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PROJECT TECHNICAL MEMORANDUM

JOB TITLE : 68-70 Oldham Street,
61 Spear Street

REF : HT: 29397/PTM3/R4

DATE : 19 December 2022

FROM : Tom Bonnert

ISSUED TO : Cumming Group

RE: 68-70 OLDHAM STREET, 61 SPEAR STREET, MANCHESTER PLANNING ADDENDUM - NOISE TRANSFER ASSESSMENT

1.0 Introduction

As part of the planning submission for the above scheme Manchester City Council (MCC) have requested that an assessment of noise transfer from the adjacent venue at the front of the building (Oldham Street elevation) be carried out.

Hann Tucker Associates contacted Sue Jones of MCC to scope the assessment. The following approach was agreed by both parties.

- To undertake an airborne sound insulation test of the existing wall separating the two demises,
- To undertake a number of sample noise level measurements during a live music event at The Castle both in the Castle itself (source) and within the existing building at 68-70 Oldham Street (receiver).

Sue Jones attended site to witness the sound insulation testing of the existing separating wall.

Since the initial release of this addendum, additional survey work in the form of on-site vibration measurements have been undertaken during a time in which The Castle was operating a live music event. The purpose of this testing is to determine the magnitude of any re-radiated noise from common elements between the two spaces, which will be used to inform the strategy to mitigate noise and vibration in the scheme.

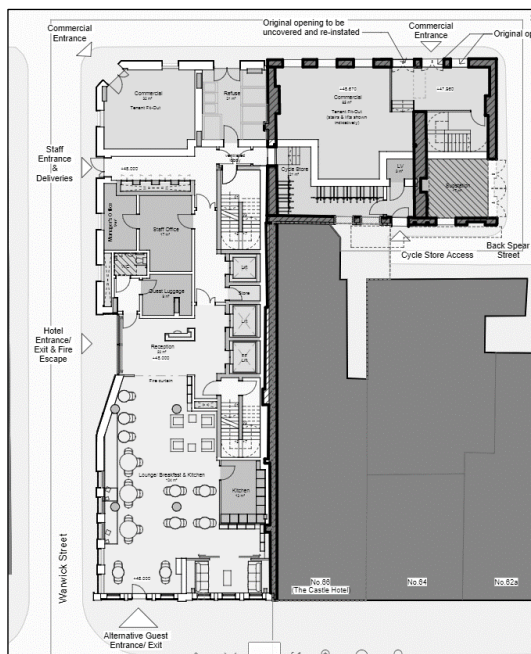


2.0 Proposed Development

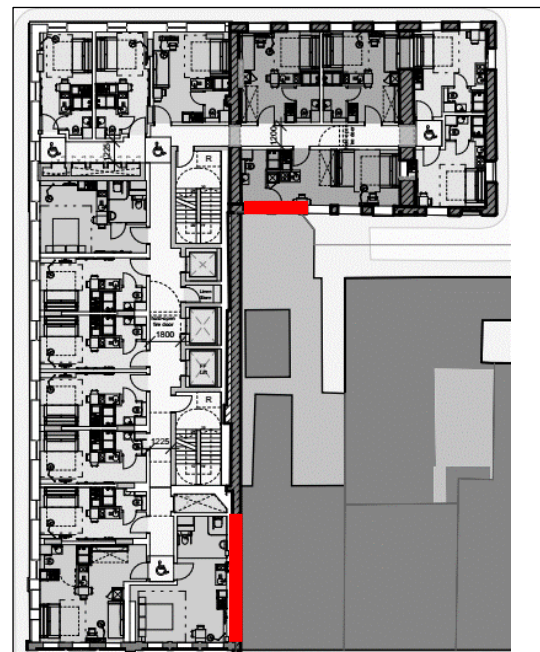
The proposed building is to be a commercial 'aparthotel' development. The development will have a shared wall separating portions of the development and The Castle at ground level and first floor level.

Internally, the majority of the development that shares a common partition with The Castle will be a circulation space (stairs wells, lifts, etc). In addition, the ground floor of the development is to comprise a reception/Lounge & kitchen area, which are considered to be less sensitive than hotel bedrooms. The first-floor level will have guestroom that shares a separating partition with The Castle on the Oldham Street elevation, and a lesser connected bedroom that is assumed to also have a separating partition with The Castle on the Spear Street elevation.

A typical floor plan layout of the ground and first floor can be seen below, with the bedrooms sharing a party walls highlighted in red.



Proposed Ground Floor Plan
(c/o SimpsonHaugh Architects)



Proposed First Floor Plan

3.0 The Castle Entertainment Noise Transfer via Wall (Airborne)

This section of the memo aims to assess airborne noise transfer from operational activities of The Castle to the proposed development via the shared party wall. Our assessment also considers measured noise during a live music event within The Castle's event space and measurements within the bar and lounge areas, capturing general patron and jukebox noise.



3.1 Separating Wall Sound Insulation Test

3.1.1 Overview

Hann Tucker Associates attended site on Friday 18th November 2022 to undertake an airborne sound insulation test across the separating wall between The Castle and the proposed development. At the time of the test, The Castle was fully furnished, and the adjacent development was mostly an open plan derelict space.

3.1.2 Instrumentation

The instrumentation used to carry out the measurements is presented in the table below:

Equipment	Model	Serial Number	Calibration Date	Certificate No
Precision Sound Analyser Meter	Brüel & Kjær Type 2250	3025397	03/10/2022	04048/2
Sound Level Calibrator	Brüel & Kjær Type 4231	2271905	30/09/2022	05505/1
Sound Source	Custom made, un-ported sealed cabinet type	N/A	N/A	N/A

The sound level meter was calibrated prior to and on completion of the measurement schedule. No significant deviation had occurred (no more than 0.3 dB).

3.2 Methodology

The sound insulation tests were undertaken by generating a broad band, random diffuse sound field within the source room. A spatial average of the resulting 1/3 octave band noise levels was obtained within the source room from measurements undertaken over a time period of a least 30 seconds. The measurement procedure was repeated in the receive room.

The sound level differences were determined by generating a broad band, random diffuse sound field within the source room. A spatial average of the resulting 1/3 octave band noise levels was obtained within the source room from measurements undertaken over a time period of a least 30 seconds. The measurement procedure was repeated in the receive room. A second speaker position was then selected in the source room and the measurement procedure was repeated.

The receive levels were corrected for background noise where necessary as follows:

Where the measured background noise level in each 1/3rd octave band was more than 6dB but less than 10dB below the receive level, the following formula was applied:



$$L = 10 \log \left(10^{\frac{L_{SB}}{10}} - 10^{\frac{L_B}{10}} \right) \text{ dB}$$

where

L is the adjusted signal level in decibels;

L_{SB} is the level of the signal and background noise levels combined, in decibels;

L_B is the background level in decibels.

Where the measured background noise level was less than 6dB below the receive level, a correction of 1.3dB was applied (corresponding to a level difference of 6dB) and the $\geq$ symbol was added to the results to show that the reported values are the limit of measurement.

The corrected receive levels are subtracted from the source levels to determine the level differences over the frequency range 50-10kHz from each source position. The level differences for each source position are arithmetically averaged at each frequency band to give the level difference, D .

3.3 Results

The on-site measured level differences of the separating walls are presented in the table below.

Description	Measured Sound Level Difference D (dB) at Octave Band Centre Frequency (Hz)								D_w
	63	125	250	500	1k	2k	4k	8k	
TEST 1 – Ground of 68 Oldham Street to Performance Space of The Castle	33	44	48	54	58	54	55	46	56
TEST 2 – Performance Space of The Castle to Ground Floor of 68 Oldham Street	37	49	53	66	69	68	55	60	66
TEST 3 – Performance Space of The Castle to First Floor of 68 Oldham Street	38	52	58	67	72	61	43*	60	66
TEST 4 – 68 Oldham Street Ground to The Castle Snug	37	42	46	51	58	61	60	49	56
TEST 5 – The Castle First Floor Space to 68 First Floor	39	45	49	57	62	65	66	60	60

*The Measured Normalised Level Difference at 4kHz was unduly affected by background noise from fire alarm beeps in 68 Oldham Street.



3.4 Discussion

We understand the separating wall structure comprised of a solid brick construction of unknown layers and depth, with no visible penetrations for columns or beams.

Whilst the wall was under test it was noted that low frequency noise was audible within the receiving room, which was emanating from the wall uniformly. There was no notable weakness of the wall on any of the levels within the development.

3.5 Entertainment Noise

Hann Tucker Associates attended and event at The Castle on Friday 18th November 2022 between the hours of 21:00-23:00 to undertake noise level measurements within The Castle. During our measurements we captured noise events from various live music acts and at multiple positions throughout the ground floor space of The Castle, and general noise from patrons and jukeboxes within the ground floor and first floor seating areas.

We understand the current Premises Licence for the Castle Hotel permits hours for live and recorded music until midnight. The permitted hours of opening are until 02.00 Monday to Thursday and Sunday, and until 03.00 on Friday and Saturday.

The highest L_{Aeq} noise levels measured within each of the spaces of The Castle are presented in the table below.

Location	Metric	Typical Highest Reverberant Noise Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Live Music and Event Space	L_{Aeq}	106	113	105	104	101	96	95	90	106
Ground Floor Front of House Bar Area	L_{Aeq}	69	74	74	77	74	71	64	55	79
First Floor Seating Area	L_{Aeq}	76	80	82	82	80	76	69	57	85
Ground Floor Seating/Lounge Area	L_{Aeq}	76	84	79	81	80	77	71	64	84

It should be noted that multiple measurements of the live music event were undertaken, and of those measurements, the loudest/worst-case has been presented in the table above. As such, the above are considered to be sufficiently robust, giving “safety” for slight fluctuations/increases in the source noise level.



In addition to the above, the noise levels measured in the 'Live Music and Event Space' are considered to be sufficiently high that they represent a sufficiently wide degree of music sources, and are typical of multiple music sources such as live bands to amplified DJ music.

3.6 Proposed Assessment Criteria

Based on MCC guidance, music noise levels in the 63 Hz and 125 Hz octave centre frequency bands (L_{eq}) is suggested to be controlled to exceed (in bedrooms) 47 dB and 41 dB, respectively. In our experience, it is also appropriate to set limits for all other frequencies based on achieving NR 15 $L_{eq,5min}$. These limits would apply any time The Castle is operational, day or night.

3.7 Minimum Level Difference Required

We have assessed noise transfer based on source noise levels measured within The Castle as presented in Section 3.5, room dimensions from Simpson Haugh Architects drawings, and the music noise criteria as presented in Section 3.6.

The table below summarises the results of the assessment and presents the octave band sound insulation performance required between the event space and the bedrooms.

Description	Octave Band Centre Frequency (Hz) dB						
	63	125	250	500	1k	2k	4k
Measured Source Room Level (The Castle Event Space), L_{eq}	106	113	105	104	101	96	95
Proposed Receive Room Limits, $L_{eq,5min}$ (dB)	47	41	26	19	15	12	9
Required Level Difference, D, (dB)	59	72	79	85	86	84	86

3.8 Required Mitigation – Airborne Noise

The performances required to sufficiently mitigate music noise transfer to the proposed bedrooms will be greater than the sound insulation performance of the existing wall construction. Therefore additional allowances will be required by the below illustrated amounts.

Description	Octave Band Centre Frequency (Hz) dB						
	63	125	250	500	1k	2k	4k
Required Level Difference, D, (dB)	59	72	79	85	86	84	86
Current Measured Level Difference, D, (dB)	38	52	58	67	72	61	55*
Required Increase in Level Difference, D, (dB)	21	20	21	18	14	23	31

*The Sound Reduction Index at 4kHz was unduly affected by background noise from fire alarm beeps in 68 Oldham Street, therefore the measured performance between ground floor spaces has been used instead.



As seen in the table above the required mitigation performance for low frequency (63Hz and 125Hz) is high and would likely require a substantial and detailed construction to be achieved. Example mitigation measured that we feel could achieve the required performance includes the following:

- Independent multiple layer plasterboard/blockwork walls built off a resilient floor, with resiliently hung ceiling or lid, essentially forming an isolated construction within the existing building envelope (ie box-in-box arrangement);
- Walls will require a resilient head detail and a cavity of up to 500mm (spec. to be developed further during detailed design);

The required mitigation identified is only required to bedrooms as it would not be considered necessary to achieve the criteria within the ground floor communal/operational spaces, or general circulation spaces.

4.0 The Castle Entertainment Noise Transfer (Vibration)

4.1 Overview

Hann Tucker Associates attended site on Sunday 11th December 2022 to undertake vibration measurements on existing structural elements expected to be connected to The Castle.

4.2 Instrumentation

The following instrumentation was used for the survey and subsequent analysis:

- 1No. Dytran Accelerometer
- 01dB –dB4 Hardware Interface
- 01dB – dBTrig Vibration Acquisition Software
- 01dB – dBTrait Vibration Analysis Software
- Microsoft Windows Based Laptop Computer

The 01dB hardware connects accelerometers via a multi-channel USB interface to the laptop computer. The system can record data in real-time to a laptop computer allowing simultaneous analysis in both the time and frequency domains.

The analysis chain was calibrated prior to the measurements to enable subsequent analysis.

The vibration measurements were undertaken with the accelerometer attached to the surfaces using magnetic coupling to a magnetic mounting plate.

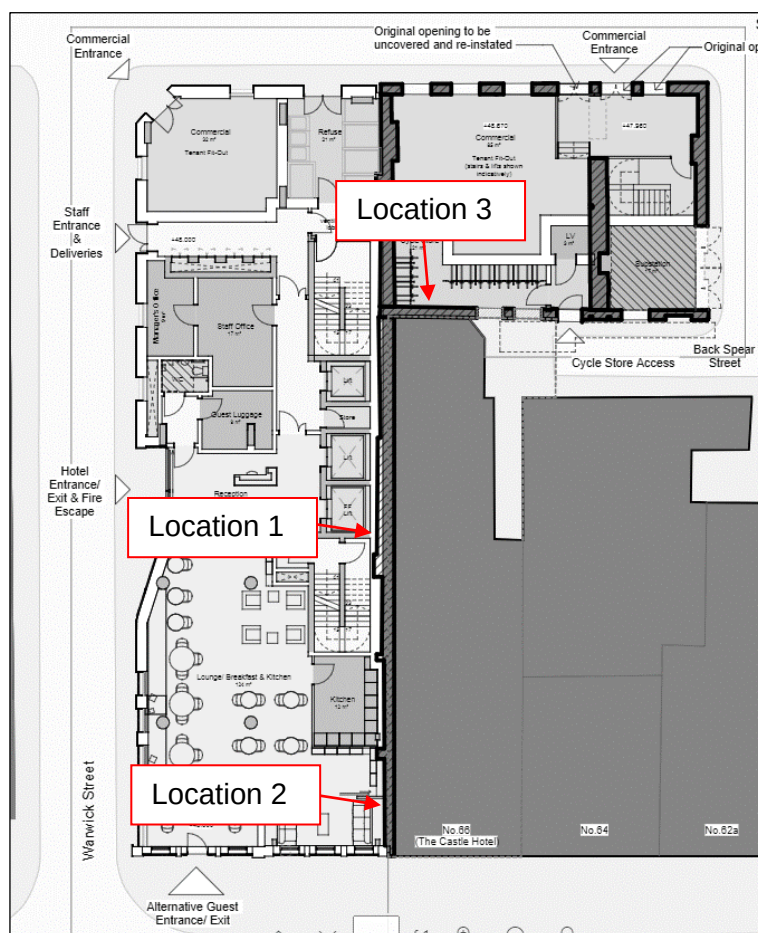


4.3 Measurement Positions

Vibration measurements were completed at the following three locations to inform possible implications of structure borne noise within the proposed development.

- Location 1 – 70 Oldham Street, Adjacent to The Castle Live Music and Event Space, Ground floor
- Location 2 – 70 Oldham Street, Adjacent to The Castle Front of House Bar Area, Ground floor
- Location 3 – The Warehouse (Spear Street), Adjacent to The Castle Party Wall, Ground floor

Each position incorporated a wall measurement and a floor measurement, with a mark-up as below.





4.4 Results

Based on the recorded vibration levels we have calculated re-radiated noise levels within the proposed development in a bedroom. The proposed criteria (perceptual inaudibility) are also provided for ease of reference. Noise levels will also decay slightly with height, though we have measured in the nearest/worst case location to the source of vibration/noise for robustness.

Description		Octave Band Centre Frequency (Hz) dB		
		31.5	63	125
Criteria		65	47	41
Location 1	Wall	65	73	69
	Floor	57	59	65
Location 2	Wall	52	61	56
	Floor	46	38	36
Location 3	Wall	51	51	40
	Floor	47	47	38

4.5 Discussion

As can be seen in Section 4.4, the predicted re-radiated noise levels range from compliant (green highlight), to slight exceedances (orange highlights), to exceedances of the criteria. Notwithstanding, these predictions account for no mitigating factors, and are presented based on the existing building fabric.

As such, to inform the mitigation approach discussed in Section 5.0, the following set outs a summary of the vibration results in terms of re-radiated noise:

- Location 1
 - The wall measurement is presented as an absolute worst-case location and it is important to keep in mind that this adjacency is unlikely to be present in the future development as a new build construction is likely to be proposed here.
 - The floor result could be viewed as a worst case assessment as any new building will still need to be constructed off of “mother earth”, and the building foundations are unlikely to be isolated themselves. Notwithstanding, the adjacency present in this location of the future development is for a lift core/stairs (ie non sensitive).
 - Ultimately, it is suggested that conclusions regarding re-radiated noise be drawn from the results of Location 2, which reflects a location representative of the worst affected bedroom.



- Location 2
 - The measurements conducted in this location show that the majority of the energy can be found in the wall, and is reflected in the higher re-radiated noise levels. Based on the measured data, the mitigation scheme should be capable of reducing the re-radiated noise levels by the following extents:
 - Wall requires a reduction of 14 dB @ 63 Hz and 15 dB @ 125 Hz
- Location 3
 - The measurements conducted in this location show a notable reduction in re-radiated noise compared to Location 1 and Location 2. Based on the measured data, the mitigation scheme in this locations should be capable of reducing the re-radiated noise levels by the following extents:
 - Wall requires a dB reduction of 4 dB @ 63 Hz
 - Floor requires a dB reduction of 2 dB @ 63 Hz

5.0 Proposed Mitigation Allowances

Based on the need for robust mitigation, the developer has made provision for a scheme of mitigation against noise transfer. This relates to a considered building layout (i.e. cores/non-residential spaces abutting The Castle entertainment space), fully independent deep-cavity party wall linings in conjunction with resilient floor and ceiling constructions (i.e. box-in-box intent).

It is also important to note that the development has a 'considered' internal layout which provides a core circulation space with lift shafts, stairwells to the majority of the shared party wall with The Castle. This arrangement not only limits the number of bedrooms sharing an immediate adjacency with The Castle party wall, but also provides additional mass and subsequently acoustic performance to the party wall which is not reflected in our initial testing of the partition (ie it does not yet exist).

There is also scope to ensure any new concrete elements are built as separate structures where built off of ground, or incorporate resilient pads at any abutments/interfaces (i.e. a gap and a movement joint in the slab) and or treatment in the 500mm party wall zone. These details would be subject to development.

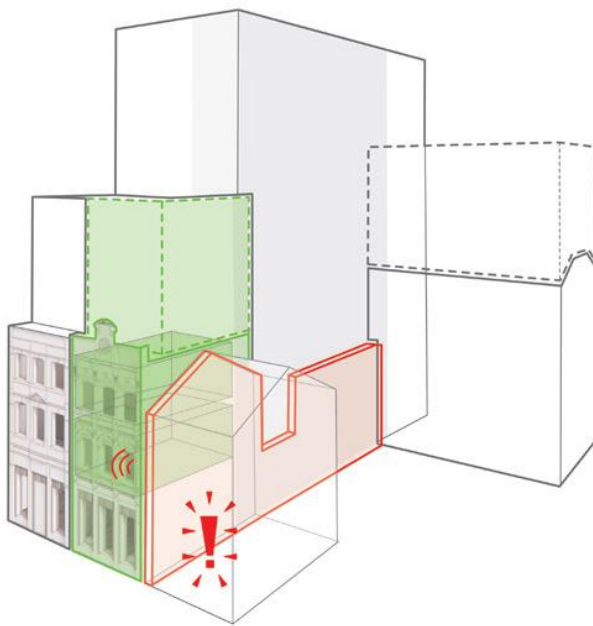
Ultimately, however, there are 3no. build conditions which have been developed which are discussed further in the following sections.



The extent to which each treatment is proposed within the scheme can be seen in the drawings appended to this memo.

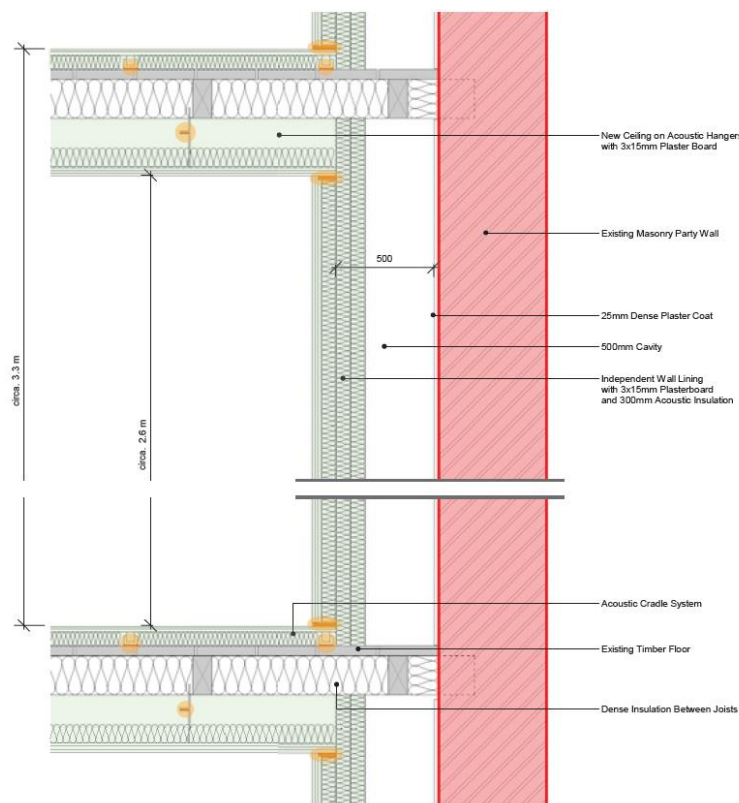
5.1 Condition 1 – Hotel Bedrooms immediately adjacent to Party Wall

An illustrative figure is provided below highlighting the area in which this condition occurs, with the party wall highlighted in **red**, and portion of the development affected in **green**. Critically however, there are also two sub-groups of this conditions, split between existing structure being retained (Level 1 and 2) and new-build construction being extended (Level 3 to 5).



5.1.1 Condition 1 – Level 1 and 2 Bedrooms

The bedrooms on Level 1 and 2 share a party wall directly with The Castle, though not directly with the event space, require acoustic mitigation in the form of an enhanced build-up in addition to existing to mitigate against airborne noise transfer during live events and the general day-to-day operation of The Castle. The following mitigation scheme for these hotel rooms is proposed, and is allowed for in the early design/feasibility studies for the scheme:



Based on test data of similar systems (note whilst similar they are likely lesser extents), and simulated airborne sound insulation performances, we have estimated the minimum expected performance at each octave band below. These are then compared with the calculated minimum requirement for the party walls.

Description	Level Difference at Octave Band Centre Frequency (Hz) dB						
	63	125	250	500	1k	2k	4k
Simulated 'brick' partition with independent plasterboard lining	60	74	80	87	94	104	98
Required Level Difference, D, (dB)	59	72	79	85	86	84	86

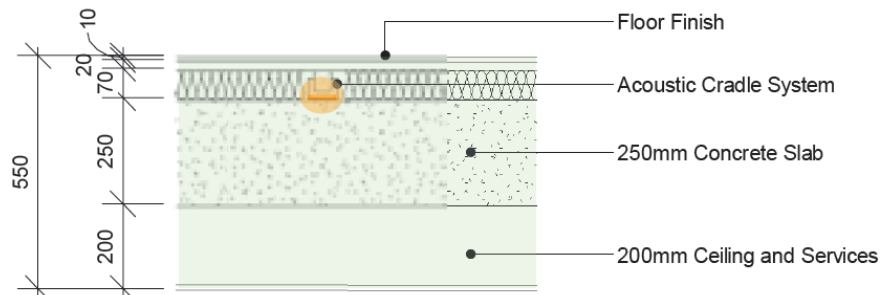
As seen in the table above, the range of estimated performances of the proposed party wall are above the required level difference presented in Section 3.7.

The current layout of The Castle relative to the nearest proposed bedrooms has been arranged such that the event space is not directly adjacent to a future occupiable room. Notwithstanding, to allow a worst case/robust assessment, our predictions/specifications have been based on mitigating a direct adjacency rather than the current staggered arrangement. This ensures the proposed mitigation can provide sufficient sound insulation for the current, more favourable layout of The Castle's live event space with respect to the bedrooms, and should the layout change undue residual impact would not be expected to arise.



5.1.2 Condition 1 – Level 3, 4 and 5 Bedrooms

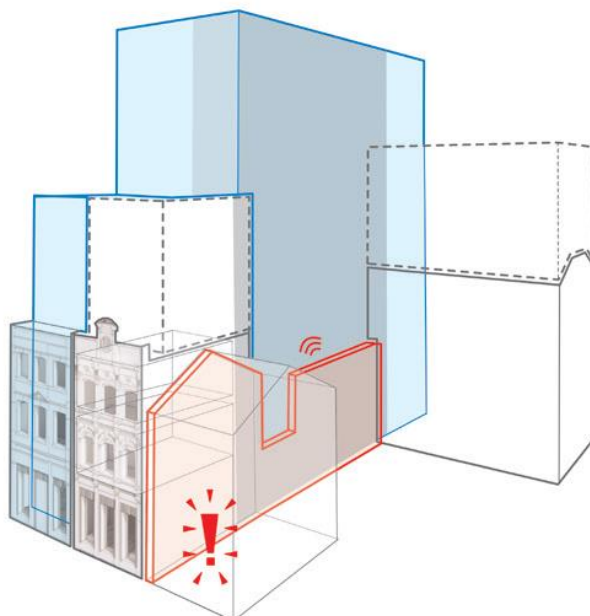
Whilst these rooms do not share a common party wall with The Castle, allowance has been made for a resilient floor finish in the form of cradle and batten flooring, given that the new extension could be built off of the existing structure that is connected to The Castle. See below.



It however important to note that the level of acoustic performance needed to these spaces is dictated not by airborne noise (as there is no party wall), but by the possible need to mitigate re-radiated noise. This will be heavily reliant on the intended construction approach so the above is considered to serve as a worst case should the new build extension remain structurally connected to The Castle. This will need to be developed further, with possible scope for reduction in the mitigation allowance.

5.2 Condition 2 – Main Building adjacent to the Party Wall

An illustrative figure is provided below highlighting the area in which this condition occurs, with the party wall highlighted in red, and portion of the development affected in blue.



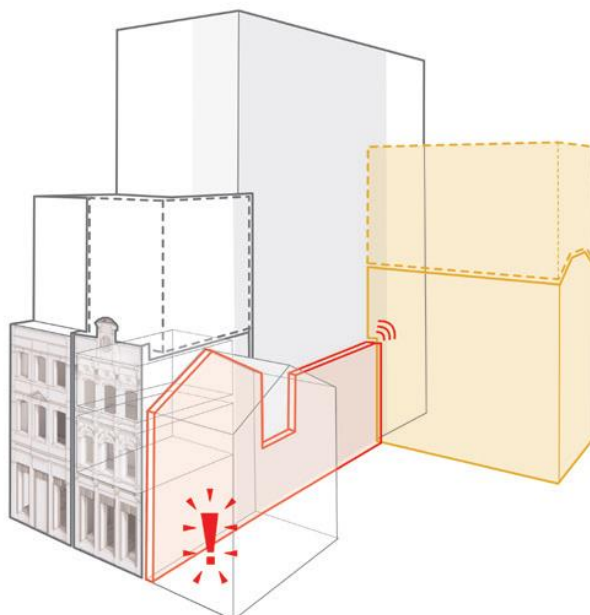


Critically however, this portion of the building is likely to be a newly formed construction, with scope to ensure a clear gap is present between the party wall of The Castle and the new building. It is also important to note that the new structure has the potential for a ca. 500mm treatment zone for any new build element along the party wall line, within the redline, which is commensurate with the more robust system proposed at lower levels. This is in addition to existing party wall and would be of further benefit in reducing noise transfer. An indicative section is provided in the figure below highlighting the intended construction approach.



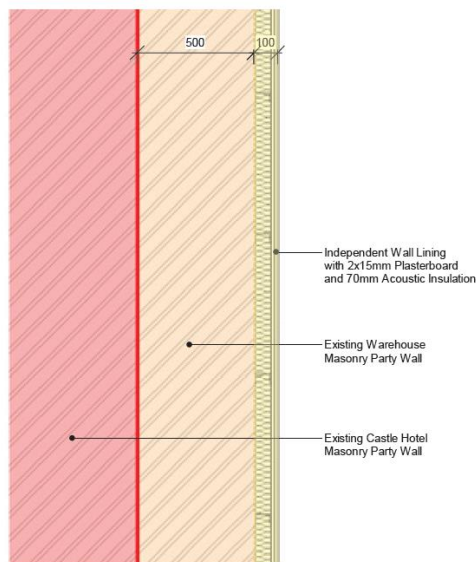
5.3 Condition 3 – Existing Warehouse Connection to The Party Wall

An illustrative figure is provided below highlighting the area in which this condition occurs, with the party wall highlighted in red, and portion of the development affected in Orange.





Initial investigations suggest there may be a structural connection between The Castle and future bedrooms within The Warehouse. As such, allowance has been made for an independent wall lining the existing wall being retained to mitigate against noise within The Castle. See below.



It however important to note that the level of acoustic performance needed to these spaces is dictated not by airborne noise (as there is limited party wall), but by the possible need to mitigate re-radiated noise.

This will be heavily reliant on the intended construction approach so the above is considered to serve as a worst case should the new build extension remain structurally connected to The Castle. This will need to be developed further, with possible scope for reduction in the mitigation allowance.

6.0 Hotel Lounge/Breakfast & Kitchen (Music) External Noise Breakout

6.1 Expected Internal Noise Levels

To inform our assessment of the spaces, we have drawn upon typical noise levels within similar spaces that incorporate music. These typical highest 1-hour noise levels are presented below.

Description	Reverberant Noise Level (dB $L_{eq,1hr}$) at Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
Typical internal noise levels in a bar with background music playing:	71	74	75	75	72	68	63	77



6.2 Criteria

MCC recommends that noise (L_{eq}) breaking out through the building frontage of an entertainment venue should not exceed 5 dB below the background noise level (L_{90}) at all octave band frequencies at the nearest noise sensitive windows. For this development, the nearest residential receptor is 8m to the north of the site.

We therefore propose the following noise limits when measured at 1m from nearby noise sensitive windows. These limits are 5 dB below the typical lowest background noise levels at each octave band during the operational hours and are subject to the final approval of MCC.

Description	Entertainment Noise Level Limit (dB $L_{90,15min}$) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	49	44 ¹	43	41	42	41	35
Night-time (23:00 – 07:00)	47 ¹	41 ¹	35	32	31	25	16

¹ Based upon threshold of audibility, see below.

At low-frequencies, achieving 5 dB below the minimum background levels at this particular site is unnecessarily onerous, the breakout noise limits have therefore been increased to 47 dB and 41 dB at 63 Hz and 125 Hz, respectively. These limits are based upon the MCC criterion for entertainment noise intrusion to bedrooms, which itself is based upon the threshold of audibility at low frequencies. It is expected, therefore, that relaxing the limits in this way will have no effect on the impact to nearby sensitive receptors.

6.3 Window Glazing Calculation

We understand the bar will be located internally with glazing that has yet to be determined. We have performed our calculations using the minimum required performance glass to demonstrate the ability to comply with the criteria, and our assessment is therefore considered to be worst-case and robust given that glazing will likely be thicker for safety/security reasons, thus increasing any acoustic performance achieved.

6.4 Assessment

We have assessed noise breakout to the nearest receptors based on standard calculation procedures for reverberant noise breakout and source noise levels in Section 6.1. The resultant external noise level has been calculated using the following equation.

$$SPL_{out} = SPL_{in} - SRI + 10\log_{10}\left(\frac{S}{r^2}\right) - 14$$



Where:

SRI estimated sound reduction performance of façade element

r distance from radiating element to receptors

S approximate area of radiating element

The tables presented below outline summary calculations for the different operational noise levels assumed. Night-time criterion has been used to ensure a worst-case assessment of minimum glazing performances required.

Typical internal noise levels in a bar with background music playing

Assessment to Residential Receptor	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Internal noise level (dB L _{eq}) <i>SPL_{in}</i>	71	74	75	75	72	68	63
Distance & radiating area propagation correction (dB) $10\log_{10}\left(\frac{S}{r^2}\right)$	-7	-7	-7	-7	-7	-7	-7
Internal diffuse field to external free-field hemispherical radiation correction (dB) -14	-14	-14	-14	-14	-14	-14	-14
External noise level at nearest receptor (dB L _{eq}) <i>SPL_{out}</i>	50	53	54	54	51	47	42
Criteria at nearest receptor (dB L _{eq})	47 ^[1]	41 ^[1]	35	32	31	25	16
Minimum required glazing sound reduction (dB R) <i>SRI</i>	3	12	19	22	20	22	26

The above minimum glazing performances can typically be achieved with double glazing. Notwithstanding, other configurations will likely be available, though it is important any system satisfies the above performances.

It should be noted that our assessment presented above has been undertaken with consideration to daytime and night-time operation. Should the desired operational hours of the hotel bar be reduced, this would reduce the reliance on glazing performance to control noise break-out.

Ultimately, the above demonstrates systems are readily available to control noise break-out from the hotel bar.



7.0 Conclusion

The minimum sound insulation performance (Level Difference, D_w) requirements between the Castle Hotel and the development have been established based on on-site testing.

Vibration measurements have also been undertaken to establish likely levels of re-radiated noise due to music.

Example mitigation measures have been proposed to allow for appropriate provisions to be made at this stage of the project. It should however be noted that the implemented mitigation would require careful consideration and should be developed throughout the next design stage, with exact design details to be incorporated as required.

Through a combination of measured on-site performances from past projects, and simulated performances, the proposed constructions should be capable of mitigating noise transfer from The Castle into hotel bedrooms on Level 1 and 2 of the development.

Elsewhere, on Levels 3 to 5, we would expect that through the proposed mitigation (ie resilient floor allowance), suitable configuration of internal spaces (ie majority of the shared party wall is adjacent to lift shafts and stairwells), and new build elements being built as a separate structure, hotel bedrooms are unlikely to be adversely affected by noise transmission through the party wall.

Ultimately, this technical note serves to present mitigation allowances that have been scope with the project team with a view to determining both that, the scheme is feasible from a design perspective and whether that scheme is considered to be commensurate with the level of performance specified. This should then serve as a starting point for design to continue from, with coordinated and detailed design principles developed further for submission and agreement.

Yours sincerely

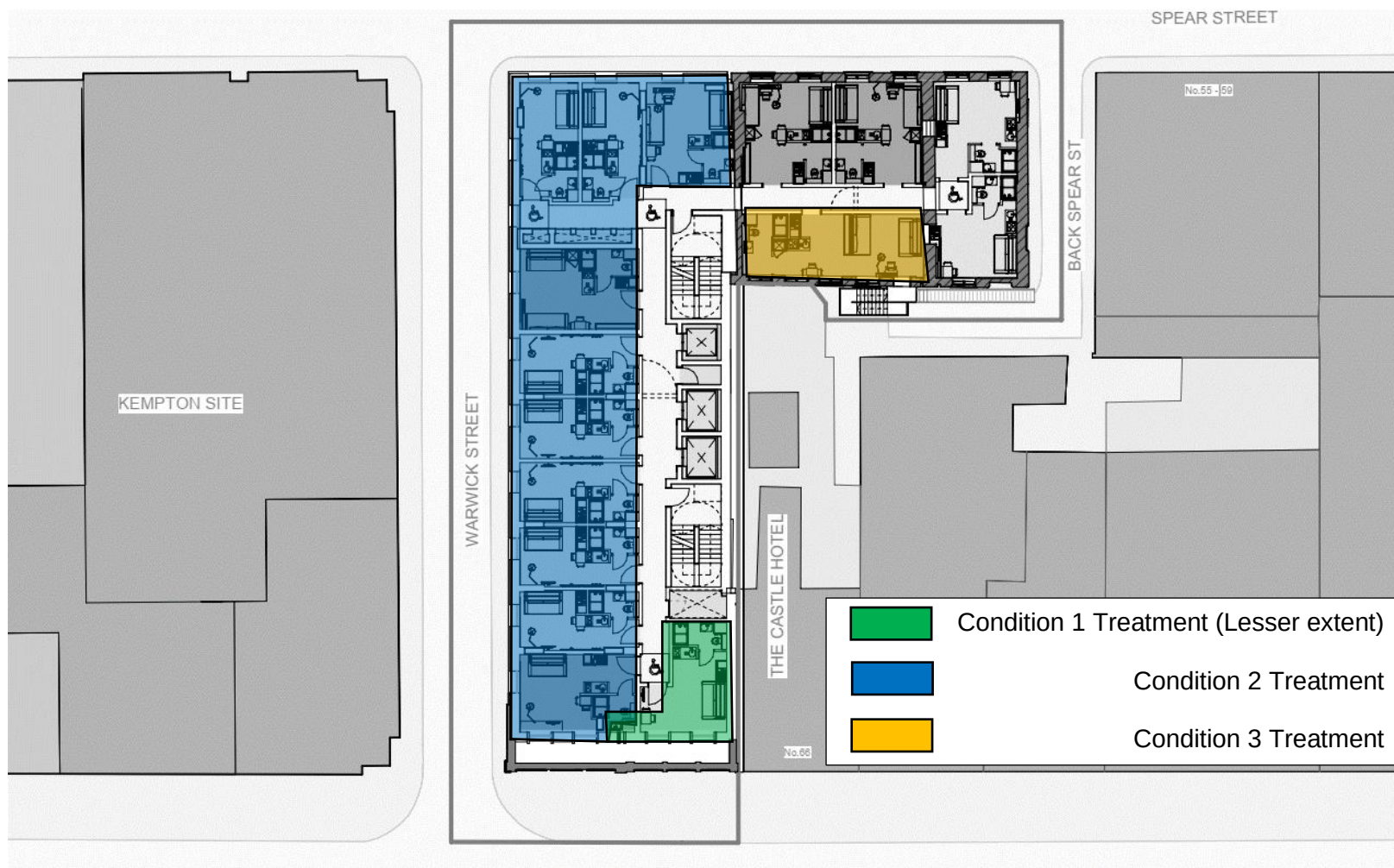
Tom Bonnert
for HANN TUCKER ASSOCIATES

Level 1 and 2



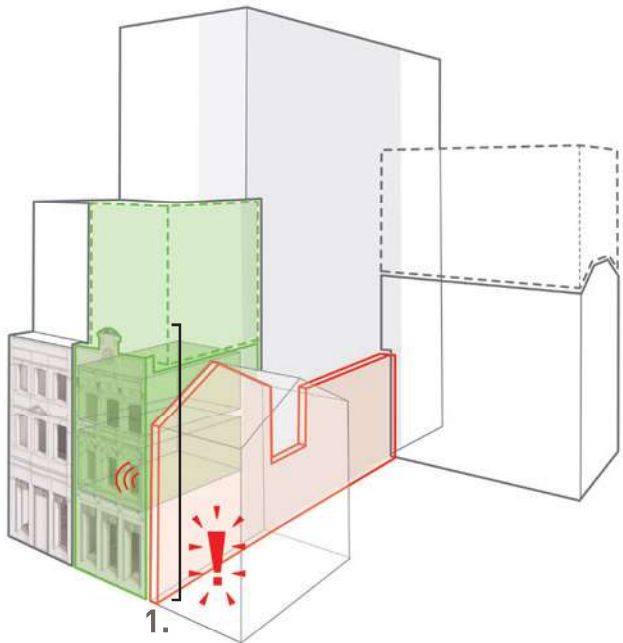
Location of rooms requiring box-in-box acoustic treatment (Level 01-02)

Level 3 to 5

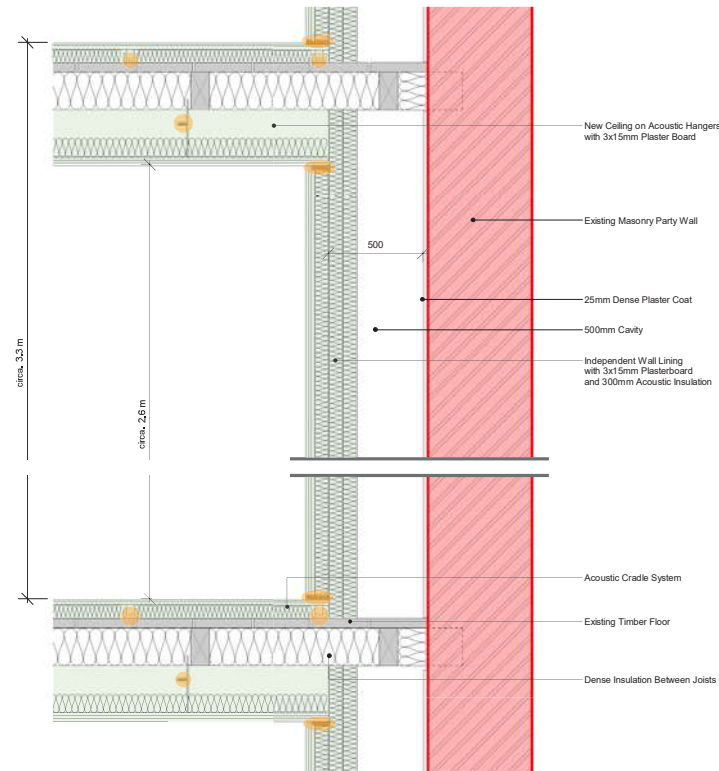
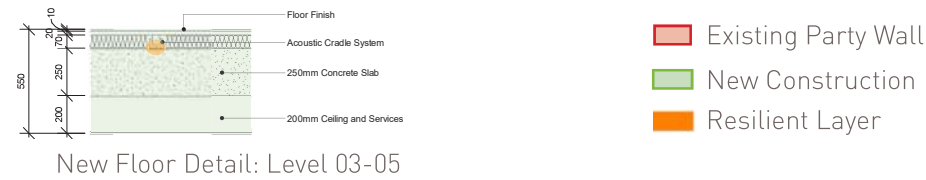


Location of rooms requiring box acoustic floor treatment (Level 03, 04 and 05)

CONDITION 1. THE HOTEL BEDROOMS IMMEDIATELY ADJACENT TO THE PARTY WALL

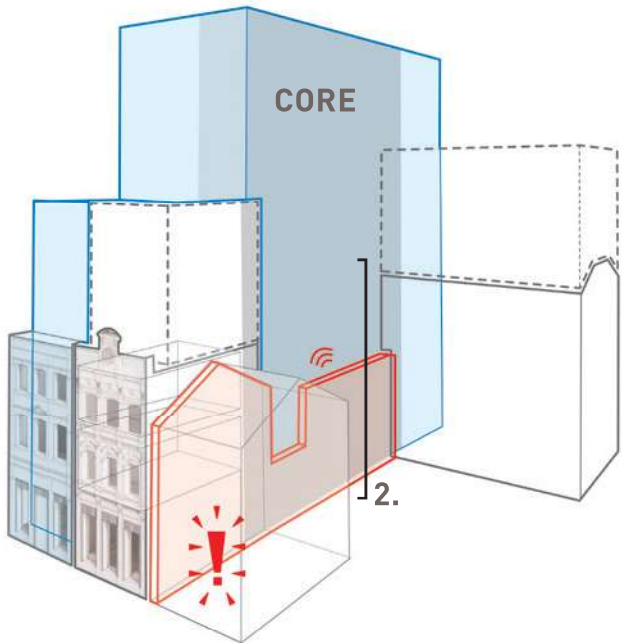


PROPOSED MITIGATION:

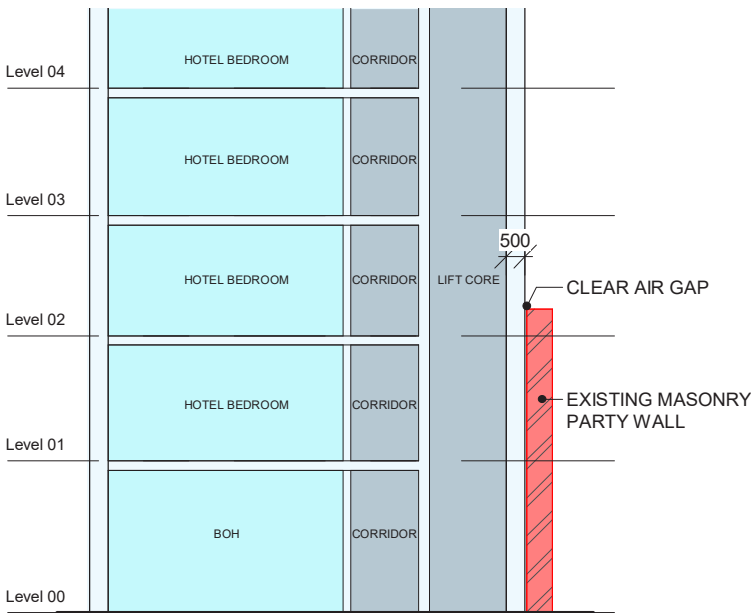


Existing Floor Detail: Level 01-02
1:40 @ A3

CONDITION 2. THE MAIN BUILDING ADJACENT TO THE PARTY WALL

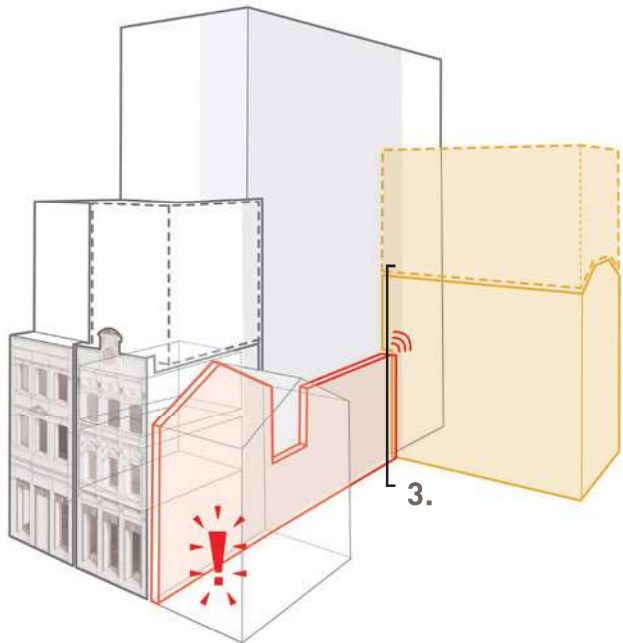


PROPOSED MITIGATION:

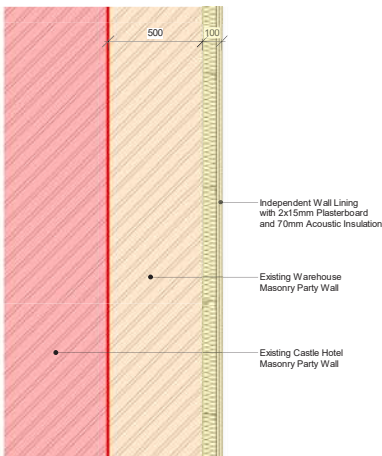


1:200 @ A3

CONDITION 3. THE EXISTING WAREHOUSE CONNECTION TO THE PARTY WALL



PROPOSED MITIGATION:



1:40 @ A3