

Internal Ambient Noise Condition No.30 Discharge

Phase 6 A
Green Park Village
Reading



On Behalf of AES Sustainability Consultants
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Revision	Date	Description

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1 Executive Summary

Condition No. 30 requires that internal sound levels are limited to the criteria taken from BS8233 and as set out in RSK's report dated May 2017 for Phase 6A for the Green Park Village Development Reading.

On the instruction of AES Sustainability Consultants this report has been prepared by Acoustic Associates SW Ltd setting out the glazing sound insulation requirements for each of the seven blocks which make up this part of the development.

RSK detailed in their report on-site sound levels and predicted sound levels around parts of each of the seven blocks, the highest being 65 dB $L_{Aeq,day}$ around Block 4/H and the lowest 59 dB $L_{Aeq,day}$ around Block 2/B.

BS8233 recommends internal ambient sound levels to be no more than 35 dB $L_{Aeq,day}$ in living and bedrooms and no more than 30 dB $L_{Aeq,night}$ in bedrooms.

All blocks will be ventilated using centrally ducted MVHR systems avoiding the need for any through window trickle vents.

Once a reasonable allowance has been made of assessment uncertainty the following glazing systems, curtain, casement & doors will need to be;

- Block 7/D glazing systems offering R_w 34 dB, potentially with 6/16/4mm glass configuration,
- Blocks 1/A, 2/B, 3/C, 6/F & 5/G glazing systems offering R_w 37 dB, potentially with 6/16/6.75mm glass configuration,
- Block 4/H glazing systems offering R_w 40 dB, potentially with 10/16/10.7mm glass configuration.

The table below details the assumed octave band sound transmission insulation losses for the complete glazed systems, installed;

Glazing Configuration	R'_w (C, CTR) dB	octave band centre frequency Hz					
		125	250	500	1000	2000	4000
6/16/4mm	34 (-1, -5)	26	22	29	43	42	44
6/16/6.76mm	37 (-2, -5)	25	29	36	41	36	48
10/16/10.76mm	40 (-2, -5)	28	31	39	43	49	61

In this way the requirements of Condition No. 30 can be seen to have been discharged.

2 Planning Condition No. 30 (internal ambient noise)

Planning permission has been granted by Reading Borough Council for the *residential led mixed-use development comprising the construction of 339 residential apartments (Class C3), 556 sqm (GIA) local retail units (Use Classes A1, A2, A3, A4, A5), residents' gym and associated car parking, pedestrian and cycle routes, services and infrastructure, landscaping and other associated works (Phase 6A) (amended)* at Green Park Village, Reading (planning reference 171019).

The consent is subject to a number of Conditions, No. 30 refers to internal noise, namely;

Until a detailed scheme, informed by the Noise and Vibration Assessment Report, ref: 296812-00(03), prepared by RSK, dated May 2017, received 23rd June 2017, has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.

Thereafter, the development shall not be carried out other than in accordance with the approved scheme which shall be completed before any part of the accommodation thereby approved is occupied, unless the Local Planning Authority otherwise agrees in writing.

3 BS8233:2014 Table 4 Sound Levels

Condition 30 requires internal sound levels from M4 and train noise to be limited to the levels set out in Table 4 of BS8233:2014 (Guidance on sound insulation and noise reduction for buildings), namely;

Table 4 Indoor ambient noise levels for dwellings

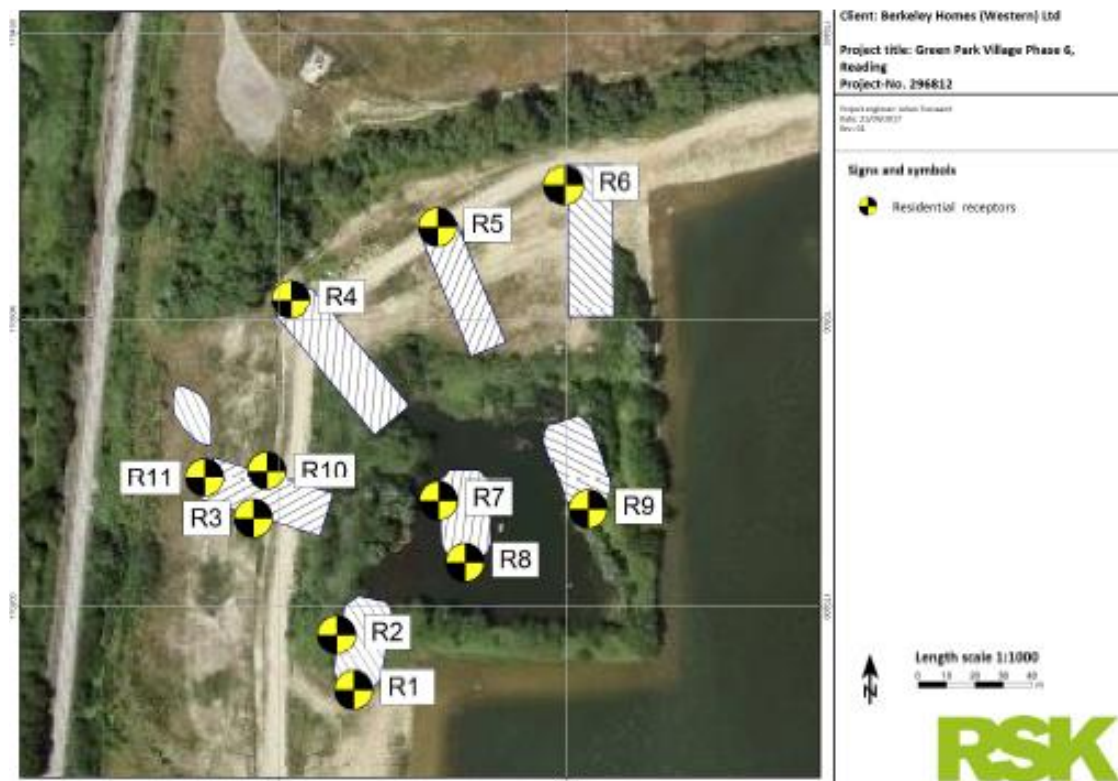
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4 External Sound Levels (RSK Report)

Condition No. 30 refers to the RSK's Noise and Vibration Assessment Report, ref: 296812-00(03), dated May 2017. In this it sets out the results of their on-site sound survey and predicted sound levels around the seven apartment blocks which form Phase 6A of this large development.

RSK observe that the soundscape is dominated by the noise of traffic passing along the M4 motorway 1.2 km to the south and a railway line running north-south on the western boundary of the site.

At Section 3.3 of RSK's report detailed their predicted external sound levels and the receptor positions shown on the image taken from their report below;



An extract of BroadwayMalyan's drawing No. 30934-13-PL-P6A below shows the preliminary layout of the site and identifies each of the 7 blocks A to H (noted there is no Block E).



RSK table 3-9 is repeated below and shows the predicted external façade sound levels;

Receiver	Period	Predicted Façade Level $L_{Aeq, T}$ dB	BS8233 Internal Ambient Noise Criteria $L_{Aeq, T}$ dB	Attenuation Required By Building Envelope $L_{Aeq, T}$ dB
Block A R1	Daytime	61	35	26
	Night time	59	30	29
Block A R2	Daytime	61	35	26
	Night time	60	30	30
Block H R3	Daytime	63	35	28
	Night time	61	30	31
Block G R4	Daytime	63	35	28
	Night time	61	30	31
Block F R5	Daytime	60	35	25
	Night time	58	30	28
Block D R6	Daytime	58	35	23
	Night time	56	30	26
Block B R7	Daytime	58	35	23
	Night time	56	30	26
Block B R8	Daytime	56	35	21
	Night time	54	30	24
Block C R9	Daytime	56	35	21
	Night time	54	30	24
Block H R10	Daytime	60	35	25
	Night time	58	30	28
Block H R11	Daytime	65	35	30
	Night time	63	30	33

This shows that the greatest required façade attenuation is 33 dB for Block H and the lowest 21 dB for Block B.

A façade with an open window (for ventilation purposes) will provide between 10 and 15 dB loss outside to inside. Here even for the least exposed block, Block B, the windows will have to be closed to achieve the 21 dB loss required.

4.1 Ventilation

The developer Berkeley Homes, has confirmed that all blocks will be ventilated using MVHR systems therefore there will be no through façade openings allowed in the assessment for the required façade constructions.

4.2 External Wall Design

The developer has provided details of the proposed wall construction for all blocks, the table below details these;

Block	Wall Type			
Block 1	1a	2a		
Block 2	1a	2a		
Block 3	1a	2a		
Block 4	1b	1c	2c	
Block 5	1c	2b	2c	
Block 6	1b	1c	2b	2c
Block 7	1b	1c	2b	2c

The table below details the make-up of each of these wall types along with their estimated¹ sound transmission loss;

Construction Ref ¹	Insul Rw	Wall makeup
1a	63 (-1, -4)	2x15mm Soundbloc - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick
1b	64 (-1, -4)	15mm Soundbloc - 15mm MR board - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick
1c	64 (-1, -4)	15mm Soundbloc - 15mm MR board - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick
2a	65 (-2, -6)	15mm plasterboard - Metal stud 80mm cavity - 2x15mm Soundbloc - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick
2b	66 (-2, -6)	15mm plasterboard - Metal stud 80mm cavity - 15mm Soundbloc - 15mm MR Board - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick
2c	66 (-2, -6)	15mm plasterboard - Metal stud 80mm cavity - 15mm Soundbloc - 15mm MR Board - 100mm metal stud - 100mm M/W - 15mm Cement board - 100mm Rockwool slab - 55mm Cavity 102mm Brick

The table below shows the spectral performance for the three main types of wall constructions;

Wall Type	octave band centre frequency Hz						
	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB
1a	39	50	52	61	65	66	75
1b	33	50	53	61	66	67	75
2c	38	50	54	62	67	70	72

The wall construction offering the lowest sound transmission loss can be seen to be Type 1A but still at level of 63 dB R_w.

¹ Using Marshall Day Acoustics Insul version 8.0.0

4.3 Predicted External Sound Levels

Based on RSK's predicted external façade sound levels (R1 to 11) a new acoustic model has been formed using Wolfe IMMI software implementing the requirements of ISO9613 Part 2² assuming only two contributory sources, both represented by line sources for the M4 and the railway line. The power levels for each has been manipulated to provide the best fit to RSK predicted levels. The table below shows the comparison between RSK predicted levels and our best fit ones;

Receiver	Period	RSK predicted façade levels dB LAeq,T	IMMI predicted façade levels at RSK receivers		IMMI predicted maximum façade levels dB LAeq,T
			dB LAeq,T	diff' dB	
Block A R1	Daytime	61	62	1	62
	Night time	59			
Block A R2	Daytime	61	61	0	
	Night time	60			
Block B R7	Daytime	58	59	1	61
	Night time	56			
Block B R8	Daytime	56	61	5	
	Night time	54			
Block C R9	Daytime	56	59	3	61
	Night time	54			
Block D R6	Daytime	58	59	1	59
	Night time	56			
Block F R5	Daytime	60	59	-1	60
	Night time	58			
Block G R4	Daytime	63	63	0	63
	Night time	61			
Block H R3	Daytime	63	63	0	65
	Night time	61			
Block H R10	Daytime	60	61	1	
	Night time	58			
Block H R11	Daytime	65	65	0	
	Night time	63			

This table shows that our predicted levels are within 1 dB of RSK's for all blocks except Block B (our predicted levels are 5 dB higher than RSK's) and Block C, where ours are 3 dB higher. The final column on the right shows our highest predicted levels right around the entire envelope of each block, not just at RSK's receiver points.

² ISO 9613-2:1996 (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation) including ISO/TR 17534-3:2015 (Acoustics - Software for the calculation of sound outdoors - Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1).

4.4 Proposal Drawings

The following Brookes Architects drawings have been used for this assessment;

Floor plans Block 1 G259 – BAL-01-00-DR-A-10-0100 to 0201
Block 2 G259 – BAL-02-00-DR-A-10-0100 to 0201
Block 3 G259 – BAL-03-00-DR-A-10-0100 to 0201
Block 4 G259 – BAL-04-00-DR-A-10-0100 to 0201
Block 5 G259 – BAL-05-00-DR-A-10-0100 to 0202
Block 6 G259 – BAL-06-00-DR-A-10-0100 to 0202
Block 7 G259 – BAL-07-00-DR-A-10-0100 to 0202

Elevations 30934-A-P6-05-001- GA Elevations Typical Block A-C
30934-A-P6-05-002- GA Elevations Typical Block D
30934-A-P6-05-003- GA Elevations Typical Block F
30934-A-P6-05-004- GA Elevations Typical Block G
30934-A-P6-05-005- GA Elevations Typical Block H

Window G259-BAL-XX-XX-DR-A-31 Window – external door glazing Blocks 1,2 & 3
Detailed design for remaining blocks under development

4.5 Highest external sound levels and façade requirements for each Block

The table below details for each block the flat with the highest external sound levels, the floor that it is on, the area and type of external walling as well as the size of the glazed elements;

Block	Block 1/A		Block 2/B		Block 3/C		Block 4/H		Block 5/G		Block 6/F		Block 7/D	
highest ext' sound level	5th floor		5th floor		5th floor		4th floor		4th floor		8th floor		7th floor	
flat No.	Flat 1.5.5 Liv	Flat 1.5.5Bed	Flat 2.5.5 Liv	Flat 2.5.5Bed	Flat 3.5.5 Liv	Flat 3.5.5Bed	Flat 4.4.5 Liv	Flat 4.4.5 Bed	Flat 5.4.7 Liv	Flat 5.4.7 Bed	Flat 6.8.4 Liv	Flat 6.8.4 Bed	Flat 7.7.1 Liv	Flat 7.7.1 Bed
Net Wall Area m2	0.0	4.0	0.0	4.0	0.0	4.0	21.3	6.5	10.0	7.0	11.6	6.2	12.3	5.7
Wall R'w dB	63	63	63	63	63	63	64	64	64	64	64	64	63	63
Glazing Area m2	14.3	4.7	14.3	4.7	14.3	4.7	17.4	4.7	17.4	2.3	11.9	4.7	11.9	4.7
Glazing R'w dB	34	34	34	34	34	34	37	37	37	37	34	34	34	34
Highest ext' Day Laeq,T dB	62	62	61	61	61	61	65	65	63	63	60	60	59	59
Highest ext' Night Laeq,T dB	60	60	59	59	59	59	63	63	61	61	58	58	57	57
Predicted Int' Day Laeq dB	34	29	33	28	34	29	34	28	32	23	31	27	30	26
Predicted Int' Night Laeq dB	32	27	31	26	32	27	32	26	30	21	29	25	28	24

	meets 8233 criteria 35 dB daytime living and bedrooms and 30 dB night time in bedrooms
	meets BS8233 criteria but with a 3 dB margin
	no requirement for living rooms at night
63	façade type 1a
64	façade type 1b & c
34	glazing system potentially with 6/16/4mm glass configuration
37	glazing system potentially with 6/16/6.75mm glass configuration

The internal noise criteria set out in Table 4 of BS8233 can be achieved with the lightest glazing system, potentially including glass with the configuration of 6/16/4mm in Blocks A, B,

C, D & F, Blocks G & H will require a higher system, potentially with 6/16/6.75mm configuration.

4.6 Uncertainty

The selections above have been arrived at, without any allowance for uncertainty, in the measurement of surveyed sound levels, due to variations in traffic flows, weather conditions and the measurement equipment itself, the acoustic modelling, or break-in calculations and the actual performance of the facade elements as installed. There will be some uncertainty associated in each element of the noise assessment. However, these uncertainties are unlikely to all be positive and accumulative.

ISO 9613 Part 2³, attenuation of sound during propagation outdoors: General method of calculation the procedure for the calculation of environmental sound levels, for example, states it is accurate to within ± 3 dB.

An overall 3 dB margin of uncertainty is often allowed for in assessment of this natural to provide a robust criterion to which the developer can use to select, in this case, their glazing systems.

4.7 Robust glazing system requirements

The table shown in 4.5 above has been reworked to show the glazing system requirements, once a 3 dB allowance for uncertainty has been allowed for;

Block	Block 1/A		Block 2/B		Block 3/C		Block 4/H		Block 5/G		Block 6/F		Block 7/D	
highest external sound level	5th floor		5th floor		5th floor		4th floor		4th floor		8th floor		7th floor	
flat No.	Flat 1.5.5 Liv	Flat 1.5.5 Bed	Flat 2.5.5 Liv	Flat 2.5.5 Bed	Flat 3.5.5 Liv	Flat 3.5.5 Bed	Flat 4.4.5 Liv	Flat 4.4.5 Bed	Flat 5.4.7 Liv	Flat 5.4.7 Bed	Flat 6.8.4 Liv	Flat 6.8.4 Bed	Flat 7.7.1 Liv	Flat 7.7.1 Bed
Net Wall Area m2	0.0	4.0	0.0	4.0	0.0	4.0	21.3	6.5	10.0	7.0	11.6	6.2	12.3	5.7
Wall R'w dB	63	63	63	63	63	63	64	64	64	64	64	64	63	63
Glazing Area m2	14.3	4.7	14.3	4.7	14.3	4.7	17.4	4.7	17.4	2.3	11.9	4.7	11.9	4.7
Glazing R'w dB	37	37	37	37	37	37	40	40	37	37	37	37	34	34
Highest ext' Day Laeq,T dB	62	62	61	61	61	61	65	65	63	63	60	60	59	59
Highest ext' Night Laeq,T dB	60	60	59	59	59	59	63	63	61	61	58	58	57	57
Predicted Int' Day Laeq dB	30	25	30	25	30	25	30	25	29	20	30	26	30	26
Predicted Int' Night Laeq dB	28	23	28	23	28	23	28	23	27	18	28	24	28	24

	meets 8233 criteria 35 dB daytime living and bedrooms and 30 dB night time in bedrooms
	meets BS8233 criteria but with a 3 dB margin
	no requirement for living rooms at night
63	façade type 1a
64	façade type 1b & c
34	glazing system potentially with 6/16/4mm glass configuration
37	glazing system potentially with 6/16/6.75mm glass configuration
40	glazing system potentially with 10/16/10.7mm glass configuration

³ ISO 9613-2:1996

This shows that in order to make a reasonable allowance for uncertainty in the assessment process the glazing systems, curtain, casement & doors will need to be;

- Block 7/D glazing systems offering R'_w 34 dB, potentially with 6/16/4mm glass configuration,
- Blocks 1/A, 2/B, 3/C, 6/F & 5/G glazing systems offering R'_w 37 dB, potentially with 6/16/6.75mm glass configuration,
- Block 4/H glazing systems offering R'_w 40 dB, potentially with 10/16/10.7mm glass configuration.

The table below details the assumed octave band sound transmission insulation losses for the complete glazed systems, installed;

Glazing Configuration	R'_w (C, CTR) dB	octave band centre frequency Hz					
		125	250	500	1000	2000	4000
6/16/4mm	34 (-1, -5)	26	22	29	43	42	44
6/16/6.76mm	37 (-2, -5)	25	29	36	41	36	48
10/16/10.76mm	40 (-2, -5)	28	31	39	43	49	61