SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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21 Bloomsbury Street

Plant noise assessment

55 Charterhouse Street, London EC1M 6HA T: +44 (0)20 7549 3500
Piccadilly House, 49 Piccadilly, Manchester M1 2AP T: +44 (0)161 771 2020
2 Walker Street, Edinburgh EH3 7LB T: +44 (0)131 235 2020 **post@sandybrown.com**
35 St Paul's Square, Birmingham B3 1QX T: +44 (0)121 227 5020 **www.sandybrown.com**

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504 Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	21 Mar 16		Jake Mroz	Richard King

Summary

Sandy Brown Associates LLP (SBA) has been commissioned by Bilfinger GVA to provide acoustic advice in relation to the proposed development at 21 Bloomsbury Street, WC1.

An environmental noise survey was performed between 02 March 2016 and 08 March 2016. The typical background sound levels measured during the survey were $L_{A90,\ 15min}$ 50 dB during the daytime and $L_{A90,15min}$ 46 dB at night.

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 45 dB during the daytime and L_{Aeq} 41 dB during the night.

Based on the policy requirements of the London Borough of Camden and on the results of the noise survey, the cumulative noise level emitted from all new plant should not exceed 5 dB below the existing background noise level (L_{A90}), when assessed at 1 m outside the nearest noise sensitive facade, during the proposed hours of operation. These limits are cumulative, and apply with all plant operation under normal conditions. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set.

Using manufacturer's noise emission data for the proposed plant, an assessment has been carried out against the noise limits. The assessment demonstrates compliance with the limits.

Contents

1 Introduction

Sandy Brown Associates LLP (SBA) has been commissioned Bilfinger GVA to provide acoustic advice in relation to the proposed development at 21 Bloomsbury Street, WC1.

As part of this an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and to set appropriate limits for noise egress from building services plant. As part of refurbishment works, proposals are to place a single condenser within an existing plant enclosure at rooftop level of 21 Bloomsbury Street.

This report presents the survey method, results of the environmental noise survey, and a discussion of acceptable limits for noise emission from building services plant. It also presents an assessment of the plant noise at the nearest noise sensitive receptor to determine compliance with the requirements of the London Borough of Camden.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1, with 21 Bloomsbury Street highlighted in red.

The site is located in the London Borough of Camden (LBC), with the busy Bloomsbury Street (A400) immediately to the east of the site, and the less trafficked Bedford Avenue to the north.

The existing plant area at Level 04 that is to house the new condenser unit has been highlighted by the red area.

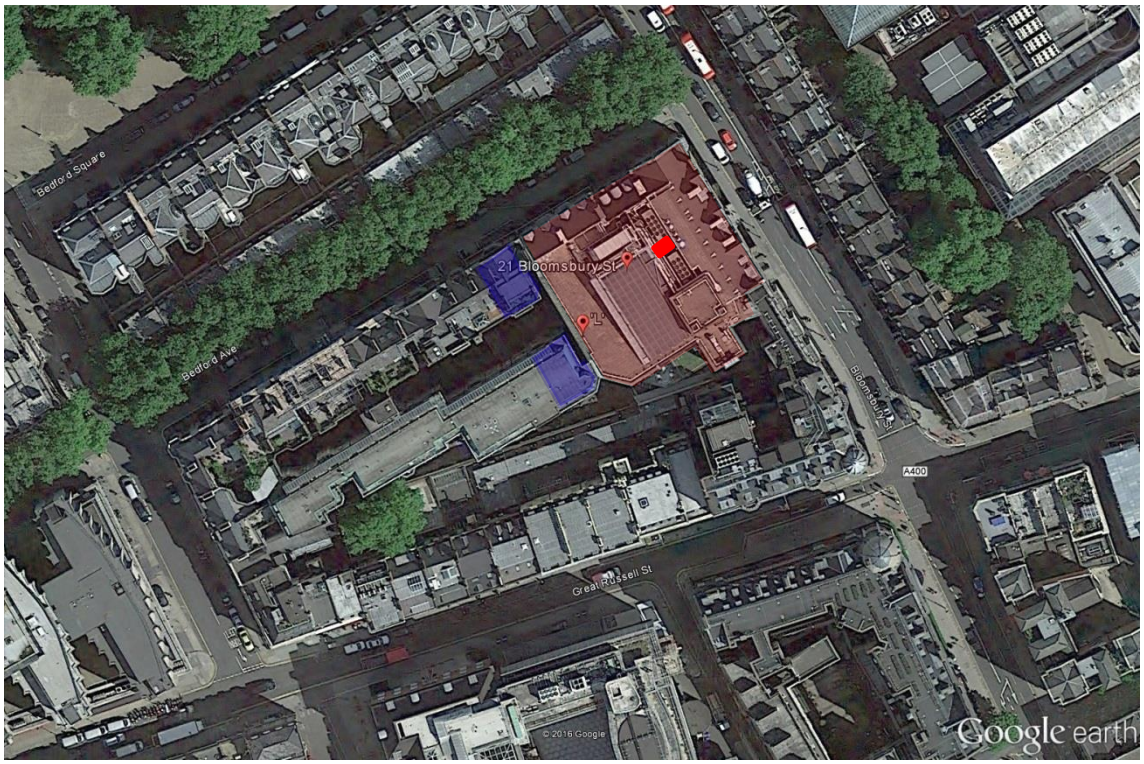


Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Adjacent premises

The nearest noise sensitive properties are upper floor balconies and residential windows at the neighbouring Bedford Mansions, to the west of 21 Bloomsbury Street. These have been shaded in blue in Figure 1.

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 6 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15 minute periods between 15:50 on 2 March 2016 and 11:20 on 8 March 2016. The equipment was installed by Jake Mroz and collected by Eric Ballestero.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided Figure 2. This location was chosen to be representative of the noise levels experienced by the nearest noise sensitive premises.

The microphone was mounted approximately 1.5 m above ground and over 3 m from any other reflective surface, as a free-field measurement.

Figure 2 Noise monitor location relative to the nearest residential window

4 Measurement results

4.1 Observations

The dominant ambient noise sources during daytime periods consisted of rooftop plant belonging to neighbouring properties. Distant construction noise activity (e.g. drilling, impacts due to hammering) were also clearly audible during typical construction working hours (09:00 – 17:00).

The monitoring position was chosen such that existing mechanical services plant supplying 21 Bloomsbury Street, most notably the intake and discharge of two air handling units was screened as much as possible.

Less significant noise sources included heavily screened road traffic, emergency vehicle sirens, along with occasional light aircraft flyovers.

4.2 Unattended measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the time history of the unattended measurements is provided in Appendix B.

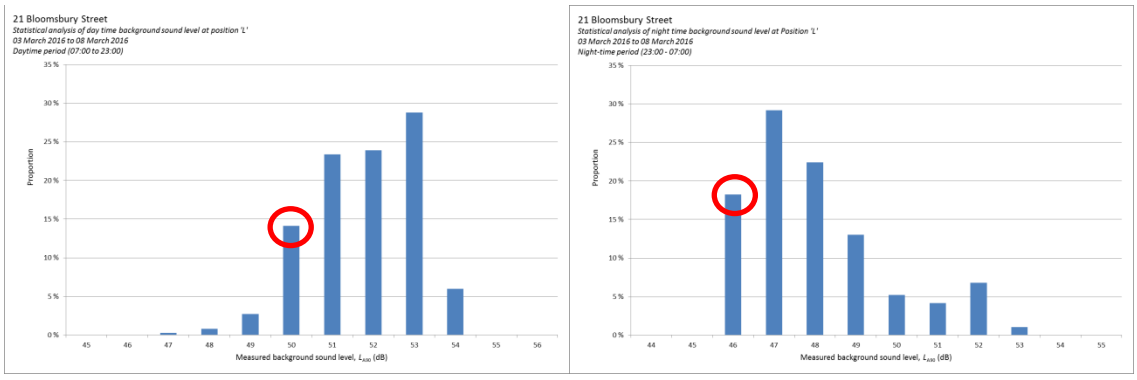
The day and night time free-field ambient noise levels measured during the unattended survey are presented in Table 1.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
2 March 2016	54*	51
3 March 2016	55	50
4 March 2016	54	49
5 March 2016	53	50
6 March 2016	52	49
7 March 2016	54	49

* Measurement not made over full period due to monitoring start and end time (the measurement on 2 March 16 was over 6 hours)

For the purpose of establishing representative background sound levels, typical day and night time background noise levels have been quantified by statistical analysis of the logging measurements. The histograms, along with the background levels derived for day and night-time periods have been presented in Figure 3.



(a) (b)

Figure 3 Statistical analysis of daytime (a) and night-time (b) background sound level at position 'L'

From this analysis, the typical background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 46 dB at night.

5 Assessment criteria

5.1 External noise levels - noise egress

5.1.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

5.1.2 Local Authority criteria

Policy DP28 of Camden Councils Local Development Framework (LDF) adopted in 2010, states the following in relation to noise and vibration:

"Policy DP28 – Noise and Vibration

The council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

(a) Development likely to generate noise pollution; or
(b) Development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's noise and vibration thresholds will not be permitted.

The council will only grant permission for plant or machinery if it can be operated without causing harm to amenity and does not exceed our noise thresholds.

The council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

Camden Councils LDF sets the external noise levels criteria for mechanical plant and machinery to determine applications for planning permission within the borough, as outlined in Figure 5."

Table E: 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$_{LAeq}$

Figure 4 Excerpt from Camden Councils LDF relating to planning criteria for noise and vibration

In summary Camden Councils requirements are:

Plant and machinery noise should not exceed 5 dB below the background noise L_{A90} (dB). Corrections should be applied if the sources exhibit any signs of tonality or impulsivity, as set out in Figure 4.

6 Plant noise limits – noise egress

6.1 Limits

6.1.1 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 2.

Table 2 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,\ 15min}$ dB)
Daytime (07:00-23:00)	45
Night-time (23:00-07:00)	41

The limits set out in Table 2 do not include any attention catching features. The penalties for attention catching features may be significant, and will need to be considered as the building services design progresses.

6.2 Assessment

6.2.1 Proposed plant

As part of refurbishment works, it is proposed a condenser unit will be installed between two existing chillers within an existing plant area on the rooftop of 21 Bloomsbury Street. Manufacturers sound power level data for the proposed condenser unit has been presented in Table 3.

Table 3 Octave band sound power level of the proposed new plant items (dB re 1pW)

Unit	No. of units	Octave band centre frequency (Hz)						
		125	250	500	1k	2k	4k	8k
Daikin RZQG71LBV1	1	71	64	61	60	52	51	43

As a conservative assessment, it has been assumed that the unit will operate continuously on maximum duty settings during the daytime. SBA has been informed that plant will not be in operation during night-time periods (23:00 – 07:00).

Figure 5 indicates the proposed location of the new plant items.

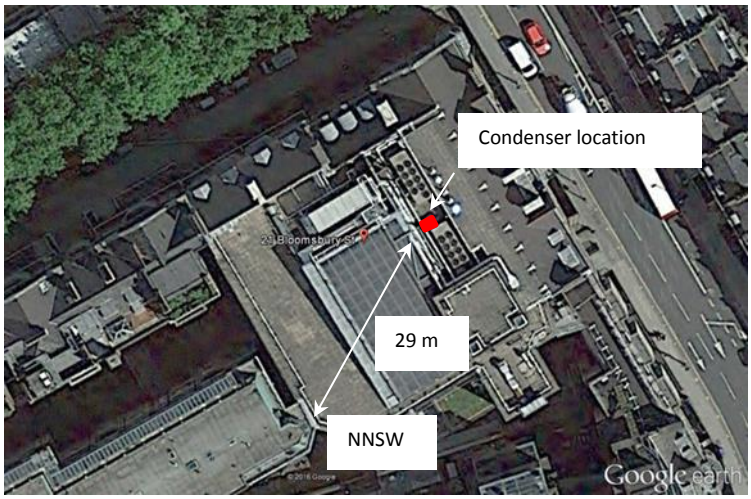


Figure 5 Proposed development with plant location indicated

An assessment of the proposed condenser unit indicated in Figure 5 has been undertaken to the nearest noise sensitive window. The calculation is based on the manufacturer's sound level data, where attenuation is due to both the distance between source and receiver, and screening provided by the 3.5 m wall between the proposed plant location and nearest noise sensitive window.

The noise level measured 1 m external to the worst affected window of each premises is predicted to be $L_{Ar,15min}$ 17 dB at the nearest window. The full calculation is given in Appendix C. These predicted levels comply with the requirements of the London Borough of Camden; consequently no further mitigation is required.

7 Conclusion

The measured representative background sound levels were $L_{A90,\ 15min}$ 50 dB during the day, and $L_{A90,\ 15min}$ 46 dB during the night. On the basis of the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 45 dB during the day and L_{Aeq} 41 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above.

Based on the policy requirements of the London Borough of Camden and on the results of the noise survey, the cumulative noise level emitted from all new plant should not exceed 5 dB below the existing background noise level (L_{A90}), when assessed at 1 m outside the nearest noise sensitive facade, during the proposed hours of operation.

An assessment of the proposed plant item associated with the development has been carried out. The noise level predicted from the proposed condenser unit complies with the requirements of the London Borough of Camden.

Appendix A

Survey details

Equipment

A Rion NL-32 sound level meter was used to undertake the unattended measurements. The calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
NL-32C				
Sound level meter	NL-32/00623762	Rion	13 Oct 17	1510549
Microphone	UC-53A/319234	Rion	13 Oct 17	1510549
Pre-amp	NH-21/76670	Rion	13 Oct 17	1510549
Calibrator	NC-74/34536130	Rion	02 Oct 17	1510534

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meter used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

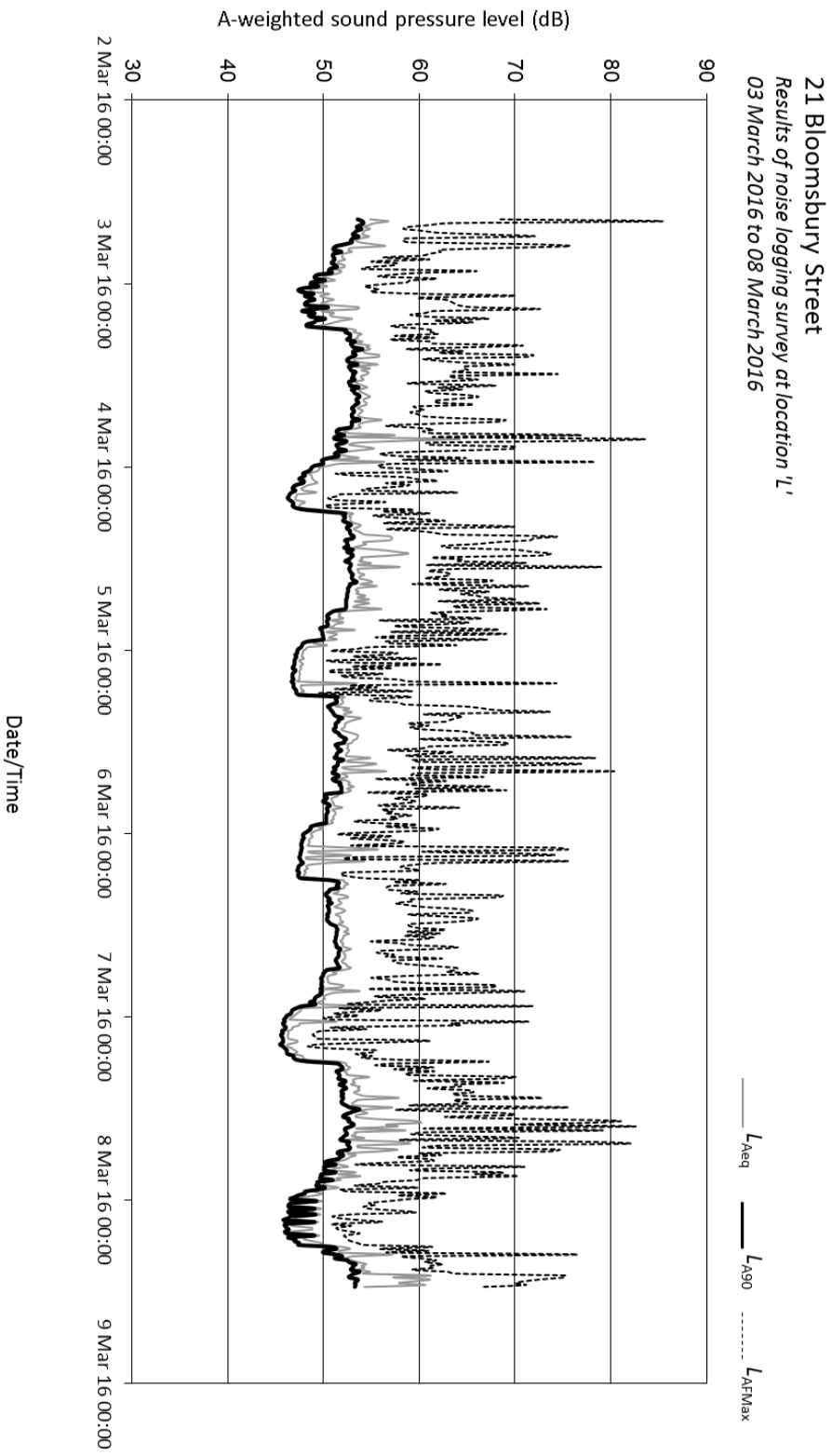
During the unattended measurements carried out on 02 March 2016 and 07 March 2016, weather reports for the area indicated that temperatures varied between 1°C at night and 10°C during the day, the weather was generally clear and dry. Wind speeds were generally < 5m/s, with occasional gusts between approximately 5 m/s and 10 m/s.

Light rain showers occurred throughout Saturday 05 March 2016 however no variation in noise levels were seen to correlate with the weather. These measurements are consequently considered to have obtained a representative sample of noise data.

These weather conditions are considered suitable for obtaining representative noise measurements.

Appendix B

Results of unattended measurements at position 'L'


21 Bloomsbury Street
Results of noise logging survey at location 'L'
03 March 2016 to 08 March 2016
A-weighted sound pressure level (dB)
30
40
50
60
70
80
90
2 Mar 16 00:00
3 Mar 16 00:00
4 Mar 16 00:00
5 Mar 16 00:00
6 Mar 16 00:00
7 Mar 16 00:00
8 Mar 16 00:00
9 Mar 16 00:00
Date/Time
L_{Aeq}
L_{A90}
L_{AFMax}

Appendix C

Detailed calculations

21 Bloomsbury Street										
Rooftop Condenser Unit (Daikin RZQG71LBV1)										
Lw (RZQG71LBV1)	76.0	71.0	64.0	61.0	60.0	52.0	51.0	43.0	L_A=	64.4
Lp calculated to nearest noise sensitive window (rooftop level) [direct path]										
Lp(direct) = Lw(total plant)-R-20log(r)+10log(Q)-11+3										
Lp(direct) = Sound pressure level at 1m from nearest noise sensitive receptor										
Lw(total plant) = Measured sound power level of plant										
r = distance from noise source to 1m from nearest noise sensitive receptor										
Q = directivity factor										
R = Barrier attenuation										
Lw (total plant)	76.0	71.0	64.0	61.0	60.0	52.0	51.0	43.0	L_A=	64.4
20log(r) [r=29]	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2		
10log(Q) [Q= 4]	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0	-11.0		
Facade reflection [+3]	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Screening by PV panel area wall	9.5	11.9	14.8	17.7	20.7	23.8	24.0	24.0		
Lp(direct) no attenuation	35.2	27.8	18.0	12.0	8.0	-3.0	-4.2	-12.2	L_A=	17
					Local Authority Criteria				L_A=	45
							Excess			-28.3