



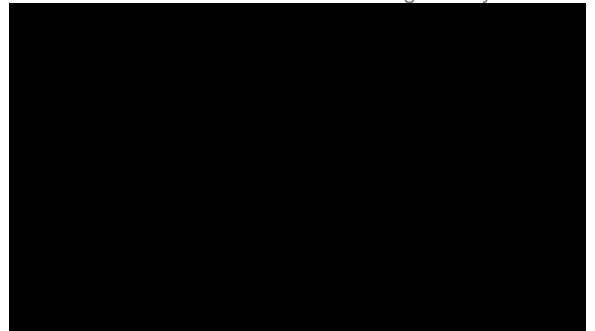
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PROJECT TECHNICAL MEMORANDUM

JOB TITLE : Bakers Quay Phase 2, Gloucester
REF : HT: 29549/PTM1
DATE : 18 March 2022
FROM : [REDACTED]
ISSUED TO : Rokeby Developments Ltd



RE: BAKER QUAY PHASE 2, ACOUSTIC DESIGN CRITERIA

1.0 Introduction

This technical memorandum sets out the proposed acoustic requirements for the Bakers Quay Phase 2 residential development in Gloucester and provides acoustic design advice to assist the design team. The advice presented herein has been formulated on the basis of achieving the requirements of the Building Regulations, local planning requirements established for the Phase 1 scheme and other relevant British Standards/design guides.

2.0 General Requirements

2.1 Relevant Standards & Legislation

All design, works, materials, installations and tolerances are to be fully in accordance with the following key documents, amongst other relevant standards/guidelines:-

- Building Regulations' Approved Document E: 2003 Edition.
- National & local planning requirements (NPPF, EPU & Planning Conditions).
- Statutory noise nuisance legislation.
- British Standard BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'.
- British Standard BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'.
- CIBSE Guides issued by the Chartered Institution of Building Services Engineers.

The key standards and legislation documents are reviewed and discussed in Appendix B.



2.2 Employer's Brief

We understand that there is no specific Employer's Brief for the scheme. As such, all guidance will be provided based on achieving the requirements of Building Regulations, any Local Authority requirements and the requirements of any other suitable guidance.

2.3 Local Authority Requirements

The reference to the planning conditions stipulated for the Phase 1 development and our subsequent liaison with the Local Authority, it is likely that Gloucester City Council would impose the following conditions of planning:

External Plant/Machinery

"The rating level of any noise generated by mechanical plant associated with the development shall not exceed the pre-existing background level by more than 0 dB(A) at any time. The noise levels shall be determined at noise sensitive premises, and measurements and assessment shall be made in accordance with BS 4142: 2014 Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas.

External Noise Intrusion into Residential Units

"No development of any building including residential units shall commence until a comprehensive scheme for mitigation of i) 'Inside Bedrooms' (30dB(A) $L_{Aeq,8hr}$) (45dB(A) L_{Amax}) and; ii) 'Dwellings, indoor' (35dB(A) $L_{Aeq,16hr}$) for all residential units within that building that will meet the WHO Guidelines for Community Noise 1999 has been submitted to and approved in writing by the Local Planning Authority. All works (façade, glazing elements, etc) that form part of the scheme shall have regard to BS8233: 2014 – Guidance on Sound Insulation and Noise Reduction for Buildings and the approved details shall be completed in full prior to first occupation of any of the residential units within that building.

Noise Testing

"Prior to occupation of any residential units within a building, noise testing shall be carried out by a professional and competent contractor (Member of the Institute of Acoustics) in 5% of the units within that building (to be agreed in writing in advance by the Local Planning Authority) to establish whether the noise criteria as specified via condition X has been met through approved mitigation measures. The testing procedure shall be submitted to the Local Planning Authority for approval at least seven days prior to noise testing being carried out. If the results are not



satisfactory, a revised approach shall be provided to meet the requirements in condition x for the Local Planning Authority’s approval and the revised approach shall be implemented in full prior to first occupation of any of the residential units within that building. “

2.4 Pre-Completion Acoustic Testing

Pre-completion testing will be required to prove compliance with the requirements of ADE Requirement E1. It is the duty of the person carrying out the building work to ensure appropriate sound insulation testing is implemented according to the guidance set out in ADE across separating walls and floors. The locations for such tests will be selected by the Building Control Body, with the measurements made by an approved specialist organization, such as Hann Tucker Associates.

Building Control should stipulate at least one set of tests for every ten “dwellings” (10%), assuming no test fails. The sound insulation criteria have built in allowances for measurement uncertainty, so if any test does not achieve the criteria by any margin the test has failed. If a test fails the Contractor will need to determine the cause. It will then be necessary for the Contractor to undertake appropriate remedial treatment, to the satisfaction of Building Control. The rate of testing should be increased until Building Control is satisfied the problem has been solved.

3.0 Acoustic Design Criteria

3.1 External Building Fabric

The following table outlines the proposed noise intrusion limits to be achieved.

Area	Location	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Residential	Living Room	35 dB $L_{Aeq,16hr}$	-
	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB* L_{Amax}
Non-habitable Areas	Corridor, Lobby/Reception, Gym, Office	NR 40 $L_{eq,1hr}$	
	Cinema	NR 30 L_{eq}	

* not to be exceeded more than 10-15 times per night.

3.2 Internal Building Fabric

Sound Insulation to Residential Areas

The following sound insulation requirements shall apply to the residential internal building fabric.



Function	Element	Sound Insulation Criterion		Notes
		Airborne (Min Value)	Impact (Max Value)	
Element that separates an apartment from any other part of the building	Party Wall	45 dB $D_{nT,w} + C_{tr}$	-	See Note 1 & 2
	Party Floor	45 dB $D_{nT,w} + C_{tr}$	62 dB $L'_{nT,w}$	See Note 2 & 3
Element within an apartment that divides a bedroom (or room containing a water closet) from another room	Internal Wall (No door)	40 dB R_w	-	-

$D_{nT,w} + C_{tr}$ & $L'_{nT,w}$ are on-site sound insulation descriptors.

R_w is a laboratory sound insulation descriptor (no on-site requirement applies).

- Note 1:** Party walls to corridors containing an entrance door cannot be accurately tested & do not form part of the PC Test scheme. For the element of corridor wall containing the entrance door, the sound level difference between the apartment and corridor will be largely dictated by the door's sound reduction performance. The tabulated sound insulation criterion is unlikely to be achieved and there would be no discernible acoustic benefit from installing a highly-rated party wall. The corridor wall rating in this area could therefore be reduced subject to client and Building Control approval.
- Note 2:** The tabulated airborne criterion shall apply as a minimum requirement, but a further requirement applies for BOH rooms expected to generate high noise levels, such as plant rooms or bin stores. The required airborne sound insulation rating shall be determined by considering [a] anticipated/specified source noise levels (e.g. from mechanical plant) and [b] acceptable noise levels within the apartment. This is discussed further in the Sound Insulation to Non-Standard Areas Section.
- Note 3:** The tabulated impact criterion need not apply to a party floor where the receive room (below floor) is not a dwelling or of other sensitive useage (e.g. back of house space).

Sound Insulation to Non-Standard Areas

For separating elements between non-residential spaces (and between a residential and non-residential space) appropriate sound reduction performance requirements for walls and floors have been assigned based on the following.

Reasonable' anticipated maximum sound levels in rooms as below.

Room	Anticipated Reverberant Activity Noise Level L_{max} (dB) Octave Band Centre Frequency (Hz)						
	63	125	250	500	1000	2000	4000
Café Unit	71	76	79	78	75	74	80
Co-working Office	Conventional office use.						
Residential Lounge/Work from Home Space	70	75	75	75	75	80	80

Where non-residential spaces (including typical plant rooms) are adjacent to apartments maximum activity noise levels should be controlled to at least 5 dB below anticipated 'background' noise levels (per octave band) within the residential space.



The ‘background’ noise levels in apartments are expected to be between NR 15 and NR 20 when considering contributions from traffic noise intrusion and whole-house ventilation systems.

Based on the above, the following on-site specifications are proposed:

WALLS

Location	Minimum Airborne Sound Insulation Value
Café Unit to Apartment	Min “ADE” ^{**} + 50 dB D _{nT,w}
Co-Working Office to Apartment	Min “ADE” ^{**}
Residential Lounge/Work from Home Space to Apartment	Min “ADE” ^{**} + 50 dB D _{nT,w}
Bin Store to Apartment	Min “ADE” ^{**} + 55 dB D _{nT,w}

^{**}“ADE” refers to minimum Building Regulations’ Approved Document E requirements

FLOORS

Location	Minimum Airborne Sound Insulation Value
Café Unit to Apartment	Min “ADE” + 50 dB D _{nT,w}
Co-Working Office to Apartment	Min “ADE” ^{**}
Residential Lounge/Work from Home Space to Apartment	Min “ADE” ^{**} + 50 dB D _{nT,w}
Bin Store to Apartment	Min “ADE” ^{**} + 55 dB D _{nT,w}

^{**}“ADE” refers to minimum Building Regulations’ Approved Document E requirements.

It is recommended that the separating elements between the bin stores and the apartments located in both the Heritage Block and the Tower Block are designed to achieve an airborne sound insulation value of 55 dB D_{nT,w}. While there are a number of partitions which could achieve this performance, we advise that the wall 215 mm dense block wall is installed for all bin store walls, with an independent plasterboard lining on the apartment side. Furthermore, it may be prudent to provide additional precautionary measures to mitigate noise transfer to the adjacent bedroom, namely a guardrail around the perimeter of the bin store. This should prevent large bins from banging into the party wall and disturbing sleeping residents

Finishes in Common Parts

ADE2003 requirement E3 states sound absorbent finishes are required to control reverberation in residential corridors providing direct access to apartments (unless alternative means to satisfy are provided). Stairwells with doors separating them from communal corridors, and that have no apartments opening into them, are not subject to the requirements of ADE E3.

There are two ways of complying with ADE E3, which are Method A or Method B:



Method A

Method A provides a minimum surface area of wall/ceiling to be treated with sound absorption.

For entrance halls, corridors and hallways, an area equal to or greater than the floor area should be covered with a Class C performing absorber (or better).

For stairwells, the combined surface area of the stair treads, the upper surface of the landings (excluding ground floor), and the ceiling area of the top floor should be calculated. Either of the following methods would comply with the ADE E3 Method A requirements, providing the absorptive material is evenly distributed between all floors:

- Cover an area equal to the calculated area with a Class D performing sound absorber;
- Alternatively, cover an area equal to 50% of the calculated area with a Class C performing sound absorber.

Method B

Method B takes into account the existing absorption in the room. It can provide flexibility in the amount of absorption needed within the space to comply with ADE E3.

To assess the extent of absorption required, octave band calculations (250 Hz to 4kHz) are required based on the proposed finishes, to show the following absorption areas are provided:

- For entrance halls provide $\geq 0.20 \text{ m}^2$ of absorption area for every cubic metre;
- For corridors/hallways provide $\geq 0.25 \text{ m}^2$ of absorption area for every cubic metre.

The additional absorptive material that is required should evenly distributed throughout the space.

Method B is intended only for corridors, hallways, and entrance halls, as it is not well suited to stairwells.

Non-Residential Areas

In certain other areas, sound absorbent finishes would be recommended to control reverberant noise build up and promote a comfortable environment to suit the spaces intended use. We would propose the following guideline reverberation time targets in finished, furnished and unoccupied rooms.



Location	Guideline Reverberation Time Target, T_{mf}
Café Unit	≤ 1.0 s
Co-Working Office	≤ 1.0 s
Residential Lounge/Work from Home Space	≤ 1.5 s

N.B There is no requirements to achieve the above. The limits are provided as guidance.

3.3 Internal Building Services Noise/Vibration

Noise and vibration transfer from mechanical services plant shall be controlled such that:-

- Noise levels does not exceed the following Noise Rating (NR) levels when measured with a precision grade sound level meter set to “fast” response.

Area	MEP Upper Noise Limit to Internal Areas (L_{eq})	
	Trickle (Background)	Boost
Bedroom	Day – NR30 Night - NR25	NR 35
Living Room / Kitchen	Day - NR30	
Bathroom, En-suite	NR40	
Common Part	NR40	
Co-Working Space, Office	NR40	
BoH	NR50	
Plantroom	To suit adjacent occupied areas*	

“NR” refers to Noise Rating curves as defined in ISO R 1996.

* Hann Tucker to be asked to review plant room constructions once plant selections have been made.

- Noise from building services that do not directly serving the space must not be dominant and should achieve a level 10 NR curve lower than the above.
- No noise source to give rise to audible tones or rattles.
- Vibration transfer from M&E services to internal occupied areas shall not exceed 0.01 m/s² peak based on the W_b weighting as defined within BS 6472-1: 2008 "Guide to Evaluation of Human Exposure to Vibration in Buildings".

The above levels are specified as the $L_{Aeq,30s}$ at 1.2 m above the floor level at a position no closer than 1 m from a wall in the absence of activity noise and noise ingress. Cooker hood noise levels should ideally not exceed NR 55 at any location 1 m from the hood grille.



Smoke extract systems shall be designed so as not to exceed NR 55 in any internal occupied area to ensure emergency announcements are clearly audible. Elsewhere (e.g. BOH), no limit is normally applied during an emergency although it will be important to ensure emergency alarms and announcements are clearly audible/intelligible.

3.4 External Plant Noise

Normal Plant

We understand that planning conditions relating to plant noise egress have been stipulated by Gloucester City Council, and is as follows:

“The cumulative noise assessment level (Excess of rating level over background level (LA90)) of sound emitted from any fixed plant or machinery associated with the development hereby permitted shall not exceed 0 dBA at the nearest noise sensitive receptor(s). All measurements shall be made in accordance with the methodology of BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.”

Therefore, following the results of our background noise survey undertaken between 11:30 am on Friday 25 February 2022 and 11:30 am on Tuesday 1 March 2022, the cumulative levels of plant noise egress should be controlled to the following plant noise rating levels at 1m from any noise sensitive receptor.

Period	BS 4142 Plant Noise Rating Limit, L _{Ar,Tr} (dB)
Daytime (07:00-23:00)	47
Night-time (23:00-07:00)	38

Noise shall be assessed in accordance with BS 4142:2014 with corrections applied for any plant emitting noise of a tonal or irregular quality.

Emergency Plant

For emergency equipment, e.g. generator and smoke extract fans, the noise output during an emergency would be inconsequently provided they do not compromise the audibility of fire alarms in all private/public outdoor spaces.



Maintenance testing should be schedule for weekday daytime (office) hours only and limited to only brief periods of operation. During these brief periods, a noise limit of 60 dB L_{Aeq} at the nearest receptors considered reasonable, as this corresponds with the prevailing daytime ambient noise levels in the area.

3.5 Amenity & Commercial Unit Operations

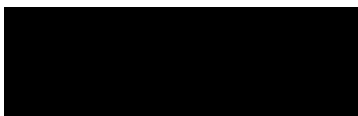
At ground floor level 1no. commercial unit is proposed as part of the development. Considering the prevailing environmental noise climate at the site, we would expect that noise egress via the unit frontage from most general commercial uses (e.g. restaurant, café, shop) should be readily controllable. However, for completeness we advise that operational noise break-out from any proposed use is controlled to no more than 5 dB below the existing background noise level as follows:

Period	Commercial Noise Break-out Limit, L_{Aeq} (dB)
Daytime (07:00-23:00)	42 dBA
Night-time (23:00-07:00)	33 dBA

Should the operation include music noise, we advise that the above limits are reduced by a further 5 dB

We trust the above is clear and of use, however, if you have any questions please let us know.


for HANN TUCKER ASSOCIATES



Appendix A

Relevant Acoustic Standards & Legislation

Building Regulations' Approved Document E

B.1.1 Party Walls & Floors

Requirement E1 of Approved Document E: 2010 Edition (ADE) covers protection against sound from other parts of the building and adjoining buildings. In this development, apartments shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.

The normal way of satisfying Requirement E1 is to build separating walls and floors together with the associated flanking constructions, in such a way that they achieve the on-site sound insulation values shown below.

Element	Airborne Sound Insulation $D_{nT,w} + C_{tr}$	Impact Sound Insulation $L'_{nT,w}$
Separating Walls	≥ 45 dB	-
Separating Floors	≥ 45 dB	≤ 62 dB

In the case of walls or floors separating an apartment from communal or non-residential spaces, reasonable resistance to sound will require at least the standard of sound insulation shown above. This will include, for example, walls and floors separating dwellings from corridors, stair cores, lift shafts, retail/commercial units, plantrooms, etc.

The performance of separating walls and floors between apartments would usually be verified by undertaking pre-completion testing, as discussed in the Report.

B.1.2 Internal Walls & Floors (within Apartments)

Requirement E2 of ADE covers protection against sound *within* apartment, so that internal walls and floors between a bedroom, or a room containing a water closet, and other rooms provide reasonable resistance to sound.

This requirement does not apply to internal walls which contain a door or walls separating an en-suite toilet from the associated bedroom.

The normal way of satisfying Requirement E2 will be to use constructions for new internal walls and floors that provide the laboratory sound insulation values set out in the table below.

Element	Airborne Sound Insulation R_w
Internal Walls	40
Internal Floors	40

As these are laboratory values there is no requirement for an on-site performance or pre-completion testing.

B.1.3 Control of Reverberation in Common Parts

Requirement E3 of ADE covers reverberation in common internal parts of buildings containing dwellings, but only applies to areas that give access to the dwellings. The common internal parts of buildings which contain dwellings shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

The intention is to prevent excessive build up of sound in corridors, stairwells, hallways and entrance halls and in doing so reduce the noise transmitted to adjoining rooms.

It is our understanding that the ADE requirement does not apply to areas that do not give direct access to rooms for residential purpose. The requirements for this development should be clarified with Building Control as it will depend upon their interpretation.

The simplest method (Method A) of determining ADE compliance is to cover 100% of the ceiling area of corridors and entrance halls with a Class C absorber.

Alternatively the existing absorption provided by all surfaces can be determined and the extra absorption required calculated. In some cases, this method (Method B) may allow greater flexibility in meeting the requirements of E3 and require less additional absorption than the Method A.

B.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF, March 2012) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

B.4 BS 8233

British Standard 8233:2014 “Sound insulation and noise reduction for buildings” recommends design criteria for internal ambient noise levels for dwellings. It states that it is desirable that internal ambient noise levels do not exceed the following guidelines:

Room Type	07:00-23:00 hrs	23:00-07:00 hrs
Living Rooms	35 dB $L_{Aeq,16hr}$	-
Bedrooms	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

The document goes on to state that the above target levels may be relaxed by 5 dB and reasonable internal conditions would still be achieved. This relaxation could be applied where there is a need for housing in a noisy area.

For outdoor living spaces, an upper guideline value of 55 dB $L_{Aeq,T}$ is quoted.

B.5 BS 4142

BS 4142: 2014 describes methods for rating and assessing the effects of outdoor sound levels, of an industrial and/or a commercial nature, “on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident”. The impact of a specific sound is indicated by subtracting the existing background noise level from the rating level (i.e. noise level from the proposed items of plant/machinery/etc plus any acoustic feature corrections)