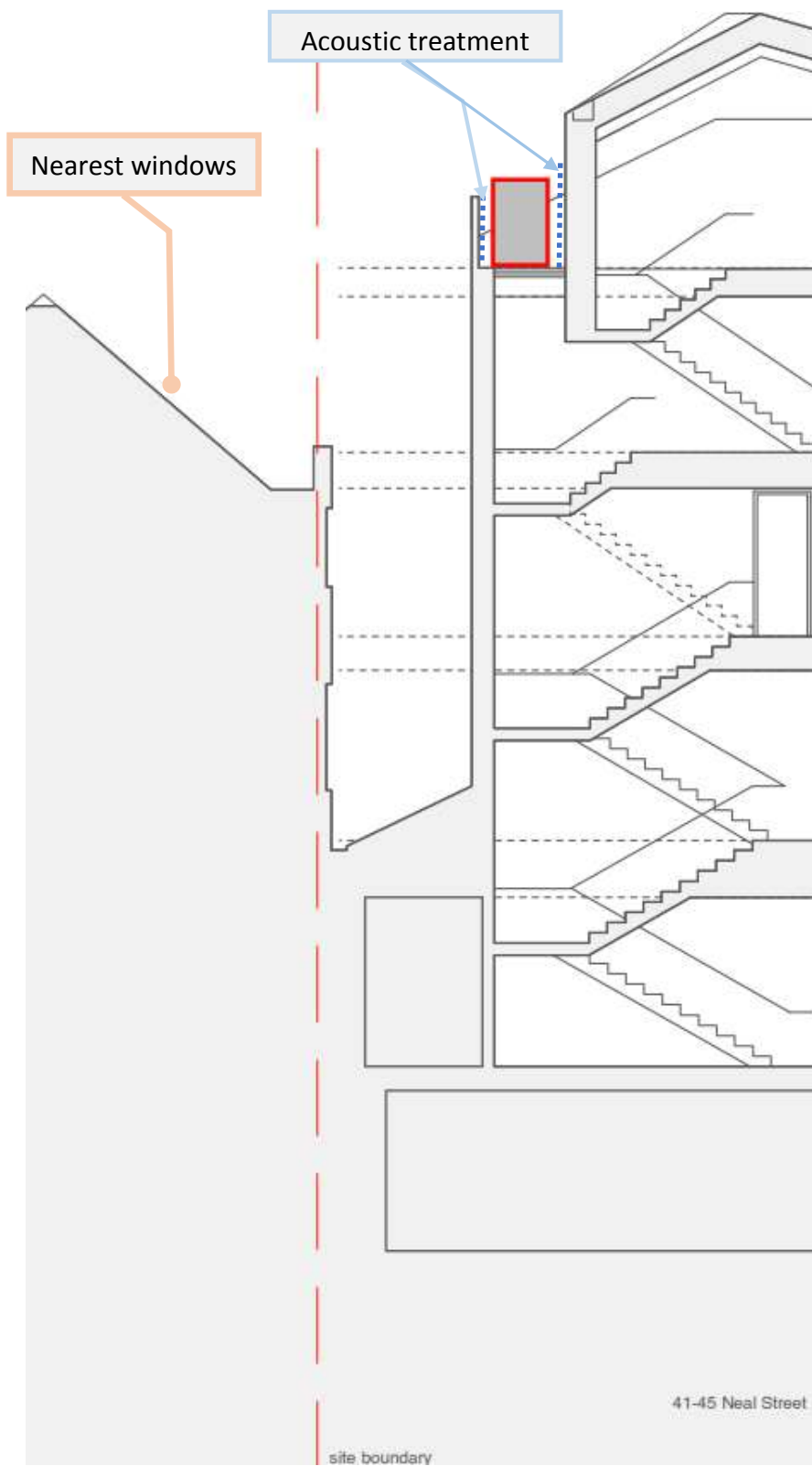


Figure 2 - Section of proposed scheme illustrating the acoustic screening offered by the building fabric

APPENDIX E: Equipment and Procedure

Background noise levels have been measured over a 4-day period at the rear of 41-45 Neal Street at third floor level. The measurement position is shown in Appendix A.

The equipment was set up to record sound levels over 5-minute intervals between 14:05 on Thursday 19th February 2015 and 16:45 on Monday 23rd February 2015.

The weather was generally calm and clear throughout.

The levels were recorded as A-weighted and octave band L_{eq} , L_{max} and L_{90} using the following equipment.

Norsonic 118 Real Time Analyser
Norsonic 1251 Calibrator
GRAS Environmental Microphone

The equipment was calibrated before and after the survey and no drift from calibration was found.

Equipment Type	Serial Number	Date of last calibration check	Calibration certificate number	Next calibration due
Calibrator - Norsonic 1251	28836	27/3/2014	U15871	March 2016
Sound level meter - Norsonic 118	28134	27/3/2014	U15873	March 2016
Microphone - Norsonic 1225	25170	27/3/2014	15872	March 2016
Preamplifier - Norsonic 1206	28548	27/3/2014		March 2016

APPENDIX F: Survey Results

Results sample - day

Date	Time	L _{Aeq}	L _{A90}	L ₉₀							
				63	125	250	500	1k	2k	4k	8k
19/02/2015	15:00:00	62.9	58.0	62.6	58.7	57.1	55.5	53.2	49.1	43.5	39.8
19/02/2015	15:05:00	57.1	56.0	61.5	57.3	55.3	52.9	51.3	46.5	41.0	37.6
19/02/2015	15:10:00	58.7	56.8	62.2	58.3	56.0	54.6	51.3	47.0	42.9	39.9
19/02/2015	15:15:00	59.2	57.5	62.3	59.2	56.9	54.4	52.4	48.8	43.5	39.5
19/02/2015	15:20:00	58.9	57.6	63.4	59.7	57.2	55.2	52.4	48.1	43.6	40.4
19/02/2015	15:25:00	57.6	56.9	62.4	58.3	56.6	53.7	52.0	47.5	42.2	38.5
19/02/2015	15:30:00	58.9	57.1	63.0	58.3	56.4	54.4	51.9	48.3	43.5	39.8
19/02/2015	15:35:00	59.4	57.2	64.0	65.2	57.0	53.5	51.6	47.5	43.5	40.6
19/02/2015	15:40:00	58.4	56.8	64.1	64.8	56.0	52.6	51.2	47.6	42.1	39.0
19/02/2015	15:45:00	58.5	57.3	64.3	66.0	56.7	53.0	52.0	48.1	42.3	39.0
19/02/2015	15:50:00	57.8	56.8	64.4	66.1	56.0	53.3	50.8	47.0	42.0	39.6
19/02/2015	15:55:00	59.4	58.1	64.9	66.3	57.8	54.5	52.6	48.4	43.0	40.0
19/02/2015	16:00:00	59.5	56.9	64.1	61.9	57.0	54.3	51.3	46.3	41.6	39.2
19/02/2015	16:05:00	59.8	57.8	63.5	58.7	57.6	55.4	52.4	48.6	43.4	40.3
19/02/2015	16:10:00	57.9	56.9	63.0	58.4	56.5	54.4	51.6	47.1	42.0	39.0
19/02/2015	16:15:00	60.2	58.0	62.9	59.5	57.3	55.1	52.9	49.1	43.7	40.4
19/02/2015	16:20:00	57.9	56.0	61.8	58.2	55.8	52.8	50.9	47.4	41.2	37.8
19/02/2015	16:25:00	58.6	56.7	63.0	58.8	56.9	53.7	51.7	47.9	41.9	38.2
19/02/2015	16:30:00	58.2	56.9	62.9	59.7	57.2	54.0	51.7	47.6	42.6	39.5
19/02/2015	16:35:00	59.2	56.9	63.2	59.3	57.8	54.2	51.6	47.8	40.8	37.1
19/02/2015	16:40:00	57.2	54.4	62.3	57.6	57.3	52.3	48.3	44.0	38.6	35.2
19/02/2015	16:45:00	60.2	59.2	65.2	63.2	58.5	56.4	53.8	50.1	44.7	41.1
19/02/2015	16:50:00	57.2	55.6	62.6	58.0	56.2	53.2	49.9	45.5	39.6	36.8
19/02/2015	16:55:00	61.7	58.6	64.1	60.2	57.6	56.1	53.4	49.3	44.4	41.2
19/02/2015	17:00:00	56.2	54.2	62.1	56.5	54.7	52.4	48.8	44.3	38.1	35.9
19/02/2015	17:05:00	60.2	58.2	62.8	59.0	56.2	55.1	53.1	49.5	44.1	40.3
19/02/2015	17:10:00	55.2	51.5	59.3	53.7	52.0	49.1	46.3	42.3	35.3	30.2
19/02/2015	17:15:00	59.0	57.6	62.4	60.6	56.6	54.7	52.7	48.7	44.3	40.6
19/02/2015	17:20:00	56.4	53.6	60.0	54.8	53.5	50.6	49.1	44.5	38.5	34.1
19/02/2015	17:25:00	58.3	56.0	61.4	58.7	55.3	52.8	51.6	46.9	41.9	38.2
19/02/2015	17:30:00	57.3	55.8	60.5	57.4	54.9	52.1	50.8	47.2	41.9	38.4
19/02/2015	17:35:00	57.9	56.4	60.4	55.8	54.1	53.0	51.0	48.5	42.1	38.2
19/02/2015	17:40:00	57.5	56.3	61.3	56.9	54.3	53.6	51.2	47.8	41.9	37.5
19/02/2015	17:45:00	57.9	56.4	61.3	57.2	54.7	53.7	51.3	47.3	41.9	38.0
19/02/2015	17:50:00	57.8	56.5	61.4	56.6	54.3	53.7	51.3	48.0	42.2	38.3
19/02/2015	17:55:00	57.2	55.5	60.5	57.8	54.0	52.2	50.6	46.6	41.2	36.9
19/02/2015	18:00:00	57.8	56.0	61.2	58.8	55.1	52.6	51.4	47.0	41.2	36.7
19/02/2015	18:05:00	57.2	54.5	60.0	56.6	54.1	51.1	49.9	45.8	39.2	33.8
19/02/2015	18:10:00	58.0	56.0	61.2	57.5	55.0	52.0	51.9	47.6	41.8	37.9
19/02/2015	18:15:00	56.6	54.4	60.2	57.8	54.2	51.4	49.6	45.2	40.0	36.2
19/02/2015	18:20:00	59.1	56.9	62.3	58.1	56.5	53.3	51.9	48.3	42.8	39.5
19/02/2015	18:25:00	57.7	55.4	62.3	57.5	56.0	52.5	50.5	45.8	40.0	36.5

19/02/2015	18:30:00	59.6	58.6	64.0	60.6	57.8	55.8	53.5	49.4	44.3	40.9
19/02/2015	18:35:00	58.1	55.7	62.6	58.2	56.6	52.6	50.9	45.8	39.7	36.3
19/02/2015	18:40:00	58.9	57.7	63.8	60.1	57.7	55.0	52.3	48.2	43.4	40.4
19/02/2015	18:45:00	57.4	56.0	61.9	59.1	56.2	53.1	50.4	46.2	41.7	38.9
19/02/2015	18:50:00	58.7	57.5	62.6	59.2	57.7	54.9	51.7	48.3	43.1	39.8
19/02/2015	18:55:00	57.5	55.9	62.6	59.3	57.1	53.4	50.3	45.9	41.3	37.6
19/02/2015	19:00:00	59.1	57.9	63.3	59.3	57.4	55.3	52.8	48.9	43.6	40.3
19/02/2015	19:05:00	57.8	56.7	62.7	59.5	57.0	53.7	51.7	47.2	42.4	39.1
19/02/2015	19:10:00	58.2	56.9	62.3	58.3	56.4	54.5	51.7	47.8	42.6	39.6
19/02/2015	19:15:00	56.8	54.9	61.8	57.6	55.7	52.4	49.4	45.5	39.3	36.6
19/02/2015	19:20:00	57.7	54.1	61.8	57.2	54.5	53.0	48.3	43.9	37.1	37.1
19/02/2015	19:25:00	57.8	55.6	61.6	58.3	56.1	53.1	48.6	45.3	39.8	37.0
19/02/2015	19:30:00	57.6	54.5	62.0	57.6	55.8	52.5	48.8	44.1	38.2	36.2
19/02/2015	19:35:00	57.7	55.3	62.1	57.7	56.0	52.5	50.5	45.9	39.7	37.1
19/02/2015	19:40:00	56.7	53.8	61.5	56.7	54.9	51.8	48.6	43.4	37.3	35.3
19/02/2015	19:45:00	57.2	55.6	61.8	58.4	56.3	52.7	50.8	46.2	39.9	37.2
19/02/2015	19:50:00	56.4	53.9	60.9	57.5	55.0	51.4	48.8	43.5	37.1	35.1
19/02/2015	19:55:00	57.8	55.8	61.9	58.9	56.3	52.8	50.9	46.6	40.2	37.6
19/02/2015	20:00:00	56.6	54.2	61.3	57.7	55.2	52.2	48.6	43.9	37.3	34.0
19/02/2015	20:05:00	55.1	54.1	59.8	56.3	54.3	51.2	49.1	44.6	38.2	35.0
19/02/2015	20:10:00	53.2	50.0	57.9	53.0	50.7	47.7	44.1	40.7	33.1	26.2
19/02/2015	20:15:00	54.3	52.7	58.7	54.2	52.4	49.4	48.3	44.1	37.0	32.7
19/02/2015	20:20:00	53.3	49.7	57.6	52.3	50.5	47.6	44.0	40.5	32.3	25.0
19/02/2015	20:25:00	53.7	49.4	58.1	52.2	49.9	47.3	44.1	40.2	32.1	24.9
19/02/2015	20:30:00	53.3	49.7	57.9	52.6	50.4	47.7	44.1	40.3	32.3	23.9
19/02/2015	20:35:00	53.4	52.6	59.0	54.0	52.1	49.3	48.0	43.7	36.7	32.3
19/02/2015	20:40:00	51.8	49.0	57.2	51.9	49.4	46.6	43.3	39.6	32.0	26.9
19/02/2015	20:45:00	53.9	52.2	57.4	53.4	51.4	48.8	47.5	43.5	37.0	32.8
19/02/2015	20:50:00	52.4	49.0	56.8	51.6	49.7	46.8	43.1	39.8	32.5	27.1
19/02/2015	20:55:00	54.0	49.4	57.5	52.1	49.8	47.3	43.8	40.3	32.3	26.7
19/02/2015	21:00:00	52.9	49.2	57.1	51.9	49.9	47.1	43.4	40.0	32.1	25.3
19/02/2015	21:05:00	54.0	52.3	58.8	54.2	52.3	48.7	47.7	43.2	36.4	32.5
19/02/2015	21:10:00	52.2	48.0	56.2	50.9	48.9	45.3	42.5	39.3	31.9	26.0
19/02/2015	21:15:00	54.3	50.4	57.1	52.7	50.5	48.7	44.4	40.0	34.1	32.2
19/02/2015	21:20:00	54.7	50.7	57.3	52.9	50.7	48.8	44.3	40.7	34.0	30.0
19/02/2015	21:25:00	53.2	48.5	56.2	51.1	48.8	46.5	42.6	39.3	32.4	28.2
19/02/2015	21:30:00	53.1	48.7	57.3	52.1	49.6	46.2	42.9	39.9	33.5	28.9
19/02/2015	21:35:00	50.5	47.7	55.5	50.7	48.2	44.7	42.1	38.9	30.6	23.7
19/02/2015	21:40:00	48.6	47.5	55.8	50.8	48.6	44.6	41.7	38.5	30.5	23.5
19/02/2015	21:45:00	48.5	47.5	55.3	50.8	48.3	44.6	41.6	38.3	30.5	22.7
19/02/2015	21:50:00	49.0	47.1	55.2	50.7	48.1	44.6	41.6	37.9	30.0	23.0

Results sample - night

Results Sample Night											
Date	Time	L _{Aeq}	L _{A90}	L ₉₀							
				63	125	250	500	1k	2k	4k	8k
22/02/2015	21:45:00	49.0	48.1	55.1	50.2	48.2	45.8	43.0	38.4	31.3	25.2
22/02/2015	21:50:00	50.2	48.5	55.5	50.5	48.8	45.8	43.4	38.7	31.8	25.2

22/02/2015	21:55:00	54.0	47.6	54.7	50.2	47.9	45.1	42.7	38.0	31.1	25.3
22/02/2015	22:00:00	49.7	48.1	55.1	50.7	48.6	45.9	43.0	38.2	31.2	25.3
22/02/2015	22:05:00	49.6	48.3	55.0	51.0	48.7	46.0	43.1	38.1	31.0	25.1
22/02/2015	22:10:00	48.7	47.7	55.2	50.7	48.5	45.1	42.6	37.6	30.9	25.3
22/02/2015	22:15:00	48.6	47.9	54.7	50.9	48.5	45.4	42.8	37.8	30.9	25.3
22/02/2015	22:20:00	49.2	47.8	55.0	50.6	48.6	45.2	42.9	38.1	31.1	25.5
22/02/2015	22:25:00	50.6	48.0	55.1	50.9	48.8	45.4	42.9	38.3	31.4	25.5
22/02/2015	22:30:00	49.4	48.3	55.4	50.9	49.0	45.8	43.3	38.6	31.4	25.3
22/02/2015	22:35:00	49.0	48.0	55.2	50.3	48.5	45.3	43.0	38.3	31.2	25.2
22/02/2015	22:40:00	48.3	47.4	54.3	50.0	48.1	44.6	42.4	37.7	30.8	25.2
22/02/2015	22:45:00	48.2	47.2	54.5	50.2	48.1	44.5	42.2	37.7	30.6	24.9
22/02/2015	22:50:00	48.3	47.3	54.8	50.4	48.2	44.5	42.1	38.0	30.9	24.9
22/02/2015	22:55:00	47.9	47.0	54.8	50.3	47.8	44.2	41.8	37.5	30.5	24.9
22/02/2015	23:00:00	47.8	46.9	54.8	50.0	48.1	44.1	41.7	37.4	30.4	24.9
22/02/2015	23:05:00	48.1	47.0	54.7	50.0	47.8	44.1	41.7	37.4	30.6	24.9
22/02/2015	23:10:00	48.0	47.1	54.4	49.8	47.8	44.4	42.0	37.5	30.4	25.0
22/02/2015	23:15:00	48.5	47.5	55.1	50.1	48.2	44.9	42.2	37.7	30.7	25.0
22/02/2015	23:20:00	48.2	47.2	54.7	49.9	48.0	44.7	42.0	37.4	30.3	25.0
22/02/2015	23:25:00	47.9	46.9	54.7	49.7	47.8	44.3	41.7	37.1	30.6	25.3
22/02/2015	23:30:00	48.9	47.2	54.2	49.8	48.1	44.8	41.8	37.1	30.5	25.1
22/02/2015	23:35:00	47.6	46.7	54.2	49.7	47.7	43.8	41.4	36.9	30.3	24.9
22/02/2015	23:40:00	47.5	46.7	54.5	49.8	47.8	43.9	41.6	37.0	30.5	24.9
22/02/2015	23:45:00	47.9	47.1	54.6	49.6	48.1	44.3	41.9	37.3	30.4	24.9
22/02/2015	23:50:00	48.0	47.1	55.3	50.2	48.3	44.3	42.0	37.3	30.6	24.8
22/02/2015	23:55:00	48.1	47.4	54.7	50.1	48.1	44.8	42.2	37.3	30.5	24.9
23/02/2015		48.6	47.8	55.0	50.2	48.5	45.4	42.5	37.7	31.0	25.1
23/02/2015	00:05:00	48.4	47.4	54.1	49.8	48.0	45.4	41.8	37.3	30.7	24.8
23/02/2015	00:10:00	48.8	47.2	54.4	49.9	48.0	45.2	41.8	37.2	30.8	25.0
23/02/2015	00:15:00	49.3	47.9	54.6	50.2	48.6	45.7	42.5	37.7	31.1	25.1
23/02/2015	00:20:00	49.4	47.8	54.8	49.9	48.4	45.3	42.7	38.0	31.2	25.0
23/02/2015	00:25:00	49.5	47.7	54.3	49.6	48.2	45.1	42.7	38.2	31.5	25.0
23/02/2015	00:30:00	49.0	47.7	54.3	49.8	48.4	44.9	42.9	38.3	31.5	24.7
23/02/2015	00:35:00	49.1	47.7	53.7	49.5	48.6	45.0	42.8	38.2	31.2	24.4
23/02/2015	00:40:00	48.2	46.7	53.5	48.6	47.5	43.8	41.9	37.3	30.7	24.3
23/02/2015	00:45:00	49.0	47.1	54.1	48.9	47.7	44.0	42.3	37.6	30.8	24.2
23/02/2015	00:50:00	48.2	47.1	53.3	48.7	47.4	44.4	42.0	37.4	30.5	24.2
23/02/2015	00:55:00	47.4	46.5	53.1	48.7	47.1	43.8	41.5	36.8	30.2	24.3
23/02/2015	01:00:00	48.2	47.0	53.7	48.8	47.5	44.2	42.1	37.4	30.4	24.4
23/02/2015	01:05:00	47.2	46.1	53.5	48.7	46.7	43.5	41.2	36.4	29.7	24.2
23/02/2015	01:10:00	49.2	46.6	52.7	48.4	47.1	43.9	41.8	36.9	29.9	24.6
23/02/2015	01:15:00	50.9	46.5	53.2	48.5	46.8	44.0	41.6	36.5	29.8	24.4
23/02/2015	01:20:00	48.9	46.6	52.5	48.4	47.5	43.7	41.6	36.6	29.7	24.3
23/02/2015	01:25:00	50.0	46.2	52.3	48.2	47.0	43.5	41.3	36.4	29.7	24.0
23/02/2015	01:30:00	47.3	45.9	52.8	48.2	46.8	43.3	41.0	36.1	29.5	24.0
23/02/2015	01:35:00	48.8	47.5	54.1	49.2	48.4	44.6	42.5	37.9	30.9	24.4
23/02/2015	01:40:00	48.3	47.1	53.2	48.7	47.8	44.1	42.2	37.6	30.5	24.3
23/02/2015	01:45:00	48.3	46.6	53.1	48.7	47.4	43.7	41.9	37.1	30.2	24.2
23/02/2015	01:50:00	47.1	46.0	52.0	47.8	47.1	43.1	41.2	36.4	29.8	24.2

23/02/2015	01:55:00	47.0	45.8	51.5	47.8	46.6	43.1	40.8	36.1	29.7	24.2
23/02/2015	02:00:00	47.4	45.7	51.6	47.9	46.3	43.2	40.7	35.8	29.6	24.0
23/02/2015	02:05:00	46.5	45.6	51.3	47.6	46.2	42.9	40.4	35.7	29.5	24.2
23/02/2015	02:10:00	47.6	45.6	51.3	47.6	46.2	43.3	40.5	35.5	29.5	24.2
23/02/2015	02:15:00	46.7	45.5	51.5	47.8	46.2	43.0	40.5	35.4	29.5	24.0
23/02/2015	02:20:00	46.3	45.3	51.7	47.7	45.9	42.5	40.3	35.5	29.4	24.1
23/02/2015	02:25:00	46.1	45.3	51.1	47.6	45.7	42.7	40.0	35.6	29.9	24.0
23/02/2015	02:30:00	45.9	45.0	51.3	47.3	45.4	42.4	39.4	36.1	30.3	23.9
23/02/2015	02:35:00	45.3	44.8	50.1	46.8	45.0	42.1	39.3	35.9	30.3	24.0
23/02/2015	02:40:00	46.1	45.1	51.0	47.3	45.7	42.5	39.9	35.4	29.7	24.1
23/02/2015	02:45:00	48.4	46.0	52.0	48.1	46.6	43.5	40.9	36.2	30.4	24.5
23/02/2015	02:50:00	46.9	45.2	51.5	47.7	45.8	42.9	40.1	35.4	29.9	24.4
23/02/2015	02:55:00	46.6	44.7	50.6	46.9	45.0	42.4	39.7	35.0	29.6	24.3
23/02/2015	03:00:00	46.5	44.8	50.7	47.0	45.0	42.3	39.8	35.1	29.8	24.4
23/02/2015	03:05:00	45.1	44.3	50.3	46.5	44.7	42.0	39.0	34.5	29.3	24.0
23/02/2015	03:10:00	45.4	44.7	50.5	46.8	45.3	42.1	39.4	34.8	29.2	24.2
23/02/2015	03:15:00	45.5	44.6	51.2	46.6	45.5	41.9	39.4	34.9	29.2	24.2
23/02/2015	03:20:00	45.3	44.5	50.2	46.6	44.9	41.8	39.4	34.8	29.3	24.1
23/02/2015	03:25:00	45.9	44.7	50.8	47.0	45.2	42.2	39.6	35.0	29.7	24.3
23/02/2015	03:30:00	45.8	44.5	50.5	46.9	45.2	41.8	39.3	34.9	29.7	24.2
23/02/2015	03:35:00	45.0	44.3	50.0	46.5	45.0	41.4	39.0	34.7	29.4	24.2
23/02/2015	03:40:00	44.8	44.1	50.7	46.6	44.9	41.3	38.8	34.4	29.4	24.2
23/02/2015	03:45:00	44.5	43.9	49.9	46.5	44.6	41.2	38.6	34.2	29.3	24.1
23/02/2015	03:50:00	45.0	44.0	50.4	46.5	44.7	41.4	38.8	34.4	29.5	24.3
23/02/2015	03:55:00	44.6	44.0	50.7	46.5	44.7	41.3	38.7	34.3	29.6	24.3
23/02/2015	04:00:00	44.8	44.0	50.3	46.7	44.8	41.3	38.7	34.4	29.6	24.1
23/02/2015	04:05:00	44.9	44.1	50.4	46.2	44.5	41.4	38.9	34.5	29.6	24.1
23/02/2015	04:10:00	45.5	44.5	49.9	46.5	44.9	42.1	39.0	34.6	29.6	24.3
23/02/2015	04:15:00	45.7	44.6	50.0	46.6	45.3	42.3	39.2	34.7	29.0	24.3
23/02/2015	04:20:00	45.8	44.9	50.3	46.7	45.5	42.5	39.6	35.1	29.2	24.1
23/02/2015	04:25:00	45.6	44.5	50.4	46.7	45.6	41.8	39.3	35.0	29.7	24.1
23/02/2015	04:30:00	45.0	44.3	49.8	46.7	44.9	41.5	39.1	34.8	29.5	24.0
23/02/2015	04:35:00	44.6	44.0	49.9	46.3	44.8	41.3	38.8	34.4	29.4	24.0
23/02/2015	04:40:00	44.9	44.1	50.1	46.6	45.1	41.4	38.8	34.5	29.5	24.1
23/02/2015	04:45:00	45.0	44.2	50.5	46.6	45.0	41.5	38.8	34.7	29.7	24.0
23/02/2015	04:50:00	45.0	44.3	50.5	46.7	44.8	41.4	39.1	34.8	29.7	24.0
23/02/2015	04:55:00	45.6	44.5	50.8	46.7	45.3	41.8	39.1	34.8	29.8	24.1
23/02/2015	05:00:00	45.4	44.4	50.1	46.4	45.0	41.8	39.0	34.7	29.8	24.2

APPENDIX G: Glossary of acoustic terms

DECIBEL (dB) - A unit of sound pressure measurement

Sound Pressure Level in dB (L_p) = $20 \log (\text{Measured sound pressure} / \text{Reference sound pressure} = 20 \mu\text{Pa})$

dB(A) - The A -weighted sound pressure level, the weighting network reduces low frequency sound in a similar way to the human ear.

REVERBERATION TIME (RT or T) – decay of sound in rooms

The time taken for a sound, once terminated, to fall through 60dB i.e. to one millionth of its original sound intensity. T_{30} – RT for first 30dB of decay. RT_{500} - Mid frequency RT.

HERTZ (Hz) - a unit of frequency measurement. The normal range of hearing is from 20Hz to about 15kHz.

ABSORPTION COEFFICIENT – degree to which a material absorbs sound.

The ratio of absorbed to incident sound energy (perfect absorber = 1)

SOUND REDUCTION INDEX R – quantity which describes a material's ability to reduce the sound pressure level across it (e.g. a wall or floor)

$$R = L_1 - L_2 + 10 \log (S/A)$$

L_1 - Average sound pressure level in source room (averaged from 100 Hz – 3150 Hz)

L_2 - Average sound pressure level in receiving room (averaged from 100 Hz – 3150 Hz)

S – Wall Area (m^2)

A – Total absorption in receiving room (m^2 units)

R_w – weighted sound reduction index

AVERAGE ROOM TO ROOM LEVEL DIFFERENCE – D , dB = $L_1 - L_2$, averaged 1/3 octave bands from 100Hz – 3150kHz.

D_w – weighted value of D (usually 2 - 3dB higher)

$D_{nT, w}$ – D_w corrected for reverberation time of receiving room

NOISE RATING CURVES (NR CURVES) – set of curves used to describe optimum background noise levels for different tasks.

$L_{10/90}$ LEVEL (dB) - The level in dB of a time varying sound pressured level (e.g. traffic) exceeded for 10%/90% of the time of measurement.

L_{90} is usually called the BACKGROUND NOISE LEVEL.

L_{eq} AVERAGE SOUND PRESSURE LEVEL – level dB of a time varying sound pressure level with equal amounts of energy above and below it, for the time of measurement.

TONAL NOISE – noise of a single frequency (or a narrow band of frequencies that can be perceived as a tone), audible above the broad band noise background. Noise which is at least 5dB above the average of the 1/3 octave band sound pressure levels immediately on either side of it.