

Background Noise Assessment

Report No: 4423-R1 – Abbey Road Phase 2, Shepley, Huddersfield.

Client: Yorkshire Country Properties, Office Suite 3, 39 Huddersfield Road, Holmfirth, HD9 3JH.

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1. Introduction

Clover Acoustics Ltd has been commissioned by Yorkshire Country properties Ltd to undertake a noise assessment of a proposed development on Land off Abbey Road Phase 2, Shepley, Huddersfield.

A baseline noise survey has been carried out over a typical 24-hour period in order to assess the impact of noise affecting the development. The survey was conducted at two monitoring locations representative of affected facades covering typical 24-hour period on Friday 24th July 2020 together with additional attended monitoring, commencing on Thursday 23rd July 2020

2. Scope

This report assesses the noise impact generated from existing sources. The scope for this assessment is as follows:

- a) A description of the sources of noise which the development site is likely to be subject to i.e. passing road and rail traffic, pedestrian noise, adjacent commercial usage etc.
- b) An assessment of the impact which these sources have on the proposed development, including bedrooms, amenity areas and gardens, having regard to the following sources of guidance and assessment methodologies, where appropriate:
 - Noise Policy Statement for England
 - BS8233:2014 – Sound Insulation and Noise Reduction for Buildings.
 - World Health Organisation – Guidelines for Community Noise 1999.
 - Night Noise Guidelines for Europe
 - Local Authority Requirements

Noise Policy Statement for England

A new document dealing with noise was released in March 2012 under the National Planning Policy Framework (NPPF). This document supersedes and replaces Planning Policy Guidance note 24 (PPG24) which previously covered issues related to noise and planning in England. Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impact (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life arising from noise from new development, including through the use of conditions;
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on

them because of changes in nearby land use since they were established (Subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and

- Identify and protect areas of tranquility which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the stated aim to ‘Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.’

Noise Policy Statement England (NPSE)

Noise Policy Aims Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: • avoid significant adverse impacts on health and quality of life; • mitigate and minimise adverse impacts on health and quality of life; and • where possible, contribute to the improvement of health and quality of life.
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A further stated aim is outlined in para 2.7:

2.7 In addition, the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications.

The Noise Policy Statement further extrapolates on the aims of the policy with a discussion of key phrases and concepts:

“What do the aims of the Noise Policy Statement for England mean?”

2.19 There are several key phrases within the NPSE aims and these are discussed below.

“Significant adverse” and “adverse”

2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.¹

The document goes on to advise that it is *“not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations”* advising that by not having specific SOAEL values the document retains *“necessary policy flexibility until further evidence and guidance is available”²*

BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings.

BS8233 gives guidance for internal noise levels within buildings to achieve reasonable or good resting/sleeping conditions within residential properties as follows:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35dB $L_{Aeq,16 \text{ hour}}$	---
Dining	Dining room/area	40dB $L_{Aeq,16 \text{ hour}}$	---
Sleeping	Bedroom	35dB $L_{Aeq,16 \text{ hour}}$	30dB $L_{Aeq,8 \text{ hour}}$

The building envelope design will be considered to ensure that these internal criteria are met. With regard to night time noise it is noted that reference to a specific level (45dB L_{Amax} derived from WHO guidelines values 1999) has been removed from BS8233:2014. It does however make comment that such a limit may be desirable for specific events: *“NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.”*

¹ Page 8 NSPE

² Page 9 NPSE

World Health Organisation – Guidelines for Community Noise 1999.

The World Health Organisation gives guidance for maximum recommended noise levels outside residential properties as follows:

Specific Environment	Critical health effect	dB L _{Aeq}	Time (hr)	dB L _{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

The WHO Guidelines for Community Noise 1999 states, *“for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10–15 times per night”*. We would view this as representative of the Significant Observed Adverse Effect Level or SOAEL referred to in NSPE derived on the basis that if noise levels are 45dB L_{Amax} or less, they will not give rise to significant sleep disturbance effects. This should be regarded as a maximum limit. The Lowest Observed Adverse Effect Level or LOAEL would in our view be 42dB L_{Amax}, since the WHO Night Noise Guidelines for Europe 2009 state that this is the threshold of any observed effect on night time awakening.

3. Site Description

The proposal is for new residential dwellings to be formed to land off Abbey Road, Shepley as phase two of a similar development immediately adjacent to the south west of the proposed current site. The site is in a pocket of land to the south east of Abbey Road and the railway line in a mixed commercial and residential area. There are existing residential dwellings to the west and south west of site, with commercial to the north west of the proposed site. It is understood the industrial site to the north west is occupied by CTS Bridges, a manufacturer of footbridges and boardwalks.



Figure 1 – Proposed Site with monitoring locations

4. Survey Information

Measurement Instrumentation

The measurement instrumentation used on the survey was as follows:

Equipment	Manufacturer & Type	Serial Number	Calibration Certificate
Sound Level Meter	Norsonic 118	28952	19/1238
Sound Level Meter	Norsonic 118	30559	18/2083
Acoustic Calibrator	Norsonic 1251	32856	20/1286

The equipment was calibrated to comply with section 4.2 of BS7445:1-2003 before and after the surveys. The calibration was as follows:

Meter	Serial	Before		After	
Norsonic 118	28952	113.9	-26.5	113.9	-26.5
Norsonic 118	30559	113.9	-26.4	113.9	-26.4

Measurements & Timescales

During the survey 5-minute measurements were made over a typical 24-hour period commencing on Friday 24th July 2020. The measurements were subsequently analysed into hourly periods. In addition, attended monitoring of the adjacent industrial units was undertaken.

The following measurements are reported: $L_{Aeq,T}$, $L_{A90,T}$, $L_{AMAX,T}$

The measurements and their interpretation shall be in accordance with BS 7445: Parts 1 and 2. All sound pressure levels are in dB (re 20 μ Pa).

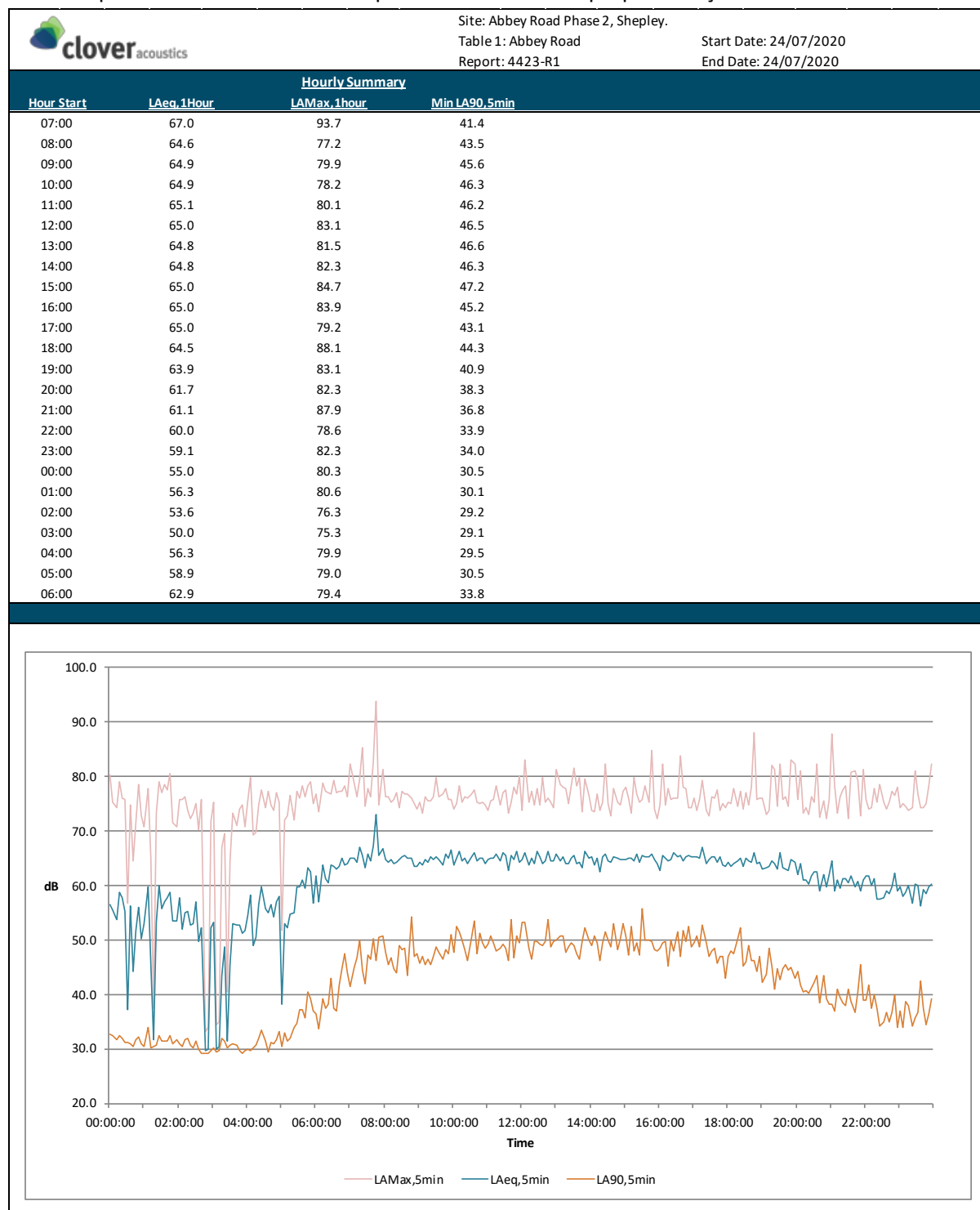
Meteorology

During the survey the weather was considered to be predominantly dry.

5. Survey Results

Background Noise Summary

The following tables show the summary of the background noise levels monitored. The reported results represent the free field sound pressure levels at the proposed façades.



Data Summary Table - Position 1

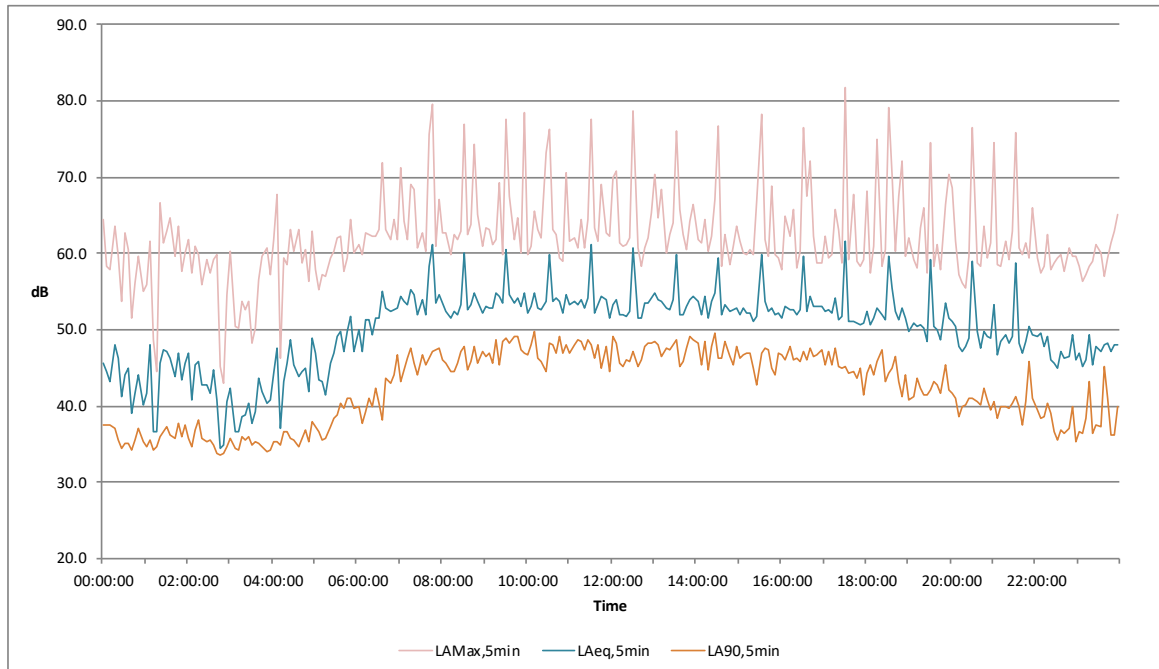
Monitoring Position 1				
Measurement	Daytime	Hour Ending/ Period	Night-time	Hour Ending/ Period
Minimum dB $L_{Aeq,1hr}$	60	22:00	50	01:00
Maximum dB $L_{Aeq,1hr}$	67	07:00	63	06:00
Average dB $L_{Aeq,16hr}/L_{Aeq,8hr}$	65	07:00 – 23:00	58	23:00 – 07:00
Night dB L_{Amax} ³	–	–	79	06:11

The daytime hourly equivalent continuous sound pressure levels at the proposed front façade ranged between 60dB $L_{Aeq,1hr}$ and 67dB $L_{Aeq,1hr}$ with an average level during the daytime period of 65dB $L_{Aeq,16hr}$.

The night-time hourly equivalent continuous sound pressure levels at the proposed front façade ranged between 50dB $L_{Aeq,1hr}$ and 63dB $L_{Aeq,1hr}$ with an average level during the night-time period of 58dB $L_{Aeq,8hr}$. The 10th highest³ night-time individual noise event between the hours of 23:00 and 07:00 was 79dB L_{Amax} .

³ The 10th highest LAMAX has been selected as in line with good sleep conditions identified in “The Guidelines for Community Noise” Section 3.4 Sleep Disturbance. This is now supported by ProPG Planning & Noise – New Residential Developments.

Hourly Summary			
Hour Start	LAeq,1Hour	LAMax,1hour	Min LA90,5min
07:00	55.7	79.6	43.1
08:00	54.3	76.9	44.5
09:00	55.0	78.5	45.4
10:00	54.5	76.3	44.6
11:00	54.9	77.5	44.4
12:00	54.3	78.6	45.1
13:00	54.5	76.1	45.1
14:00	54.2	76.7	44.8
15:00	53.7	78.3	42.7
16:00	54.0	76.4	45.8
17:00	54.1	81.7	41.5
18:00	53.7	79.2	41.2
19:00	52.4	74.5	40.8
20:00	51.5	76.4	38.5
21:00	51.5	75.8	37.4
22:00	47.5	62.4	35.2
23:00	47.4	65.0	36.1
00:00	44.3	64.5	34.3
01:00	45.2	66.7	34.1
02:00	43.1	61.9	33.6
03:00	40.3	60.7	34.0
04:00	45.5	67.8	34.7
05:00	47.7	64.4	35.6
06:00	51.9	71.8	37.8



Data Summary Table - Position 2

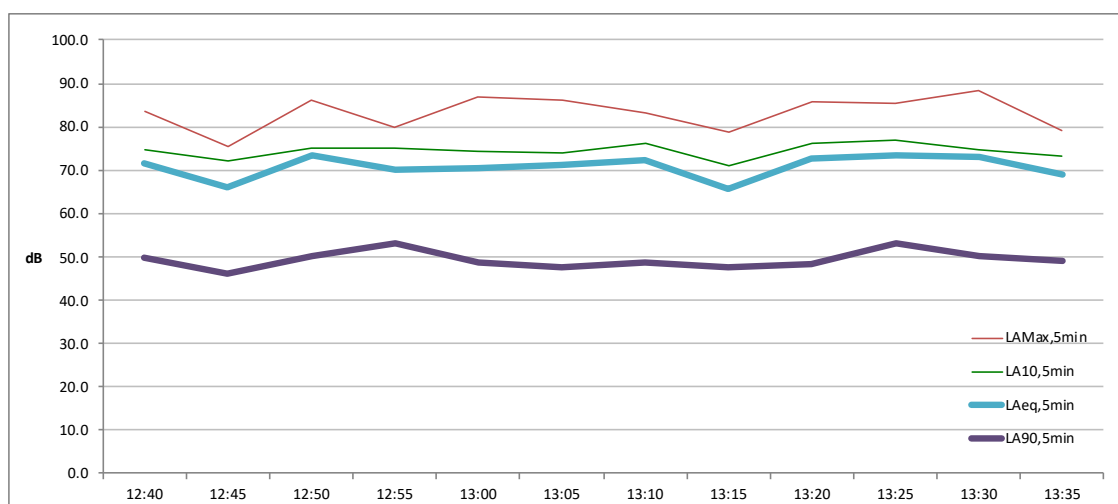
Monitoring Position 2				
Measurement	Daytime	Hour Ending/ Period	Night-time	Hour Ending/ Period
Minimum dB $L_{Aeq,1hr}$	48	22:00	40	03:00
Maximum dB $L_{Aeq,1hr}$	56	07:00	52	06:00
Average dB $L_{Aeq,16hr}/L_{Aeq,8hr}$	54	07:00 – 23:00	47	23:00 – 07:00
Night dB L_{Amax} ⁴	–	–	64	01:49

The daytime hourly equivalent continuous sound pressure levels at the proposed front façade ranged between 48dB $L_{Aeq,1hr}$ and 56dB $L_{Aeq,1hr}$ with an average level during the daytime period of 54dB $L_{Aeq,16hr}$.

The night-time hourly equivalent continuous sound pressure levels at the proposed front façade ranged between 40dB $L_{Aeq,1hr}$ and 52dB $L_{Aeq,1hr}$ with an average level during the night-time period of 47dB $L_{Aeq,8hr}$. The 10th highest³ night-time individual noise event between the hours of 23:00 and 07:00 was 64dB L_{Amax} .

⁴ The 10th highest LAMAX has been selected as in line with good sleep conditions identified in “The Guidelines for Community Noise” Section 3.4 Sleep Disturbance. This is now supported by ProPG Planning & Noise – New Residential Developments.

Hourly Summary					
Time	LAeq,5min	LA90,5min	LA10,5min	LAMax,5min	Comments
12:40	71.5	49.7	74.7	83.6	passing vehicles
12:45	66.1	46.1	72.0	75.4	passing vehicles
12:50	73.4	50.2	75.1	86.3	passing vehicles
12:55	70.2	53.2	75.0	79.7	passing vehicles
13:00	70.6	48.7	74.3	86.9	passing vehicles
13:05	71.2	47.4	73.9	86.1	passing vehicles
13:10	72.2	48.5	76.2	83.1	passing vehicles
13:15	65.8	47.5	71.1	78.7	passing vehicles
13:20	72.6	48.3	76.3	85.7	passing vehicles
13:25	73.5	53.0	76.9	85.3	passing vehicles
13:30	72.9	50.3	74.8	88.4	passing vehicles
13:35	69.0	49.2	73.2	79.2	passing vehicles
LAeq,1hour	Lowest LA90,5min	Highest LA10,5min	LAMax,1hour		
71.3	46.1	76.9	88.4		



Data Summary Table – Attended Position 1

Commentary

During the attended period noise from the adjacent factory depot was not evident with dominant noise being road traffic from the surrounding area. The attended monitoring position was 5m closer to the roadside in relation to position 1 which would account for the small difference in noise levels between the attended and fixed monitoring.

6. Design Criteria

Internal Design Criteria

The internal design criteria proposed is in line with the guidance from BS8233:2014 for indoor ambient noise levels within spaces when they are unoccupied.

Area	Internal Level, dB(A)
Living Rooms (07:00 – 23:00)	35 dB(A)
Dining Rooms (07:00 - 23:00)	40 dB(A)
Bedrooms (23:00 – 07:00)	30 dB(A)

As the nature of the dominant noise affecting site is road traffic and may during the night time be sporadic the previously referred to level of 45dB L_{Amax} should be considered in line with the discussion in section 2 of this report. The follow section gives recommendations for achieving the proposed internal design criteria.

7. Mitigation

Glazing Design

The internal design criteria can be achieved through a glazing performance requirement. The following table summarises the recorded levels on site and show the glazing performance requirement to achieve the criteria. This uses the simple calculation method from the Appendix in BS8233:2014. Standard forms of construction are assumed therefore it is likely the glazing will be the lowest performing façade element.

Monitoring Position 1	Living Room Areas	Dining Room Areas	Bedroom Areas	
Average Case Levels	65 dB $L_{Aeq,16hr}$	65 dB $L_{Aeq,16hr}$	58 dB $L_{Aeq,8hr}$	79 dB L_{AMAX}
Internal Design Criteria	35 dB(A)	40 dB(A)	30 dB(A)	45 dB L_{AMAX}
Glazing Performance Requirement	30 dB R_{TRA}	25 dB R_{TRA}	28 dB R_{TRA}	34 dB R_{TRA}

Monitoring Position 2	Living Room Areas	Dining Room Areas	Bedroom Areas	
Average Case Levels	54dB $L_{Aeq,16hr}$	54 dB $L_{Aeq,16hr}$	47 dB $L_{Aeq,8hr}$	64 dB L_{AMAX}
Internal Design Criteria	35 dB(A)	40 dB(A)	30 dB(A)	45 dB L_{AMAX}
Glazing Performance Requirement	19 dB R_{RAIL}	14 dB R_{RAIL}	17 dB R_{RAIL}	19 dB R_{RAIL}

The glazing performance requirement is based on the traffic corrected sound reduction index R_{TRA} . Where the single event L_{Amax} criteria exceeds the night-time average $L_{Aeq,8hr}$ criteria this will be used in the specification of glazing to these façades.

Glazing Configurations

The table below is a summary of the typical performance of Pilkington glazed units as detailed in *Pilkington Design Guide "Glass & Noise Control" – Technical Bulletin May 1997*. Glazing from any other manufacturer can be used providing it can be shown that it will achieve the glazing performance requirements above.

Pilkington Configurations	dB R _{TRA}	Position 1	
		Living/Dining	Bed
Double Glazing			
4.12.4	25	-	-
6.12.6	26	-	-
6.12.6-4pvb ⁵	27	-	-
10.12.4	29	-	-
10.12.6	32	✓	-
10.12.6-4pvb	34	✓	✓
Secondary Glazing			
6.100.4 Secondary	37	✓	✓
6.150.4 Secondary	39	✓	✓
10.200.6 Secondary	45	✓	✓

Monitoring Position 1 – In living areas to ensure the values identified in Table 4 of BS8233:2014 for suitable “Indoor ambient noise levels for dwellings” are achieved a minimum glazing performance of 30dB R_{TRA} is required. The minimum Pilkington glazing configuration to achieve this is 10.12.6 double glazing which has a performance of 32dB R_{TRA}. In bedroom areas to ensure the values identified in Table 4 of BS8233:2014 for suitable “Indoor ambient noise levels for dwellings” are achieved a minimum glazing performance of 34dB R_{TRA} is required. The minimum Pilkington glazing configuration to achieve this is 10.12.6-4-pvb double glazing which has a performance of 34dB R_{TRA}.

Pilkington Configurations	dB R _{RAIL}	Position 2	
		Living/Dining	Bed
Double Glazing			
4.12.4	28	✓	✓
6.12.6	29	✓	✓
6.12.6-4pvb	30	✓	✓
10.12.4	32	✓	✓
10.12.6	35	✓	✓
10.12.6-4pvb	37	✓	✓
Secondary Glazing			
6.100.4 Secondary	40	✓	✓
6.150.4 Secondary	42	✓	✓
10.200.6 Secondary	48	✓	✓

⁵ PVB laminated glass - polyvinyl butyrate.

Monitoring Position 2 – In living areas to ensure the values identified in Table 4 of BS8233:2014 for suitable “Indoor ambient noise levels for dwellings” are achieved a minimum glazing performance of 19dB R_{Rail} is required. The minimum Pilkington glazing configuration to achieve this is 4.12.4 double glazing which has a performance of 28dB R_{Rail} . In bedroom areas to ensure the values identified in Table 4 of BS8233:2014 for suitable “Indoor ambient noise levels for dwellings” are achieved a minimum glazing performance of 19dB R_{Rail} is required. The minimum Pilkington glazing configuration to achieve this is 4.12.4 double glazing which has a performance of 28dB R_{Rail} .

Ventilation Strategy & Specification

Care should be taken with regard to selection of ventilation, so it shall not compromise the glazing specification. We would recommend that Greenwood be consulted for confirmation that the range will meet the necessary ventilation requirements for the project.

Greenwood Airvac Contact: Gary Swift – M:07801 039584

World Health Organisation – Guidelines for Community Noise 1999.

The World Health Organisation gives guidance for maximum recommended noise levels outside residential properties as follows:

Specific Environment	Critical health effect	dB L_{Aeq}	Time (hr)	dB L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Noise levels are above the criterion for moderate and serious annoyance as identified in WHO Guidance to the Abbey Road boundary of site. The proposed layout identifies gardens to No's 50 & 44 at this boundary. Should this layout be retained it is likely those garden areas will require screening. A 2.2m close boarded fence has been calculated to provide up to 11dB attenuation. This is predicted to reduce noise levels to below the 55dB criterion of serious annoyance. Whilst external levels exceed the external guideline value, internal criterion as prescribed in BS8233:2014 can be achieved with the prescribed glazing solution.

8. Conclusion

The site has been surveyed in line with the recommendations in BS7445:1 – 2003 and BS7445:2 – 1991. This report has shown that the target internal noise levels for bedroom and living/dining areas in accordance with internal ambient levels from the guidance in BS8233:2014 can be achieved by using the correct glazing specification.

Position 1

In living/dining areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 30dB R_{TRA} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 10.12.6 double glazing with a performance of 32dB R_{TRA} .

In bedroom areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 34dB R_{TRA} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 10.12.6.4-pvb double glazing with a performance of 34dB R_{TRA} .

Position 2

In living/dining areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 19dB R_{RAIL} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 4.12.4 double glazing with a performance of 28dB R_{RAIL} .

In bedroom areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 19dB R_{TRA} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 4.12.4 double glazing with a performance of 28dB R_{RAIL} .

Redacted

Steve Clow MIOA

Acoustic Consultant

9. Appendix

Glossary of Terms

Specific Noise Source

The noise source under investigation for assessing the likelihood of complaints.

Specific Noise Level, $L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.

Rating Level, $L_{A,T}$

The specific noise level plus any adjustment for the characteristic features of the noise.

Background Noise Level, $L_{A90,T}$

The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T.

Residual Noise

The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

Ambient Noise

Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Reference Time Interval, T

The specified interval over which an equivalent continuous A-weighted sound pressure level is determined.

$L_{Aeq,T}$

The A-weighted equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as the fluctuating sound over a specified measurement period, T.

$L_{A10,T}$

The A-weighted sound level exceeded for 10% of the specified measurement period, T.

L_{Amax}

The highest short duration A-weighted sound level recorded during a noise event.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to approximate to the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

Octave Band

A frequency band in which the upper limit of the band is twice the frequency of the lower limit.

One-third-octave Band

A frequency band in which the upper limit of the band is 1/3 times the frequency of the lower limit.

Data Appendix

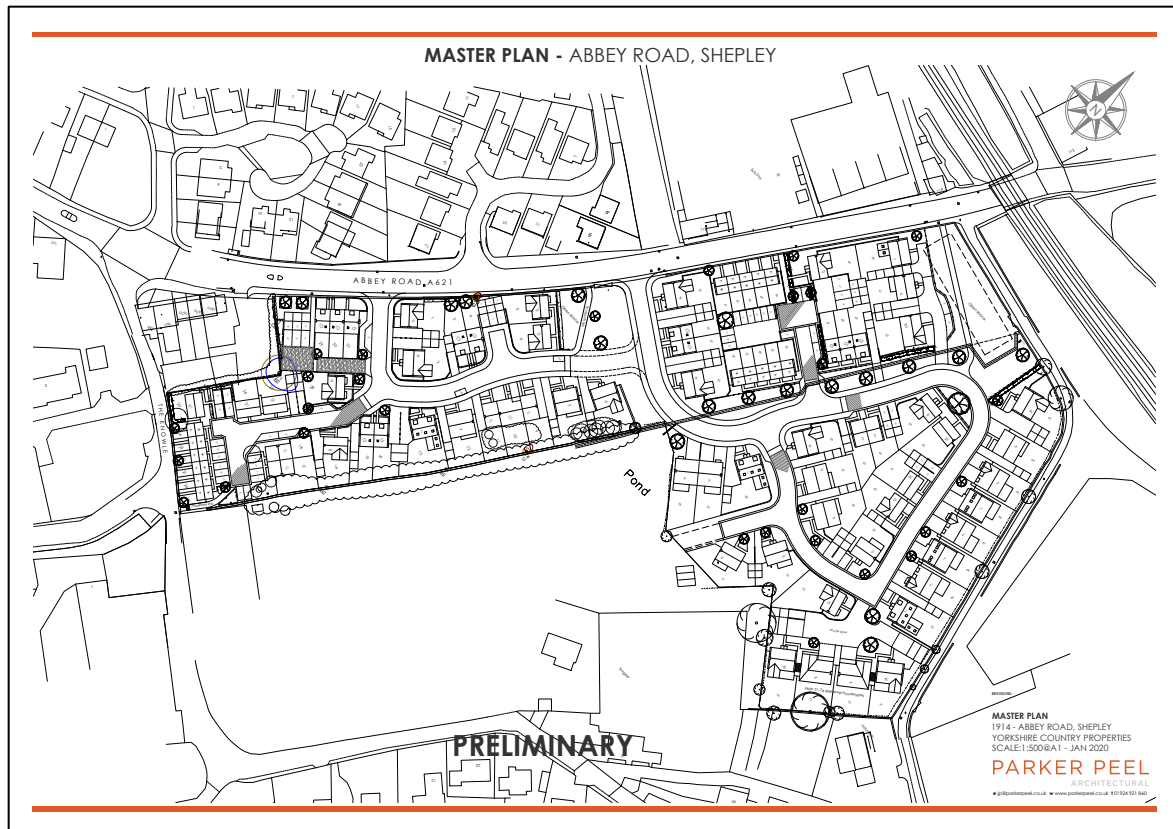
				Site: Abbey Road Phase 2, Shepley. Table 1a: - Abbey Road Report: 4423-R1														Start Date: 24/07/2020 End Date: 24/07/2020				Table 1b: - 1min Night-time LAMax Events Highest Ranked		
Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	#	Time	LAMax		
00:00	56.6	32.6	80.3	04:50	57.0	31.6	77.0	09:40	63.8	46.5	76.9	14:30	64.5	49.9	75.1	19:20	64.0	40.9	81.4	1	23:55	82.3		
00:05	55.5	32.4	75.2	04:55	58.0	33.1	75.4	09:45	65.7	48.2	77.9	14:35	64.3	48.7	72.8	19:25	63.0	44.7	74.6	2	23:28	81.1		
00:10	53.7	31.8	74.4	05:00	38.3	30.5	51.8	09:50	65.1	47.6	75.7	14:40	65.3	52.9	77.9	19:30	65.9	42.7	82.3	3	01:49	80.6		
00:15	58.7	32.4	79.0	05:05	53.1	33.0	72.0	09:55	66.5	51.0	75.7	14:45	65.1	48.3	75.2	19:35	63.2	44.7	75.7	4	00:01	80.3		
00:20	57.8	32.0	76.0	05:10	52.2	31.4	72.9	10:00	63.7	47.8	74.1	14:50	64.7	50.2	74.8	19:40	63.1	45.6	76.3	5	04:05	79.9		
00:25	55.2	31.3	75.7	05:15	54.9	32.0	76.5	10:05	65.1	52.4	75.0	14:55	64.7	53.1	77.3	19:45	62.8	44.6	74.6	6	06:34	79.4		
00:30	37.3	31.1	56.7	05:20	55.1	34.0	72.1	10:10	66.3	51.5	78.2	15:00	64.8	50.7	78.0	19:50	64.8	44.9	83.1	7	00:15	79.0		
00:35	56.2	30.9	74.9	05:25	59.8	34.8	77.4	10:15	64.5	50.0	75.4	15:05	65.0	47.2	76.0	19:55	64.2	42.9	82.2	8	01:29	79.0		
00:40	44.1	30.5	64.6	05:30	59.6	37.3	76.0	10:20	65.0	48.3	76.4	15:10	65.0	52.4	73.4	20:00	62.0	44.2	75.8	9	05:50	79.0		
00:45	51.8	31.6	71.5	05:35	60.9	37.2	78.3	10:25	64.0	46.3	76.1	15:15	64.6	47.9	79.7	20:05	64.1	41.8	81.0	10	06:11	78.9		
00:50	55.9	32.1	78.5	05:40	59.6	35.7	76.2	10:30	65.2	50.4	76.7	15:20	65.7	49.6	76.7	20:10	60.9	40.5	73.2	11	00:51	78.5		
00:55	50.2	30.9	72.9	05:45	63.3	40.5	78.3	10:35	66.0	53.5	77.5	15:25	64.2	47.3	75.3	20:15	61.1	40.8	74.3	12	01:36	78.5		
01:00	53.0	30.5	70.8	05:50	62.5	39.3	79.0	10:40	64.6	47.5	75.4	15:30	65.4	55.8	75.9	20:20	60.2	40.3	73.1	13	23:50	78.3		
01:05	59.9	34.0	77.8	05:55	56.7	37.0	75.1	10:45	65.1	51.2	75.1	15:35	65.2	50.0	78.4	20:25	61.8	41.3	76.2	14	05:35	78.3		
01:10	45.5	30.1	64.9	06:00	61.7	36.6	76.8	10:50	65.1	49.6	75.2	15:40	65.2	50.1	75.4	20:30	62.6	42.2	75.2	15	05:49	78.3		
01:15	31.8	30.5	37.5	06:05	56.9	33.8	73.5	10:55	63.9	48.4	74.8	15:45	65.8	49.7	84.7	20:35	62.6	43.4	82.3	16	05:47	78.2		
01:20	53.2	30.8	73.3	06:10	63.7	39.3	78.9	11:00	64.7	49.2	73.8	15:50	64.7	48.3	74.0	20:40	59.0	38.6	72.6	17	06:54	78.2		
01:25	60.0	32.5	79.0	06:15	61.2	37.5	77.4	11:05	65.1	50.7	75.6	15:55	64.1	48.1	72.4	20:45	61.9	43.6	75.6	18	06:31	78.0		
01:30	55.7	31.4	77.0	06:20	60.4	38.2	77.1	11:10	65.0	49.5	75.9	16:00	62.8	48.4	74.9	20:50	59.9	39.2	72.3	19	01:05	77.8		
01:35	57.1	31.5	78.5	06:25	63.7	43.1	76.7	11:15	65.6	47.9	78.3	16:05	65.4	49.4	82.4	20:55	62.0	38.3	75.9	20	01:44	77.5		
01:40	57.7	31.5	77.5	06:30	63.5	37.4	79.4	11:20	64.5	48.6	74.8	16:10	65.0	49.7	74.8	21:00	64.5	38.2	87.9	21	04:27	77.5		
01:45	58.8	32.5	80.6	06:35	62.9	37.1	77.1	11:25	66.1	49.3	77.0	16:15	64.5	45.2	77.7	21:05	59.1	36.9	78.3	22	05:28	77.4		
01:50	53.4	30.9	71.6	06:40	63.5	41.7	77.2	11:30	65.6	48.4	77.6	16:20	64.7	50.0	75.7	21:10	60.9	41.1	73.4	23	06:16	77.4		
01:55	53.5	31.6	70.7	06:45	65.0	44.7	77.4	11:35	62.7	46.2	73.4	16:25	66.0	48.1	76.0	21:15	59.6	39.5	76.3	24	06:49	77.4		
02:00	57.9	31.0	75.8	06:50	63.7	47.4	78.2	11:40	65.4	53.8	75.2	16:30	65.2	51.6	76.1	21:20	61.2	38.5	77.6	25	04:36	77.2		
02:05	52.0	30.5	75.7	06:55	64.0	43.9	76.2	11:45	64.7	46.8	78.0	16:35	65.5	47.0	83.9	21:25	61.4	38.1	78.3	26	06:42	77.2		
02:10	55.1	31.8	76.3	07:00	65.1	41.4	82.3	11:50	66.2	50.8	76.8	16:40	64.6	51.8	78.0	21:30	60.6	41.0	72.3	27	06:22	77.1		
02:15	55.2	32.0	73.7	07:05	65.1	44.9	78.9	11:55	64.3	49.6	80.1	16:45	65.2	49.7	77.9	21:35	61.7	38.8	80.7	28	06:35	77.1		
02:20	52.7	30.7	72.2	07:10	64.2	46.8	76.3	12:00	64.8	53.2	73.7	16:50	65.6	52.4	74.2	21:40	59.7	36.8	81.0	29	06:39	77.1		
02:25	53.0	30.2	73.4	07:15	67.0	49.9	79.5	12:05	66.0	53.2	83.1	16:55	65.2	48.8	74.2	21:45	60.9	40.4	79.3	30	01:33	77.0		
02:30	56.9	31.4	75.0	07:20	65.5	44.6	85.3	12:10	63.8	48.6	75.2	17:00	65.4	49.5	76.1	21:50	59.0	45.5	72.7	31	04:54	77.0		
02:35	49.7	29.9	70.4	07:25	63.3	42.0	74.5	12:15	64.9	46.5	77.2	17:05	65.3	50.8	73.9	21:55	61.0	39.0	81.4	32	23:34	76.9		
02:40	52.1	29.3	75.7	07:30	65.7	47.2	77.7	12:20	63.9	49.8	74.9	17:10	65.1	48.8	75.9	22:00	61.8	39.0	75.7	33	06:02	76.8		
02:45	29.8	29.2	33.1	07:35	64.4	46.6	76.2	12:25	66.2	49.7	77.8	17:15	66.9	52.7	79.2	22:05	61.9	41.8	74.1	34	06:45	76.8		
02:50	29.9	29.2	34.0	07:40	67.2	50.3	82.7	12:30	65.3	49.3	74.8	17:20	64.1	49.4	73.7	22:10	60.0	37.5	74.4	35	01:08	76.7		
02:55	52.3	29.7	71.7	07:45	73.1	46.2	93.7	12:35	64.0	49.0	79.9	17:25	64.9	47.0	72.7	22:15	61.3	39.9	77.7	36	06:29	76.7		
03:00	53.1	30.3	75.3	07:50	65.5	50.5	74.8	12:40	64.5	49.7	75.2	17:30	65.2	47.9	76.3	22:20	57.5	37.4	75.2	37	06:33	76.6		
03:05	30.1	29.4	34.4	07:55	66.8	50.7	81.2	12:45	66.2	53.7	76.1	17:35	65.2	48.5	76.0	22:25	57.5	34.3	78.6	38	05:19	76.5		
03:10	30.5	29.6	35.0	08:00	64.9	47.7	76.2	12:50	64.5	48.7	75.3	17:40	64.2	45.8	77.5	22:30	57.7	35.1	75.4	39	02:10	76.3		
03:15	43.6	32.0	67.1	08:05	64.4	45.4	76.3	12:55	64.6	49.7	74.3	17:45	65.2	46.9	73.8	22:35	59.1	36.7	74.1	40	05:54	76.3		
03:20	48.8	31.5	69.5	08:10	64.9	46.7	75.4	13:00	65.9	50.0	81.2	17:50	63.7	46.9	75.0	22:40	58.5	35.0	75.3	41	06:12	76.3		
03:25	31.5	30.2	40.5	08:15	63.9	44.7	75.8	13:05	64.5	50.8	78.5	17:55	63.6	43.1	74.4	22:45	59.7	36.8	77.2	42	05:43	76.2		
03:30	45.4	30.6	64.4	08:20	64.2	43.9	77.1	13:10	65.3	50.8	78.0	18:00	64.3	47.0	75.4	22:50	62.2	40.0	76.5	43	06:57	76.2		
03:35	52.9	31.0	73.2	08:25	64.8	48.9	74.3	13:15	64.0	47.7	77.8	18:05	63.5	47.9	75.0	22:55	58.9	33.9	78.0	44	00:24	76.0		
03:40	52.7	30.8	71.0	08:30	65.2	48.2	77.2	13:20	63.9	48.8	75.0	18:10	63.9	47.4	77.9	23:00	59.8	36.9	74.2	45	05:33	76.0		
03:45	52.7	29.6	74.1	08:35	65.5	48.5	76.9	13:25	65.0	49.5	78.2	18:15	64.6	50.2	74.5	23:05	58.0	34.0	75.0	46	05:38	75.9		
03:50	51.3	29.1	74.8	08:40	65.0	43.5	76.8	13:30	65.6	49.1	81.5	18:20	65.0	52.2	77.4	23:10	58.7	38.7	74.6	47	02:03	75.8		
03:55	51.7	29.6	70.9	08:45	65.1	54.2	76.0	13:35	64.0	47.5	78.2	18:25	63.5	45.3	74.1	23:15	60.1	38.1	73.8	48	00:29	75.7		
04:00	54.6	29.9	75.6	08:50	63.6	47.0	75.1	13:40	64.2	46.6	79.9	18:30	65.0	46.1	77.0	23:20	56.9	34.3	74.4	49	02:08	75.7		
04:05	58.2	29.7	79.9	08:55	63.5	47.6	74.0	13:45	63.2	49.7	73.5	18:35	64.6	48.9	74.7	23:25	60.3	35.8	81.1	50	02:40	75.7		
04:10	49.1	30.2	69.4	09:00	64.2	45.7	75.2	13:50	66.3	52.2	79.6	18:40	64.3	46.2	78.0	23:30	59.9	36.8	76.9	51	04:04	75.6		
04:15	50.5	30.7	69.7	09:05	63.8	47.1	73.4	13:55	65.1	49.9	76.6	18:45	66.1	46.2	88.1	23:35	56.4	42.6	74.3	52	05:41	75.6		
04:20	56.4	32.0	74.8	09:10	64.7	45.6	76.3	14:00	65.3	48.9	73.8	18:50	63.9	44.3	75.9	23:40	59.3	37.4	74.2	53	04:25	75.5		
04:25	59.9	33.4	77.5	09:15	64.4	46.4	75.6	14:05	63.9	50.7	73.5	18:55	64.3	47.1	76.0	23:45	58.5	34.5	75.0	54	04:56	75.4		
04:30	55.8	31.5	74.4	09:20	65.4	45.6	75.6	14:10	65.0	49.4	76.7	19:00	6											

 Site: Abbey Road Phase 2, Shepley. Table 2a: - Abbey Road Report: 4423-R1 Start Date: 24/07/2020 End Date: 24/07/2020																			
Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax	Time	LAeq	LA90	LAMax
00:00	45.7	37.5	64.5	04:50	41.9	35.4	56.4	09:40	53.5	49.0	61.9	14:30	59.4	46.3	76.7	19:20	50.3	41.4	66.0
00:05	44.5	37.4	58.4	04:55	48.8	37.9	62.9	09:45	54.2	49.2	64.6	14:35	51.9	46.3	58.2	19:25	48.4	41.5	57.5
00:10	43.2	37.4	57.8	05:00	46.9	37.3	57.8	09:50	53.1	47.4	60.1	14:40	53.3	48.5	62.4	19:30	59.3	42.1	74.5
00:15	47.9	37.1	63.5	05:05	43.4	36.6	55.2	09:55	54.8	47.0	78.5	14:45	52.4	46.5	58.5	19:35	50.4	43.2	58.2
00:20	46.3	35.6	59.7	05:10	43.1	35.6	57.1	10:00	52.1	46.6	59.9	14:50	52.7	45.3	61.0	19:40	49.9	42.7	61.2
00:25	41.2	34.5	53.6	05:15	41.5	35.8	56.9	10:05	53.0	48.0	60.9	14:55	52.7	47.8	63.6	19:45	48.6	41.7	57.8
00:30	44.1	35.0	62.6	05:20	45.6	37.3	59.4	10:10	54.8	49.8	65.6	15:00	51.9	46.3	61.6	19:50	53.4	45.3	66.5
00:35	44.9	35.0	60.4	05:25	46.9	38.3	60.2	10:15	52.9	46.3	63.1	15:05	52.9	46.6	60.1	19:55	51.5	42.1	70.4
00:40	39.0	34.3	51.5	05:30	49.0	38.7	62.1	10:20	52.7	45.8	62.1	15:10	52.2	46.8	59.9	20:00	51.0	41.6	68.7
00:45	41.6	35.6	56.2	05:35	49.8	40.4	62.2	10:25	53.6	44.6	73.1	15:15	52.1	47.0	60.4	20:05	50.3	40.9	61.5
00:50	44.2	37.0	59.6	05:40	47.0	39.7	57.7	10:30	59.8	48.3	76.3	15:20	51.1	44.9	59.9	20:10	47.7	38.5	57.3
00:55	40.1	35.2	55.0	05:45	49.7	40.9	59.5	10:35	53.6	48.0	63.2	15:25	51.8	42.7	66.9	20:15	47.1	39.8	56.0
01:00	41.7	34.7	55.8	05:50	51.7	41.1	64.4	10:40	54.2	46.9	62.5	15:30	59.9	47.0	78.3	20:20	47.7	40.2	55.4
01:05	48.1	35.6	61.5	05:55	47.2	39.6	60.1	10:45	53.6	49.0	59.3	15:35	53.6	47.5	61.9	20:25	48.8	40.9	59.6
01:10	36.6	34.1	48.6	06:00	50.0	40.0	61.1	10:50	52.1	47.0	58.9	15:40	52.3	47.3	59.7	20:30	59.0	41.1	76.4
01:15	36.6	34.7	44.6	06:05	47.2	37.8	59.9	10:55	54.7	48.0	70.5	15:45	52.8	45.0	68.8	20:35	49.7	40.6	58.8
01:20	45.5	36.0	66.7	06:10	51.4	39.3	62.7	11:00	53.2	46.8	61.6	15:50	51.9	44.1	59.9	20:40	47.6	40.2	58.4
01:25	47.2	36.7	61.4	06:15	51.2	41.1	62.5	11:05	53.8	48.1	62.1	15:55	52.1	46.8	59.3	20:45	49.8	42.3	63.5
01:30	47.1	37.2	62.9	06:20	49.4	39.8	62.3	11:10	53.3	48.7	60.8	16:00	51.5	46.6	57.8	20:50	49.1	40.8	59.5
01:35	46.2	36.1	64.7	06:25	51.6	42.3	62.2	11:15	54.0	48.5	64.4	16:05	53.0	46.1	64.8	20:55	48.9	39.4	61.3
01:40	43.9	35.7	59.7	06:30	51.5	40.3	63.2	11:20	52.8	47.4	60.7	16:10	52.5	47.8	62.2	21:00	53.2	40.6	74.6
01:45	46.9	37.8	63.5	06:35	55.0	38.1	71.8	11:25	54.1	48.7	64.4	16:15	52.6	46.1	65.7	21:05	46.6	38.4	58.5
01:50	43.3	36.0	57.7	06:40	52.7	43.7	63.2	11:30	61.1	47.9	77.5	16:20	52.0	46.3	58.0	21:10	48.3	39.8	58.3
01:55	45.6	37.5	60.0	06:45	52.3	42.9	61.7	11:35	52.2	46.3	63.3	16:25	52.6	45.8	60.3	21:15	49.4	39.9	61.5
02:00	46.9	35.8	61.9	06:50	52.7	44.0	64.5	11:40	53.3	47.9	61.6	16:30	59.6	47.1	76.4	21:20	48.2	39.7	59.2
02:05	40.7	34.6	57.5	06:55	52.8	46.7	61.9	11:45	54.3	44.9	69.1	16:35	52.3	46.1	67.4	21:25	49.1	40.3	62.9
02:10	45.5	36.9	60.9	07:00	54.4	43.1	71.2	11:50	53.9	47.7	62.6	16:40	54.3	47.6	72.1	21:30	58.7	41.3	75.8
02:15	45.8	38.1	59.9	07:05	53.6	44.8	64.2	11:55	51.6	44.4	62.2	16:45	53.0	46.5	62.2	21:35	48.2	39.9	60.7
02:20	42.6	35.8	55.8	07:10	53.3	46.2	61.7	12:00	53.3	49.2	70.0	16:50	53.0	46.6	58.8	21:40	46.9	37.4	59.9
02:25	42.8	35.2	59.2	07:15	55.3	47.5	69.1	12:05	53.9	48.2	70.7	16:55	53.1	47.4	58.8	21:45	48.4	40.6	61.4
02:30	41.6	35.6	57.4	07:20	54.5	45.6	68.3	12:10	51.9	45.7	61.4	17:00	52.5	45.4	62.3	21:50	50.4	45.8	59.3
02:35	44.7	34.8	59.2	07:25	51.9	44.0	60.7	12:15	51.8	45.2	61.0	17:05	52.6	47.2	59.5	21:55	49.4	41.1	66.0
02:40	40.7	33.7	59.9	07:30	53.9	46.6	62.6	12:20	51.7	46.0	61.1	17:10	52.2	45.4	59.9	22:00	49.0	39.4	59.4
02:45	34.5	33.6	45.2	07:35	51.9	45.3	60.3	12:25	52.3	45.8	62.0	17:15	54.2	47.5	65.8	22:05	49.5	38.4	57.4
02:50	34.8	33.7	43.0	07:40	58.4	46.3	75.5	12:30	60.7	47.2	78.6	17:20	51.2	45.1	63.2	22:10	47.7	38.5	58.4
02:55	40.6	34.6	54.6	07:45	61.2	47.1	79.6	12:35	51.5	45.1	60.6	17:25	51.8	45.0	58.8	22:15	49.2	40.3	62.4
03:00	42.4	35.7	60.3	07:50	53.6	47.4	60.9	12:40	51.5	46.1	58.3	17:30	61.5	45.2	81.7	22:20	46.0	39.1	57.9
03:05	36.5	34.4	50.4	07:55	54.6	47.5	67.1	12:45	53.5	47.8	60.7	17:35	51.0	44.2	59.2	22:25	45.5	36.6	58.7
03:10	36.5	34.1	50.1	08:00	53.4	46.0	62.7	12:50	53.4	48.2	62.1	17:40	51.2	44.4	67.7	22:30	44.9	35.6	59.3
03:15	38.7	35.9	53.7	08:05	52.5	45.6	62.7	12:55	54.2	48.3	65.3	17:45	50.8	43.7	59.0	22:35	47.2	36.9	59.9
03:20	38.9	35.5	52.7	08:10	51.5	44.5	59.8	13:00	54.8	48.5	70.3	17:50	50.7	44.9	58.3	22:40	46.4	36.3	57.6
03:25	40.3	36.0	53.8	08:15	52.4	44.5	62.5	13:05	53.9	48.1	64.6	17:55	50.8	41.5	59.1	22:45	46.5	37.0	60.8
03:30	37.7	34.8	48.3	08:20	52.0	45.6	61.7	13:10	53.7	46.5	68.4	18:00	52.5	44.2	68.2	22:50	49.4	39.9	59.6
03:35	39.2	35.2	50.3	08:25	53.2	47.2	62.8	13:15	52.9	47.5	60.1	18:05	50.6	45.4	57.5	22:55	46.0	35.2	59.7
03:40	43.6	35.0	56.6	08:30	60.1	47.7	76.9	13:20	52.6	47.4	62.4	18:10	51.5	44.1	60.9	23:00	47.0	36.6	58.4
03:45	42.0	34.6	59.6	08:35	52.6	44.8	62.4	13:25	53.8	47.9	64.1	18:15	52.7	45.9	75.0	23:05	45.2	36.4	56.4
03:50	40.4	34.0	60.7	08:40	53.3	45.8	63.8	13:30	59.9	48.7	76.1	18:20	52.0	47.3	58.4	23:10	46.1	38.4	57.1
03:55	40.8	34.1	57.1	08:45	54.9	47.7	74.2	13:35	52.0	45.1	65.7	18:25	51.2	43.1	60.5	23:15	49.3	43.2	58.3
04:00	44.3	35.4	61.8	08:50	53.7	45.7	65.0	13:40	51.9	45.8	62.4	18:30	59.7	44.3	79.2	23:20	45.5	36.5	59.0
04:05	47.5	35.4	67.8	08:55	52.2	47.1	61.0	13:45	53.0	47.6	60.5	18:35	55.5	45.0	70.4	23:25	47.8	37.4	61.1
04:10	37.1	34.8	46.3	09:00	53.1	46.4	63.4	13:50	54.0	49.0	64.2	18:40	52.3	46.4	60.2	23:30	47.2	37.3	60.1
04:15	43.2	36.6	59.4	09:05	52.8	46.9	63.1	13:55	54.4	48.6	66.4	18:45	51.2	43.1	67.4	23:35	48.0	45.1	56.9
04:20	45.5	36.6	58.5	09:10	52.8	45.7	61.1	14:00	53.7	48.3	61.9	18:50	52.7	41.2	72.2	23:40	48.2	40.9	59.5
04:25	48.6	35.8	63.1	09:15	54.9	48.6	61.7	14:05	51.9	45.3	61.3	18:55	51.6	44.0	59.6	23:45	47.2	36.1	61.4
04:30	45.4	35.6	60.3	09:20	54.3	45.4	69.3	14:10	54.4	48.4	64.4	19:00	49.7	40.8	62.0	23:50	48.0	36.1	62.8
04:35	43.9	34.7	63.1	09:25	53.5	48.4	59.9	14:15	51.5	44.8	60.2	19:05	50.9	41.3	59.2	23:55	48.0	39.8	65.0
04:40	44.6	35.8	58.8	09:30	60.5	48.8	77.6	14:20	53.8	47.8	62.3	19:10	50.4	43.7	58.0				
04:45	45.0	36.8	60.4	09:35	54.6	48.3	67.6	14:25	54.7	49.6	67.1	19:15	50.7	42.2	63.3				

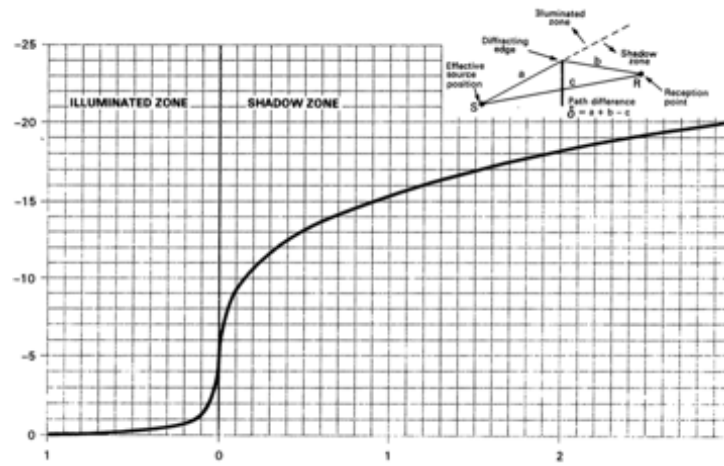
Table 2b: - 1min Night-time LAMax
Events Highest Ranked

#	Time	LAMax
1	06:37	71.8
2	04:06	67.8
3	01:24	66.7
4	23:56	65.0
5	01:37	64.7
6	00:02	64.5
7	06:50	64.5
8	05:50	64.4
9	00:16	63.5
10	01:49	63.5
11	05:51	63.4
12	06:35	63.4
13	06:32	63.2
14	06:43	63.2
15	04:05	63.1
16	04:27	63.1
17	04:37	63.1
18	01:30	62.9
19	04:56	62.9
20	23:51	62.8
21	06:30	62.8
22	06:12	62.7
23	00:30	62.6
24	06:16	62.5
25	00:15	62.3
26	06:21	62.3
27	06:40	62.3
28	04:25	62.2
29	05:39	62.2
30	06:13	62.2
31	06:25	62.2
32	05:34	62.1
33	06:23	62.0
34	06:44	62.0
35	02:04	61.9
36	04:36	61.9
37	06:59	61.9
38	04:04	61.8
39	06:36	61.7
40	06:48	61.7
41	06:42	61.6
42	01:08	61.5
43	01:09	61.5
44	04:55	61.5
45	06:26	61.5
46	23:47	61.4
47	01:26	61.4
48	01:34	61.4
49	06:34	61.3
50	23:46	61.2
51	23:29	61.1
52	06:03	61.1
53	06:15	61.1
54	06:28	61.0
55	06:39	61.0
56	01:29	60.9
57	02:11	60.9
58	06:31	60.9

Plans – Proposed Layout



Barrier Attenuation



from CRTN Appendix 3

Barrier Attenuation - 1					0	1	2	3	4	5	6	7
Source to Barrier	3	Receiver to Barrier	3	A Shadow	-15.4	-8.26	-2.787	-0.831	-0.198	0.1539	0.12248	0.02175
Source Height	1.2	Receiver Height	1.5	A(Logd)^n	-15.40	5.19	-1.10	0.21	-0.03	-0.02	0.01	0.00
Barrier Height	2.2											
Path Difference	0.24			Barrier Effect	-11.1							

Barrier Calculation