

FAO: NIGEL TENWICK

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Report No2257

PPG24 Noise Survey:

Britannia St, London WC1

For: Durkan

11/12/2006

MEADOW VIEW, NEWNHAM GROUNDS, KINGS NEWNHAM LANE, BRETTFORD, WARCS CV23 0JU

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1.0 Object

The object of this report is to present the findings of a noise survey carried out at the proposed development site at Britannia St, London WC1 on Wednesday & Thursday 29th and 30th November 2006.

2.0 Scope

The scope of this report is as follows:

- 1) Presentation of survey findings
- 2) Presentation of acoustic findings and comparison with PPG24.
- 3) Recommendations.

3.0 Survey

The measurement exercise was carried out to collect noise data over a 24 hour time period which spanned Wednesday & Thursday 29th and 30th November 2006.

This enabled full information to be collected to cover the 24-hour period. The monitoring position were free field positions approximately 1.7m from the ground on top of the wall overlooking the railway cutting running along the side of site.

Position No1: Boundary position overlooking railway cutting.

The sound pressure levels were free field levels which are detailed in Table 1 in the Appendix. The monitoring positions are detailed in the Site Plan in the Appendix. The microphone positions had direct line of sight with the adjacent noise source. The closest positions to the boundary was selected to represent the worst case conditions.

The weather conditions were as follows:

- Wind – light
- Roads – Dry.
- Average Temp daytime – cool 10C deg+

4.0 Measurements

During the survey recordings were made which were subsequently analysed into hourly periods.

The following measurements are reported:

$L_{Aeq,1hr}$, $L_{Amax,1min}$ (Rail Noise)

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The measurements and their interpretation shall be in accordance with BS 7445: Parts 1, 2, and 3.

All sound pressure levels are in dB re 20 micro pascals.

5.0 Measurement Equipment

The measurements were made using the following equipment:

- 1) 1 off CEL 480 Precision Sound Level Meter
- 2) CEL 284/2 Calibrator.

The equipment was calibrated before and after the surveys. The calibration was as follows:

METER	480 - 1
BEFORE	114.0DB
AFTER	114.0DB

There was no adverse deviation.

The equipment has valid traceable calibration.

6.0 Survey Findings

The site is located on Britannia St, London and is currently being used as a car park. The site is relatively flat and is bounded on its western edge by a railway that runs in a cutting, to the North by Britannia St and to the South by Wicklow St. The eastern side of site is bounded by existing buildings. A rail tunnel runs under the site following a parallel line with the rail cutting and featuring a circular ventilation shaft approx 2 – 3m in diameter which protrudes from the middle of the car parking area and is positioned directly above the Apex of the rail tunnel. The rail tunnel is clearly shown as a hatched area in the site plan in the Appendix.

From our observations, the site is mainly affected by rail noise from the trains that run in the cutting running along side site although there are contributions from the road traffic passing along Britannia St and Wicklow St. Subjectively there were few other noise sources in the area.

7.0 Acoustic Findings

The fixed monitoring position was chosen to obtain representative readings of the potential noise sources affecting site. The monitoring positions were sited on the boundary to the rail frontage, the proposed building façade is set back approximately 12m from this position and because of this a correction is needed to the free field measurements taken on the boundary to allow for a distance correction. In this case it is estimated that the distance approximates to a doubling of distance to the source and the correction for this (Assuming the rail line is a line source) is summarised below:

Correction = $10 \log_{10} (d1/d2)$:

Where d1 = distance from the source for the monitoring position and d2 is the distance from the source for the proposed building façade.

For a doubling of distance this is:

$$10 \log_{10} (0.5) = 3\text{dB};$$

8.0 Discussion of Results

Rail Noise

Table 1 show the free field noise levels recorded over the 24-hour period for the monitoring position together with the resultant prediction for the position of the building façade after the correction for distance has been adopted..

Position No1:

The readings peak at 68dB LAeq,1hr free field during the day. The peak night time reading was 67dB LAeq.

The daytime 16 hour free field level is calculated as 67.0dB.

The night-time 8 hour free field level is calculated as 62.0dB

Acoustic findings are compared against the PPG 24 document.

Rail Noise

Because the railway is the dominant noise source on site the criteria for rail traffic in the PPG 24 document is selected. This is detailed in the Table below.

The planning Policy Guidance document divides the noise to be analysed into four categories A, B, C, and D with a further division between nighttime (2300-0700hrs) and daytime (0700-2300hrs) periods.

PPG 24 NOISE LEVELS CORRESPONDING TO THE NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS AT 0.1 DB				
NOISE SOURCE	NOISE EXPOSURE CATEGORY			
Rail Traffic	A	B	C	D
0700-2300	<55	55 - 66	66 - 74	>74
2300-0700	<45	45 - 59	59 - 66	>66

Assessment Position No1: calculated facade of proposed property.

The site is categorised as NEC C for night time & NEC C for day time for both monitoring positions.

The guidance states:

NEC C: "Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise."

NOTE: This is not unusual for development sites in urban areas and City centres

Internal Noise:

Treating the property for the worst case condition and referring to the recommended BS8233: 1999 internal design criterion (Table 5, p19) which are as follows:

Area	Internal dB(A)
Bedrooms	30dB "Good" ; 35dB "reasonable" ; 45dB L _{Amax}
Living Areas	30dB "Good" ; 40dB "reasonable"

Internal Criteria

The specification for glazing will determine the internal environment in the dwellings. The intention is to base the design of the dwellings on the criterion stated in the table above. Note: "worst case" hourly noise level conditions are assumed below.

Rail Noise – Night Time Noise

Because the railway operates during the night time period a check on the L_{Amax} levels was carried out during the night time period: PPG24 states:

"Night time noise levels (2300 – 0700): sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the L_{Aeq}, 8hr (except where the L_{Aeq}, 8hr already puts the site in NEC D)."

In this case Nighttime events >82dB L_{Amax}¹ = 14 over 8 hrs (See Table 4 & Graph, SPLMAX Graph in the Appendix). No recategorisation necessary.

¹ Note that the L_{Amax} readings were taken on fast response not slow as depicted in the PPG24 document. This is because the sound level meter used does not have the dual function to allow simultaneous slow and fast response recordings. L_{Amax} fast is a worst case condition. There will in reality be fewer events >82dB than this because fast response will give higher readings than a slow response meter.

Night Time – Glazed Option:

Usually the L_{Amax} events of frequent passing trains will dictate the specification of the glazing for the bedrooms on the facades facing the rail line.

If we assume that the glazing design is based on 87dB L_{Amax} level (See Table 4 & Graph in the Appendix) which covers all night time events the performance of the glazing can be calculated using the information contained in the Pilkington Glass "Technical Bulletin (1997)"

The simple BS8233 glazing selection procedure is detailed in Table 2.

Position No2: Approx facade position on railway frontage

Night time Noise – Bedrooms: L_{Amax}

$$87 - 45 = 42\text{dB(A)}$$

The Glazing Specification is 6.150.4 Secondary Glazing = 42dB R_{RAIL}²

This glazing selection satisfies the 45dB L_{Amax} criteria for the worst case conditions when referenced to bedrooms with "windows closed".

Daytime Noise Living Areas

$$68 - 35 = 33\text{dB(A)}$$

The Glazing Specification is 10.12.6 Double Glazing = 35dB R_{RAIL}³

This glazing selection tends towards the "Good" 30dB(A) criteria for the worst case conditions when referenced to living rooms with "windows closed".

9.0 Conclusion

The sound pressure level survey recorded 24 hours of data which details both the L_{Aeq} levels and L_{Amax} sound pressure levels along the railway boundary. One monitoring position was selected which had clear line of sight of the rail source. Because monitoring was taken on the boundary to site (it being impracticable in the working car park to take a monitoring position at the proposed façade elevation) a correction was applied for the difference in distance from the boundary to the proposed façade location on the site. This correction is 3dB and is detailed in the data tables 1, 3 & 4 in the Appendix.

The predicted sound pressure levels at the proposed facade position show the site can be classed as NEC C for daytime and NEC C night-time. The site is developable providing attention is paid to the noise affecting site. To ensure internal criterion are met noise

² Glazing Performance related to traffic noise spectra. Table 2 p3 Pilkington "Glass & Noise Control" – Technical Bulletin May 1997. See Appendix: NOTE $R_{RAIL} = R_{TRA} + 3\text{dB}$

³ Glazing Performance related to traffic noise spectra. Table 2 p3 Pilkington "Glass & Noise Control" – Technical Bulletin May 1997. See Appendix: NOTE $R_{RAIL} = R_{TRA} + 3\text{dB}$

mitigation should be considered. In this case a suitable glazing option should be used. The preferred options are detailed in the Recommendations below.

10.0 Recommendations

Minimum - Glazed Option: (worst case): Proposed Development : Approx facade position.

Bedrooms: 6.150.4 Secondary glazing or a glazing option with a minimum performance specification of 42dB R_{RAIL} *(Based on Worst Case Condition & "Good" criterion being achieved)*

Living Areas: 10.12.6 double glazing or a glazing option with a minimum performance specification of 35dB R_{RAIL} *(Based on Worst Case Condition & "Good" criterion being achieved)*

Note: To ensure internal design criterion are met all windows must remain closed.

We recommend that Greenwood acoustic passive vents or similar are selected so as not to compromise the acoustic performance of the fenestration in the properties.

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W.A.Whitfield BA, MSc, MIOA

Noise & Vibration Consultant.

Table 1

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Survey Date: 29th - 30th November 2006

All readings sound pressure levels

Hour End	Measured Levels dB LAeq	Distance Correction dB	Free Field dB LAeq
17:00:00	69.6	3	66.6
18:00:00	70.5	3	67.5
19:00:00	69.8	3	66.8
20:00:00	70.7	3	67.7
21:00:00	68.5	3	65.5
22:00:00	67.8	3	64.8
23:00:00	69.7	3	66.7
00:00:00	69.6	3	66.6
01:00:00	65.3	3	62.3
02:00:00	52.0	3	49.0
03:00:00	51.1	3	48.1
04:00:00	52.3	3	49.3
05:00:00	53.9	3	50.9
06:00:00	64.8	3	61.8
07:00:00	69.8	3	66.8
08:00:00	70.5	3	67.5
09:00:00	70.7	3	67.7
10:00:00	70.0	3	67.0
11:00:00	70.5	3	67.5
12:00:00	69.3	3	66.3
13:00:00	69.5	3	66.5
14:00:00	69.3	3	66.3
15:00:00	69.2	3	66.2
16:00:00	69.2	3	66.2
Max Night Time Hourly dB LAeq			67
Max Day Time Hourly dB LAeq			68
Min Night Time Hourly dB LAeq			48
PPG 24 Rail Noise NEC Calculation			
Daytime	67		NEC C
Night time	62		C

Table 2a - Internal Noise Criteria & Glazing Options

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Assumptions

Survey Date: 29th - 30th November 2006

Assume Rail noise dominant

BS8233: 1999

Bedroom Criteria LAeq, T -30dBA "Good" - 35dBA "Reasonable" 45dBLAmax

Living Rooms Criteria LAeq, T - 30dBA "Good" - 40dBA "Reasonable"

$R_{AIR} = R_{TRA} + 2$ Pilkington Glass & Noise Control "Technical Bulletin": Design Guide p16

Double Glazing	R_{TRA}	R_{RAIL}
4.12.4	25	28
6.12.6	26	29
6.12.6.4pvb	27	30
10.12.4	29	32
10.12.6	32	35
10.12.6.4pvb	34	37
Secondary Glazing		
6.100.4 Secondary	37	40
6.150.4 Secondary	39	42
10.200.6 Secondary	45	48

Internal Criteria: Calculation for Acoustic Glazing

Noise Level at Property dB(A)

Desired Internal Level

Required Glazing Performance R_{RAIL}

Glazing Selection

Achieves Internal Criteria

Specification of Glazing	Selected Minimum Glazing Performance dB R_{RAIL}
Bedrooms	6.150.4 Secondary 42
Living Rooms	10.12.6 35

note: windows must remain closed to ensure compliance with internal design criteria

Type in Noise Levels Here
Worst Case Noise Levels

Night LAeq	Night LAmax	Day LAeq
67	87	68

Barrier Performance dB(A)
From barrier Calc Sheet
if Applicable

0	0	0
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Calculation

67	87	68
30	45	35
37	42	33
10.12.6.4pvb	6.150.4 Secondary	10.12.6
Yes	No	Yes

Predicted Internal Levels with Glazing Selected

Night LAeq	Night LAmax	Day LAeq
25	47	33

Table 3 Chart: SPLMAX F - Typical Train Events 2300 - 0700hrs - 29th - 30th November 2006 - Britannia St Development Site

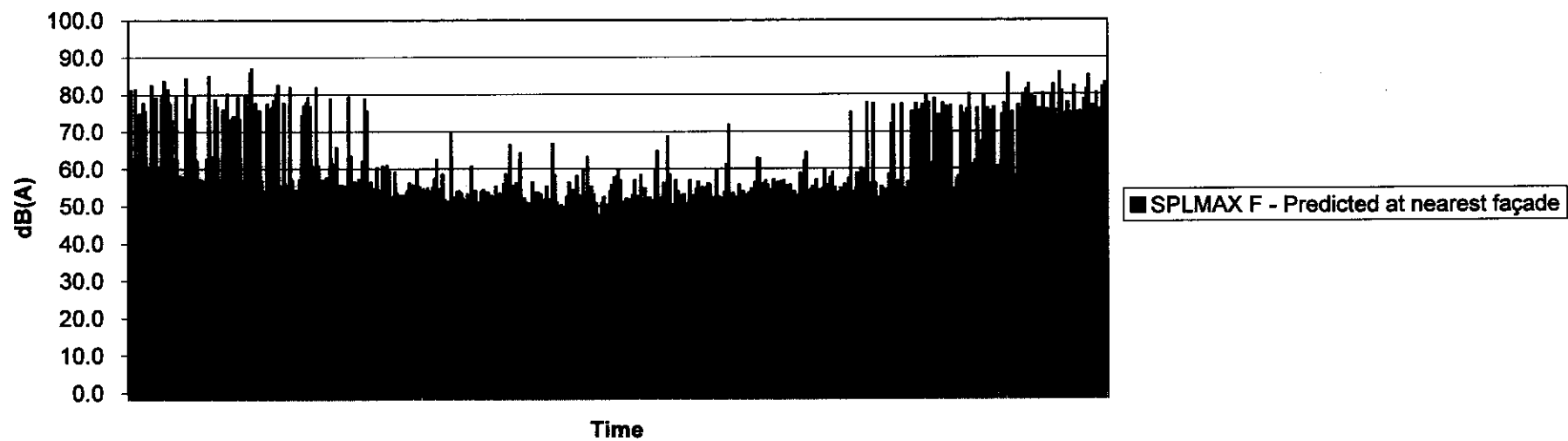


Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (LAmax >70dBA)
29-Nov-06	23:00:00	77.8	3	80.8	1
29-Nov-06	23:01:00	81.1	3	84.1	1
29-Nov-06	23:02:00	52.6	3	55.6	0
29-Nov-06	23:03:00	81.3	3	84.3	1
29-Nov-06	23:04:00	58.4	3	61.4	0
29-Nov-06	23:05:00	74.8	3	77.8	1
29-Nov-06	23:06:00	58.5	3	61.5	0
29-Nov-06	23:07:00	77.6	3	80.6	1
29-Nov-06	23:08:00	75.5	3	78.5	1
29-Nov-06	23:09:00	60.6	3	63.6	0
29-Nov-06	23:10:00	58.8	3	61.8	0
29-Nov-06	23:11:00	82.5	3	85.5	1
29-Nov-06	23:12:00	73.0	3	76.0	1
29-Nov-06	23:13:00	79.0	3	82.0	1
29-Nov-06	23:14:00	53.1	3	56.1	0
29-Nov-06	23:15:00	60.4	3	63.4	0
29-Nov-06	23:16:00	79.9	3	82.9	1
29-Nov-06	23:17:00	83.7	3	86.7	1
29-Nov-06	23:18:00	70.8	3	73.8	1
29-Nov-06	23:19:00	81.4	3	84.4	1
29-Nov-06	23:20:00	77.5	3	80.5	1
29-Nov-06	23:21:00	73.0	3	76.0	1
29-Nov-06	23:22:00	62.1	3	65.1	0
29-Nov-06	23:23:00	79.5	3	82.5	1
29-Nov-06	23:24:00	56.7	3	59.7	0
29-Nov-06	23:25:00	58.0	3	61.0	0
29-Nov-06	23:26:00	57.4	3	60.4	0
29-Nov-06	23:27:00	56.0	3	59.0	0
29-Nov-06	23:28:00	84.4	3	87.4	1
29-Nov-06	23:29:00	56.3	3	59.3	0
29-Nov-06	23:30:00	73.4	3	76.4	1
29-Nov-06	23:31:00	77.5	3	80.5	1
29-Nov-06	23:32:00	79.5	3	82.5	1
29-Nov-06	23:33:00	62.0	3	65.0	0
29-Nov-06	23:34:00	54.2	3	57.2	0
29-Nov-06	23:35:00	57.1	3	60.1	0
29-Nov-06	23:36:00	56.7	3	59.7	0
29-Nov-06	23:37:00	55.6	3	58.6	0
29-Nov-06	23:38:00	62.6	3	65.6	0
29-Nov-06	23:39:00	84.9	3	87.9	1
29-Nov-06	23:40:00	63.3	3	66.3	0
29-Nov-06	23:41:00	54.6	3	57.6	0
29-Nov-06	23:42:00	78.7	3	81.7	1
29-Nov-06	23:43:00	76.6	3	79.6	1
29-Nov-06	23:44:00	57.2	3	60.2	0
29-Nov-06	23:45:00	54.9	3	57.9	0
29-Nov-06	23:46:00	75.8	3	78.8	1
29-Nov-06	23:47:00	58.2	3	61.2	0
29-Nov-06	23:48:00	80.2	3	83.2	1
29-Nov-06	23:49:00	70.5	3	73.5	1
29-Nov-06	23:50:00	73.3	3	76.3	1
29-Nov-06	23:51:00	74.2	3	77.2	1
29-Nov-06	23:52:00	62.7	3	65.7	0
29-Nov-06	23:53:00	79.1	3	82.1	1
29-Nov-06	23:54:00	73.3	3	76.3	1
29-Nov-06	23:55:00	56.7	3	59.7	0
29-Nov-06	23:56:00	53.5	3	56.5	0
29-Nov-06	23:57:00	79.9	3	82.9	1
29-Nov-06	23:58:00	53.7	3	56.7	0
29-Nov-06	23:59:00	85.8	3	88.8	1
30-Nov-06	00:00:00	87.0	3	90.0	1
30-Nov-06	00:01:00	75.6	3	78.6	1
30-Nov-06	00:02:00	77.6	3	80.6	1
30-Nov-06	00:03:00	75.7	3	78.7	1
30-Nov-06	00:04:00	75.6	3	78.6	1
30-Nov-06	00:05:00	58.8	3	59.8	0
30-Nov-06	00:06:00	53.5	3	56.5	0
30-Nov-06	00:07:00	63.9	3	66.9	0
30-Nov-06	00:08:00	77.5	3	80.5	1
30-Nov-06	00:09:00	63.9	3	66.9	0
30-Nov-06	00:10:00	76.4	3	79.4	1
30-Nov-06	00:11:00	78.4	3	81.4	1
30-Nov-06	00:12:00	80.1	3	83.1	1
30-Nov-06	00:13:00	82.5	3	85.5	1
30-Nov-06	00:14:00	55.5	3	58.5	0
30-Nov-06	00:15:00	53.6	3	56.6	0
30-Nov-06	00:16:00	77.7	3	80.7	1
30-Nov-06	00:17:00	55.6	3	58.6	0
30-Nov-06	00:18:00	53.2	3	56.2	0
30-Nov-06	00:19:00	81.9	3	84.9	1
30-Nov-06	00:20:00	57.0	3	60.0	0
30-Nov-06	00:21:00	53.9	3	56.9	0

Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (LAmax >70dBA)
30-Nov-06	00:22:00	54.3	3	57.3	0
30-Nov-06	00:23:00	53.2	3	56.2	0
30-Nov-06	00:24:00	57.1	3	60.1	0
30-Nov-06	00:25:00	74.3	3	77.3	1
30-Nov-06	00:26:00	76.9	3	79.9	1
30-Nov-06	00:27:00	77.8	3	80.8	1
30-Nov-06	00:28:00	79.1	3	82.1	1
30-Nov-06	00:29:00	76.8	3	79.8	1
30-Nov-06	00:30:00	60.7	3	63.7	0
30-Nov-06	00:31:00	57.6	3	60.6	0
30-Nov-06	00:32:00	81.8	3	84.8	1
30-Nov-06	00:33:00	60.7	3	63.7	0
30-Nov-06	00:34:00	53.3	3	56.3	0
30-Nov-06	00:35:00	56.8	3	59.8	0
30-Nov-06	00:36:00	55.0	3	58.0	0
30-Nov-06	00:37:00	57.5	3	60.5	0
30-Nov-06	00:38:00	54.0	3	57.0	0
30-Nov-06	00:39:00	78.8	3	81.8	1
30-Nov-06	00:40:00	81.3	3	84.3	0
30-Nov-06	00:41:00	57.2	3	60.2	0
30-Nov-06	00:42:00	65.6	3	68.6	0
30-Nov-06	00:43:00	52.5	3	55.5	0
30-Nov-06	00:44:00	55.5	3	58.5	0
30-Nov-06	00:45:00	55.5	3	58.5	0
30-Nov-06	00:46:00	55.3	3	58.3	0
30-Nov-06	00:47:00	55.3	3	58.3	0
30-Nov-06	00:48:00	79.3	3	82.3	1
30-Nov-06	00:49:00	63.4	3	66.4	0
30-Nov-06	00:50:00	54.7	3	57.7	0
30-Nov-06	00:51:00	56.4	3	59.4	0
30-Nov-06	00:52:00	55.9	3	58.9	0
30-Nov-06	00:53:00	57.1	3	60.1	0
30-Nov-06	00:54:00	51.9	3	54.9	0
30-Nov-06	00:55:00	61.9	3	64.9	0
30-Nov-06	00:56:00	78.7	3	81.7	1
30-Nov-06	00:57:00	75.6	3	78.6	1
30-Nov-06	00:58:00	52.0	3	55.0	0
30-Nov-06	00:59:00	56.3	3	59.3	0
30-Nov-06	01:00:00	54.7	3	57.7	0
30-Nov-06	01:01:00	54.1	3	57.1	0
30-Nov-06	01:02:00	60.2	3	63.2	0
30-Nov-06	01:03:00	54.3	3	57.3	0
30-Nov-06	01:04:00	50.4	3	53.4	0
30-Nov-06	01:05:00	60.6	3	63.6	0
30-Nov-06	01:06:00	50.9	3	53.9	0
30-Nov-06	01:07:00	60.9	3	63.9	0
30-Nov-06	01:08:00	59.5	3	62.5	0
30-Nov-06	01:09:00	51.8	3	54.8	0
30-Nov-06	01:10:00	52.5	3	55.5	0
30-Nov-06	01:11:00	59.0	3	62.0	0
30-Nov-06	01:12:00	53.4	3	56.4	0
30-Nov-06	01:13:00	52.3	3	55.3	0
30-Nov-06	01:14:00	52.9	3	55.9	0
30-Nov-06	01:15:00	52.8	3	55.8	0
30-Nov-06	01:16:00	51.0	3	54.0	0
30-Nov-06	01:17:00	54.0	3	57.0	0
30-Nov-06	01:18:00	56.1	3	59.1	0
30-Nov-06	01:19:00	54.3	3	57.3	0
30-Nov-06	01:20:00	55.6	3	58.6	0
30-Nov-06	01:21:00	53.8	3	56.8	0
30-Nov-06	01:22:00	59.7	3	62.7	0
30-Nov-06	01:23:00	55.1	3	58.1	0
30-Nov-06	01:24:00	54.3	3	57.3	0
30-Nov-06	01:25:00	54.5	3	57.5	0
30-Nov-06	01:26:00	54.2	3	57.2	0
30-Nov-06	01:27:00	54.7	3	57.7	0
30-Nov-06	01:28:00	53.7	3	56.7	0
30-Nov-06	01:29:00	53.8	3	56.8	0
30-Nov-06	01:30:00	55.0	3	58.0	0
30-Nov-06	01:31:00	57.2	3	60.2	0
30-Nov-06	01:32:00	62.5	3	65.5	0
30-Nov-06	01:33:00	54.6	3	57.6	0
30-Nov-06	01:34:00	49.8	3	52.8	0
30-Nov-06	01:35:00	58.5	3	61.5	0
30-Nov-06	01:36:00	51.6	3	54.6	0
30-Nov-06	01:37:00	51.2	3	54.2	0
30-Nov-06	01:38:00	49.2	3	52.2	0
30-Nov-06	01:39:00	69.4	3	72.4	0
30-Nov-06	01:40:00	49.7	3	52.7	0
30-Nov-06	01:41:00	52.4	3	55.4	0
30-Nov-06	01:42:00	53.8	3	56.8	0
30-Nov-06	01:43:00	54.0	3	57.0	0

Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (L _{Amax} >70dBA)
30-Nov-06	01:44:00	53.4	3	56.4	0
30-Nov-06	01:45:00	52.0	3	55.0	0
30-Nov-06	01:46:00	51.4	3	54.4	0
30-Nov-06	01:47:00	53.2	3	56.2	0
30-Nov-06	01:48:00	51.2	3	54.2	0
30-Nov-06	01:49:00	60.6	3	63.6	0
30-Nov-06	01:50:00	51.1	3	54.1	0
30-Nov-06	01:51:00	54.1	3	57.1	0
30-Nov-06	01:52:00	51.0	3	54.0	0
30-Nov-06	01:53:00	50.3	3	53.3	0
30-Nov-06	01:54:00	53.9	3	56.9	0
30-Nov-06	01:55:00	54.4	3	57.4	0
30-Nov-06	01:56:00	53.0	3	56.0	0
30-Nov-06	01:57:00	53.6	3	56.6	0
30-Nov-06	01:58:00	52.4	3	55.4	0
30-Nov-06	01:59:00	52.8	3	55.8	0
30-Nov-06	02:00:00	52.4	3	55.4	0
30-Nov-06	02:01:00	55.1	3	58.1	0
30-Nov-06	02:02:00	52.3	3	55.3	0
30-Nov-06	02:03:00	53.3	3	56.3	0
30-Nov-06	02:04:00	53.1	3	56.1	0
30-Nov-06	02:05:00	55.9	3	58.9	0
30-Nov-06	02:06:00	58.5	3	61.5	0
30-Nov-06	02:07:00	54.3	3	57.3	0
30-Nov-06	02:08:00	66.4	3	69.4	0
30-Nov-06	02:09:00	54.2	3	57.2	0
30-Nov-06	02:10:00	55.4	3	58.4	0
30-Nov-06	02:11:00	56.2	3	59.2	0
30-Nov-06	02:12:00	55.3	3	58.3	0
30-Nov-06	02:13:00	64.2	3	67.2	0
30-Nov-06	02:14:00	47.8	3	50.8	0
30-Nov-06	02:15:00	52.0	3	55.0	0
30-Nov-06	02:16:00	50.8	3	53.8	0
30-Nov-06	02:17:00	49.9	3	52.9	0
30-Nov-06	02:18:00	50.8	3	53.8	0
30-Nov-06	02:19:00	56.4	3	59.4	0
30-Nov-06	02:20:00	51.8	3	54.8	0
30-Nov-06	02:21:00	53.6	3	56.6	0
30-Nov-06	02:22:00	53.5	3	56.5	0
30-Nov-06	02:23:00	53.2	3	56.2	0
30-Nov-06	02:24:00	49.9	3	52.9	0
30-Nov-06	02:25:00	51.7	3	54.7	0
30-Nov-06	02:26:00	55.2	3	58.2	0
30-Nov-06	02:27:00	51.8	3	54.8	0
30-Nov-06	02:28:00	49.5	3	52.5	0
30-Nov-06	02:29:00	66.7	3	69.7	0
30-Nov-06	02:30:00	58.3	3	61.3	0
30-Nov-06	02:31:00	50.9	3	53.9	0
30-Nov-06	02:32:00	49.8	3	52.8	0
30-Nov-06	02:33:00	50.2	3	53.2	0
30-Nov-06	02:34:00	46.3	3	49.3	0
30-Nov-06	02:35:00	49.8	3	52.8	0
30-Nov-06	02:36:00	52.5	3	55.5	0
30-Nov-06	02:37:00	56.3	3	59.3	0
30-Nov-06	02:38:00	54.0	3	57.0	0
30-Nov-06	02:39:00	54.2	3	57.2	0
30-Nov-06	02:40:00	53.2	3	56.2	0
30-Nov-06	02:41:00	58.0	3	61.0	0
30-Nov-06	02:42:00	52.8	3	55.8	0
30-Nov-06	02:43:00	47.7	3	50.7	0
30-Nov-06	02:44:00	59.5	3	62.5	0
30-Nov-06	02:45:00	52.7	3	55.7	0
30-Nov-06	02:46:00	63.1	3	66.1	0
30-Nov-06	02:47:00	52.1	3	55.1	0
30-Nov-06	02:48:00	55.2	3	58.2	0
30-Nov-06	02:49:00	53.1	3	56.1	0
30-Nov-06	02:50:00	50.7	3	53.7	0
30-Nov-06	02:51:00	47.5	3	50.5	0
30-Nov-06	02:52:00	47.3	3	50.3	0
30-Nov-06	02:53:00	50.7	3	53.7	0
30-Nov-06	02:54:00	52.3	3	55.3	0
30-Nov-06	02:55:00	47.7	3	50.7	0
30-Nov-06	02:56:00	50.3	3	53.3	0
30-Nov-06	02:57:00	53.8	3	56.8	0
30-Nov-06	02:58:00	55.6	3	58.6	0
30-Nov-06	02:59:00	57.5	3	60.5	0
30-Nov-06	03:00:00	57.9	3	60.9	0
30-Nov-06	03:01:00	59.9	3	62.9	0
30-Nov-06	03:02:00	56.8	3	59.8	0
30-Nov-06	03:03:00	50.7	3	53.7	0
30-Nov-06	03:04:00	51.0	3	54.0	0
30-Nov-06	03:05:00	51.9	3	54.9	0

Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (LAmax >70dBA)
30-Nov-06	03:06:00	51.3	3	54.3	0
30-Nov-06	03:07:00	51.8	3	54.8	0
30-Nov-06	03:08:00	52.9	3	55.9	0
30-Nov-06	03:09:00	56.9	3	59.9	0
30-Nov-06	03:10:00	52.6	3	55.6	0
30-Nov-06	03:11:00	52.5	3	55.5	0
30-Nov-06	03:12:00	58.2	3	61.2	0
30-Nov-06	03:13:00	51.9	3	54.9	0
30-Nov-06	03:14:00	54.7	3	57.7	0
30-Nov-06	03:15:00	51.9	3	54.9	0
30-Nov-06	03:16:00	52.2	3	55.2	0
30-Nov-06	03:17:00	50.2	3	53.2	0
30-Nov-06	03:18:00	51.4	3	54.4	0
30-Nov-06	03:19:00	59.7	3	62.7	0
30-Nov-06	03:20:00	64.7	3	67.7	0
30-Nov-06	03:21:00	52.1	3	55.1	0
30-Nov-06	03:22:00	52.3	3	55.3	0
30-Nov-06	03:23:00	56.1	3	59.1	0
30-Nov-06	03:24:00	52.9	3	55.9	0
30-Nov-06	03:25:00	68.5	3	71.5	0
30-Nov-06	03:26:00	58.4	3	61.4	0
30-Nov-06	03:27:00	50.4	3	53.4	0
30-Nov-06	03:28:00	49.6	3	52.6	0
30-Nov-06	03:29:00	56.8	3	59.8	0
30-Nov-06	03:30:00	53.9	3	56.9	0
30-Nov-06	03:31:00	50.5	3	53.5	0
30-Nov-06	03:32:00	52.9	3	55.9	0
30-Nov-06	03:33:00	53.0	3	56.0	0
30-Nov-06	03:34:00	45.5	3	48.5	0
30-Nov-06	03:35:00	50.7	3	53.7	0
30-Nov-06	03:36:00	56.8	3	59.8	0
30-Nov-06	03:37:00	52.9	3	55.9	0
30-Nov-06	03:38:00	51.9	3	54.9	0
30-Nov-06	03:39:00	54.5	3	57.5	0
30-Nov-06	03:40:00	56.4	3	59.4	0
30-Nov-06	03:41:00	50.8	3	53.8	0
30-Nov-06	03:42:00	55.0	3	58.0	0
30-Nov-06	03:43:00	53.7	3	56.7	0
30-Nov-06	03:44:00	55.0	3	58.0	0
30-Nov-06	03:45:00	55.9	3	58.9	0
30-Nov-06	03:46:00	55.6	3	58.6	0
30-Nov-06	03:47:00	52.2	3	55.2	0
30-Nov-06	03:48:00	52.2	3	55.2	0
30-Nov-06	03:49:00	59.7	3	62.7	0
30-Nov-06	03:50:00	52.5	3	55.5	0
30-Nov-06	03:51:00	52.2	3	55.2	0
30-Nov-06	03:52:00	48.4	3	51.4	0
30-Nov-06	03:53:00	53.6	3	56.6	0
30-Nov-06	03:54:00	61.1	3	64.1	0
30-Nov-06	03:55:00	71.8	3	74.8	1
30-Nov-06	03:56:00	49.2	3	52.2	0
30-Nov-06	03:57:00	53.3	3	56.3	0
30-Nov-06	03:58:00	48.0	3	51.0	0
30-Nov-06	03:59:00	52.4	3	55.4	0
30-Nov-06	04:00:00	55.6	3	58.6	0
30-Nov-06	04:01:00	53.0	3	56.0	0
30-Nov-06	04:02:00	53.8	3	56.8	0
30-Nov-06	04:03:00	52.0	3	55.0	0
30-Nov-06	04:04:00	53.0	3	56.0	0
30-Nov-06	04:05:00	53.5	3	56.5	0
30-Nov-06	04:06:00	54.5	3	57.5	0
30-Nov-06	04:07:00	54.2	3	57.2	0
30-Nov-06	04:08:00	56.4	3	59.4	0
30-Nov-06	04:09:00	62.8	3	65.8	0
30-Nov-06	04:10:00	62.7	3	65.7	0
30-Nov-06	04:11:00	49.7	3	52.7	0
30-Nov-06	04:12:00	55.9	3	58.9	0
30-Nov-06	04:13:00	56.7	3	59.7	0
30-Nov-06	04:14:00	55.6	3	58.6	0
30-Nov-06	04:15:00	54.3	3	57.3	0
30-Nov-06	04:16:00	53.3	3	56.3	0
30-Nov-06	04:17:00	57.1	3	60.1	0
30-Nov-06	04:18:00	54.0	3	57.0	0
30-Nov-06	04:19:00	56.3	3	59.3	0
30-Nov-06	04:20:00	52.8	3	55.8	0
30-Nov-06	04:21:00	56.6	3	59.6	0
30-Nov-06	04:22:00	56.8	3	59.8	0
30-Nov-06	04:23:00	54.6	3	57.6	0
30-Nov-06	04:24:00	55.5	3	58.5	0
30-Nov-06	04:25:00	55.6	3	58.6	0
30-Nov-06	04:26:00	50.6	3	53.6	0
30-Nov-06	04:27:00	53.9	3	56.9	0

Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (L _{Amax} >70dBA)
30-Nov-06	04:28:00	51.3	3	54.3	0
30-Nov-06	04:29:00	52.8	3	55.8	0
30-Nov-06	04:30:00	58.8	3	61.8	0
30-Nov-06	04:31:00	53.8	3	56.8	0
30-Nov-06	04:32:00	62.1	3	65.1	0
30-Nov-06	04:33:00	64.4	3	67.4	0
30-Nov-06	04:34:00	52.6	3	55.6	0
30-Nov-06	04:35:00	54.3	3	57.3	0
30-Nov-06	04:36:00	55.2	3	58.2	0
30-Nov-06	04:37:00	52.4	3	55.4	0
30-Nov-06	04:38:00	57.0	3	60.0	0
30-Nov-06	04:39:00	54.2	3	57.2	0
30-Nov-06	04:40:00	53.3	3	56.3	0
30-Nov-06	04:41:00	54.6	3	57.6	0
30-Nov-06	04:42:00	59.3	3	62.3	0
30-Nov-06	04:43:00	55.7	3	58.7	0
30-Nov-06	04:44:00	52.9	3	55.9	0
30-Nov-06	04:45:00	57.7	3	60.7	0
30-Nov-06	04:46:00	58.9	3	61.9	0
30-Nov-06	04:47:00	55.0	3	58.0	0
30-Nov-06	04:48:00	53.6	3	56.6	0
30-Nov-06	04:49:00	48.8	3	51.8	0
30-Nov-06	04:50:00	54.8	3	57.8	0
30-Nov-06	04:51:00	54.3	3	57.3	0
30-Nov-06	04:52:00	55.7	3	58.7	0
30-Nov-06	04:53:00	55.3	3	58.3	0
30-Nov-06	04:54:00	57.3	3	60.3	0
30-Nov-06	04:55:00	75.1	3	78.1	1
30-Nov-06	04:56:00	52.6	3	55.6	0
30-Nov-06	04:57:00	53.7	3	56.7	0
30-Nov-06	04:58:00	58.8	3	61.8	0
30-Nov-06	04:59:00	51.5	3	54.5	0
30-Nov-06	05:00:00	60.1	3	63.1	0
30-Nov-06	05:01:00	57.5	3	60.5	0
30-Nov-06	05:02:00	58.9	3	62.9	0
30-Nov-06	05:03:00	77.6	3	80.6	1
30-Nov-06	05:04:00	52.5	3	55.5	0
30-Nov-06	05:05:00	56.1	3	59.1	0
30-Nov-06	05:06:00	77.5	3	80.5	1
30-Nov-06	05:07:00	56.1	3	59.1	0
30-Nov-06	05:08:00	51.9	3	54.9	0
30-Nov-06	05:09:00	52.2	3	55.2	0
30-Nov-06	05:10:00	55.1	3	58.1	0
30-Nov-06	05:11:00	54.5	3	57.5	0
30-Nov-06	05:12:00	50.5	3	53.5	0
30-Nov-06	05:13:00	54.3	3	57.3	0
30-Nov-06	05:14:00	58.6	3	61.6	0
30-Nov-06	05:15:00	72.1	3	75.1	1
30-Nov-06	05:16:00	77.0	3	80.0	1
30-Nov-06	05:17:00	55.4	3	58.4	0
30-Nov-06	05:18:00	56.7	3	59.7	0
30-Nov-06	05:19:00	55.7	3	58.7	0
30-Nov-06	05:20:00	77.3	3	80.3	1
30-Nov-06	05:21:00	54.8	3	57.8	0
30-Nov-06	05:22:00	49.4	3	52.4	0
30-Nov-06	05:23:00	56.3	3	59.3	0
30-Nov-06	05:24:00	56.0	3	59.0	0
30-Nov-06	05:25:00	75.3	3	78.3	1
30-Nov-06	05:26:00	56.7	3	59.7	0
30-Nov-06	05:27:00	77.4	3	80.4	1
30-Nov-06	05:28:00	57.3	3	60.3	0
30-Nov-06	05:29:00	75.7	3	78.7	1
30-Nov-06	05:30:00	77.2	3	80.2	1
30-Nov-06	05:31:00	53.1	3	56.1	0
30-Nov-06	05:32:00	79.4	3	82.4	1
30-Nov-06	05:33:00	77.7	3	80.7	1
30-Nov-06	05:34:00	59.9	3	62.9	0
30-Nov-06	05:35:00	61.5	3	64.5	0
30-Nov-06	05:36:00	78.8	3	81.8	1
30-Nov-06	05:37:00	57.2	3	60.2	0
30-Nov-06	05:38:00	74.4	3	77.4	1
30-Nov-06	05:39:00	74.0	3	77.0	1
30-Nov-06	05:40:00	77.5	3	80.5	1
30-Nov-06	05:41:00	59.0	3	62.0	0
30-Nov-06	05:42:00	78.7	3	79.7	1
30-Nov-06	05:43:00	59.5	3	62.5	0
30-Nov-06	05:44:00	76.8	3	79.8	1
30-Nov-06	05:45:00	51.1	3	54.1	0
30-Nov-06	05:46:00	54.5	3	57.5	0
30-Nov-06	05:47:00	57.0	3	60.0	0
30-Nov-06	05:48:00	57.8	3	60.8	0
30-Nov-06	05:49:00	76.6	3	79.6	1

Table 3: Night Time Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F - Predicted at nearest façade	Distance Correction	SPLMAX F	Trains (L _{Amax} >70dBA)
30-Nov-06	05:50:00	74.8	3	77.8	1
30-Nov-06	05:51:00	60.2	3	63.2	0
30-Nov-06	05:52:00	76.0	3	79.0	1
30-Nov-06	05:53:00	80.0	3	83.0	1
30-Nov-06	05:54:00	53.7	3	56.7	0
30-Nov-06	05:55:00	61.2	3	64.2	0
30-Nov-06	05:56:00	62.2	3	65.2	0
30-Nov-06	05:57:00	76.2	3	79.2	1
30-Nov-06	05:58:00	55.0	3	58.0	0
30-Nov-06	05:59:00	67.1	3	70.1	0
30-Nov-06	06:00:00	79.7	3	82.7	1
30-Nov-06	06:01:00	74.7	3	77.7	1
30-Nov-06	06:02:00	76.2	3	79.2	1
30-Nov-06	06:03:00	75.4	3	78.4	1
30-Nov-06	06:04:00	64.6	3	67.6	0
30-Nov-06	06:05:00	76.4	3	79.4	1
30-Nov-06	06:06:00	57.0	3	60.0	0
30-Nov-06	06:07:00	60.6	3	63.6	0
30-Nov-06	06:08:00	54.2	3	57.2	0
30-Nov-06	06:09:00	74.5	3	77.5	1
30-Nov-06	06:10:00	77.5	3	80.5	1
30-Nov-06	06:11:00	53.6	3	56.6	0
30-Nov-06	06:12:00	85.5	3	88.5	1
30-Nov-06	06:13:00	59.2	3	62.2	0
30-Nov-06	06:14:00	75.2	3	78.2	1
30-Nov-06	06:15:00	57.6	3	60.6	0
30-Nov-06	06:16:00	56.3	3	59.3	0
30-Nov-06	06:17:00	77.1	3	80.1	1
30-Nov-06	06:18:00	57.0	3	60.0	0
30-Nov-06	06:19:00	80.0	3	83.0	1
30-Nov-06	06:20:00	77.7	3	80.7	1
30-Nov-06	06:21:00	81.3	3	84.3	1
30-Nov-06	06:22:00	82.7	3	85.7	1
30-Nov-06	06:23:00	79.7	3	82.7	1
30-Nov-06	06:24:00	79.1	3	82.1	1
30-Nov-06	06:25:00	79.0	3	82.0	1
30-Nov-06	06:26:00	75.4	3	78.4	1
30-Nov-06	06:27:00	76.1	3	79.1	1
30-Nov-06	06:28:00	57.9	3	60.9	0
30-Nov-06	06:29:00	80.1	3	83.1	1
30-Nov-06	06:30:00	59.8	3	62.8	0
30-Nov-06	06:31:00	75.9	3	78.9	1
30-Nov-06	06:32:00	61.9	3	64.9	0
30-Nov-06	06:33:00	79.5	3	82.5	1
30-Nov-06	06:34:00	82.5	3	85.5	1
30-Nov-06	06:35:00	75.6	3	78.6	1
30-Nov-06	06:36:00	73.9	3	76.9	1
30-Nov-06	06:37:00	85.9	3	88.9	1
30-Nov-06	06:38:00	80.8	3	83.8	1
30-Nov-06	06:39:00	62.8	3	65.8	0
30-Nov-06	06:40:00	74.9	3	77.9	1
30-Nov-06	06:41:00	77.7	3	80.7	1
30-Nov-06	06:42:00	75.1	3	78.1	1
30-Nov-06	06:43:00	57.6	3	60.6	0
30-Nov-06	06:44:00	82.1	3	85.1	1
30-Nov-06	06:45:00	75.2	3	78.2	1
30-Nov-06	06:46:00	60.7	3	63.7	0
30-Nov-06	06:47:00	75.3	3	78.3	1
30-Nov-06	06:48:00	58.2	3	61.2	0
30-Nov-06	06:49:00	78.6	3	81.6	1
30-Nov-06	06:50:00	81.2	3	84.2	1
30-Nov-06	06:51:00	85.0	3	88.0	1
30-Nov-06	06:52:00	62.9	3	65.9	0
30-Nov-06	06:53:00	77.0	3	80.0	1
30-Nov-06	06:54:00	57.3	3	60.3	0
30-Nov-06	06:55:00	80.3	3	83.3	1
30-Nov-06	06:56:00	60.4	3	63.4	0
30-Nov-06	06:57:00	76.0	3	79.0	1
30-Nov-06	06:58:00	81.9	3	84.9	1
30-Nov-06	06:59:00	83.1	3	86.1	1
30-Nov-06	07:00:00	79.4	3	82.4	1
Maximum L _{Amax} Level		87.0		90.0	
Estimated Night Time Trains (2300 - 0700hrs)					120

Graph of Table 4: Ordered SPLMAX F 2300 - 0700hrs - 29th - 30th November 2006 - Britannia St Development Site

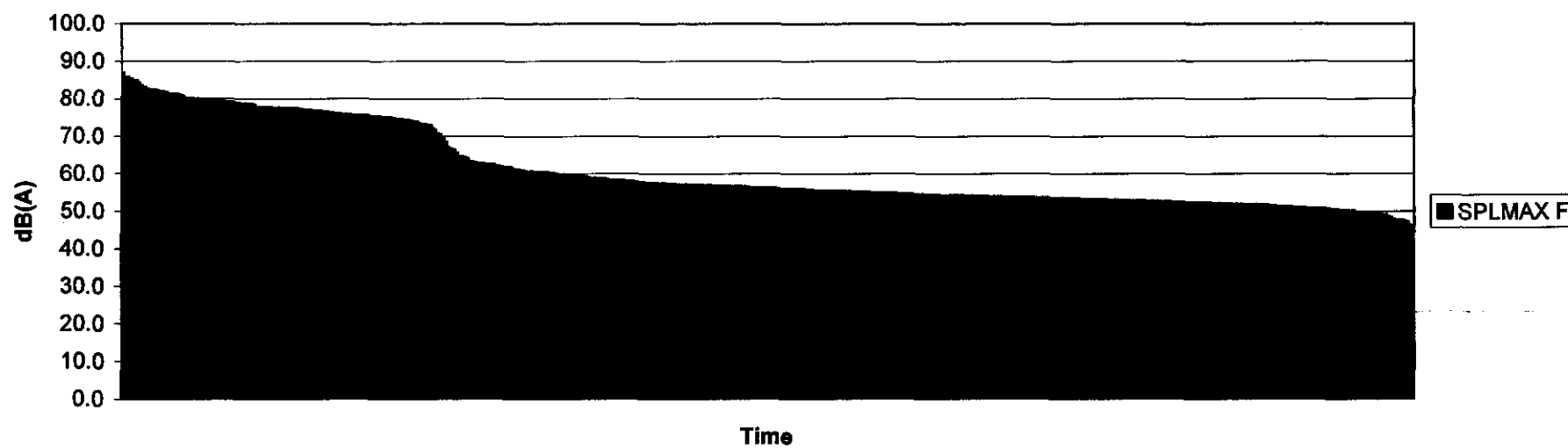


Table 4: Night Time LAmax Train Events

Development Site: Britannia St, London WC1 - Site Noise Survey - Position No1

Date	Time	SPLMAX F	Trains (LAmax >82dBA)
30-Nov-06	00:00:00	87.0	1
30-Nov-06	06:37:00	85.9	1
29-Nov-06	23:59:00	85.8	1
30-Nov-06	06:12:00	85.5	1
30-Nov-06	06:51:00	85.0	1
29-Nov-06	23:39:00	84.9	1
29-Nov-06	23:28:00	84.4	1
29-Nov-06	23:17:00	83.7	1
30-Nov-06	06:59:00	83.1	1
30-Nov-06	06:22:00	82.7	1
30-Nov-06	00:13:00	82.5	1
30-Nov-06	06:34:00	82.5	1
29-Nov-06	23:11:00	82.5	1
30-Nov-06	06:44:00	82.1	1
30-Nov-06	00:19:00	81.9	0
30-Nov-06	06:58:00	81.9	0
30-Nov-06	00:32:00	81.8	0
29-Nov-06	23:19:00	81.4	0

Table 5 — Indoor ambient noise levels in spaces when they are unoccupied

Criterion	Typical situations	Design range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable industrial working conditions	Heavy engineering	70	80
	Light engineering	65	75
	Garages, warehouses	65	75
Reasonable speech or telephone communications	Department store	50	55
	Cafeteria, canteen, kitchen	50	55
	Wash-room, toilet	45	55
	Corridor	45	55
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff room	35	45
	Meeting room, executive office	35	40
Reasonable listening conditions	Classroom	35	40
	Church, lecture theatre, cinema	30	35
	Concert hall, theatre	25	30
	Recording studio	20	25
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms ^a	30	35

^a For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax} .

Table 6 — Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important

Criterion	Typical situations	Design range $L_{Aeq,T}$ dB
Reasonable acoustic privacy in shared spaces	Restaurant	40-55
	Open plan office	45-50
	Night club, public house	40-45
	Ball room, banquet hall	35-40
	Reception room	35-40

7.8.1.4 Other precautions

It is recommended that any partition separating a WC from a noise sensitive room should have a weighted standardized level difference ($D_{nT,w}$) of at least 36 dB.

In flats, sound absorbent materials should be applied to the ceiling surfaces of internal corridors and stairwells to reduce propagation of noise through the building.

NOTE Carpets can also provide useful absorption.

Resilient floor coverings, such as carpet with underlay, can be used to minimize noise from footsteps on stair treads, corridors and landings. Noise will be reduced at the same floor level and to rooms below the floor or stair. The quietest types of sanitary, heating and plumbing equipment (e.g. WCs, ball valves, refuse chutes etc.) should be used; however their location is more important than their detailed design.

It is good practice to isolate vibration in the heating pipework from the building structure, at least near the pump. This may be achieved by using resilient fixings on pipe runs. Where pipes penetrate walls and floors, air gaps should be sealed to reduce airborne noise transmission in such a way that structure-borne noise is not transmitted; this may be achieved by packing the gap with mineral wool, and sealing the faces with non-hardening mastic. Building Regulations guidance for fire safety should be taken into account [24], [25], [26]. Ventilation fans and similar equipment should have resilient mountings where structure-borne noise could be a problem.

Care should be taken to position lifts to minimize noise disturbance from the operation of the control gear. Lift doors should operate quietly, and acoustic signals to herald lift arrival should not be audible within dwellings.

NOTE For additional guidance see [10].

Tables 1-3 Sound Insulation Data for a Variety of Glazings

(No contribution from wall)

In addition to the full third octave band sound insulation spectra, corresponding octave band equivalent values are given in adjacent columns. Pilkington AUDIOSCREEN is a special acoustic laminate.

Table 1 - Single Glazing

Third octave band Centre Frequency (Hz)	Sound Insulation (dB) for Glass Thickness (mm)									
	4	6	10	19	6.4 PVB	Pilkington AUDIOSCREEN				
	7	9	11	13	17					
100	17	18	24	25	18	23	25	26	27	26
125	23 20	22 20	26 26	29 28	22 20	26 25	27 26	29 27	30 29	28 28
160	22	22	28	31	22	25	27	29	30	32
200	21	22	26	31	22	26	28	29	31	31
250	21 22	26 24	28 27	32 32	26 24	27 27	29 29	31 31	33 32	33 32
315	24	26	29	33	26	28	30	32	33	34
400	26	29	32	36	29	30	32	34	35	37
500	29 28	31 31	34 34	38 37	31 31	32 31	34 34	36 36	37 37	39 39
630	30	33	36	36	33	33	36	38	38	41
800	32	34	37	35	34	35	37	39	40	42
1000	34 33	36 35	36 35	38 37	36 35	36 36	38 38	39 39	40 40	44 43
1250	34	36	33	40	36	38	39	41	43	45
1600	36	37	33	44	36	39	41	40	40	46
2000	36 34	36 29	38 36	47 46	34 33	40 40	41 40	38 38	38 40	44 41
2500	31	30	41	50	31	40	38	37	41	38
3150	25	34	43	52	35	38	37	42	45	42
4000	31	28	44 44	55 54	39 38	36 38	41 40	45 44	51 48	46 45
R _w (dB)	27	29	33	37	30	32	34	35	36	38
R _a (dB)	30	32	36	40	33	36	37	38	39	41
R _{TR,A} (dBA)	25	28	32	35	29	31	33	34	36	36

Table 2 - Pilkington Insulating Units

Third octave band Centre Frequency (Hz)	Sound Insulation (dB) for Glass Thickness (mm)										
						Pilkington ALUDOSCREEN					
	4/12/4	6/12/6	6/12/6.4 revs	10/12/4	10/12/6	10/12/6.4 revs	6/12/7	6/12/9	6/12/11	6/12/13	13/12/13
100	23	17	19	23	27	27	26	24	26	27	29
125	24	26	24	28	27	28	28	27	28	27	28
160	23	22	21	26	24	26	26	25	26	24	29
200	21	18	19	19	24	26	23	24	24	25	33
250	21	20	18	19	20	23	20	26	28	30	36
315	19	24	24	26	31	32	28	30	31	32	39
400	22	27	28	31	33	34	30	33	34	36	42
500	25	29	32	33	34	36	34	37	38	40	45
630	30	33	34	36	37	40	36	40	41	43	49
800	33	37	38	39	39	41	41	43	44	45	52
1000	36	35	40	39	41	42	43	45	45	46	52
1250	38	39	40	41	41	41	45	46	46	46	52
1600	40	39	39	41	39	41	45	45	44	44	50
2000	41	38	34	35	37	37	42	45	42	44	51
2500	35	37	39	45	40	44	46	47	44	46	55
3150	31	42	44	42	43	49	55	50	51	52	60
4000	40	35	47	44	44	47	57	55	56	57	65
R _w (dB)	29	30	31	34	34	36	36	37	37	38	44
R _a (dB)	31	33	34	36	38	40	38	40	40	41	47
R _{TR,A} (dBA)	25	26	27	29	32	34	31	32	33	33	39

Table 3 - Double Windows (Secondary Sashes)

Third octave band Centre Frequency (Hz)	Sound Insulation (dB) for Glass Thickness (mm)		
	6/10/4	6/12/4	10/20/6
100	25	27	32
125	27 26	30 29	37 35
160	27	30	39
200	33	34	45
250	33 34	34 35	46 46
315	37	39	46
400	41	42	47
500	46 44	46 45	45 46
630	50	50	45
800	54	54	44
1000	57 56	57 56	45 46
1250	59	58	50
1600	58	58	53
2000	52 53	52 52	58 56
2500	51	49	58
3150	48	47	64
4000	57 52	53 50	64 65
R _w (dB)	44	44	47
R _a (dB)	46	47	49
R _{TR,A} (dBA)	37	39	45