Beckenham Public Hall

Acoustic Feasibility Report

27737/AFR

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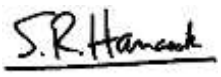
0	28/04/2020	-		
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1.0 Introduction

It is proposed refurbish the Grade II listed Beckenham Public Hall and use the space as a 'cultural hub' and library. Hann Tucker Associates have been commissioned to assess the acoustic feasibility of this proposal.

In order to inform our assessment we visited site to undertake an acoustic survey of the existing building, including:

- airborne and impact sound insulation testing between selected rooms
- reverberation time measurements
- internal ambient noise level measurements
- external manned environmental noise level measurements.

Our findings are presented in our Acoustic Survey Report.

With regard to the acoustic feasibility of converting Beckenham Public Hall into a library, we have considered the following potential noise and vibration issues:

- Sound insulation of existing floors
- Noise due to road traffic
- Room finishes and reverberation
- Noise and vibration due to the building services

Our advice on each of these potential issues is presented in the following sections.

2.0 Sound Insulation of Existing Floors

2.1 Results of Sound Insulation Testing

The following table summarises the airborne results of the walls tested:

Airborne Results for Walls			
Source Room	**Receive Room**	**$D_{nT,w}$**	**$D_{nT,w}$ + C_{tr}**
The Club, Games Room 0/022	Ground Floor, Circulation Space 0/002	53 dB	50 dB
The Club, Lounge, 0/019	Ground Floor, Circulation Space, 0/002	53 dB	49 dB

The following table summarises the airborne results of the floors tested.

Airborne Results for Floors			
Source Room	**Receive Room**	**$D_{nT,w}$**	**$D_{nT,w} + C_{tr}$**
First Floor, Small Hall 1/003	The Club, Games Room, 0/022	52 dB	45 dB
First Floor, Large Hall Stage, 1/009	The Club, Lounge, 0/017	53 dB	46 dB
First Floor, Large Hall, 1/009	Ground Floor, Small Hall, 0/003	58 dB	53 dB
First Floor, Large Hall 1/009	Ground Floor, Circulation Space, 0/002	55 dB	52 dB

The following table summarises the impact results of the floors tested.

Impact Results for Floors		
Source Room	**Receive Room**	**$L'_{nT,w}$**
First Floor, Small Hall, 1/003	The Club, Games Room, 0/022	60 dB
First Floor, Green Room (store), 1/007	The Club, Lounge 0/017	64 dB
First Floor, Large Hall Stage, 1/009	The Club, Lounge, 0/018	52 dB
First Floor, Large Hall, 1/009	Ground Floor, Small Hall, 0/003	63 dB

2.2 Discussion of Sound Insulation Results

We understand there are no project specific criteria. The guidance of Building Regulations: Approved Document E (ADE) and Building Bulletin 93: Acoustic Design for Schools Performance Standards (BB93) requirements could be considered to be useful benchmarks.

These are summarised in the table below:-

Sound Insulation	BB93 Library Receive Room (medium noise tolerance)			Approved Document E (ADE)	
	Source Room Activity Noise	New Build requirements	Refurbishment requirements	Purpose built dwellings Floors and Stairs	Dwellings formed by a material change of use
Airborne	'Very High' 'High' 'Medium' 'Low'	$D_{nT,w} \geq 55$ dB $D_{nT,w} \geq 50$ dB $D_{nT,w} \geq 45$ dB $D_{nT,w} \geq 40$ dB	$D_{nT,w} \geq 45$ dB $D_{nT,w} \geq 45$ dB $D_{nT,w} \geq 40$ dB $D_{nT,w} \geq 30$ dB	$D_{nT,w} + C_{tr} > 45$	$D_{nT,w} + C_{tr} > 43$
Impact	N/A	$L'_{nT,w} \leq 60$ dB	$L'_{nT,w} \leq 65$ dB	$L'_{nT,w} \leq 62$ dB	$L'_{nT,w} \leq 64$ dB

The airborne sound insulation test results, compared with BB93 new build requirements, would be deemed sufficient to allow 'High' activity noise levels in rooms neighbouring a library. Refurbishment requirements would be deemed sufficient to allow 'Very High' activity noise levels in rooms neighbouring the library. The results were also at least equal to the minimum new build performance standards requirement of ADE for floors separating dwellings. As such the airborne sound insulation between the rooms tested is reasonably good.

The impact sound insulation results measured underneath the stage were better than the ADE and BB93 new build requirements. However, on the existing exposed wooden floorboards, the impact sound insulation results measured in the first-floor halls and green room were approximately equal to or exceeding the various BB93 and ADE benchmarks. This is unlikely to be sufficient to control impact noise from the proposed room uses.

2.3 Mitigation Measures

Given the above the main acoustic concern is likely to be to impact noise due to footfall, at first floor level (especially from a multi-purpose area), to the ground floor areas below. There is a wide range of possible options to mitigate this. We would summarise the possible options as follows, arranged in notionally descending order of preference/effectiveness:

1. Avoid locating a multi-purpose area above another occupied space (either by relocating the multipurpose area to the ground floor or, if there is a general shortage of space, to another building)

2. Installing a thick resilient soft floor finish. A suitable finish could be thick carpet & underlay or, alternatively, thick gym style acoustically resilient matting.

3. Installing an acoustic mass barrier ceiling. A suitable construction could comprise multiple layers of plasterboard on an MF grid on vibration isolation hangers. We realise the listed ceiling would be concealed but this option is probably more effective and straightforward than “above the floor” options that would raise the floor level. An example drawing is attached in Appendix A.

4. Installing a floating floor (if a hard floor finish is required rather than Options 2 or) on high performance isolators. A suitable construction would comprise a floating raft on Mason MFS isolators. An example floor build-up is attached in Appendix B.

5. Installing a vinyl floor finish with acoustic backing e.g. Tarkett Starfloor Click Ultimate.

6. Installing a resilient layer (if a hard floor finish is required) on a resilient layer. A suitable construction would comprise Regupol 3912 or similar.

7. Reducing the noise sensitivity of the area below (i.e. on the Ground Floor). Less sensitive uses could involve a cafe or the use of headphones.

8. Management controls (to avoid/control certain activities)

3.0 Road Traffic Noise

3.1 Results of External Noise Survey

The nearest source of noise due to road traffic is Bromley Road (B320). We have undertaken internal and external noise surveys to establish the levels of noise due to road traffic.

The external environmental A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound levels are recorded below.

Position	Sound Levels dBA		
	L_{90}	L_{eq}	L_{max}
Front	55	68	78
Rear	47	52	60

At Position 1 measurements were also taken of idling busses, approximately 4m from the bus stop. These were measured to be approximately 72 dB L_{Amax}.

3.2 Results of Internal Noise Survey

The following table presents the results of our internal ambient noise levels measurements in various rooms.

Internal Ambient Noise Level Results	
Test Location	**L_{Aeq}**
First Floor Large Hall	45 dB
First Floor Small Hall	42 dB
Ground Floor Small Hall	38 dB
Ground Floor Circulation Space	37 dB

3.3 Discussion of Road Traffic Noise

With windows open we would expect the internal ambient noise levels measurements to be approximately:

Internal Ambient Noise Level Results with Windows Open	
Test Location	**L_{Aeq} (Approx)**
First Floor Large Hall	53 dB
First Floor Small Hall	53 dB
Ground Floor Small Hall	53 dB
Ground Floor Circulation Space	53 dB

Guideline internal noise levels for libraries can be found within BB93 and British Standard 8233:2014 and are presented in the table below.

BB93 Upper Limit for Indoor Ambient Noise Level for Libraries $L_{Aeq,30min}$ (dB)		**BS8233: 2014 Design Range $L_{Aeq,T}$ (dB)**
New Build	**Refurbishment**	**Study and Work Requiring Concentration Library, Gallery, Museum**
40	45	40 – 50

Based on the above, upper limits for noise break in to libraries from road traffic varies from 40 dB to 50 dB $L_{Aeq,T}$.

With windows open the internal ambient noise levels are likely to exceed the BB93 guidelines and also exceed the BS8233:2014 guidelines for noise levels in libraries. However, the noise levels may be acceptable for less noise sensitive areas

With windows closed the internal ambient noise levels measured during our visit were slightly above BB93 new build guidelines in the Small and Large Halls on the first floor, but otherwise generally below BB93 refurbishment and BS8233:2014 upper limits.

The internal ambient noise levels measured during our visit were slightly above BB93 new build guidelines in the Small and Large Halls on the first floor, but otherwise generally below BB93 refurbishment and BS8233:2014 upper limits.

Ideally, consideration should thus be given to installing secondary glazing to library areas on the first floor. We would recommend consulting Selectaglaze to assess the feasibility/aesthetics of secondary glazing. However, given the budget constraints it is accepted that this is likely to be discounted.

4.0 Room Finishes and Reverberation

4.1 Results

The following table presents the measured mid-frequency (500Hz to 2kHz octave band) reverberation times in the listed halls.

Reverberation Time Results	
Test Location	**Reverberation Time T_{mf}**
First Floor Large Hall	1.5 seconds
First Floor Small Hall	0.9 seconds
Ground Floor Small Hall	0.9 seconds

Please note the halls were unfurnished at the time of testing.

4.2 Discussion

A guideline maximum mid-frequency (500Hz to 2kHz octave band) reverberation time to be achieved in library spaces in BB93 is outlined in the table below. This requirement applies to fully furnished rooms.

BB93 Maximum Reverberation Time, T_{mf} Library	
New Build	**Refurbishment**
1.0 seconds	1.2 seconds

The two small hall reverberation time are within the BB93 new build and refurbishment requirements. The large hall reverberation time measurements, in the absence of furnishings, do not meet the BB93 requirements.

Reverberation times in the large hall may need to be improved if it is used as a library space. The measurements were undertaken when the halls were unfurnished. Therefore, the introduction of furnishings such as books, shelving, appropriate floor coverings will reduce reverberation times. If this is not sufficient, suitably specified and positioned acoustically absorbent finishes or absorbers may also need to be considered. From an acoustic viewpoint, an acoustically absorbent ceiling would be preferable in the library areas – however it is accepted that this is likely to be discounted for various reasons.

5.0 Building Services Noise and Vibration

We would be pleased to comment on the acoustic feasibility of the proposed building services serving the proposed library upon receipt of details. In the meantime we do not anticipate any major problems, but would offer the following comments:-

- Atmospheric plant noise emissions should be suitably controlled to comply with the requirements of the local authority. This could be particularly onerous if plant is installed in the rear courtyard due to the proximity of residents to the rear and the low background noise levels. Therefore, we recommend noisy plant should be located internally where possible to control atmospheric noise emissions.
- Mechanical ventilation and building services should be selected and attenuated to meet suitable internal noise levels.

6.0 Conclusion

With regard to the acoustic feasibility of converting Beckenham Public Hall into a library, we have considered the following potential noise and vibration issues:

- Sound insulation of existing floors
- Noise due to road traffic
- Room Finishes and Reverberation
- Noise and vibration due to the building services
- Noise due to the club

Based on the testing results, airborne sound insulation between floors should be adequate. However, impact sound insulation is a concern, especially where a hard floor finish is preferred, so we have outlined various options for consideration.

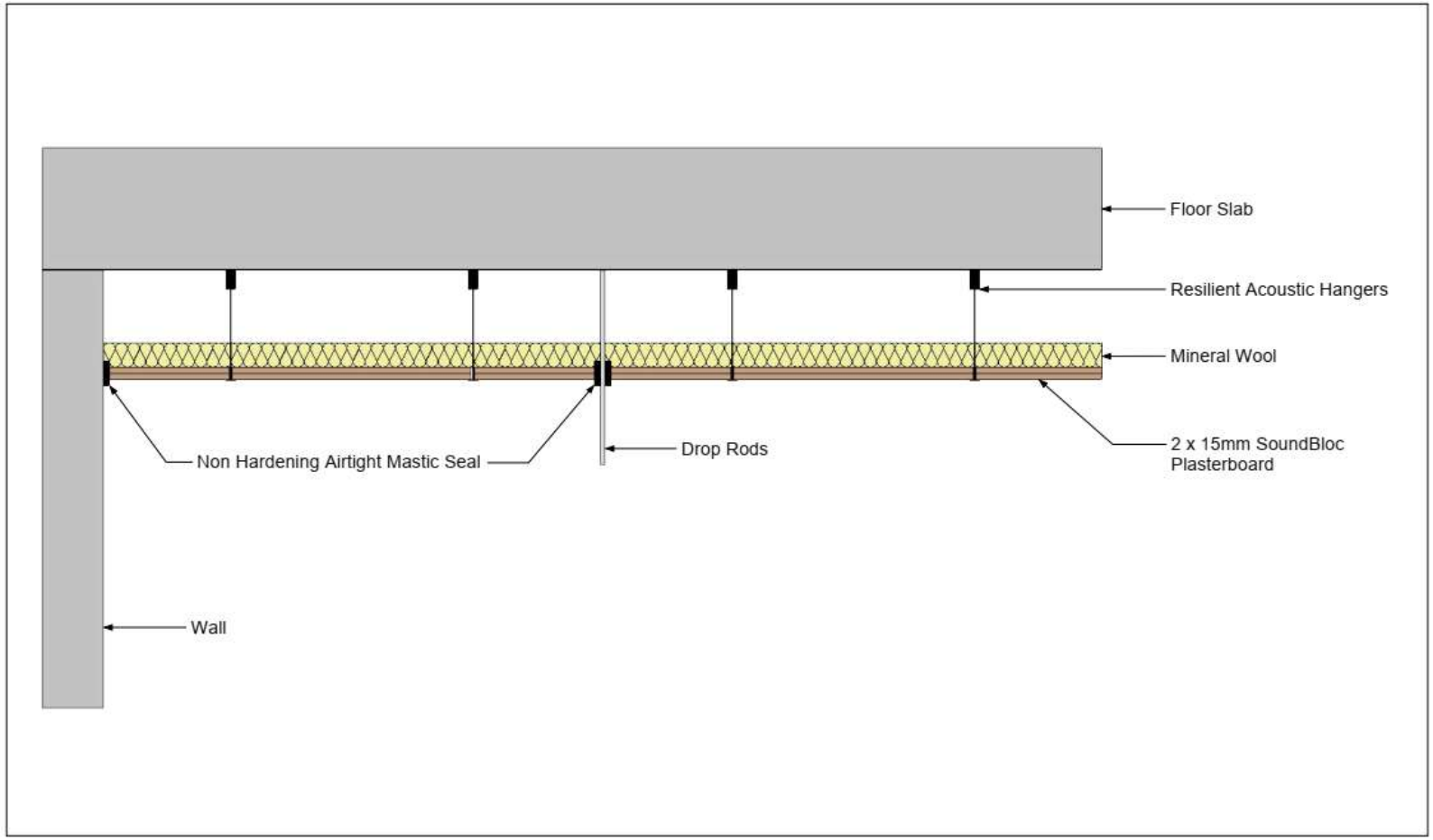
Based on our measurements, noise due to road traffic may be audible, but should be within acceptable limits for the building use.

Reverberation time measurements in the small halls should be reasonable or a library use. In the larger hall consideration should be given to reducing the reverberation time by incorporating suitable acoustically absorbent furnishings and finishes.

Preliminary guidance to consider for building services has been provided.

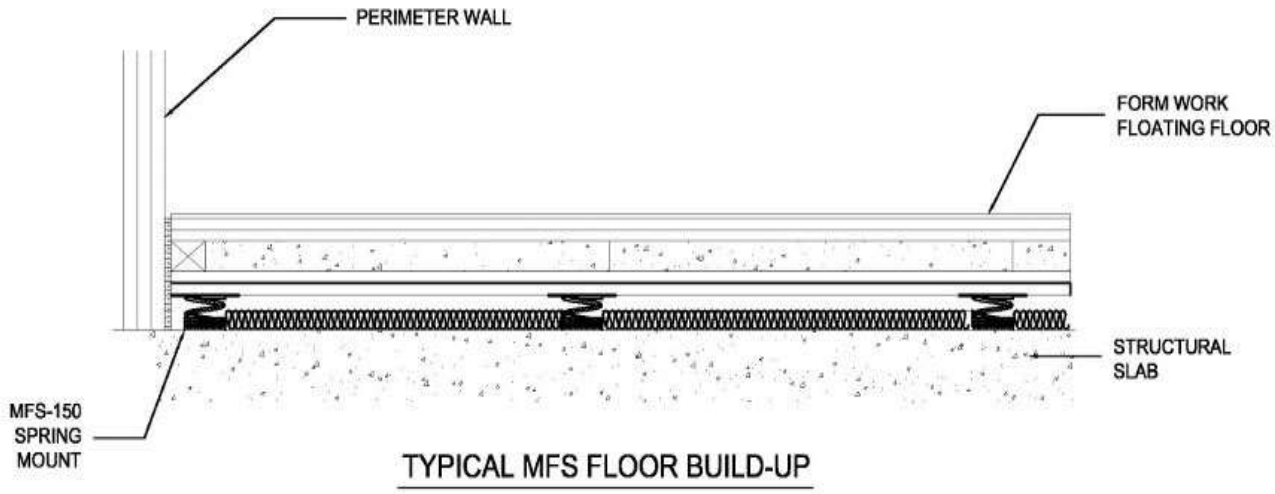
APPENDIX A

MASS BARRIER CEILING EXAMPLE



APPENDIX B

FLOATING FLOOR EXAMPLE



TYPICAL MFS FLOOR BUILD-UP