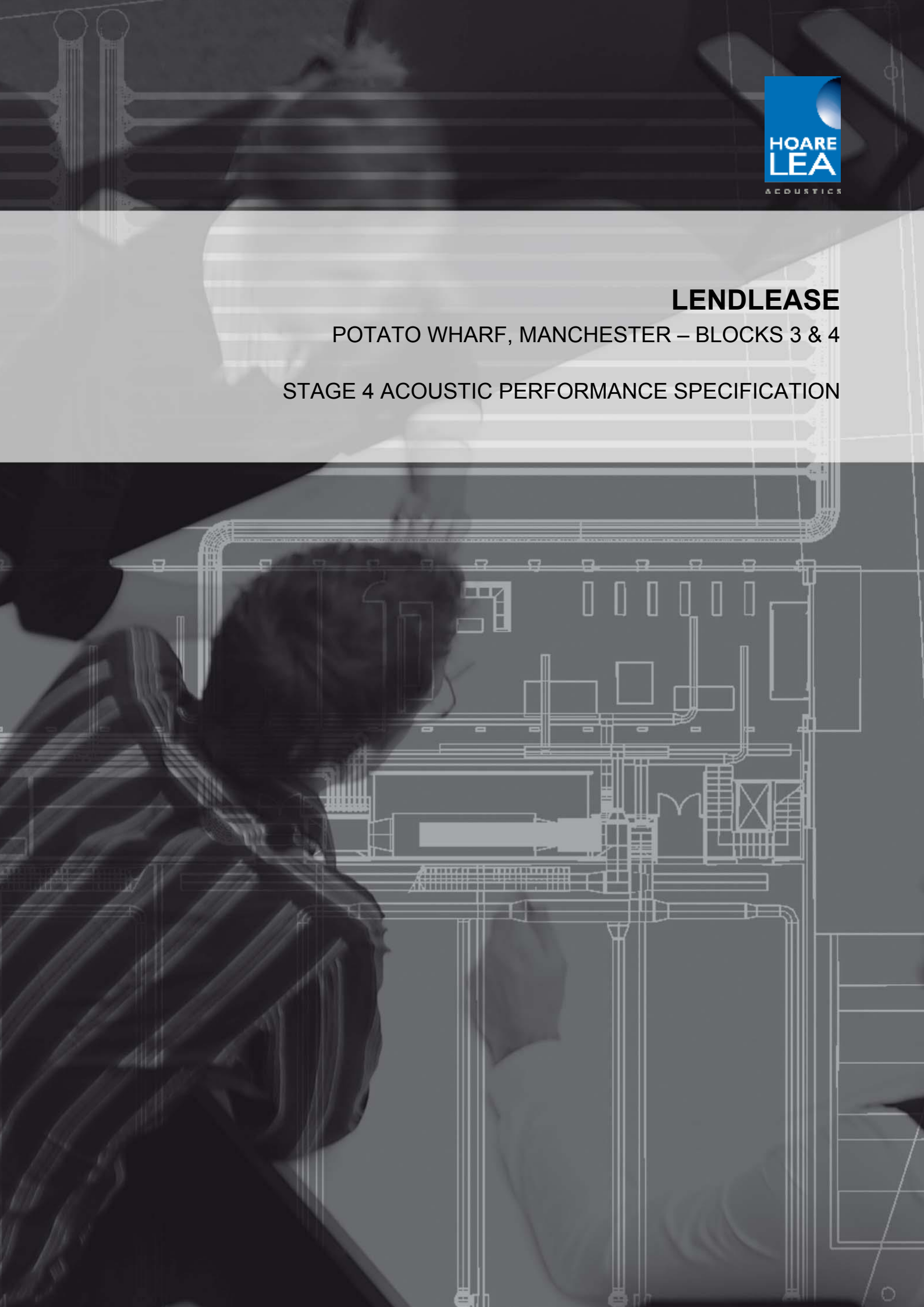


LENDLEASE

POTATO WHARF, MANCHESTER – BLOCKS 3 & 4

STAGE 4 ACOUSTIC PERFORMANCE SPECIFICATION

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AUDIT SHEET

REVISION	DESCRIPTION	DATE	ISSUED BY	REVIEWED BY
R0 DFC	Acoustic Performance Specification	04/04/16	DM	
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R2	Updated for PRS Link	18/11/16	DM	DM
R3	Design team comments	29/11/16	DM	DM
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R5	Updated for NHBC comments	08/05/17	DM	DM
R6	Updated for removal of Link	08/08/17	DM	HCSE
R7	Updated with Client Comments	23/08/17	HCSE	DM

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1. INTRODUCTION

It is proposed that a new residential mixed use building be constructed on behalf of Lendlease at a site adjacent to Potato Wharf, Manchester.

The development is to comprise two buildings with seven floors of residential accommodation providing 112no apartments to Block 3 and 79no apartments to Block 4. The remainder of the site will be given over to surface level parking and landscaping.

A site plan is shown at Appendix 1.

The development requires a good standard of acoustic performance to achieve acceptable internal sound levels. The design and construction of the residential development shall meet all requirements of the Local Planning Authority and the requirements of the Building Regulations Approved Document E 2003 Edition.

The building envelope is required to reduce noise ingress from road traffic and rail / tram noise in the apartment bedroom and living rooms to meet Manchester City Council planning criteria.

In addition, it is intended that the project is to achieve an enhanced sound insulation performance of 5dB better than Building Regulations requirements.

The acoustic criteria given in the sections below shall be achieved throughout the development.

2. SITE

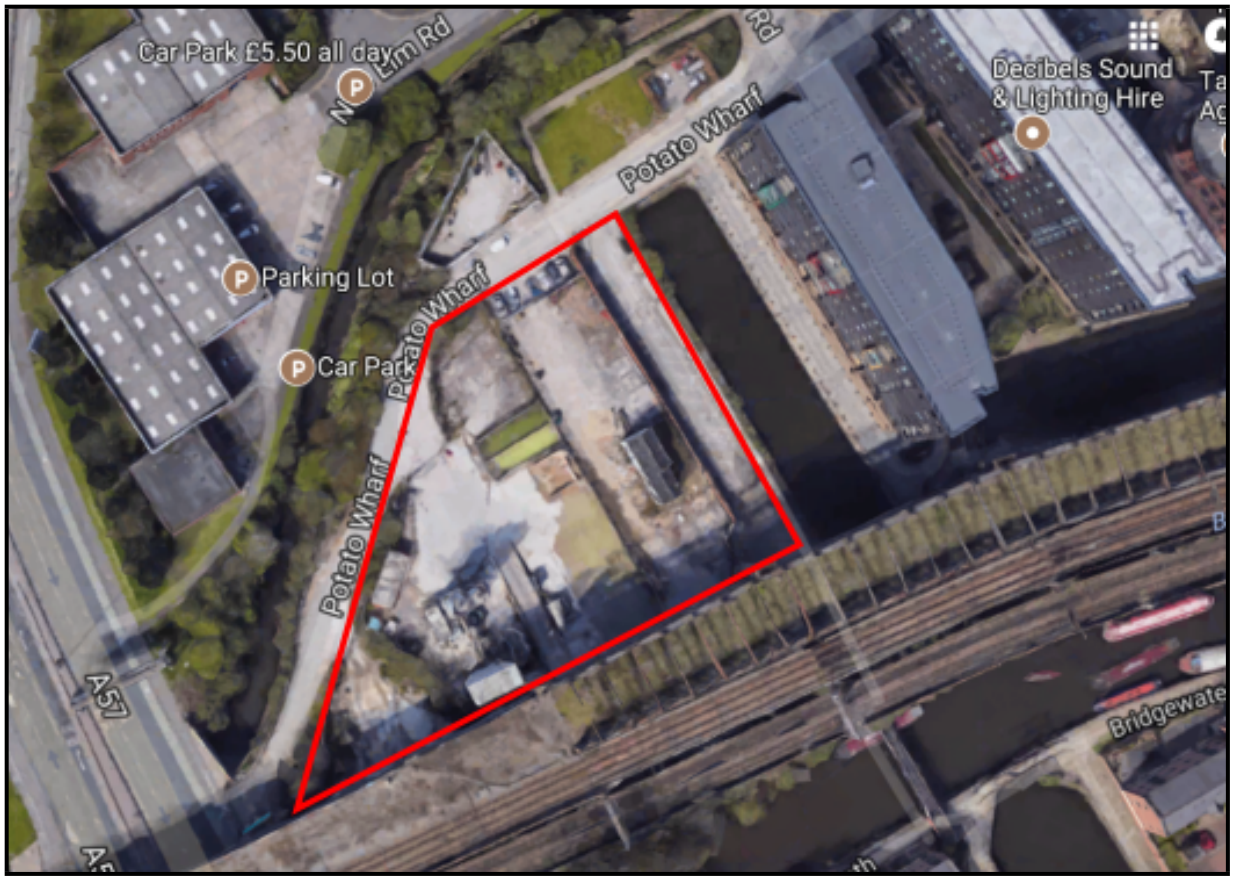
The development site is located at Potato Wharf, Castlefield, Manchester and represents a further phase of a larger residential scheme at this site. The proposed development comprises two blocks on seven storeys.

The site is bounded to the east by an earlier phase of apartment development at Block 2.

To the south, the site overlooks three viaducts which carry mainline rail traffic and the trams for Manchester Metrolink. The nearest of the three viaducts is currently unused.

To the north, the site adjoins the Potato Wharf access road beyond which lies an area of public open space.

An aerial view of the site and surroundings is shown below:



3. EXISTING NOISE CLIMATE

The general noise climate around the site is primarily attributable to traffic noise generated by the A57/ A57(M) which lies to the west and the A56 Chester Road which lies to the south. Noise measurements were taken on various dates starting with measurements for earlier phases of Potato Wharf in November 2012 and then again in April 2015 for this current phase. We also had access to noise survey data undertaken by Sol Acoustics report dated April 2007 for the original design of phase 1 of the development.

This general noise climate is punctuated by higher, short duration, noise events attributable to the elevated tramway and railway line that lie approximately 25m and 35m respectively from the southernmost facade of the building. Tram movements occur every few minutes continuously throughout the day into the late evening whilst mainline railway activity is more intermittent but with occasional freight traffic in addition to the regular passenger services.

From current site measurements, the typical daytime ambient noise climate around the site is of the order of L_{Aeq} 55-57dB but increasing significantly during tram and rail movements. At the southern façade of the building, event sound levels during tram/train movements can increase to L_{Aeq} 80-85dB with highest levels generated by mainline movements and particularly freight traffic. Typical maximum levels during tram/train pass-by are in the range L_{Amax} 85-90dB.

Scheduled tram and train services extend into the early morning and late evening periods which, from a planning perspective, would be classified as night time. There will also be occasional night time movements on the main line. On this basis, the typical levels for rail activity given above can occur during night time.

For positions along the building that are further from the railway, event noise levels will reduce due to distance attenuation and reduced angle of view/screening.

Typical daytime sound levels at the western elevation of Block 4 nearest to the A57 are of the order of L_{Aeq} 57dB.

4. BUILDING ENVELOPE

4.1 Overall requirements

The design and construction of the external building envelope shall be such that noise levels within residential dwellings comply with the requirements of BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'. The maximum acceptable internal noise levels within dwellings as advised by BS 8233 are detailed in the Table 1 below.

Table 1: BS 8233 intrusive noise criteria for dwellings

Activity	Location	Day time (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living rooms	$L_{Aeq,16hr}$ 35dB	-
Dining	Dining room	$L_{Aeq,16hr}$ 40dB	-
Sleeping (daytime resting)	Bedroom	$L_{Aeq,16hr}$ 35dB	$L_{Aeq,8hr}$ 30dB

It is noted that the night time requirement complies with Manchester City Council (MCC) planning criteria. The MCC criteria also require that night time noise events do not regularly exceed L_{Amax} 45dB within bedrooms.

4.2 Glazing

The internal requirements of section 4.1 above shall be achieved with all windows closed. All windows shall incorporate compressible seals on all opening lights.

The positioning and orientation of the building relative to nearby roads and the railway will alter incident sound levels at the individual elevations of the building. Considered on a specific room by room basis, this would result in a large range of performance requirements and window types. It is considered that this would not be practicable or cost effective and, consequently, the proposals are to rationalise and minimise the number of window types on the basis of generic requirements. The highest performance requirements will be for bedrooms and particularly those nearest to the railway.

From the review of the measurement data, three residential window types are recommended as follows:

Table 2: Glazing acoustic requirements

Type	Location	R_w	Octave band Centre Frequency (Hz)					
			125	250	500	1k	2k	4k
1	Bedrooms adjacent railway	41	24	26	40	48	46	54
2	Living rooms adjacent railway	38	23	24	34	42	43	52
2	All other bedrooms	38	23	24	34	42	43	52
3	All other living rooms	34	22	21	29	40	41	42

The window types are marked on the architectural drawings. The higher performance requirement for bedrooms (R_w 41) and living rooms (R_w 38) will apply to windows between grids 3.14 and 3.18 on Block 3 and between grids 4.09 and 4.14 on Block 4.

Where alternative window types are to be used, the manufacturer's performance data must be at least equal to all of the quoted values above.

4.3 Ventilation

4.3.1 Passive Elements

All ventilation openings within the external building envelope other than windows but inclusive of trickle vents and airbricks, shall be selected and installed such that the external building envelope achieves the acoustic requirements of Section 4.1 above. All such vents shall, when open, have a manufacturer's acoustic rating that is equivalent to that of the room window system; i.e. the passive ventilation elements of bedrooms between grids 3.14 and 3.18 on Block 3 and between grids 4.09 and 4.14 on Block 4 must be rated at R_w 41dB when open. The passive elements of living rooms between grids 3.14 and 3.18 on Block 3 and between grids 4.09 and 4.14 on Block 4 will need to be acoustically rated at R_w 38dB when open.

All proprietary components proposed to be implemented for ventilation purposes shall have a British Board of Agrément Certificate.

4.3.2 Forced Systems

All mechanically assisted ventilation systems located within the external building envelopes, whether located in walls or glazing, shall not, when added to the intrusive noise components, result in any exceedance of the internal noise level criteria given in Section 4.1 above.

All proprietary units proposed to be located within the external building envelope, shall have a British Board of Agrément Certificate.

Ventilation systems shall be selected and installed such that internal noise level criteria given in section 4.1 above are not exceeded.

As a minimum requirement, all ductwork connections to fan unit casings shall be made using flexible connectors. Fan unit casings will be vibration isolated at fixings into the structure. The requirements of BS 6472:2008 'Guide to evaluation of human exposure to vibration in buildings (1Hz to 80Hz)' as applied to residential dwellings shall be complied with as a maximum for all forced ventilation systems.

5. INTERNAL SOUND INSULATION

All separating elements between adjacent dwellings or between dwellings and plant/core circulation areas shall be designed to achieve the sound insulation criteria given below. All residential areas must comply with the requirements of the Building Regulations as defined in Approved Document E 2003.

5.1 Airborne Sound Insulation

The sound reduction between adjacent spaces, when measured in accordance with BS EN ISO 140: 1998 and rated in accordance with BS EN ISO 717: 1997 shall be not less than as listed below.

Location	Building Regulations	Project requirement
Between apartments	D_{nTw} + C_{tr} 45dB	D_{nTw} + C_{tr} 50dB
Rooms within apartments	R_w 40dB	-
Plant areas to apartments	-	D_w 60dB

5.2 Impact Sound Insulation

The weighted standardised impact sound pressure level of separating floors between apartments and between corridors, without floor covering, when measured in accordance with BS EN ISO 140-8:1998 and rated in accordance with BS EN ISO 717-2:1996 shall not exceed L'_{nTw} 57dB, 5dB netter than the Building Regulations.

5.3 Apartment entrance doors

Main entrance doors to apartments shall have a minimum mass of 25kgm^{-2} or else a minimum acoustic rating of R_w 29dB. In addition, all door frames should be fitted with proprietary compressible seals to allow, subject to agreement with Building Control, the omission of an absorptive ceiling within the communal corridor. This principle has been successfully adopted on the following recent projects:

- Potato Wharf Blocks 1 and 2
- Hungate Apartments, York
- Orion Building, Navigation Street, Birmingham
- Sirius Building , Birmingham

6. MECHANICAL SERVICES PLANT

6.1 Common services and service penetrations

All mechanical services installations associated with the development shall not give rise to sound levels in excess of L_{Aeq} 25dB at any time within any residential demise of the development. This includes the background ventilation and/or heat recovery systems associated with individual apartments.

All mechanical services installations associated with the development shall not give rise to continuous vibration levels within any residential demise in excess of the following values when assessed in accordance with BS 6472-1:2008:

Period	Vibration Dose Value (VDV)
Daytime	$0.4ms^{-1.75}$
Night time	$0.2ms^{-1.75}$

All mechanical services plant shall incorporate noise and vibration control measures as appropriate to enable the design criteria to be achieved. Note that any equipment such as substations, pumps, fans, boilers etc are considered mechanical plant.

Where common services pass through habitable areas of dwellings they shall be appropriately insulated and isolated from the structure so as to achieve all internal noise criteria.

All soil vent pipes, rainwater pipes and common water service pipes shall be boxed out in accordance with the recommendations given in Approved Document E of the Building Regulations.

Where common ventilation system ductwork exists, acoustic cross-talk attenuators shall be installed to provide at least the same noise level reduction in the ductwork paths between the spaces as offered by the separating building fabric.

Ductwork and pipework lagging shall be installed where appropriate to achieve all internal noise criteria. If lagging is required, a proprietary product shall be installed to manufacturer's recommendations.

An airtight seal to ductwork and pipework shall be provided for all penetrations through walls or floors. Care shall be taken to ensure that the penetrations are isolated from the building fabric by packing the cavity with a dense mineral wool quilt or equivalent product and sealing both exposed faces.

Noise within dwellings due to the operation of lifts shall not exceed a sound pressure level of L_{Aeq} 35dB and L_{Amax} 45dB at any time. The sub-contractor must consider the location of guide rails, the speed of the lift and the construction of the lift shaft wall.

6.2 External plant noise levels

All external mechanical services plant and ventilation openings shall achieve a noise Rating Level no greater than the background sound level at any residential window when assessed in accordance with British Standard BS 4142:2014.

7. ABSORPTIVE FINISHES

In order to comply with Approved Document E of the Building Regulations, common corridors should be provided with Class C type absorptive ceiling tiles to minimise noise transfer into apartments.

Where it is desirable to use plasterboard ceilings or similar within corridors it will be necessary for all apartment entrance doors to be fitted with proprietary acoustic seals to minimise sound transfer into apartments. This approach will require written agreement from Building Control.

The preferred Client approach to satisfy the requirements of ADE with respect to minimising noise transfer from communal corridors is to fit entrance doors with good quality acoustic seals. Adoption of this strategy provides a more effective solution to noise transfer from corridors than the use of absorptive ceilings and, consequently, absorptive ceilings would not be required to communal corridors when appropriate acoustic seals are provided to entrance doors.

8. CONSTRUCTION DETAILING

All mortar joints in blockwork or brickwork walls shall be completely filled so that no air gaps exist.

If plasterboard dry lining systems are used, all joints shall be taped and sealed. Where two or more layers of plasterboard are incorporated in the system, joints shall be staggered.

All air gaps at the head and base of plasterboard dry lining systems should be packed with a dense mineral wool quilt where possible and shall be sealed with flexible mastic. They shall not degrade in general the sound insulation performance requirements.

In studwork wall systems, conduit and electrical sockets/fixings and pipework shall incorporate specific treatments to maintain the acoustic integrity of the wall construction in line with manufacturer's standard details. Details should be submitted for review.

Light switches and fitting should only be made to a solid backing. They should not be mounted mid-span of dabs on a plasterboard wall lining system unless a mineral quilt packing or other suitable resilient material is used around the rear of such fixtures.

9. COMMISSIONING

The noise criteria specified shall be met when the building is fully complete. Tested rooms shall be unfurnished, uncarpeted and unoccupied.

The commissioning requirements of Approved Document E 2003 Edition shall be complied with, and a test report shall be provided upon completion of the tests.

The exact number and location of the tests needs to be agreed with Building Control. However, it is usual to test 10% of the apartments. Where Building Control is in agreement, a reduced amount of testing may be acceptable.

The Contractor shall carry out an initial sound insulation test to a sample apartment during the early phase of fit-out to demonstrate to the Client that the acoustic requirements for party walls and floors are achieved by the construction methods adopted for the project. It would be beneficial for HLA to witness these early tests.

10. ARCHITECTURAL PROPOSALS

10.1 Building envelope

10.1.1 External walls

The design intent is for external walls to residential units to be constructed as follows:

- 102.5mm facing brick (external)
- 50mm cavity (clear)
- Breather membrane
- 100mm mineral wool insulation
- 10-12.5mm cement particle board
- 100mm SFS with full fill mineral wool insulation
- Vapour layer
- 2 x 12.5mm plasterboard (tape and joint)

Based on these proposals, the wall would be expected to provide a high level of sound reduction, capable of sufficiently attenuating the external noise levels.

10.1.2 Roof

The roof construction is to be to the Contractor's design and certain sections are to be a green/bio-diverse roof. The likely construction format is as follows:

- Concrete slab
- Vapour control layer
- Rigid insulation
- Membrane underlay
- Capping sheet
- Green roof overlay system with gravel margin

This type of construction would provide adequate attenuation of external noise sources as well as providing sufficient attenuation from rain noise.

10.1.3 Glazing

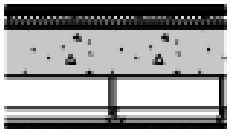
Glazing to habitable rooms is based upon the performance requirements detailed in section 4.2, Table 2 of this Specification.

10.2 Separating floors

The base structural floors throughout the development are to be concrete with a nominal thickness of 250mm in accordance with the structural requirements. Within apartments, the slab will be underdrawn with a proprietary suspended MF type ceiling with plasterboard lining.

The design intent for separating floors between flats is described as follows and shown in Figure:

- 15mm floor finish
- 10mm resilient matting to achieve min ΔLw 17dB
-
-
-
- 220mm concrete slab
- Ceiling void between 150-275mm
- 12.5mm plasterboard suspended on a metal frame system



Floor Type 23-01

Apartment to Apartment / Apartment to Corridor
Acoustic: 50 Dntw + Ctr dB
Thermal: 0.0 W/m2K

Type 23-01

Build up (typical):-
100mm UFH zone inc. 15mm floor finish and 10mm resilient matting as K20:150A
220mm thick reinforced concrete slab to structural engineers specification and details
Ceiling void
MF plasterboard suspended ceiling as K10:216 - for further details refer to reflected ceiling plans

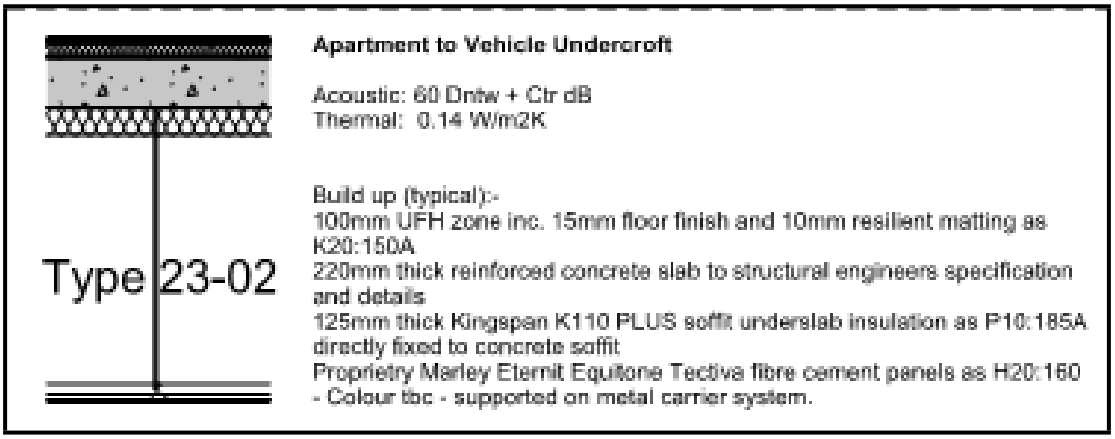
The proposed floor construction is comparable to Robust Detail E-FC-2 and would be expected to be capable of achieving the +5dB enhancement over Approved Document E requirements.

Where it can be demonstrated from early site testing that the resilient layer is not required to achieve the impact sound insulation requirements for the project, the resilient layer may be omitted.

The design intent for separating floors between the Vehicle undercroft and apartments is described as follows and shown in the figure below:

- 100mm zone for acoustic timber floor with integrated underfloor heating consisting of 15mm floor finish and 10mm resilient matting
- 220mm concrete slab
- 125mm Kingspan K110 plus soffit under slab insulation fixed directly to concrete soffit.

- Proprietary cement panels



The base slab with the above floor build-up would be expected to provide a sound insulation performance of approximately R_w 65dB. This would correspond to an on-site performance of approximately D_w 60dB. This separating construction would therefore be expected to satisfy the project requirement between plant areas and apartments. Special measures should be adopted to control flanking between plant areas and apartments and should allow for boxing in of structural columns and other continuous/structural elements between these spaces. On this basis, a spatial allowance of an additional 100mm around continuous structures should be made.

It is noted that external steel balconies will provide a potential flanking pathway at slab level between apartments and it is recommended that bolt fixings for balconies incorporate proprietary resilient collars and washers.

10.3 Party walls

The minimum party wall detail between apartments to be adopted for this project is as follows:

- 2 x layers of 15mm dense (13kgm^{-2}) plasterboard
- 50mm metal C stud
- Full fill mineral wool (10-15kgm^{-3})
- 50mm metal C stud
- 2 x layers of 15mm dense(13kgm^{-2}) plasterboard

Partitions, generally, will have a minimum overall width of 200mm increasing to 300mm where the wall encloses a structural column.

Available test data for the proposed construction gives a rating of R_w + C_{tr} 56dB which would be expected to achieve the project requirement of ADE + 5dB. The wall construction is also comparable to Robust Detail E-WS-1.

Electrical sockets and switches on either side of the wall should be staggered such that they are not positioned back to back. Back boxes are to be fitted with proprietary putty pads to maintain the acoustic performance of the wall.

Where wall cavities are required to be fully filled to satisfy thermal criteria, this should be by means of mineral fibre with a nominal density of 10-15kgm^{-3}.

10.4 Internal partition walls

The minimum internal partition wall construction within apartments is to be as follows:

- 12.5mm plasterboard (tape and joint)
- 70mm metal C stud
- 25mm mineral wool (10kg/m^3)
- 12.5mm plasterboard (tape and joint)

The above construction is comparable to British Gypsum system reference A206045 which has a manufacturer sound insulation rating of R_w 42dB. This would, therefore, be deemed suitable for use for internal apartment walls.

APPENDIX 1 – SITE PLAN

