CURZON CINEMA, CAMDEN ARCHES

Sound Insulation Report

Reference: 10048.RP04.IBF.0
Prepared: 26 April 2021
Revision Number: 0

Curzon Cinemas

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	21 December 2020	Andrew Heath	Torben Andersen
1	Comments from Design Team	26 April 2021	Andrew Heath	Torben Andersen

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

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Contents

1.0 INTRODUCTION

This report outlines recommended acoustic measures for the building fabric associated with the proposed Curzon Cinema, Water Lane, Camden. The cinema auditoria will be constructed within railway arches within the Hawley Wharf development.

This sound insulation report has been prepared in order to discharge Condition 51 of planning permission ref: 2020/0362/P.

Condition 51 states: *Before the cinema use in the northern arches commences, sound insulation shall be provided for the premises in accordance with a scheme to be first approved in writing by the local planning authority. The use shall thereafter not be carried out other than in complete compliance with the approved scheme.*

The site is located within arches N7 to N14 within the Hawley Wharf development site, as approved under s73 application ref: 2020/0362/P

2.0 OPERATIONAL NOISE CRITERIA

2.1 Typical Curzon Criteria

We understand that the Curzon standard noise criteria in relation to noise intrusion is as follows:

Table 1 – Target intrusive noise criteria

Location	Noise Source Type	Maximum noise Level
Inside Auditoria	All sources other than music	NR 30 $L_{Max, Slow}$
Other internal locations	All Sources	NR 40 $L_{Max, Slow}$

2.2 Target Criteria

Given the challenging acoustic environment and significant reduction in noise levels required we would recommend that a relaxation to the target intrusive noise levels be considered. From our experience a more lenient noise criteria has proven acceptable for similarly located venues, including a music venue and cinema beneath railway arches.

The following proposed noise criteria relate to a fully fitted-out screen, including absorptive wall and ceiling finishes, seating, carpets etc in place.

The levels outlined below are considered a suitable balance between what is achievable taking into account the noise levels in the space and the loss of floor area that can be accommodated with acoustic wall and ceiling linings. There are also significant cost and buildability issues with higher performance solutions.

Proposed target intrusive levels within auditoria

Target intrusive noise levels for Overground trains – NR 40 $L_{Max, Slow}$
Target intrusive noise levels for Freight trains – NR 45 $L_{Max, Slow}$

We understand that given the limitations of the site, Curzon have agreed the above intrusive noise limits.

2.3 Noise Break-out to Adjacent Premises

The site is surrounded by a number of adjacent residential and commercial premises.

Noise break-out calculations have been based on the following maximum (L_{max}) source noise levels as outlined in the Curzon standard specification:

Table 2 –Curzon $L_{max, slow}$ spectrum

Cinema $L_{max,slow}$ Noise Levels (dB)								
31.5Hz	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
115	108	105	100	98	96	96	91	86

Condition 51 of the planning permission for the scheme states:

> *Before the cinema use in Area C commences, sound insulation shall be provided for the premises in accordance with a scheme to be first approved in writing by the local planning authority. The use shall thereafter not be carried out other than in complete compliance with the approved scheme.*

There are no absolute limits outlined within this condition, we have therefore proposed the limits outlined in Table 3 which are considered to be reasonable and likely to result in a low likelihood of disturbance.

Table 3 – Recommended Soundtrack Break-out Noise to Adjacent Premises

Adjacent Space	Break-out Criterion
1m outside Residential Adjacencies	NR 40 $L_{max, slow}$
1m outside Commercial Adjacencies	NR 50 $L_{max, slow}$

These limits are proposed such that an intrusive noise level of NR 25 $L_{max, slow}$ is achieved within residential units based on a 15 dB reduction for a partially open window. We would anticipate intrusive noise at this level would be mostly inaudible and reasonable given the general noise climate of high maximum noise levels from the adjacent railway viaduct.

N.B. We note that these are relatively stringent levels and may not be practically possible to commission as they could be at a lower level than the prevailing background noise levels at the site.

3.0 NOISE & VIBRATION SURVEYS

Noise and vibration measurements were undertaken in all arches on Monday 27 April 2020.

Simultaneous sound pressure level measurements were taken at different heights in order to assess the reduction in noise level throughout the arches. Vibration measurements were taken on the floor, walls and lids of the arches in order to quantify the level of tactile vibration within the various linings.

The results of the survey have been used in order to determine appropriate acoustic linings to achieve the criteria outlined in Section 2.2.

4.0 AUDITORIA SHELL WALL LININGS

The following recommendations are based on the existing screeds within the arches (understood to be an approximate depth of 75mm) to be removed and the existing plywood linings to remain in place.

4.1 Arch Linings

To achieve the reduction in levels outlined above, a box-in-box construction is recommended formed using an isolated steel frame structure supported on the existing concrete slab. The principles of the acoustic isolation scheme are outlined in Figure 1 in the Appendix.

The following wall and ceiling linings are proposed which can be fixed to purlins spanning between the steels:

- Minimum 250mm void between arch brickwork and first board lining with 150mm mineral wool insulation
- 2x15mm dense plasterboard (e.g. SoundBloc)
- 15mm plywood (for fixings)
- 2x15mm Dense plasterboard (e.g. SoundBloc)

Overall minimum dimension from existing arch: 325mm (Due to the non-uniform nature of the arches the lining depths will vary.)

The lining of the lids of the arches should ideally provide a minimum overall cavity of 325mm, overall dimension with boarding 400mm.

The steelwork structure supporting the lining should be fully isolated from the slab on acoustic mounts to achieve a maximum natural frequency of 10Hz. Acoustic washers must be used to secure the steel flanges to the sub floor.

The steel frame structure and associated boarding should be free-standing and supported fully from the sub floor only.

4.2 Arch N14 – Network Rail Access

We understand that Network Rail will require regular access to inspect a crack in the head of the brickwork of arch N14. The current proposal is to provide the same acoustic lining as outlined in Section 5.1 with a tray above to enable camera access from the rear plant rooms above the acoustic linings.

An access hatch will be supplied in the

This detail is to be developed further following clarification from Network Rail.

4.3 Auditoria Front and Rear Linings

There are residential flats to front and rear of the arches so consideration has been given in order to control noise break-out from the auditoria. Acoustic linings are recommended in the following sections to control breakout to the levels proposed in Table 3.

Front Lining

It is recommended that a minimum 100mm medium density blockwork (1350-1600 kg/m3) wall be constructed to infill the entire front of arch opening. The proposed render finish could then be directly applied to this. The 75mm lining fixed to steelwork as outlined in Section 5.1 should run in board of this new wall.

Fixings between the blockwork wall and steelwork structure must be resilient (e.g. EP400 Sylomer bracket from Total Vibration Solutions).

Rear Lining

The rear of the screens are bricked up part way with glazing above. Low level doors and windows are to be bricked up and the high level glazing to be replaces with louvres to the plant decks.

The 75mm lining fixed to steelwork as outlined in Section 5.1 should run in board of the rear wall and turn across and around to form plant decks either side of the projector pod.

The vertical sections of the rear wall should be lined with an additional Gyplyner lining (see Figure 2):

- 35mm Gyplyner channel
- 2x15mm Dense plasterboard (e.g. SoundBloc)

Any access doors in the rear wall, e.g. electrical cupboards, should have an acoustic rating of at least R_w 35 dB.

The preferred arrangement for these linings are provided in Figures 2 & 3.

4.4 Rear Plant Decks

As the rear of the plant decks will be louvred, additional acoustic lining is required to the inner faces of the plant decks.

2x20mm cement board (1800 kg/m^3) are recommended as indicated in Figure 2 in order to reduce noise break out via the plant deck.

Cabling and mechanical penetrations should ideally only occur between the plant deck and the projector pod.

4.5 Projector Pods

The projector pods will be formed in the void between the two plant decks. The new wall to the front of the pods should comprise 2x15mm Soundbloc either side of metal studs with insulation between.

A single glazed porthole is proposed.

The base of the projector pods will be formed from a sandwich panel to reduce noise breakout from below.

4.6 Central Plant Enclosure

Plant running within the lid of the screens is required to move air in and out of the auditoria as indicated on Figure 3 taking in and discharging air to the front of the auditoria.

This should be boxed in as follows:

- 15mm plywood
- 90mm studwork with 50mm mineral wool insulation
- 2 x 15mm dense plasterboard

Additional general recommendations:

- Cross talk attenuation will be required on all penetrations in and out of the enclosure.
- Access panels into the enclosure should have an acoustic rating of R_w 40 dB.
- Anti-vibration mounts should be specified for all plant within the enclosures.
- Any services or cabling should only penetrate the acoustic line within the projector pod box

4.7 Acoustic Floor Construction

An isolated floating floor system is recommended to control noise break-in as well as reduce the likelihood of any tactile vibration entering the auditoria. This build up is shown on Figure 1.

To achieve a suitable reduction the following floor build-up is recommended (from top to bottom):

- 75mm Screed (2000kg/m^3) on TVS Dovetailed metal decking
- TVS Sylomer (or equivalent approved) Acoustic isolators to achieve 10 Hz maximum natural frequency
- 38mm cavity with 25mm mineral wool insulation
- 15mm Plywood / Chipboard to form a flat surface for acoustic isolators
- Existing waterproofing layer

Allowing for deflection of the acoustic isolators the finished floor level would be ~125mm above the existing waterproofing.

4.8 Bar Glazing

Some glazing to the bar is to be replaced, the performance of new glass should be specified at R_w 35 dB. The new sliding door to the café hatch should be specified with a minimum acoustic performance of R_w 30 dB.

5.0 LOBBY WALLS & DOORS

5.1 Guidance Construction

We propose the following construction of overall width 152mm comprising:

- 2No. layers of 15mm dense plasterboard (min. 12.5kg/m^2 each, e.g. SoundBloc/dB Board)
- 92mm studwork with 50mm mineral wool (10-36kg/m3) between
- 2No. layers of 15mm dense plasterboard (min. 12.5kg/m^2 each, e.g. SoundBloc/dB Board)

5.2 Auditoria Doors

Due to the high external noise levels at the site during train pass-bys and in order to control sound-track noise break out to adjacent areas, high performance acoustic doorsets are recommended for both entrance lobby doors.

R_w 45 dB doors are recommend for each lobbied door to achieve R'_w 40 dB (each) on site.

- All doors must be fitted within a "stopped" frame.
- Gaps at the threshold stiles should be minimised.
- The lobbies should have all "side" wall areas acoustically treated with absorbent panels typically ~35mm thickness.

6.0 CONCLUSION

This report demonstrates a sound insulation methodology that will adequately mitigate noise emissions from the approved cinema and on this basis it is considered that the requirements of Condition 51 are satisfied and the condition should be discharged.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Acoustic Floor and Steelwork Isolation Specifications

Floating Floor Specifications

The floating floor should achieve a natural frequency of 10Hz under dead and anticipated working live loads. The dead and working live loads shall be obtained from the structural engineer. Air gap stiffening has already been considered, so the specification applies to the mounts only.

It will be the responsibility of the specialist supplier to design the floating floor (type and spacing of mounts) to accommodate dead and anticipated working live loads and achieve the natural frequency specification.

The suitable supplier should advise on any stability issues associated with the floating floor and any isolated wall linings.

The suitable supplier will provide information on the type of mounts and recommended spacing to the lead consultant/ project manager such that this information can be incorporated in to the final design and construction stage drawings. The lead consultant/ project manager shall disseminate this information throughout the design team for the various design team members to comment on issues relevant to their discipline. RBA Acoustics will comment on the acoustic acceptability of final proposals.

Specification for Steelwork Isolation

All advice given herein is for acoustic purposes only. The structural engineer should design the steelwork system based upon their calculated working live loads (including loading from any wall linings, building services, absorbent ceiling tiles and any other items supported from the steelwork etc.).

The acoustic isolation beneath the steelwork frame should achieve a natural frequency of 10Hz under dead and anticipated working live loads (including loading from any building services, absorbent ceiling tiles and any other items supported from the steelwork etc.). The dead and working live loads shall be obtained from the structural engineer and the supplier must confirm the structural integrity of the system is not compromised by the isolators. The spacing of the pads should be based on the proposed steelwork arrangement with information again obtained from the structural engineer.

The suitable supplier will provide information on the type of pads to the project manager such that this information can be incorporated into the final design and construction stage drawings. The project manager shall disseminate this information throughout the design team for the various design team members to comment on issues relevant to their discipline. RBA Acoustics will comment on the acoustic acceptability of final proposals.

Appendix C – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

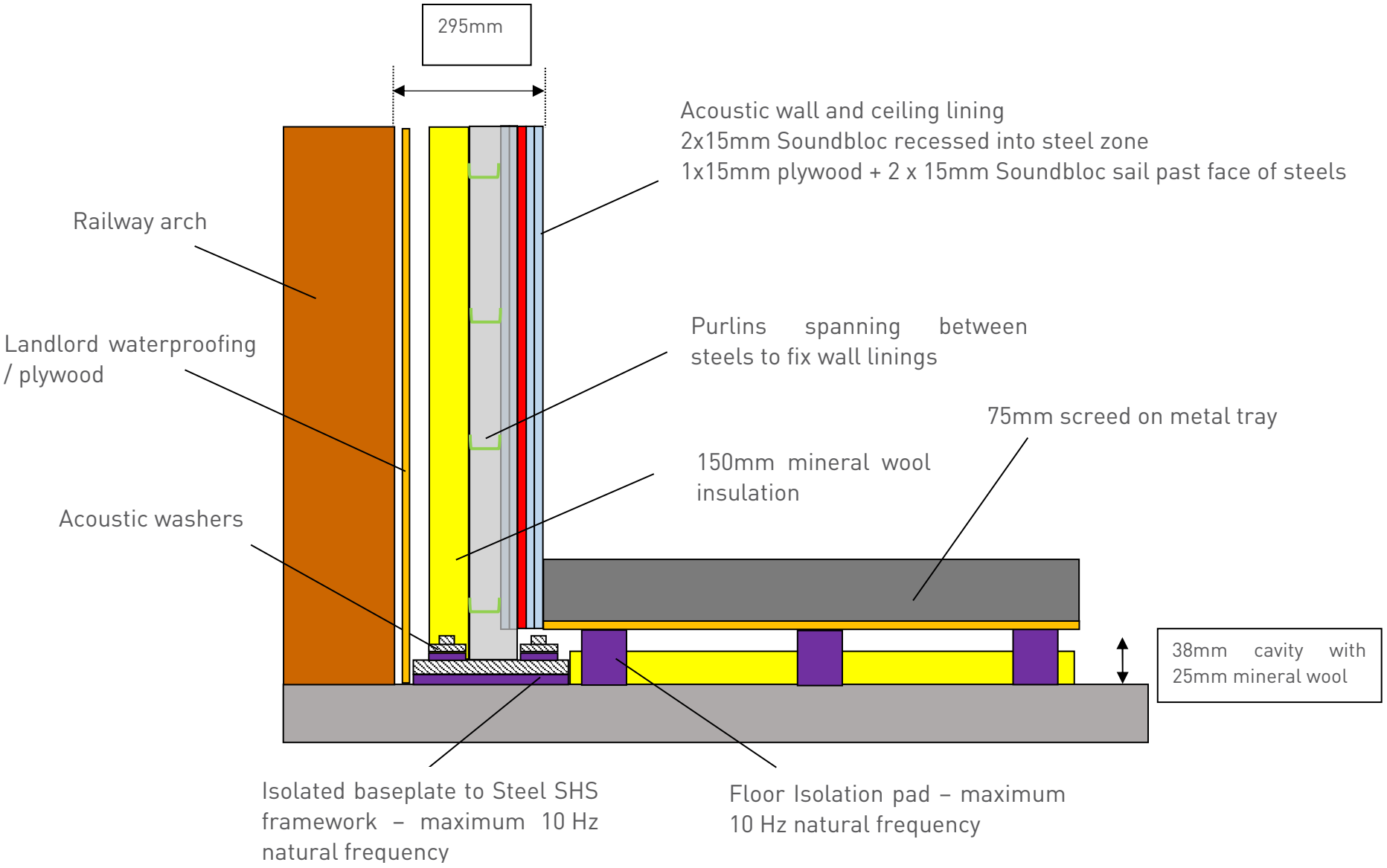
Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Acoustic doors - weight	Strain of neck, limbs or back	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging	Skin & respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Heavy linings to ceilings	Strain of neck, limbs or back	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4

L: Likelihood S: Severity R: Rating

Appendix D – Sketches & Details



Curzon Cinema, Camden Arches
Indicative low-level wall section
Project 10048

Figure 1
26 April 2021
Not to Scale

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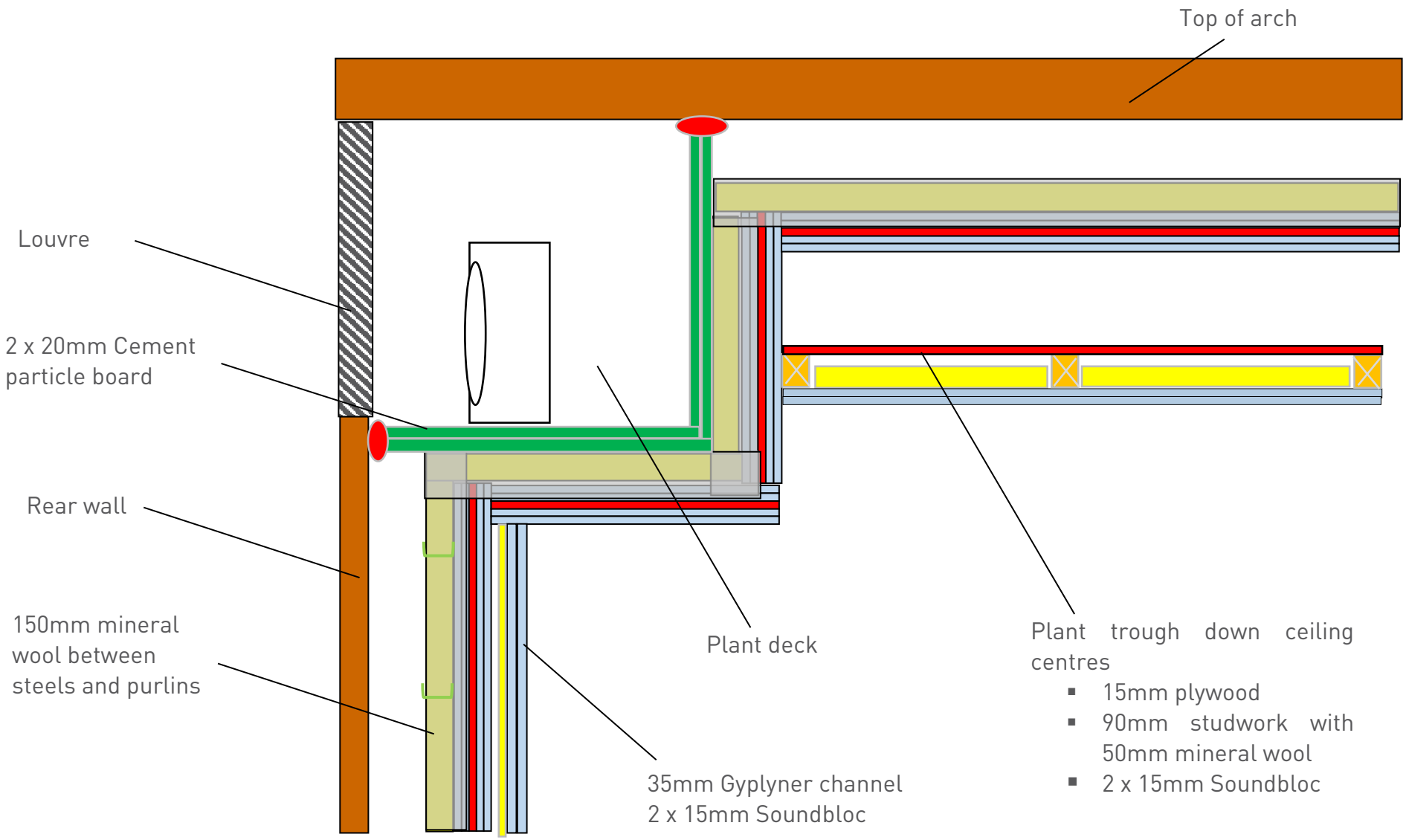

Curzon Cinema, Camden Arches
Indicative Section through plant deck and rear wall
Project 10048

Figure 2
26 April 2021
Not to Scale

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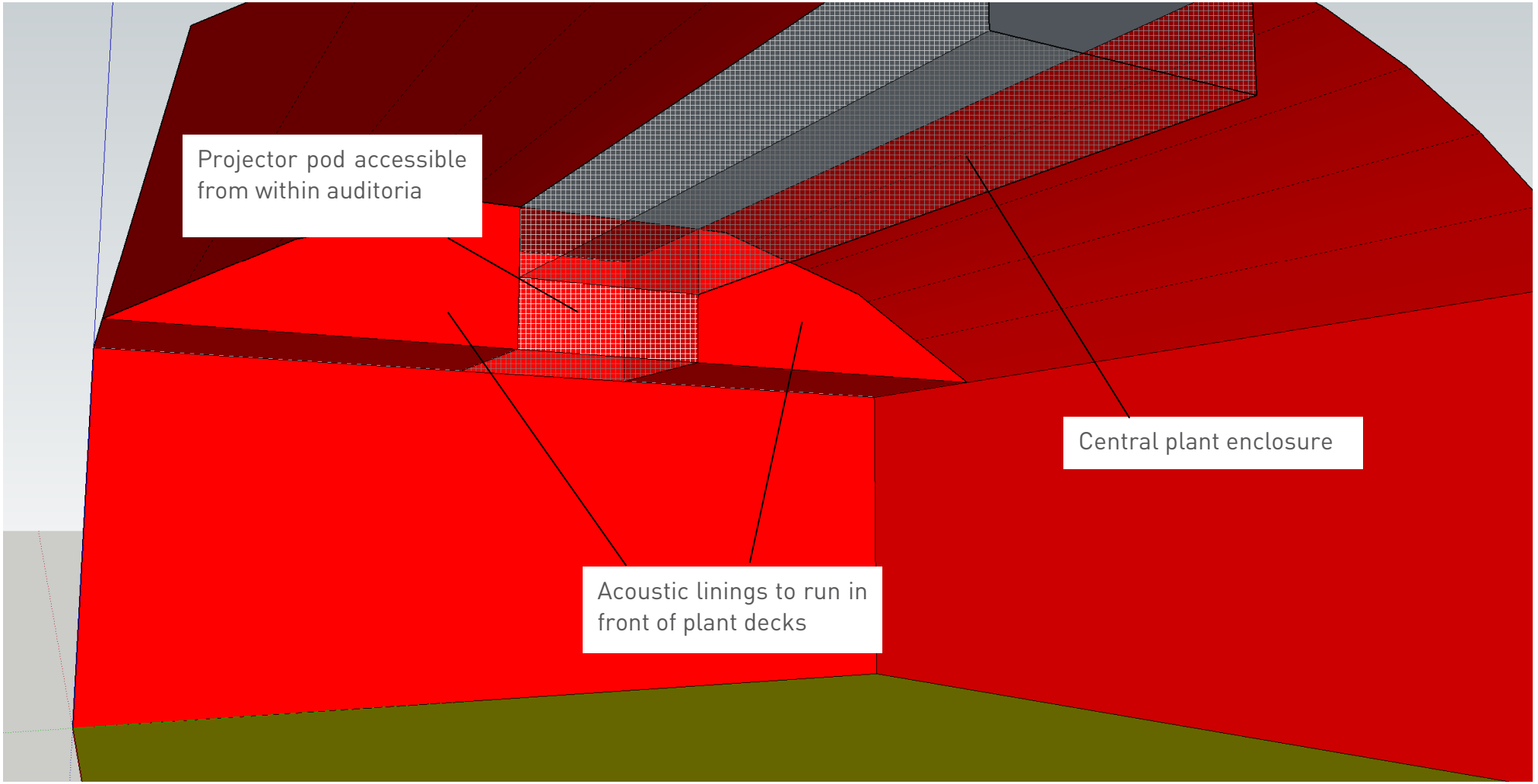

Curzon Cinema, Camden Arches
Indicative arrangement of rear plant decks and projector pod
Project 10048

Figure 3
26 April 2021
Not to Scale

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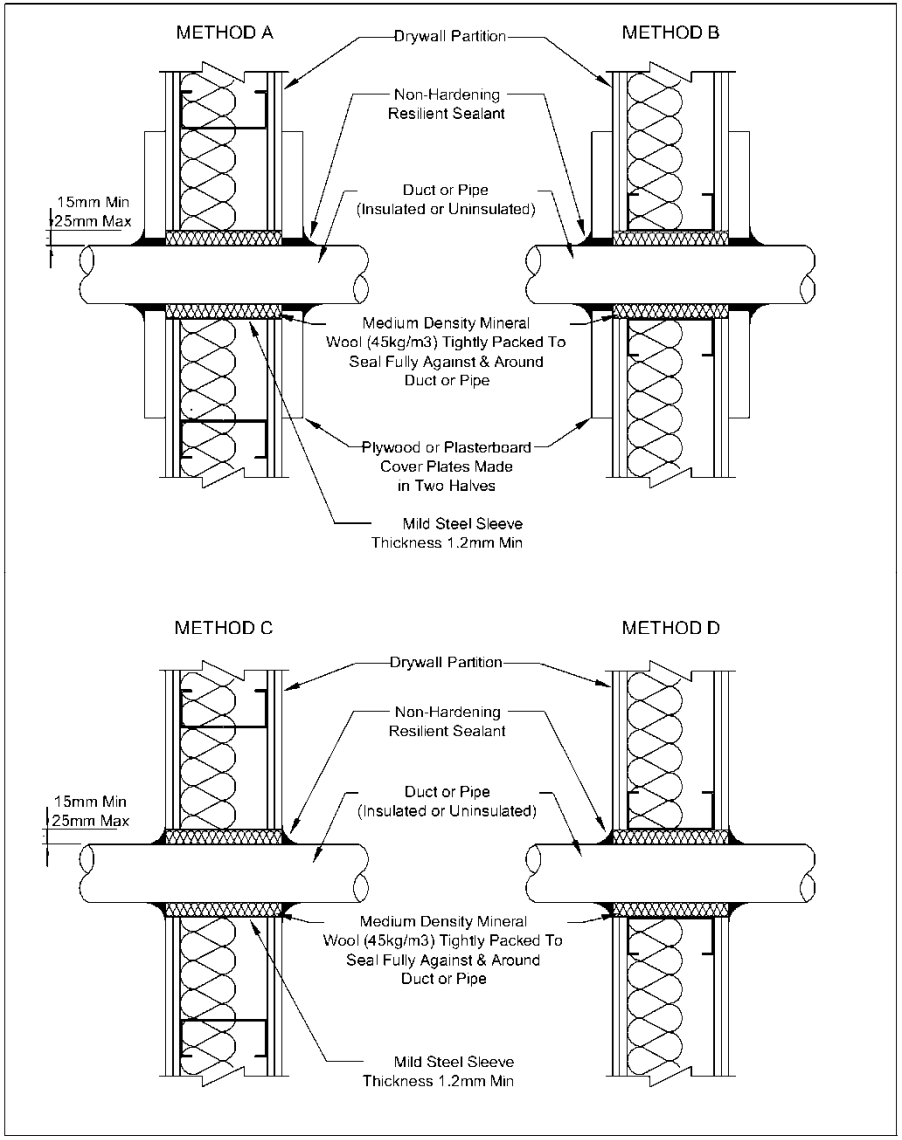

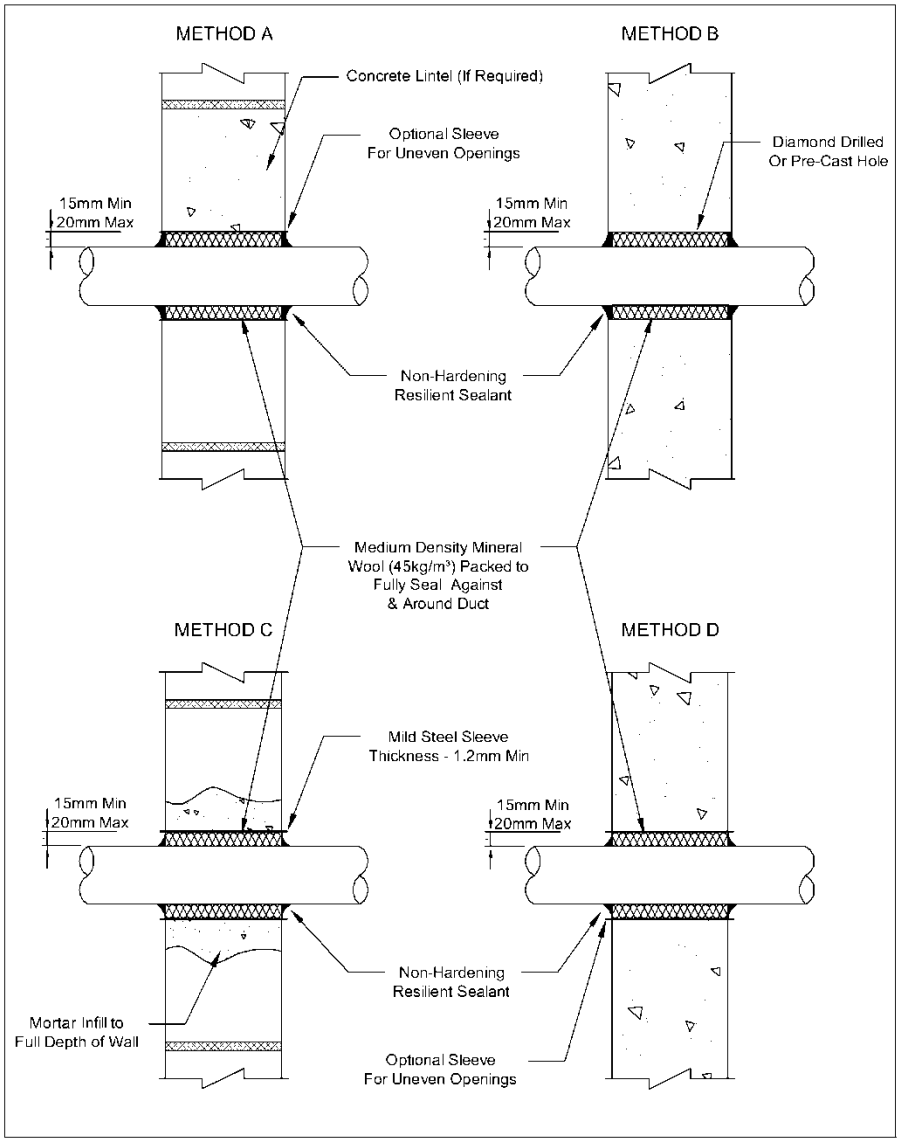

Curzon Cinema, Camden Arches
Drywall / Masonry Penetration Details
Project 10048

Figure 4
26 April 2021
Not to Scale

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