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Consultants in Acoustics, Noise & Vibration

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Old Granada Studios, Manchester

Stage 4 acoustic design report – zone 6

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Summary

Sandy Brown has been appointed by Manchester Quays Development Three Limited to provide acoustic advice in relation to Old Granada Studios. This report covers zone 6 of the Old Granada Studios development.

The proposed zone 6 development includes the construction of a ten-storey new build block with nine speculative office floors (Shell & Core) and retail units at ground and basement level. External terraces are proposed at level 9 and 10, along with a rooftop plant area.

This report sets out the specified acoustic standards for the zone 6 development and provides RIBA Workstage 4 design advice on:

- Building envelope sound insulation, including glazing requirements and flanking sound transmission control
- Internal sound insulation of floors, partitions and doors, including advice on constructions and interfaces between building elements
- Sound absorbing finishes
- Noise from building services, including advice on mounting mechanical services, routing pipework, internal noise levels, and external noise egress.

The following key items require further development and coordination:

- Use of existing OGS studio spaces. The design has been based on the TV studios being used as they currently are for filming with background music, and occasional concerts (up to 12 per year finishing by 2300 hrs). This should be discussed with the client and operator.
- The roof build-up below the plant area. Either the tapered screed should have a minimum thickness of 90 mm, or the structural slab should be increased to be 200 mm thick.
- Building services routing, tenant limits, noise attenuation measures. A plant noise egress assessment is currently underway and the MEP layout/routing drawings will be reviewed when available.

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1 Introduction

Sandy Brown has been appointed by Manchester Quays Development Three Limited to provide acoustic advice in relation to the proposed development at Old Granada Studios.

This report relates to zone 6, which comprises of a ten-storey new-build office building with retail units at ground and basement level.

This report provides the specified acoustic requirements for the building envelope, internal sound insulation, sound absorbing finishes and building services noise & vibration, as well as operational noise limitations for future tenants.

Appendix A provides mark-ups of the partition and internal door sound insulation requirements for the zone 6 scheme.

2 Performance requirements

2.1 Basis of review

2.1.1 Information received

Advice in this report is based on the following design information:

- Architectural tender drawings received on 8 July 2019
- Structural Stage 3 tender drawings received on 11 May 2018
- Email correspondence relating to structural floors dated 17 June 2019
- MEP drawings and noise data received to date
- Workshop with 3DR dated 20 March 2019
- Email correspondence with the design team during Stage 4.

2.1.2 Design standards

The criteria set out in this report are based the following design standards and guidance:

- Manchester City Council *Planning & noise technical guidance* dated December 2015
- BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*
- British Council for Offices (BCO) *Guide to Specification* 2014
- World Health Organisation (WHO) *Guidelines for Community Noise* 1999
- BS 6472-1:2008 *Evaluation of Human Exposure to Vibration in Buildings – Part 1: Vibration from sources other than blasting*.

2.1.3 Studio usage

There are large TV studios adjacent to zone 6. It is understood that these studios are:

- mainly used for filming/events with background music only
- occasionally (a few times per year) be used for gigs and concerts.

The use of the studios for filming with background music is not expected to be problematic based on the observations during our previous visit. The large studios are all structurally independent from the zone 6 new build development.

If the large TV studios are only occasionally used for loud amplified music events, this is less of an issue acoustically as we would typically assess this against the *Code of Practice on Environmental Noise Control at Concerts*. This requires maximum limits of $L_{Aeq,15mins}$ 66 dB outside noise sensitive premises based on up to 12 concerts per year (before 2300 hrs).

Appropriate internal limits will need to be set inside the studios during noisy events to ensure these external limits are met.

No information is available regarding the constructions of the existing studios. However, on the basis that they are the same as the Low Four studio (where testing has been carried out during an amplified music event), it is anticipated that loud concert type events could be accommodated up to 12 concerts per year (before 2300 hrs). For reference a level of L_{Aeq} 56 dB was measured outside the roof of the Low Four studio when high amplified sound levels were being produced within it.

Airborne noise transfer from Studio 12 to the new-build via the separating wall is considered in Sections 5.2.3 and 5.3.4.

2.2 Sound insulation

2.2.1 Calculation of rating values

All of the laboratory and site sound insulation performance parameters referred to in this report should be calculated in accordance with BS EN ISO 717-1:2013 *Acoustics – rating of sound insulation in buildings and of building elements – Part 1: airborne sound insulation*.

2.2.2 Laboratory sound insulation

Measurements of the laboratory sound insulation of building elements should be carried out in accordance with BS EN ISO 10140-2: 2010 *Acoustics – Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation* and BS EN ISO 10140-3: 2010 *Acoustics – Laboratory measurement of sound insulation of building elements – Part 3: Measurement of impact sound insulation*.

2.2.3 Site sound insulation

Site sound insulation performances should be measured in according to BS EN ISO 140-4:1998 *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms* and BS EN ISO 140-7:1998 *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 7: Field measurements of impact sound insulation of floors*.

2.3 Sound absorption

Sound absorbent finishes should be rated in accordance with BS EN ISO 11654: 1997 *Acoustics – Sound absorbers for use in buildings – Rating of sound absorption*.

2.4 Site tolerances

The following minimum tolerances should be used when selecting elements based on weighted sound reduction index (R_w) values measured under laboratory conditions:

- Masonry walls $R_w \geq D_{nT,w} + 2 \text{ dB}$
- Drywalls elsewhere $R_w \geq D_{nT,w} + 5 \text{ dB}$
- Doors $R_w \geq R'_w + 2 \text{ dB}^*$

* If laboratory tests on single doors are used as the basis for selecting leaf-and-a-half or double doors, an overall tolerance of at least 5 dB should be used.

Where laboratory sound insulation performances have been specified the on-site performance should be in line with the above tolerances. Interface details between elements should be constructed to ensure site sound insulation values are not compromised.

Where weighted sound absorption coefficients (α_w) are specified, elements should be installed such that the laboratory measured performance is not degraded.

3 Building envelope

3.1 Self-noise

The building envelope is to be constructed in a way that prevents noise arising from thermal movement, rattling, whistling or other attention-catching noise inside or outside the building arising from air movement over its surface.

Suitable flexible elements and movement joints are likely to be required which major cladding contractors should be familiar with.

Where relevant, consideration will need to be given to potential resonance effects as a result of airflow across any externally protruding elements.

Where the existing cladding is to be retained there will be limitations in the scope to improve any self-noise issues which may already exist. It is understood that there are no known issues with the existing cladding, however.

3.2 Internal noise criteria

3.2.1 Offices

Guidance on acceptable internal noise levels in offices is given in BS 8233:2014 *Guidance on Sound insulation and noise reduction for buildings*, and is also provided by the British Council for Offices (BCO) 2014. These are presented in Table 1 and Table 2 respectively.

Table 1 Internal noise criteria for offices from BS 8233: 2014

Internal space	Design range for indoor ambient noise level L_{Aeq} (dB)
Meeting room	35-45
Open plan office	45-50
Circulation	45-55

Table 2 Internal noise ratings from British Council for Offices 2014 guidance

Internal space	Maximum noise level due to external noise intrusion
Open plan offices	NR 40
Speculative offices	NR 38
Meeting rooms	NR 35

Based on the above, environmental noise ingress shall be controlled to meet $L_{Aeq,16hr}$ 40 dB for the shell & core speculative office spaces.

3.2.2 Retail units

External noise ingress to the ground floor retail units in zone 6 shall be controlled to not exceed $L_{Aeq,16hr}$ 50 dB.

3.3 External noise levels

3.3.1 3D noise modelling

A noise survey has been carried out at the site, the details of which are provided in the Sandy Brown planning report 15037-R03-B.

A model of the proposed development has been generated using CadnaA software by Datakustik with the purposes of calculating the external noise level at the different facades of the building based on the results of the environmental noise survey.

The software carries out calculations using a ray tracing technique. This takes into account the effects of topography, reflections, screening and distance attenuation for noise sources to predict noise levels in three dimensions. Calculations are carried out in accordance with ISO 9613 Attenuation of sound during propagation outdoors.

3.3.2 Occasional noisy events in TV studios

If the large TV studios are only occasionally used for loud amplified music events, this would typically be assessed against the *Code of Practice on Environmental Noise Control at Concerts*. This requires maximum limits of $L_{Aeq,15mins}$ 66 dB outside noise sensitive premises based on up to 12 concerts per year (before 2300 hrs).

Appropriate internal limits will need to be set inside the studios during noisy events to ensure these external limits are met.

No information is available regarding the constructions of the existing studios. However, on the basis that they are the same as the Low Four studio, it is anticipated that loud concert type events could be accommodated up to 12 concerts per year (before 2300 hrs).

For reference a level of L_{Aeq} 56 dB was measured outside the roof of the Low Four studio when high amplified sound levels were being produced within it.

3.4 Facade sound insulation

3.4.1 Acoustic rating

Acoustic rating values shall be calculated in accordance with BS EN ISO 717-1:2013 *Acoustics – Rating of sound insulation in buildings and of building elements Part 1: Airborne sound insulation*.

The facade shall provide the Spectrum Adapted Weighted Sound Reduction Index (R_w+C_{tr}) performances set out in the following section when measured in accordance with BS EN ISO 10140-2:2010 *Acoustics -*

Laboratory measurement of sound insulation of building elements Part 2: Measurement of airborne sound insulation.

The facade shall be constructed on site so as to ensure that the laboratory sound insulation performance is not degraded when measured in accordance with BS EN ISO 140-5: 1998 *Acoustics – Measurement of sound insulation in buildings and of building elements, Part 5: Field measurements of airborne sound insulation of facade elements and facades*.

3.4.2 Offices

Office facades shall provide a minimum overall sound insulation performance of R_w+C_{tr} 28 dB.

3.4.3 Ground floor retail units

Retail unit facades shall provide a minimum overall sound insulation performance of R_w+C_{tr} 28 dB.

3.5 External walls

The proposed external wall build-up is proposed to consist of the following:

- 33 mm corium brick slips
- Cavity of around 100 mm
- 150 mm SFS containing minimum 50 mm mineral fibre insulation with 2 x 12.5 mm plasterboard internally (built slab-to-slab).

This is expected to be capable of providing a sound insulation performance of at least R_w+C_{tr} 45 dB which sufficiently meets the most onerous facade sound insulation requirements.

3.6 External windows/glazing and ventilation

Mechanical ventilation strategies with no reliance upon openings in the facade for ventilation are proposed for all areas of the other areas of the development.

Standard thermal double glazing (6 mm/16 mm cavity /6 mm) is typically capable of achieving a sound insulation performance of R_w+C_{tr} 28 dB. This is expected to be sufficient to control environmental noise ingress to the offices and retail units.

3.7 Roof and terraces

3.7.1 Accessible roof/terraces

130 mm thick normal-weight concrete ($\geq 2350 \text{ kg/m}^3$) on re-entrant decking is proposed for the roof and terraces, with a tapered screed, insulation and 20 mm pavers on pedestals above. This is expected to sufficiently control environmental noise ingress, and noise transfer associated with normal amenity usage on the terraces.

3.7.2 Below plant area

A minimum sound insulation performance of R'_w 55 dB shall be provided by the floor below the rooftop plant area to control airborne noise transfer to the speculative offices below.

A structural floor comprising of 130 mm thick normal-weight concrete ($\geq 2350 \text{ kg/m}^3$) on re-entrant decking with a tapered screed (10-200 mm), insulation and 20 mm pavers on pedestals above is proposed below the plant area.

This arrangement is expected to fall short of the acoustic requirements where the screed is less than 90 mm thick. As such, a screed at least 90 mm (assuming density $\geq 1800 \text{ kg/m}^3$) shall be provided below the plant area.

3.8 External doors

External doors shall be selected to maintain the overall sound insulation performance of the building envelope as detailed in Section 3.4.

3.9 Flanking sound insulation

There are two principal types of flanking sound transmission to consider in relation to the facades, namely:

- Horizontal flanking sound insulation refers to the situation where partitions connect to the cladding to form two rooms or spaces, and sound is transmitted from one space to another via the cladding.
- Vertical flanking sound insulation refers to the transmission of sound from one space to another that is immediately above or below via the cladding, including the slab edge detail.

Where partitions and floors abut the building envelope, it shall provide the minimum Weighted Normalized Flanking Level Difference, $D_{n,f,w}$ set out below when measured in accordance with BS EN ISO 10848: 2006.

Where floors between offices interface with the cladding, a flanking sound insulation performance of at least $D_{n,f,w}$ 50 dB shall be provided at Shell & Core stage. It is not clear from the details received whether the stick system includes any continuous mullions between floors. If these are proposed they would need to be capped and/or filled to allow the flanking specification to be met.

Where floors between offices and retail units interface with the cladding, a flanking sound insulation performance of at least $D_{n,f,w}$ 55 dB shall be provided. The facade is staggered between ground and first floor and, as such, flanking via the cladding itself is expected to be controlled accordingly.

Dense mineral fibre cavity barriers at least 100 mm thick shall be provided to close-off the slab edge. 2 mm thick aluminium plating or equivalent weight boarding/plating shall be provided to at least one side of the slab edge detail to control flanking via this path.

3.10 Noise egress via the building envelope

Internal operational sound limits are set for retail units in Section 10 to ensure that noise egress from the retail units meets with the requirements of Manchester City Council.

4 Floors

4.1 Airborne sound insulation criteria

4.1.1 Office floors

BCO 2014 states that the sound level difference between individual office floors should be at least $D_{nT,w}$ 45 dB at shell and core stage, or $D_{nT,w}$ 48 dB if fitted out to Cat A standards.

A minimum performance of $D_{nT,w}$ 48 dB shall be provided between the containers and $D_{nT,w}$ 45 dB shall be provided for the shell and core speculative offices.

A minimum sound insulation performance of $D_{nT,w}$ 50 dB shall be provided by the floors between offices and retail units.

4.1.2 Plant rooms / Bin store

A minimum sound insulation performance of $D_{nT,w}$ 50 dB shall be provided for the ground floor above the basement plant rooms and bin store.

4.2 Floor constructions

130 mm thick normal-weight concrete ($\geq 2350 \text{ kg/m}^3$) on re-entrant decking is proposed for the floors between offices. This is expected to be capable of meeting the BCO sound insulation requirement between Shell & Core offices.

The same floor is proposed between the retail units and offices above. This is expected to be capable of providing $D_{nT,w}$ 50 dB.

250 mm solid flat normal-weight concrete is proposed between the ground floor level and basement and this is capable of providing $D_{nT,w}$ 55 dB.

As the development is Shell & Core, provisions to control impact sound transfer will need to be provided by fit-out elements. Appropriate clauses to be included in tenancy agreements for this.

5 Partitions

5.1 Lab-to-site tolerance

Lab-to-site tolerances for partitions are set out in Section 2.2.3.

5.2 Airborne sound insulation criteria

5.2.1 Retail units

Partitions to the retail units should provide a minimum sound insulation performance of $D_{nT,w}$ 45 dB.

5.2.2 Plant rooms

A minimum in-situ sound insulation performance of $D_{nT,w}$ 45 dB shall be provided between the basement plant rooms and BoH areas.

A minimum in-situ sound insulation performance of $D_{nT,w}$ 50 dB shall be provided between the basement plant rooms and retail.

5.2.3 Party walls between zones

The following minimum sound insulation performances shall be provided by the party walls between zones 5 and 6.

Table 3 Minimum sound insulation performances for party walls between zones 5 and 6

Level	Adjacency	Minimum sound insulation performance
B1	Plant to BoH/plant	$D_{nT,w}$ 45 dB
GF	Office entrance to plant	$D_{nT,w}$ 50 dB
	Concierge store to BoH	$D_{nT,w}$ 45 dB
	Circulation to circulation	$D_{nT,w}$ 45 dB
L1-4	Circulation to circulation	$D_{nT,w}$ 45 dB
	Office/circulation to guestroom	$D_{nT,w}$ 60 dB
L5-10	Circulation to circulation	$D_{nT,w}$ 45 dB
	Circulation to guestroom	$D_{nT,w}$ 60 dB

A minimum overall sound insulation performance of $D_{nT,w}$ 65 dB shall be provided for the party wall between studio 12 and zone 6 along GL6. With this performance, noise transfer from typical studio use with background music is expected to be well-controlled to the offices.

Noise transfer from occasional concerts with loud amplified music would still be expected to be potentially disturbing in the offices if the studio and offices were used simultaneously. As such, events need to be limited, it is advisable that a management strategy be adopted for events in studio 12 to minimise the risk of complaints from the offices, including the following:

- Planning such events when the offices are not in use (eg evenings/weekends)
- Giving the office tenant prior warning of such events.

5.2.4 Risers

Riser constructions shall be selected to meet the following laboratory performances:

- Mechanical and public health risers – R_w 47 dB
- Electrical risers – R_w 42 dB.

5.2.5 Mark-ups

Mark-ups showing the minimum sound insulation requirements for partitions are provided in Appendix A.

5.3 Partition types

5.3.1 Drywalls and dry-linings

The proposed partition and lining constructions indicated on *180146_OGS Wall Types Zone 6 revision E* received from 3D Reid Architects have been reviewed in relation to the acoustic performance requirements. The proposed build-ups and comments are provided below.

Table 4 Comments on proposed partition and lining types

Partition reference	Proposed build-up	Comments
IWS-103a	15 mm FireLine in Gypframe GL1 channels braced back with GL2 channels to provide a 25 mm cavity	Blockwork wall lining proposed to circulation/stores/risers – fine from an acoustic perspective.
IWS-103b	15 mm FireLine in Gypframe GL1 channels braced back with GL2 channels to provide a 50 mm cavity	Blockwork wall lining proposed to circulation/stores/risers – fine from an acoustic perspective.
IWS-106	2 x 12.5 mm SoundBloc on 35 mm Gypliner channel containing 25 mm mineral fibre insulation	Core wall lining in basement. Fine from an acoustic perspective.

Partition reference	Proposed build-up	Comments
IWS-212	R_w 49 dB drywall 2 x 15 mm Fireline to both sides of 70 mm C studs containing 25 mm Isover APR 1200	Fine where proposed (between WCs and core)
IWS-217	R_w 50 dB modified Shaftwall with 3 x 15 mm Fireline on I-studs containing 4 x 75 mm Isover Infill Batt, and 19 mm Coreboard on an independent I-stud	Proposed along GL-RN (refer to comments in Section 5.3.3)
IWS-221	R_w 50 dB modified Shaftwall with 2 x 15 mm Fireline on I-studs containing 4 x 75 mm Isover Infill Batt, and 19 mm Coreboard on an independent I-stud	Proposed along GL-R6 on ground and basement floor levels (refer to comments in Section 5.3.4)
IWS-222	R_w 49 dB drywall 2 x 12.5 mm WallBoard (or Gyproc Moistureboard) to both sides of 48 mm C studs containing 25 mm Isover APR 1200	Fine where proposed (WCs)
IWS-223	R_w 48 dB Shaftwall with 19 mm Coreboard between 148TI90 studs and 2 x 15 mm Fireline to one side	Fine where proposed (MEP risers)
IWS-301 and 302	301: 30 mm Glassroc F Firecase 302: 3 x 12.5 mm Fireline on GL10 Gypliner frame	The locations will need to be confirmed for comment.

5.3.2 Blockwork

Wall type 9 is proposed to the retail units which consists of 140 mm thick blockwork. This shall be medium density as a minimum ($\geq 1450 \text{ kg/m}^3$) and be well-sealed to enable the $D_{nT,w}$ 45 dB airborne sound insulation performance to be met. This wall type is also proposed for the riser on GL-RM and is fine from an acoustic perspective providing it is medium density Blockwork.

This construction alone is not capable of providing the specified $D_{nT,w}$ 50 dB rating between the basement plant rooms and retail unit B in the basement. As such, it should be enhanced to 215 mm medium density blockwork or a drylining should be provided (IWS-106 is expected to enhance the wall accordingly).

5.3.3 Party wall zone 6 to zone 5

It is understood that there is no intrusive survey information available regarding the existing wall construction but that it consists of solid masonry. Wall type IWS-217 is proposed to be provided along GL-RN.

On the basis that the existing wall consists of well-sealed 200 mm thick solid masonry with density of at least 1600 kg/m^3 , the proposed arrangement (as shown on the section wall type details) is expected to be capable of providing the recommended performance.

5.3.4 Party wall to studios

The party wall just off grid line 6 (GL6) separates the proposed development from the studios.

No intrusive survey information available regarding the existing studio wall construction. It is, however, understood that it consists of solid masonry. Wall type IWS-221 is proposed to be provided along GL6.

On the basis that the existing wall consists of well-sealed 200 mm thick solid masonry with density of at least 1600 kg/m^3 , the proposed arrangement (as shown on the section wall type details) is expected to be capable of providing $D_{nT,w}$ 65 dB.

6 Doors

The acoustic performance of doors depends on three principal factors, namely:

- The weight of the door leaf and any weaknesses due to vision panels, etc
- The tolerances around the door leaf when hung
- The type and extent of seals including meeting jambs for double doors.

Where acoustically rated doorsets are required they need to close onto a frame and have perimeter acoustic seals. Drop threshold seals are likely to be required on higher performance doorsets ($\geq R_w$ 35 dB) whereas lower ratings typically require a diminishing strip under the threshold to close off the gap when the door is shut.

Where double doors are used in a location with an acoustic performance rating, meeting jambs will need to be rebated and fitted with seals.

Frameless doors are weak acoustically owing to typically large perimeter gaps. Likewise doors with integral pivot hinges and standard sliding doors are often acoustically weaker owing to the difficulty of accommodating perimeter acoustic seals. Offset pivot or side hung doors tend to perform better as perimeter seals are easier to fit and can be continuous.

6.1 Riser doors

Doors to mechanical and public health risers shall be selected to meet a following laboratory performance of R_w 35 dB. All riser doors shall be side hinged rather than pivoted.

6.2 LV switch room

A door with a minimum sound insulation performance of R_w 35 dB shall be provided between the LV switch room and the VIP access corridor.

6.3 Mark-ups

The sound insulation requirements for internal doors are marked-up in Appendix A.

7 Interface details

Interfaces between sound insulating elements and other elements shall ensure that the sound insulation performance is not degraded, and that the site sound insulation requirements are met. These adjacent elements include:

- Partitions
- Door frames
- Floors
- Cladding
- Structural columns and beams
- Service penetrations
- Roof.

All partitions are to be built full height from slab-to-slab. All suspended ceilings, floated floors/screeds and floor finishes shall be individual to each apartment/guestroom.

7.1 Head details

Drywall partitions with a rating of $\geq R_w$ 50 dB shall be built full height slab-to-slab. An example head detail is provided below.

Any gaps in the re-entrant decking above partitions will need to be packed with mineral fibre insulation to the full-depth of the partition.

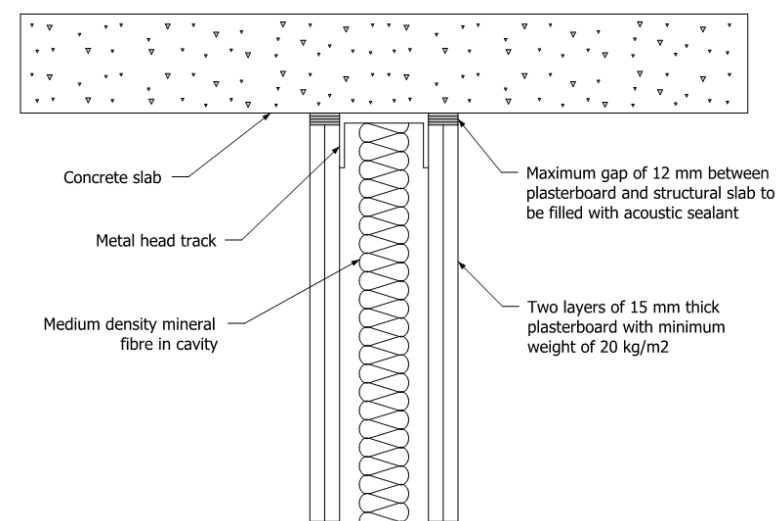


Figure 1 Sketch detail of drywall partition meeting concrete floor slab

Where partitions are formed from blockwork they shall be built full height slab-to-slab. Example head details are provided in Figure 2 and Figure 3.

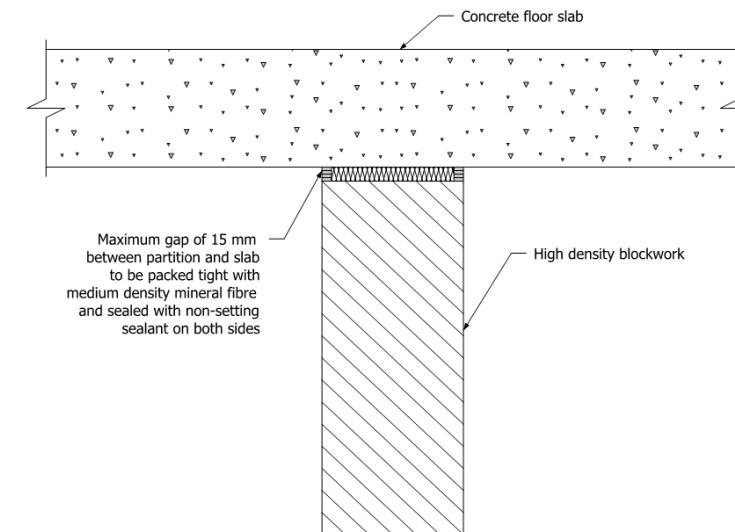


Figure 2 Example blockwork head detail (maximum 15 mm deflection)

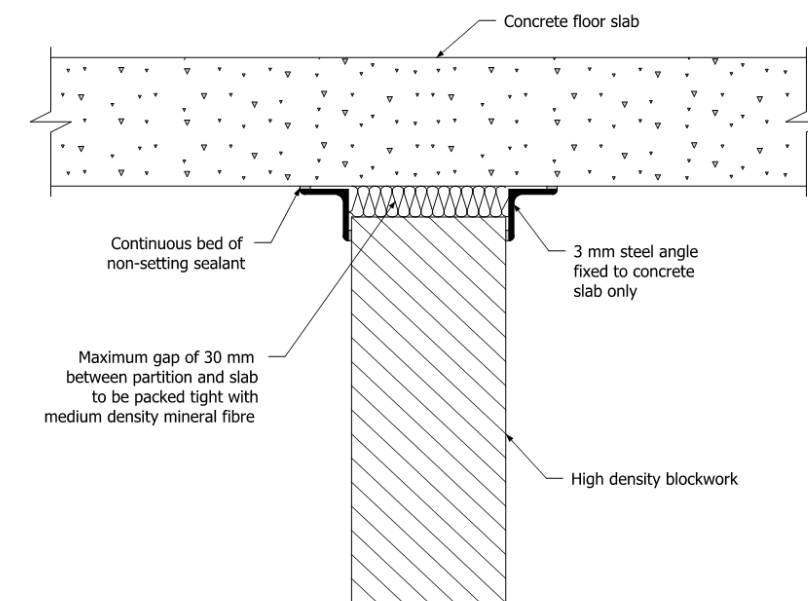


Figure 3 Example blockwork head detail (maximum 30 mm deflection)

Where drywall partitions with a rating of $\geq R_w$ 50 dB abut other drywalls they shall break the inner leaf of the construction. An example detail is provided in Figure 4.

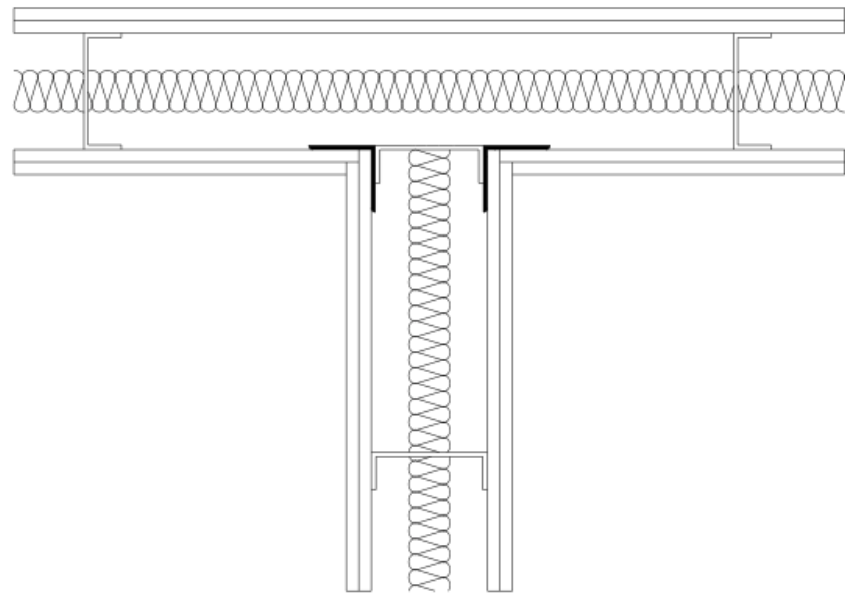


Figure 4 Sketch detail of drywall interface with other partition

8 Sound absorbent finishes

8.1 Office finishes

As the offices are intended to be shell & core, the tenants will be responsible for provided the following as part of their fit-out. The tenant should be made aware that no sound absorbent finishes are being provided as part of the base-build.

Appropriate clauses should be provided in the tenancy agreement to cover these items.

8.2 Office entrance lobby

Sound absorbent treatment should be provided local to the reception desk to help control reverberation in the office entrance lobby. This could be in the form of Class C sound absorbent wall panels around the desk areas. However, as the offices are shell & core, the introduction of such treatment may be a fit-out item for the tenant.

9 Building services noise & vibration

9.1 External noise egress criteria

As per Section 5.1 of the Sandy Brown acoustic planning report 15037-R03-B, the cumulative noise level resulting from the operation of all new plant at 1 m from the most affected windows of the nearest noise sensitive premises shall not exceed 5 dB below the minimum broadband (L_{Aeq}) external noise level. This relates to the overall plant noise egress levels from entire Old Granada Studios scheme.

Where an item of plant contains tonal characteristics, the limits should not exceed 5 dB below the minimum external noise level in octave bands.

For zone 6, the overall OGS limits have been corrected by 3 dB to allow for contributions from other zones of the development. These limits are set out in Tables 5 and 6.

Table 5 Plant noise limits 1m from the nearest sensitive premises to the west and south of the site

	Maximum sound pressure level at 1m from noise sensitive premises (dB)							L_{Aeq}
	Octave-band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	
Daytime (07:00 – 23:00)	44	43	42	41	39	32	22	43
Night (23:00 – 07:00)	44	44	42	41	38	30	21	42

Table 6 Plant noise limits 1m from the nearest sensitive premises to the east of the site

	Maximum sound pressure level at 1m from noise sensitive premises (dB)							L_{Aeq}
	Octave-band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	
Daytime (07:00 – 23:00)	52	46	40	38	40	34	27	43
Night (23:00 – 07:00)	52	47	35	32	32	26	19	37

9.1.1 Limits for separate zones and tenants

As the development consists of a number of different zones and tenants, the overall cumulative limits need to be split accordingly. This will be done as part of the plant noise egress assessment work.

9.1.2 External amenity areas

Within the new development, an external noise limit of L_{Aeq} 55 dB shall be achieved in external amenity areas (eg, terraces).

9.1.3 Tenant criteria

Appropriate clauses should be provided in the tenancy agreement to ensure that noise egress associated with tenant plant is controlled to meet the relevant criteria.

9.1.4 Emergency plant noise limits

Noise egress from emergency plant will need to be controlled. MCC typically allows emergency plant to achieve a rating level of 10 dB (L_{Aeq}) above the typical background level. On this basis, emergency plant limits are given in Table 7.

Table 7 Emergency plant noise limits at 1 m from the noise sensitive facades

Time of day	Maximum noise rating level at 1 m from noise sensitive facades (L_{Aeq} dB)
07:00-23:00	61
23:00-07:00	55

9.2 Internal noise criteria

The maximum internal noise criteria are provided in Table 8.

Table 8 Maximum internal noise levels

Space	NR level
Speculative offices	38*
Entrance lobby/reception	40
Retail	40
Stairs/circulation	45
WCs	45
Stores	45
Refuse	55
Car park	55
Electrical plant rooms	55
Mechanical plant rooms	70**

* This applies for normally operational plant assuming a Cat A fit-out. Noise associated with the Shell & Core MEP shall be limited to be at least 5 dB below this.

** Low frequency limit of 80 dB in the 63 Hz and 125 Hz octave bands. Specific octave band noise limits in plant spaces will need to be established as the design progresses.

The building services noise shall not contain any attention catching characteristics (such as clicks, ticks, hiss, hum, whirring etc).

Internal noise levels associated with emergency plant shall be no higher than 10 dB above these limits.

9.3 Plant area risers

All service risers shall be closed off from plant areas to minimise noise travelling vertically through the building.

9.4 Airflow regenerated noise

It is important to minimise airflow-regenerated noise in ducts and at duct fittings. Appropriate limiting air velocities will need to be adopted to control this and guidance on these is given in Table 9 in terms of the maximum in-duct air velocity (m/s).

Table 9 Maximum airflow velocities (m/s)

Duct	NR 33	NR 40-45
Primary	10.0	10.0
Main branch	6.0	8.0
Sub branch	4.5	6.0
Final duct	2.5	4.0

Grilles and terminals will need to be selected with regard to their noise characteristics and balancing dampers should not be situated behind or close to grilles, nor used to provide more than a slight balancing resistance.

9.5 External noise control

All plant will need to be appropriately selected along with mitigation measures provided as required to ensure that the external noise criteria are met.

A plant noise egress assessment is currently being undertaken to check the proposals are capable of meeting with the specified external noise criteria. General methods for reducing plant noise egress are outlined below.

- Screening and acoustic louvres
- In-duct attenuators and enhanced casing for AHUs and extract fans.
- Low noise cooling units and/or provision of an attenuation packages
- Locating cooling units away from the noise sensitive receptors
- Acoustic louvres.

9.6 Air-handling units

Where appropriate, air handling units shall be 'double skinned' to reduce noise breakout.

Ductwork between the air-handling units and associated primary attenuator (where this is duct mounted) shall be externally acoustically lagged.

In general, primary attenuators shall be fitted in the air-handling units or in the ductwork close to them.

Environmental attenuators shall be provided to ensure that noise emanating from the air-handling plant does not exceed the external noise criteria.

9.7 Vibration criteria

Vibration associated with building services shall not cause:

- disturbance in terms of perceptibility
- the maximum noise criteria to be exceeded in terms of structure-borne noise.

Maximum permissible vibration amplitudes from building services shall not:

- Exceed a Vibration Dose Value (VDV) of $0.4 \text{ m/s}^{1.75}$ as given in BS 6472 Part 1: 2008 '*Guide to evaluation of human exposure to vibration in buildings : Part 1 Vibration sources other than blasting*' in all occupiable spaces throughout the scheme
- Exceed 0.01 m/s^2 peak based on the W_b weighting as given in BS 6472 Part 1: 2008 in occupiable spaces
- Be of a magnitude which causes the maximum noise criteria specified above to be exceeded.

9.8 Recessed services

Recessed services (lighting, sockets etc) shall be avoided. Where this is not possible, they shall not be mounted back-to-back, (must be staggered by at least 600 mm, or in line with manufacturers' recommendations).

Plasterboard wall linings shall be returned around the rear of sockets to maintain sound insulation. Proprietary backing pads are an acceptable alternative to returning linings around the rear of sockets.

Where practicable, it is advised that electrical sockets be installed within furniture (eg credenzas/tables) or surface mounted trunking.

Sockets and switches chased into masonry walls shall be located and detailed such that they do not undermine the sound insulation performance of the wall in which they are located.

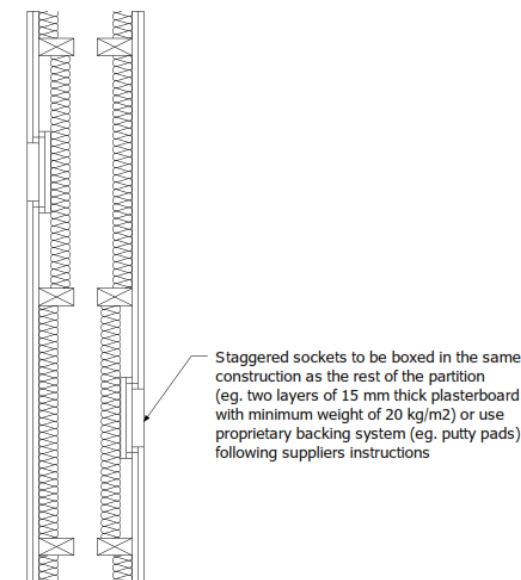


Figure 5 Electrical socket strategy

9.9 Service penetrations

Wherever possible building services should enter rooms via the room fronts. Services running between rooms should be avoided, particularly where partitions have a rating of $D_{nT,w}$ 45 dB or above.

Where ducts are required to penetrate sound insulating partitions, cross-talk attenuators shall be provided where necessary to ensure that the sound insulation of the partition is not compromised.

Where building services pass out of plant rooms or through walls, floors or ceilings separating spaces, care should be taken to avoid the degradation of the sound insulation between these spaces. Size builders work holes to accommodate the duct, pipe, trunking or conduit with the minimum clearance that is practicable. It is recommended that where pipes penetrate partitions they should be fitted with metal pipe collars on both sides of the partition in lieu of patching.

Service penetrations through partitions and other sound insulating elements will need to be acoustically sealed to ensure the sound insulation between rooms meets the specified requirements.

Example details are provided in Figures 12 and 13.

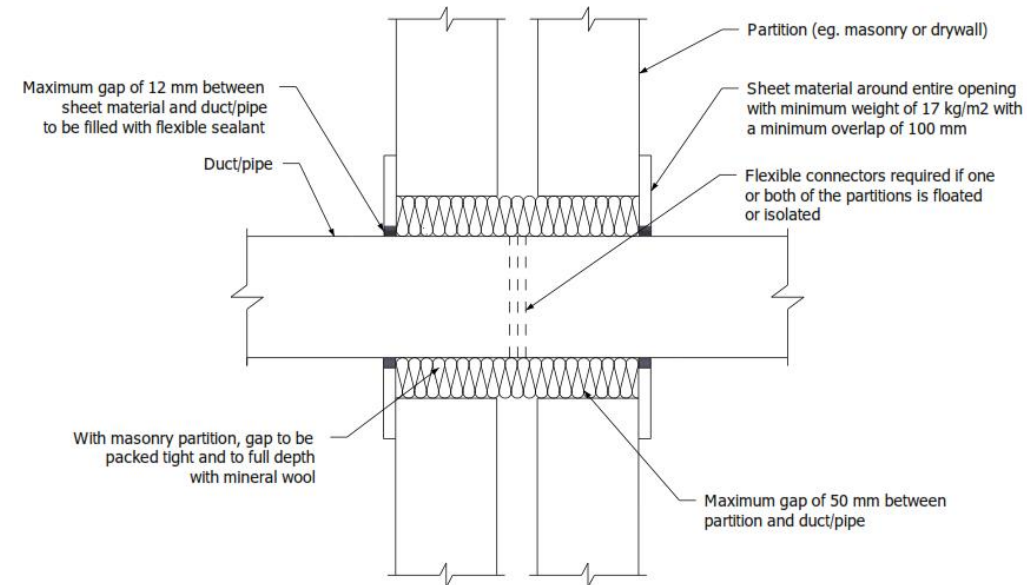


Figure 6 Example sketch duct/pipe penetration detail through double partition

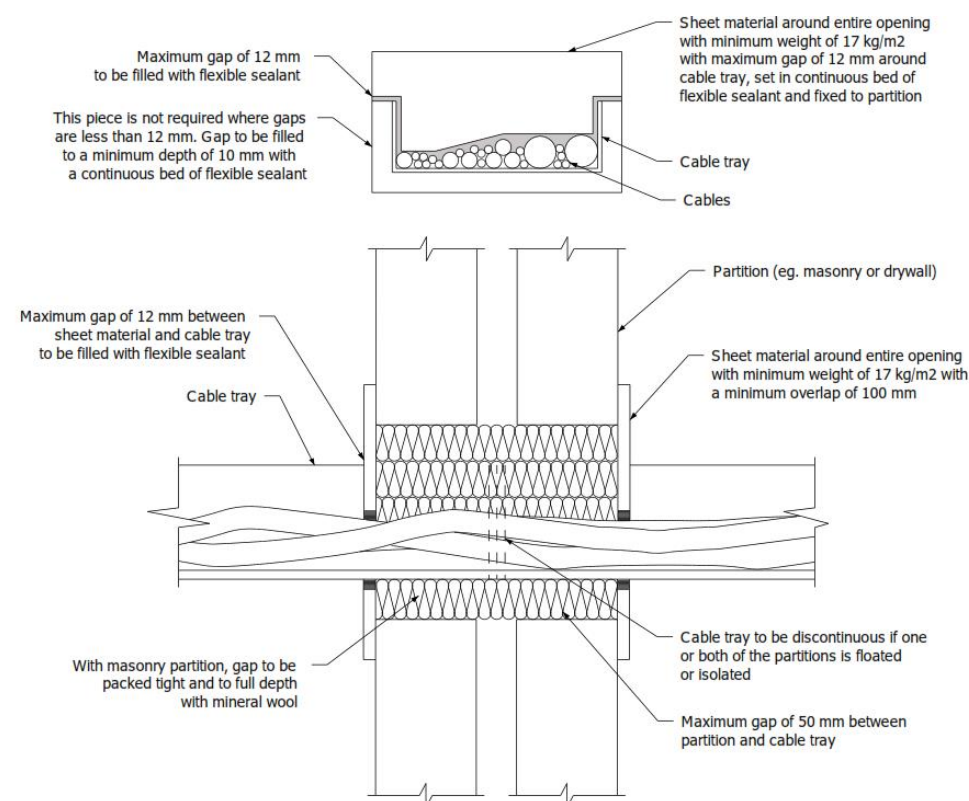


Figure 7 Example sketch cable tray penetration detail through double partition

9.10 Anti-vibration measures

All mechanical plant will need to be isolated from the building structure using efficient anti-vibration mountings (AVMs). Plant mounted on AVMs will need to be isolated by flexible connections from ducts, pipes and conduits.

All pump sets will need to be installed on suitable concrete inertia bases on spring mounts.

Ductwork and pipework in the plant rooms and ductwork and pipework in contact with structures bounding occupied areas will need to be supported on anti-vibration hangers/supports.

9.11 Drainage pipework

Rainwater pipes and other drainage routes shall be routed in circulation areas away from noise sensitive areas and should not be in any rooms with a maximum internal noise criterion of NR 38 or lower, wherever possible.

Where this is not possible they should be lagged with 25 mm mineral fibre insulation (minimum density 33 kg/m³) and boxed in with 2 layers of 12.5 mm plasterboard (minimum density 640 kg/m³).

RWPs are currently shown to pass through office areas below the terraces and roof areas so these shall be lagged and boxed as described above.

Syphonic drainage systems shall be avoided wherever possible and should not pass through spaces with a criterion of NR 40 or less.

9.12 Lifts

The following noise limits shall be met:

- L_{AFmax} 50 dB outside lifts opening directing into the speculative offices
- L_{AFmax} 55 dB in the lift lobby at 1 m from the landing entrance doors
- L_{AFmax} 55 dB in lift cars.

The following vibration shall be met:

- Horizontal vibration – Maximum RMS acceleration level in any one-third octave band (1-80 Hz) not to exceed 0.12 m/s²
- Vertical vibration – Maximum RMS acceleration level in any one-third octave band (1-80 Hz) not to exceed 0.12 m/s² at maximum speed and 0.15 m/s² during acceleration/deceleration and start/stop periods.

10 Operational noise

10.1 Amplified sound

Amplified sound limits are required for the retail units for the following reasons:

- To meet with the MCC criteria outside nearby noise sensitive receptors
- To minimise the risk of disturbance to the offices above.

A 130 mm thick normal-weight concrete slab on re-entrant decking is proposed above the retail which is expected to be capable of providing a sound insulation performance of $D_{nT,w}$ 50 dB.

Manchester City Council require amplified sound egress to be 10 dB below the typical background noise level in octave bands outside the nearby noise sensitive premises. This applies over the entire OGS development (including other zones). As such, limits for zone 6 are set out below.

Table 10 Maximum amplified sound egress limits to east of site – zone 6

	Maximum sound pressure level at 1m from noise sensitive premises (dB)						
	Octave-band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	47	41	35	33	35	29	22
Night (23:00 – 07:00)	47	42	30	27	27	21	14

As two retail tenants are currently proposed, the above limits would need to be reduced by a further 3 dB per tenant.

Initial guidance on internal amplified sound limits in the retail units are provided below based on the following:

- The Manchester City Council requirements for entertainment noise outside noise sensitive premises (set out above).
- The facade to retail units providing a sound insulation performance of R_w+C_{tr} 28 dB as a minimum (typically achieved with standard thermal double glazing – 6 mm/16 mm cavity/6 mm).
- Minimising the risk of disturbance to the offices above based on the proposed floor slab and a background noise level of NR 35.

Table 11 Guidance on internal amplified sound limits in retail units

	Maximum sound pressure level in retail units (dB)						
	Octave-band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	77	73	68	73	73	68	66
Night (23:00 – 07:00)	77	74	63	68	73	65	65

The above would allow typically for background music only and would not be suitable for high music levels such as DJs/live bands.

10.1.1 Tenant enhancements

If tenants wish to have levels higher than the limits set out in the previous sections, they will be required to carry out enhancements works to ensure the following:

- Noise egress to the nearby noise sensitive receptors meets the limits set out in Table 10
- The level of noise transfer to the office above is no higher than L_{Aeq} 35 dB with limits of 50 dB at 63 Hz and 47 dB at 125 Hz.
- The level of noise transfer to the adjacent retail/ and office entrance is no higher than L_{Aeq} 40 dB with limits of 50 dB at 63 Hz and 47 dB at 125 Hz.

Possible enhancements may include:

- Secondary glazing/linings to the facade
- Sound insulating ceilings
- Boxing to common structure e.g. columns
- Wall linings
- Treatment to common services
- Electronic limiters to PA systems.

If amplified music is proposed by the tenants, MCC typically require a lobbied entrance door arrangement to be provided. This would be a tenant fit-out item.

10.2 Studios

Operational noise associated with the use of the existing studios is outside the scope of this report but commentary in provided earlier sections of the report.

10.3 Deliveries

To minimise the risk of disturbance to nearby noise sensitive premises, it is advised that access times for deliveries and service vehicles to the development be restricted to daytime hours only, between 07:00 and 23:00 hrs.

11 Construction (Design & Management) Regulations

The Construction (Design and Management) Regulations 2015 places legal duties on virtually everyone involved in construction work. Those with legal duties are commonly known as 'dutyholders' and include clients, designers, contractors and workers.

Typical risks specifically associated with acoustic design are:

- Access at height to install and to maintain such elements as acoustic sound absorbent ceilings
- Manual handling of heavy building elements such as concrete blocks

Acoustic treatment is proposed which will require installation at height, eg soffit of spaces. However, this would be required in any event for installation of ceiling finishes, lighting, etc and is therefore not a risk specifically related to the acoustic design.

Man-made mineral fibres (MMMf) are used extensively in the construction industry and these are sometimes specified for their acoustic properties. When contractors make use of MMMf they should act on relevant legislation and the latest guidance issued by the Health and Safety Executive. The above risks are not unusual and would be appropriately managed by a competent contractor.

Appendix A

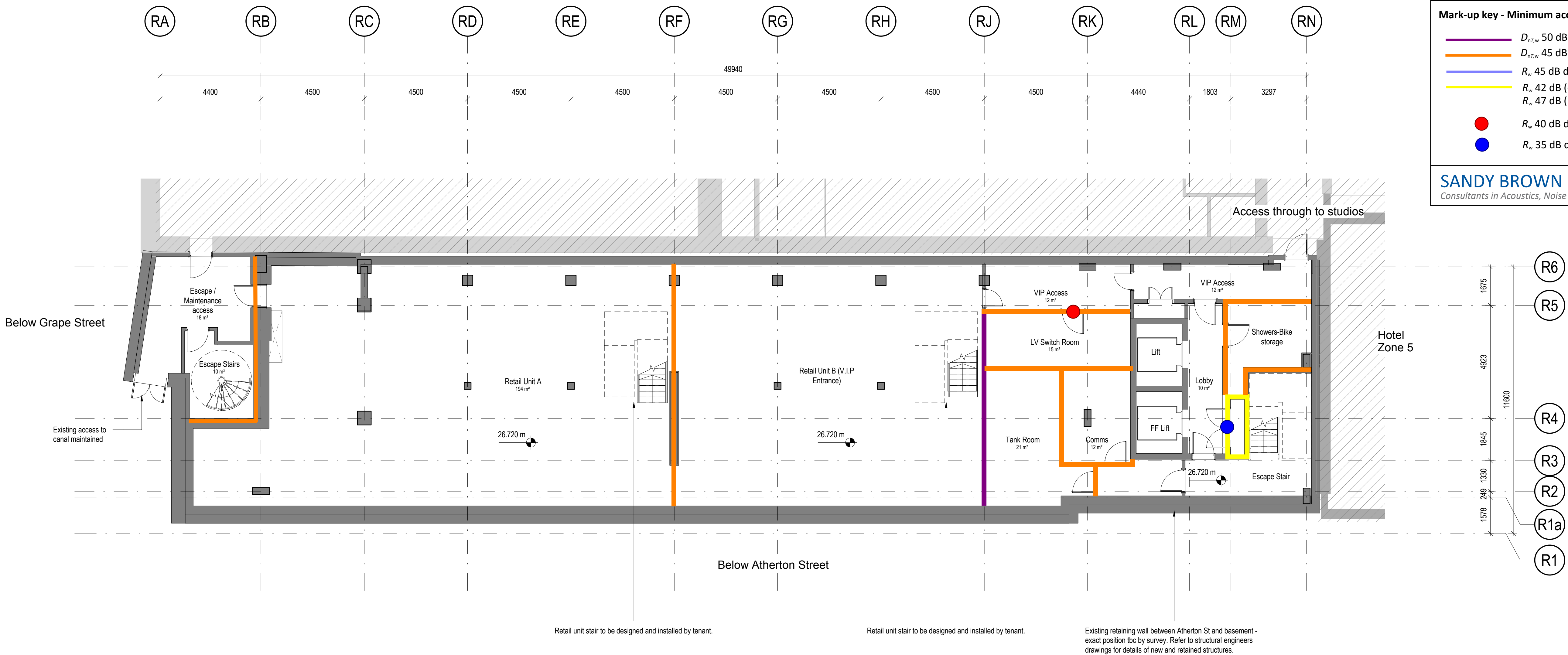
Sound insulation mark-ups – partitions and internal doors

Title	Internal sound insulation mark-ups
Project	Old Granada Studios
Project no.	15037
Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

Mark-up key - Minimum acoustic ratings

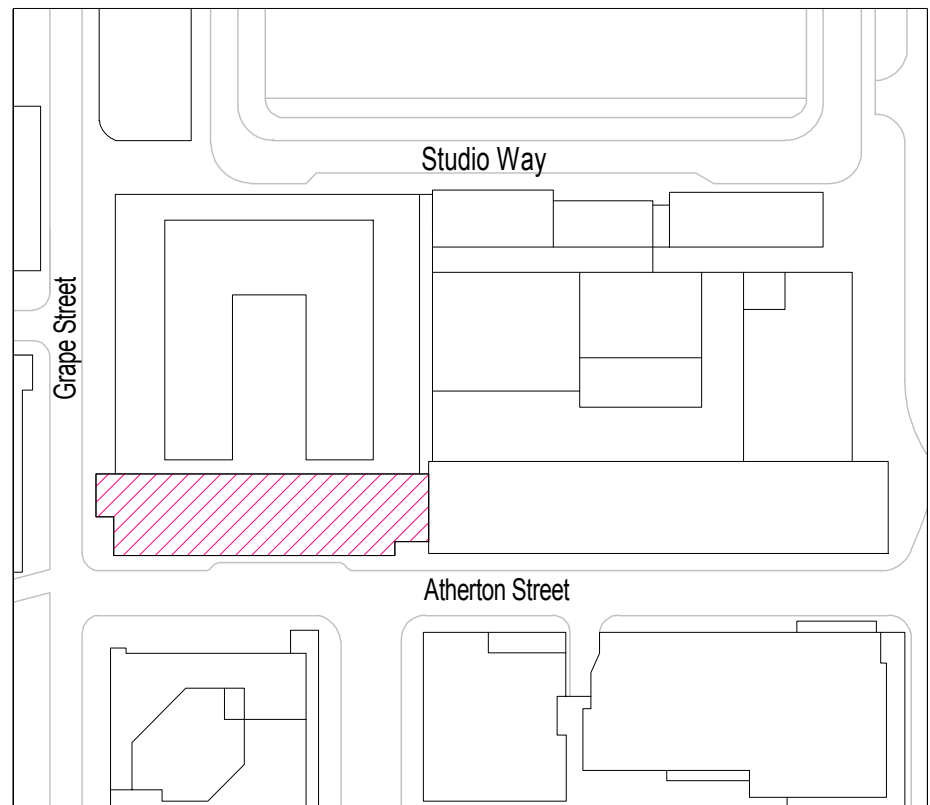
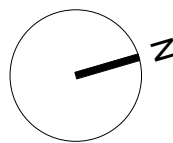
- $D_{nT,w}$ 50 dB partition
- $D_{nT,w}$ 45 dB partition
- R_w 45 dB drywall
- R_w 42 dB (electrical riser)
 R_w 47 dB (mechanical riser)
- R_w 40 dB door
- R_w 35 dB door

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Notes

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G	02/07/19	New scheme design	LP
F	17/04/19	VIP Entrance added to scheme	CLH
E	05/04/19	Issue for Workstage 4	MM
D	29/03/19	Updated issue	AV
C	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.	CH
B	18/01/19	Issued for information	HEM
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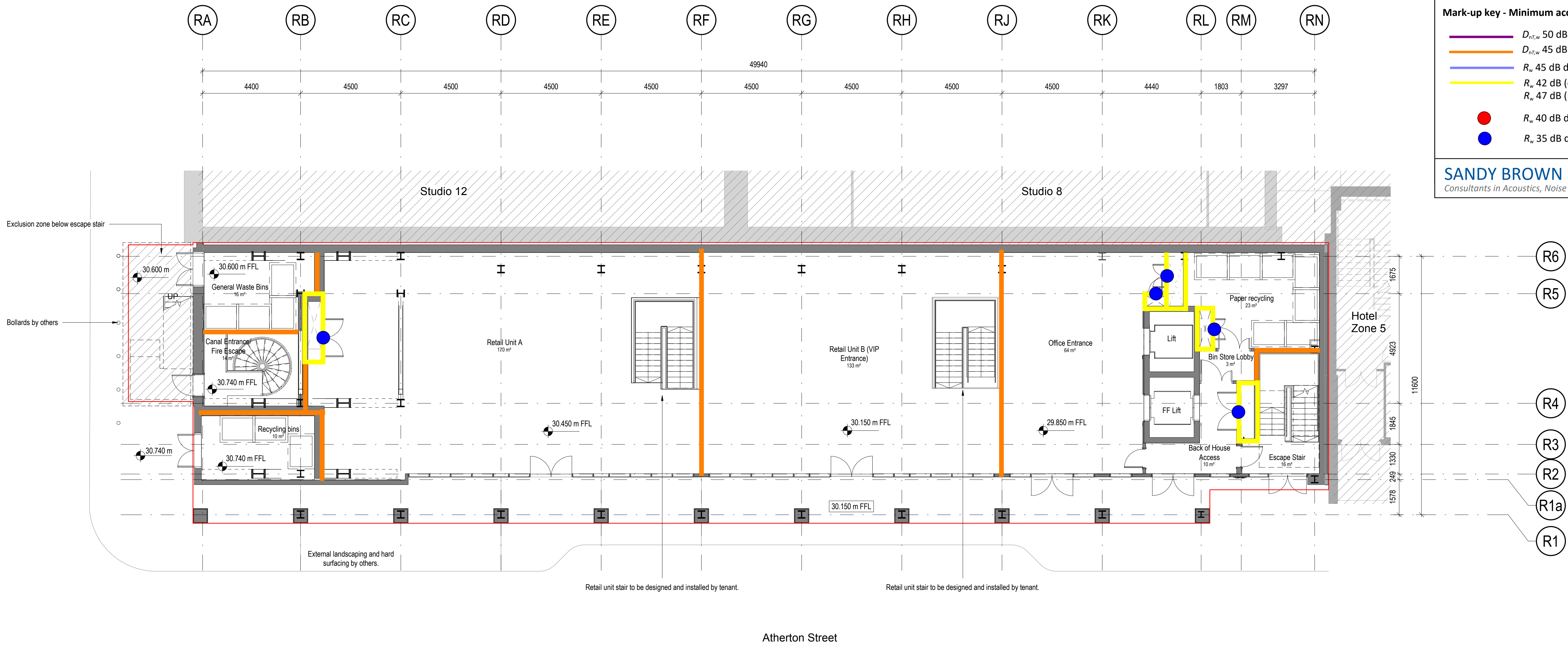
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Reviewed by	James Atha
Date	11 July 2019

- Mark-up key - Minimum acoustic ratings**
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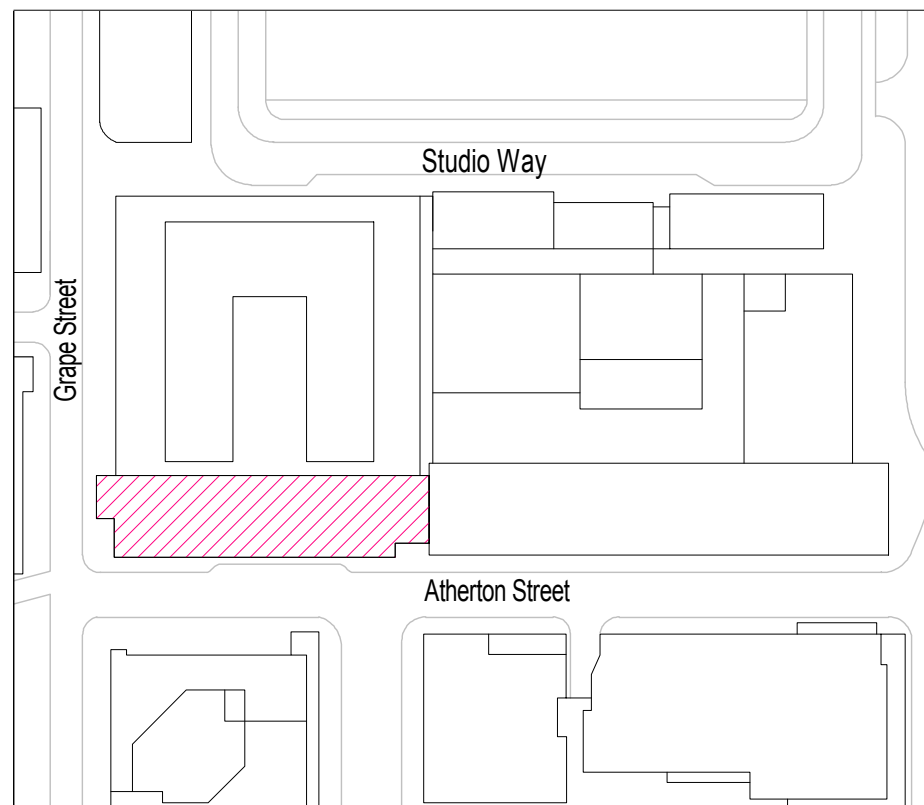
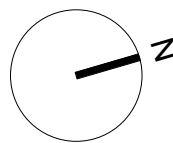


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G	06/05/19	Disabled bays removed	CH
F	17/04/19	VIP Entrance added to scheme	CLH
E	05/04/19	Issue for Workstage 4	MM
D	29/03/19	Updated issue	AV
C	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.	CH
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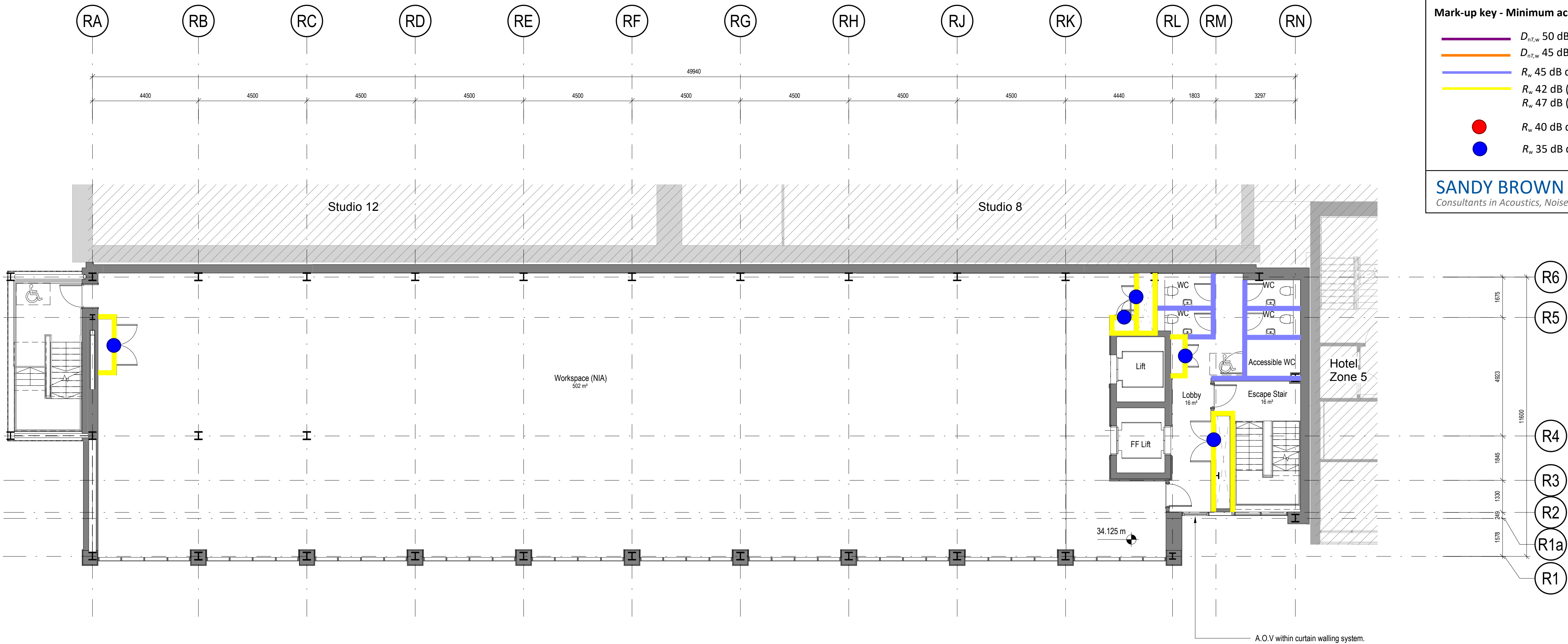
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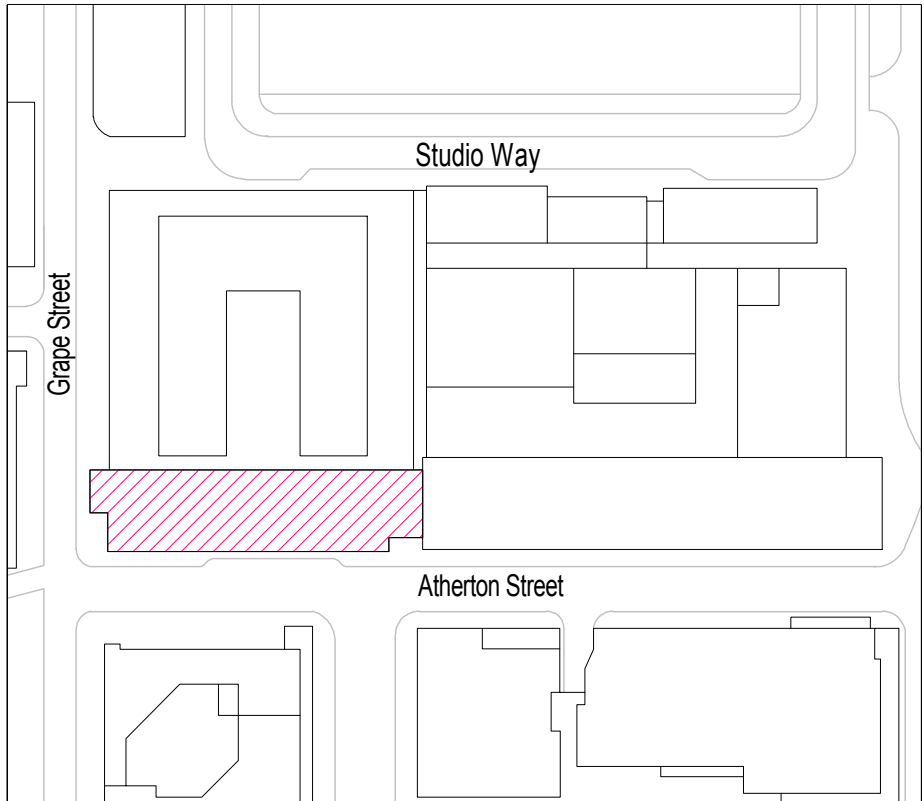
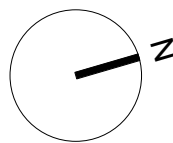


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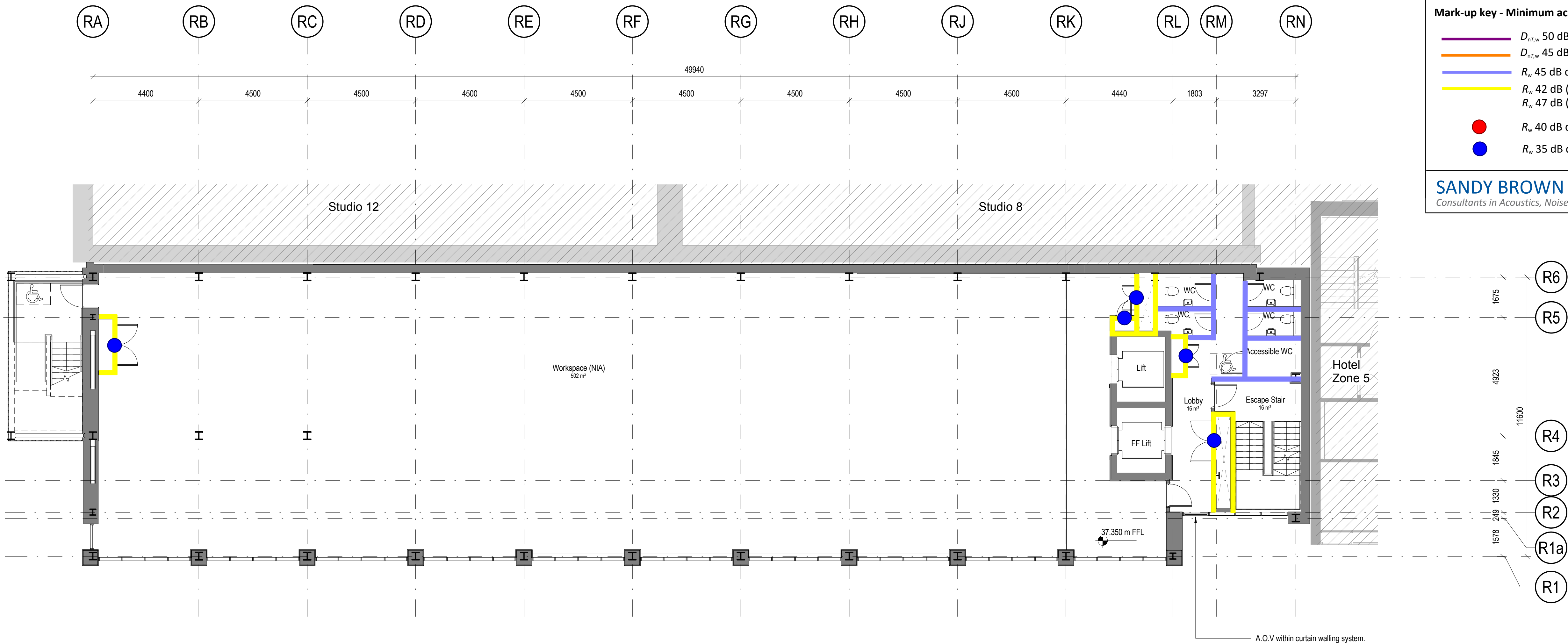
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Project no.	15037
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Reviewed by	James Atha
Date	11 July 2019

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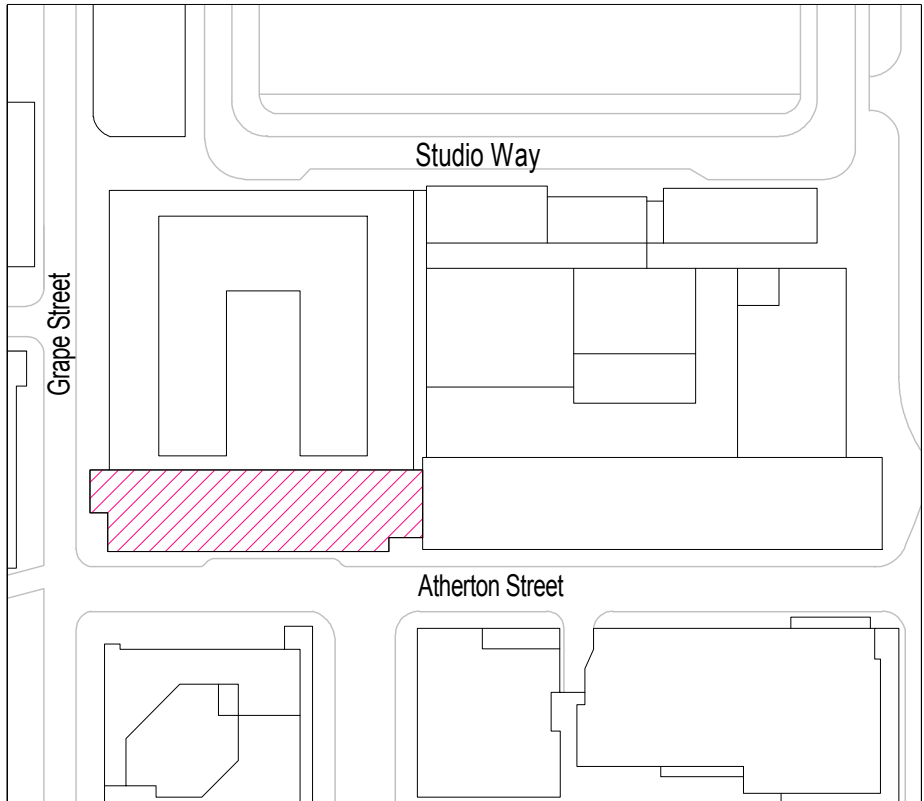
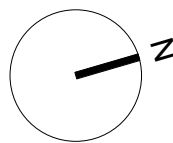


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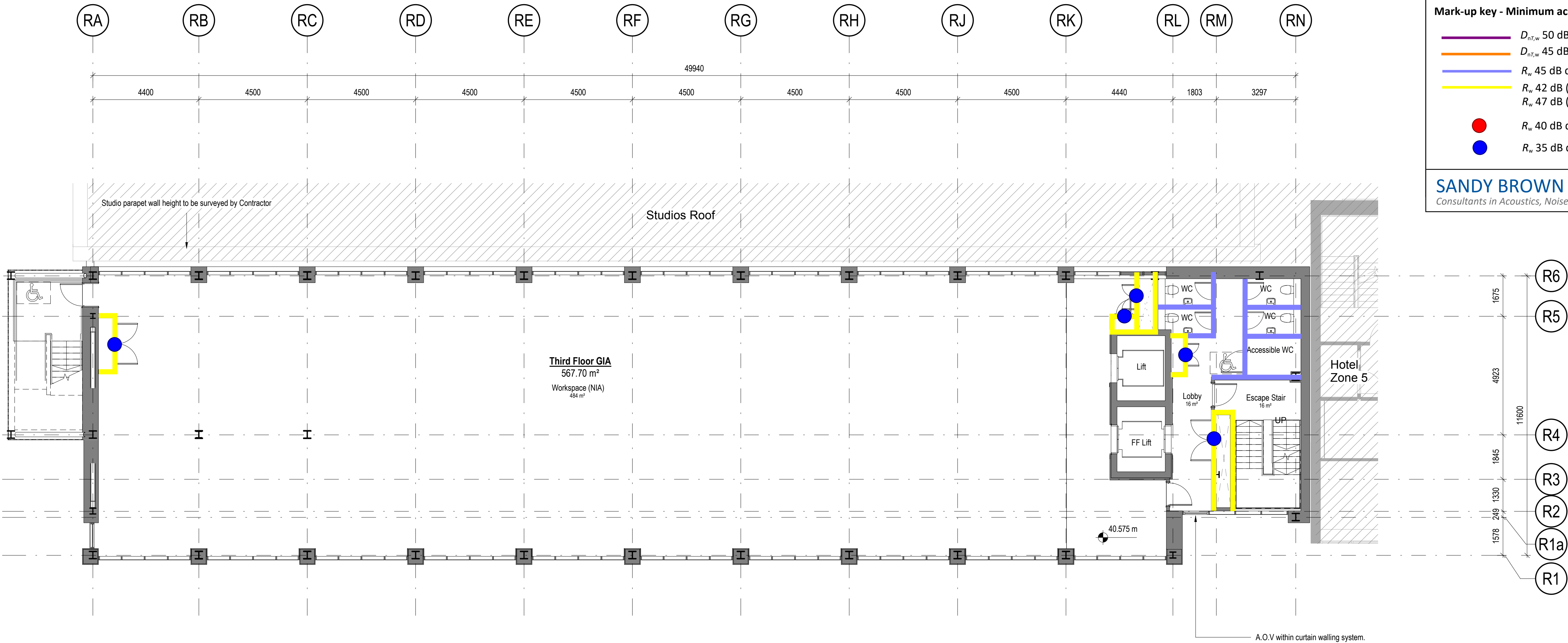
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Project	Old Granada Studios
Project no.	15037
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Reviewed by	James Atha
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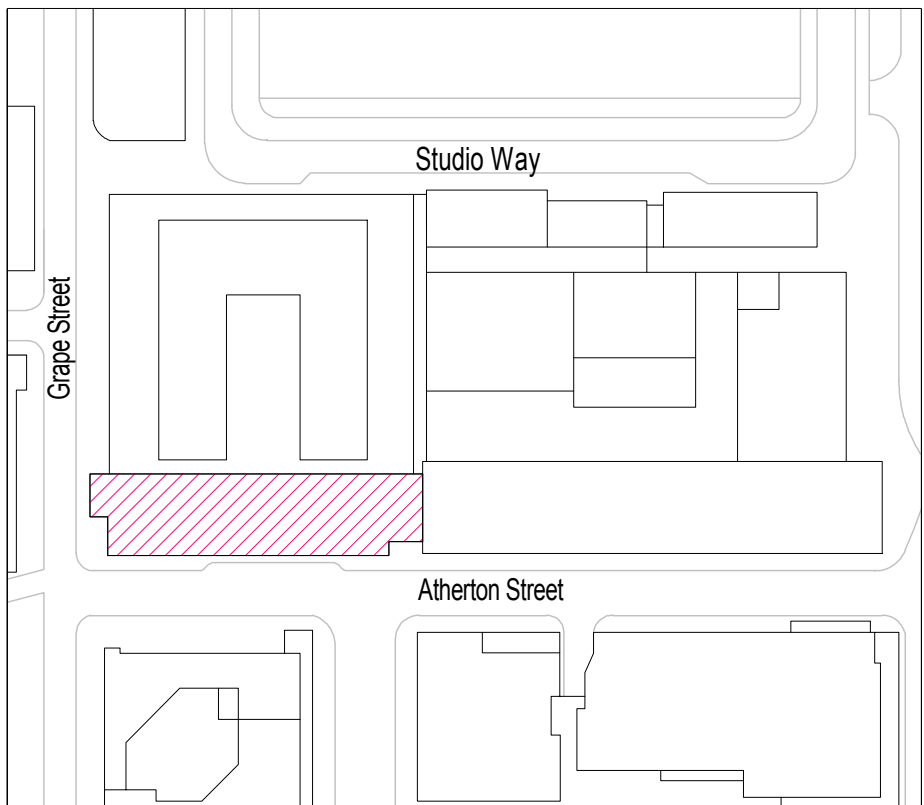
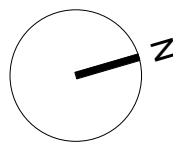


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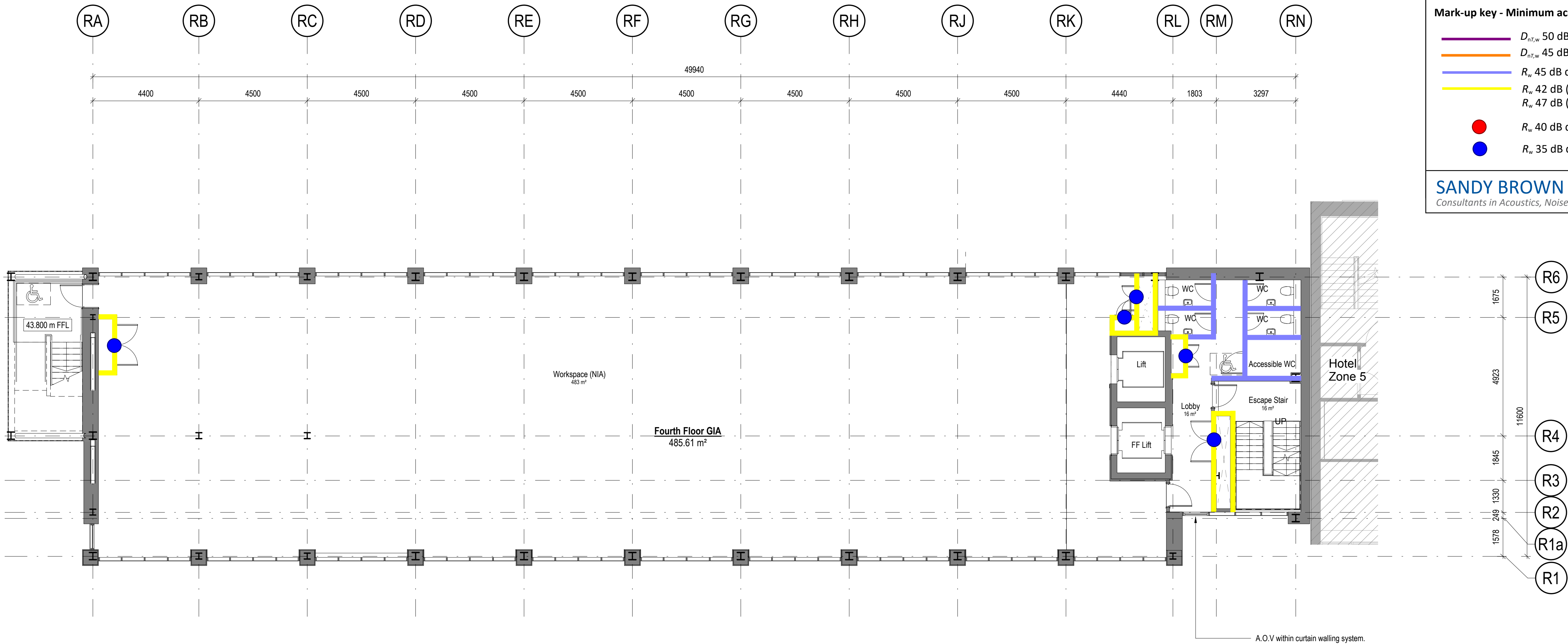
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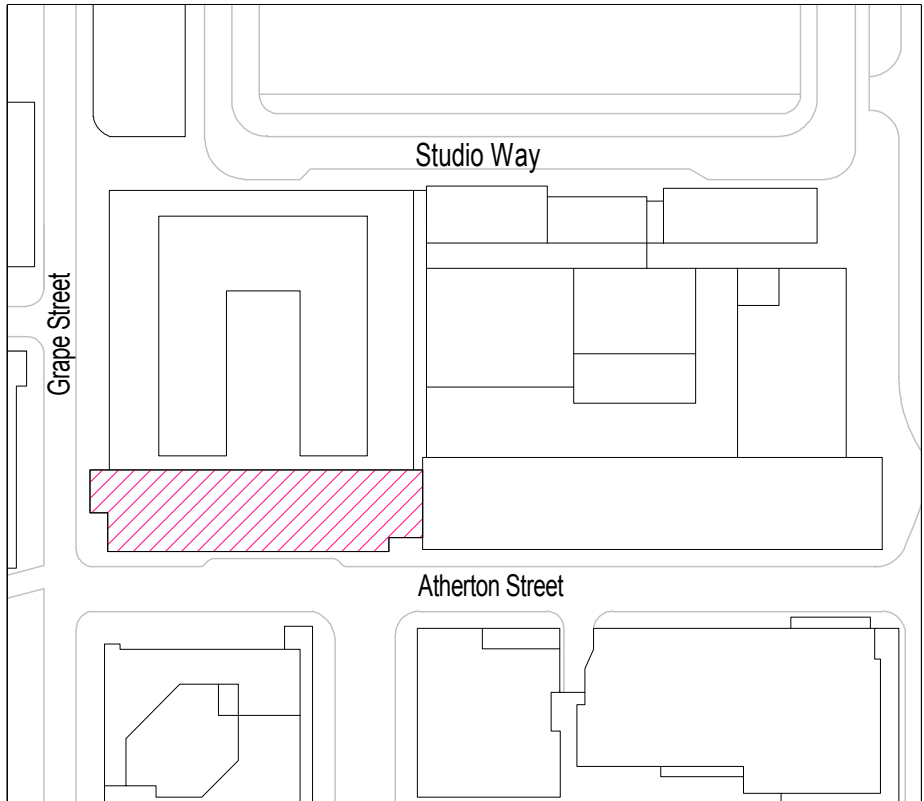
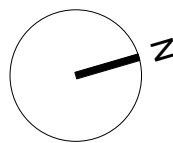


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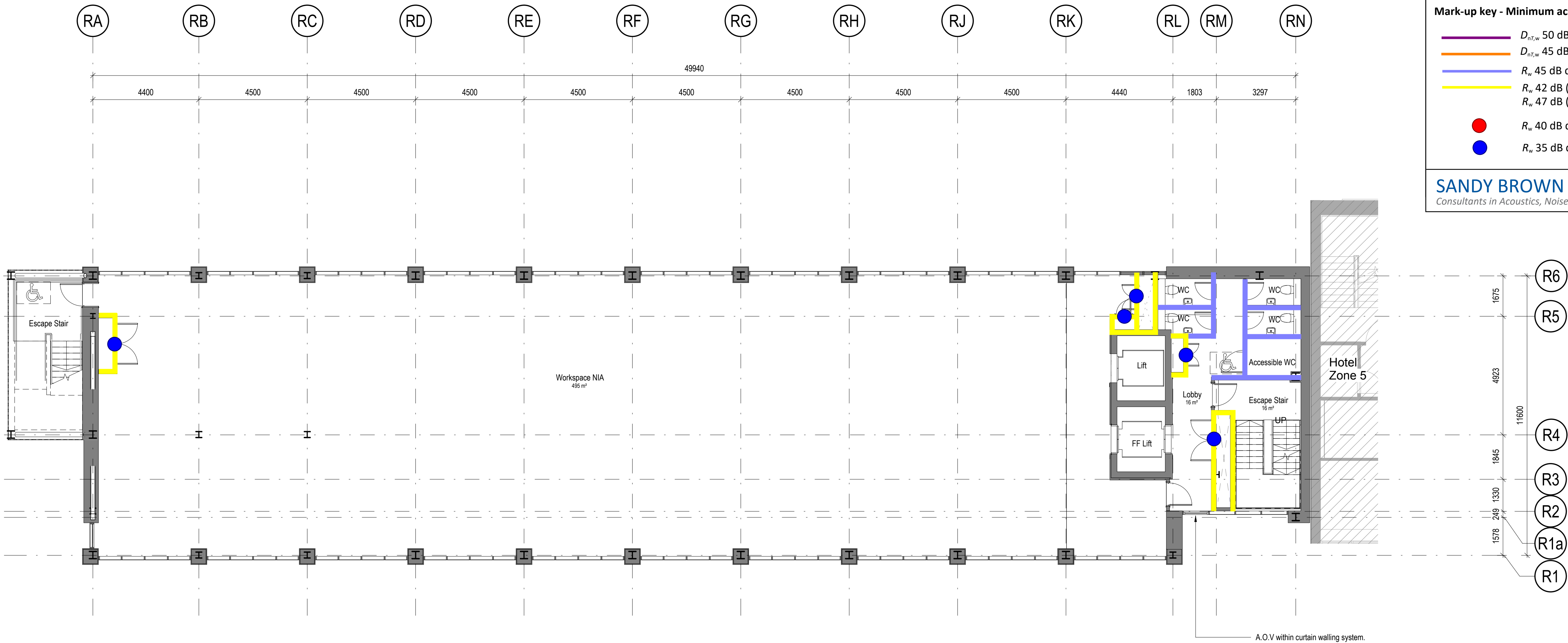
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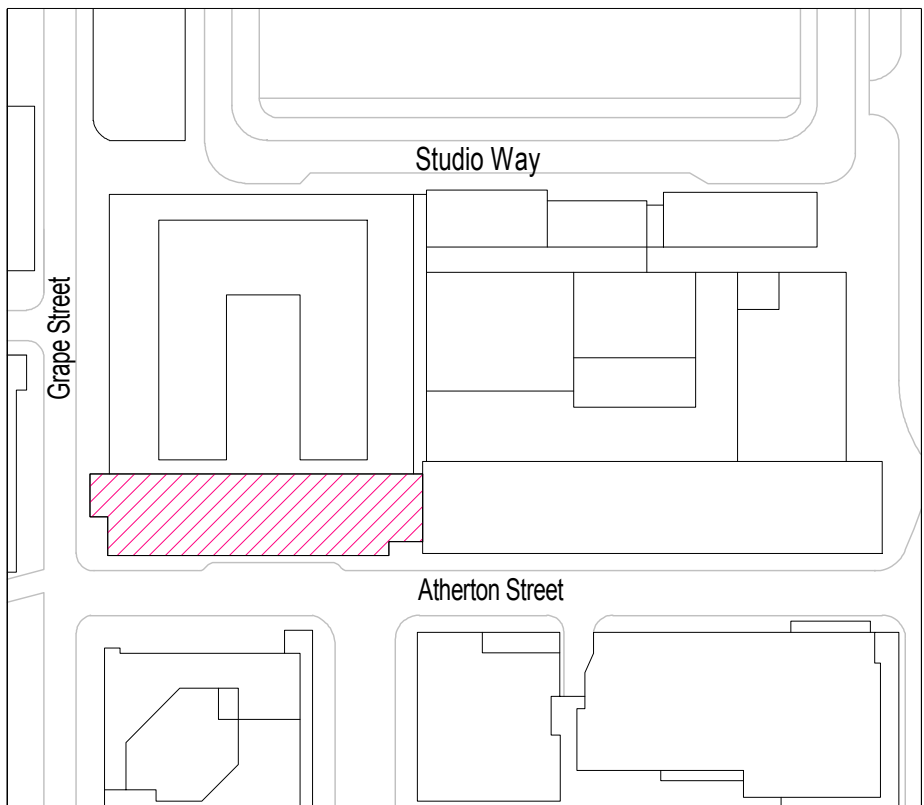
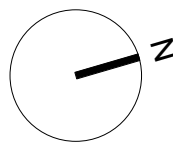


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F	13/05/19	Apartment kitchens and WCs updated	CH
E	05/04/19	Issue for Workstage 4	MM
D	29/03/19	Updated issue	AV
C	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.	CH
B	18/01/19	Issued for information	HEM
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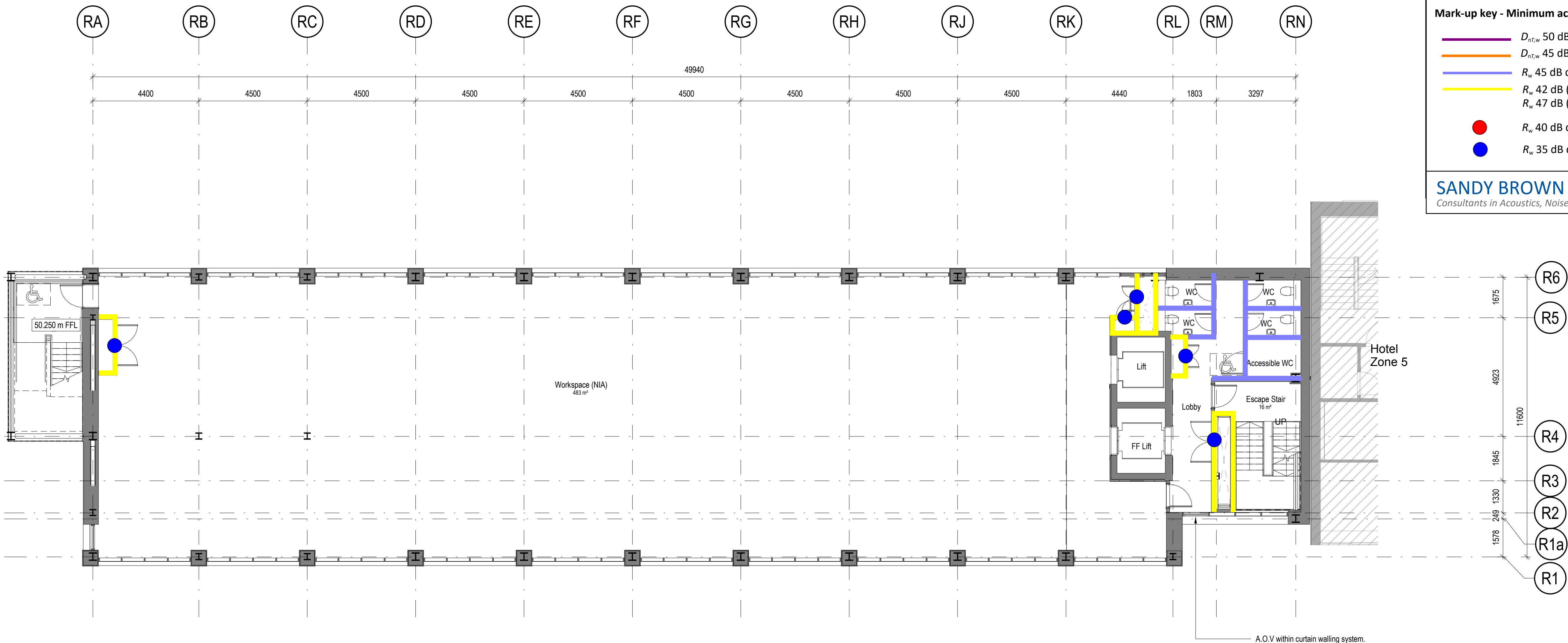
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Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

- Mark-up key - Minimum acoustic ratings**
- $D_{nT,w}$ 50 dB partition
 - $D_{nT,w}$ 45 dB partition
 - R_w 45 dB drywall
 - R_w 42 dB (electrical riser)
 R_w 47 dB (mechanical riser)
 - R_w 40 dB door
 - R_w 35 dB door

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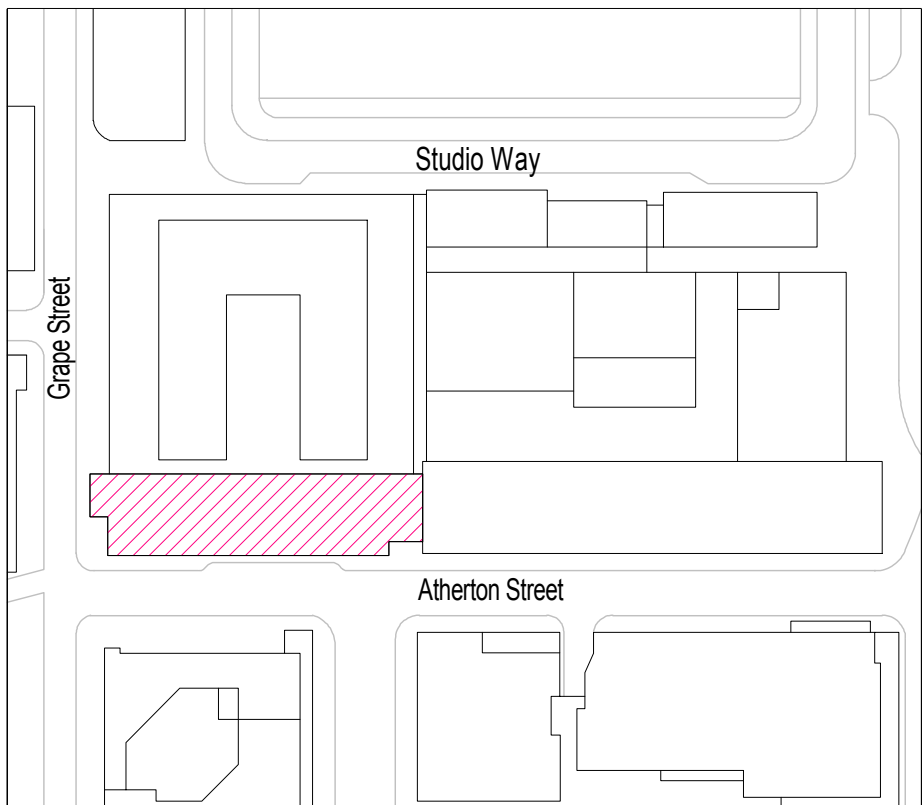
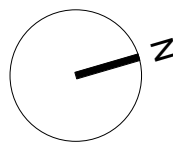


Notes

Do not scale from this drawing.

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G	08/07/19	Tender issue
F	02/07/19	New scheme design
E	13/05/19	Apartment kitchens and WCs updated
D	05/04/19	Issue for Workstage 4
C	29/03/19	Updated issue
B	18/01/19	Issued for information
A	10/12/18	Issued for Workstage 3

Revisions

CL
LP
CH
MM
AV
HEM
HEM

Status

TENDER

Client

Manchester Quays Ltd

Project

OGS
Manchester

Title

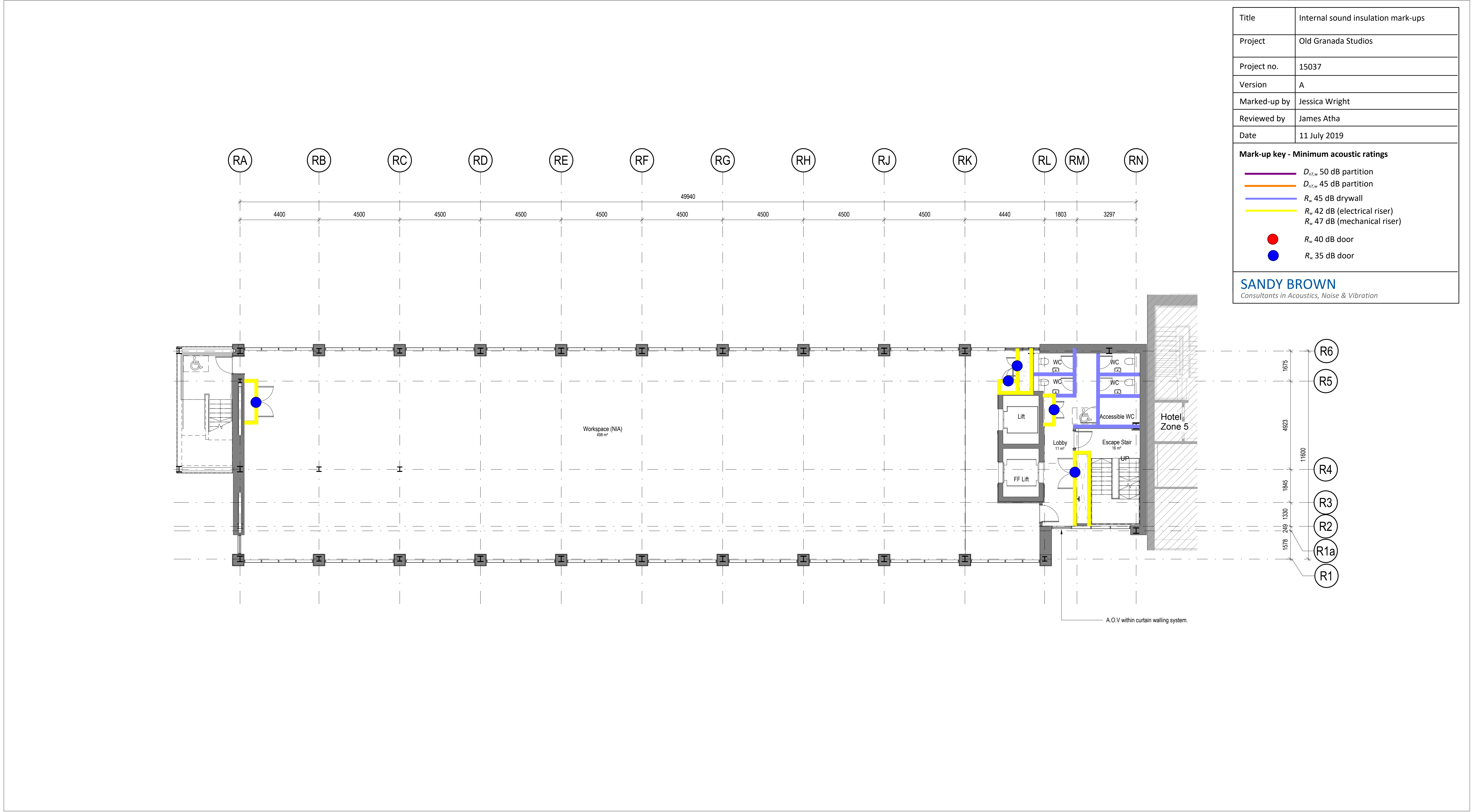
Zone 6 - GA Plan - Level 06

Scale	Size	Date	Drawn	Checked
1 : 100	A1	10/12/18	AT	NS

Drawing No.	Rev.
180146-3DR-Z6-06-DR-20606	G

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REID**



Title	Internal sound insulation mark-ups
Project	Old Granada Studios
Project no.	15037
Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

- Mark-up key - Minimum acoustic ratings**
- $D_{nT,w}$ 50 dB partition
 - $D_{nT,w}$ 45 dB partition
 - R_w 45 dB drywall
 - R_w 42 dB (electrical riser)
 - R_w 47 dB (mechanical riser)
 - R_w 40 dB door
 - R_w 35 dB door

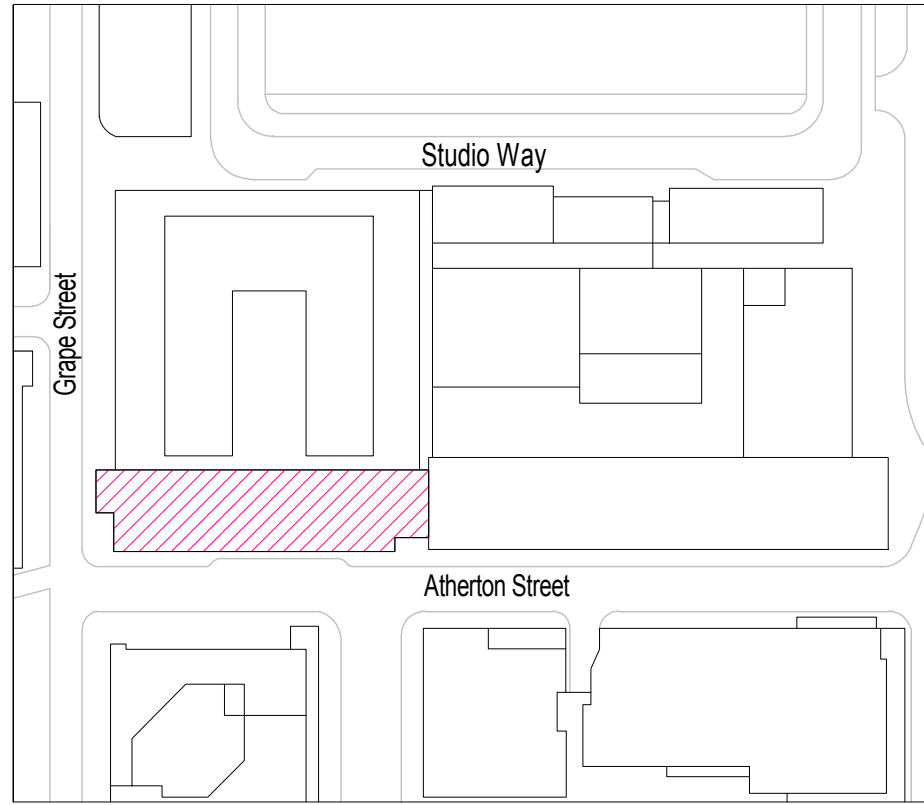
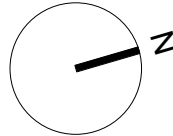
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Notes

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F	08/07/19	Tender issue
E	02/07/19	New scheme design
D	05/04/19	Issue for Workstage 4
C	29/03/19	Updated issue
B	18/01/19	Issued for information
A	10/12/18	Issued for Workstage 3

Revisions

QL
LP
MM
AV
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HEM

Status
TENDER

Client
Manchester Quays Ltd

Project
**OGS
Manchester**

Title
Zone 6 - GA Plan - Level 07

Scale	Size	Date	Drawn	Checked
1 : 100	A1	10/12/18	AT	NS

Drawing No.	Rev.
180146-3DR-Z6-07-DR-20607	F

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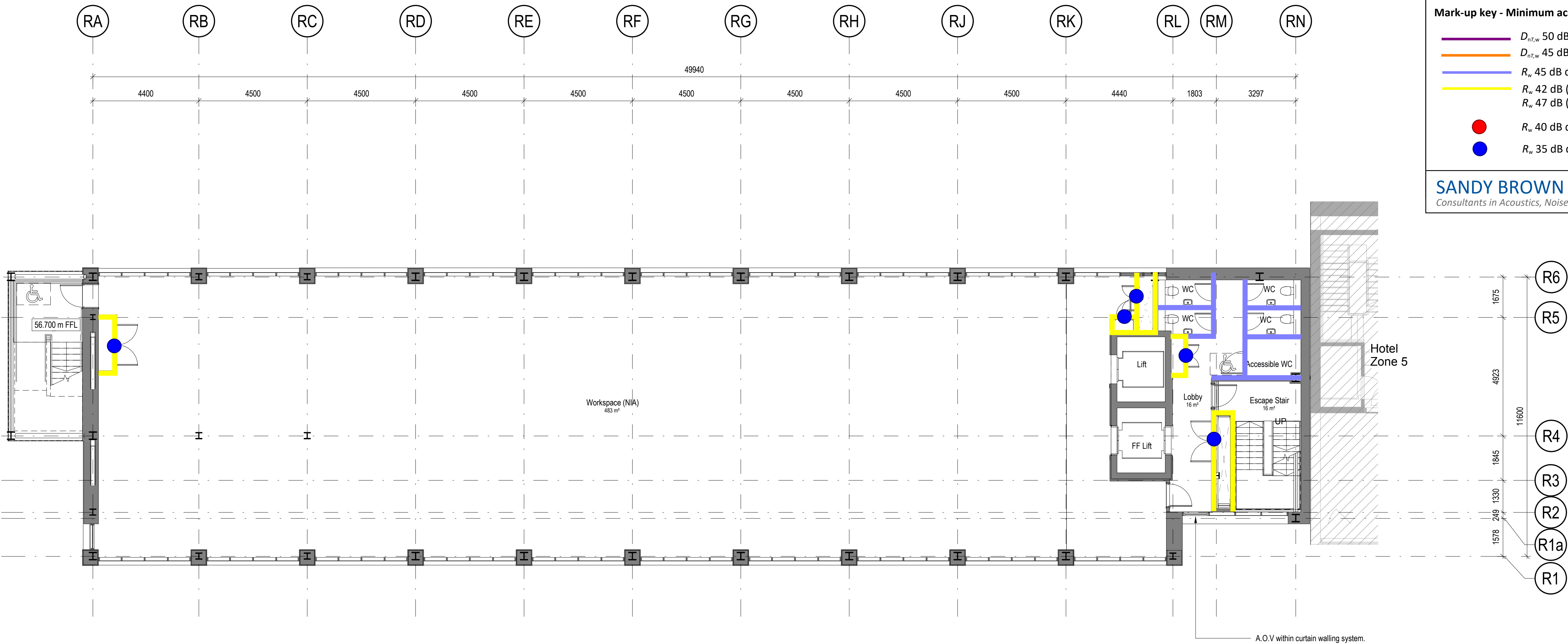
**3D
REID**

Title	Internal sound insulation mark-ups
Project	Old Granada Studios
Project no.	15037
Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

Mark-up key - Minimum acoustic ratings

- $D_{nT,w}$ 50 dB partition
- $D_{nT,w}$ 45 dB partition
- R_w 45 dB drywall
- R_w 42 dB (electrical riser)
 R_w 47 dB (mechanical riser)
- R_w 40 dB door
- R_w 35 dB door

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Consultants in Acoustics, Noise & Vibration

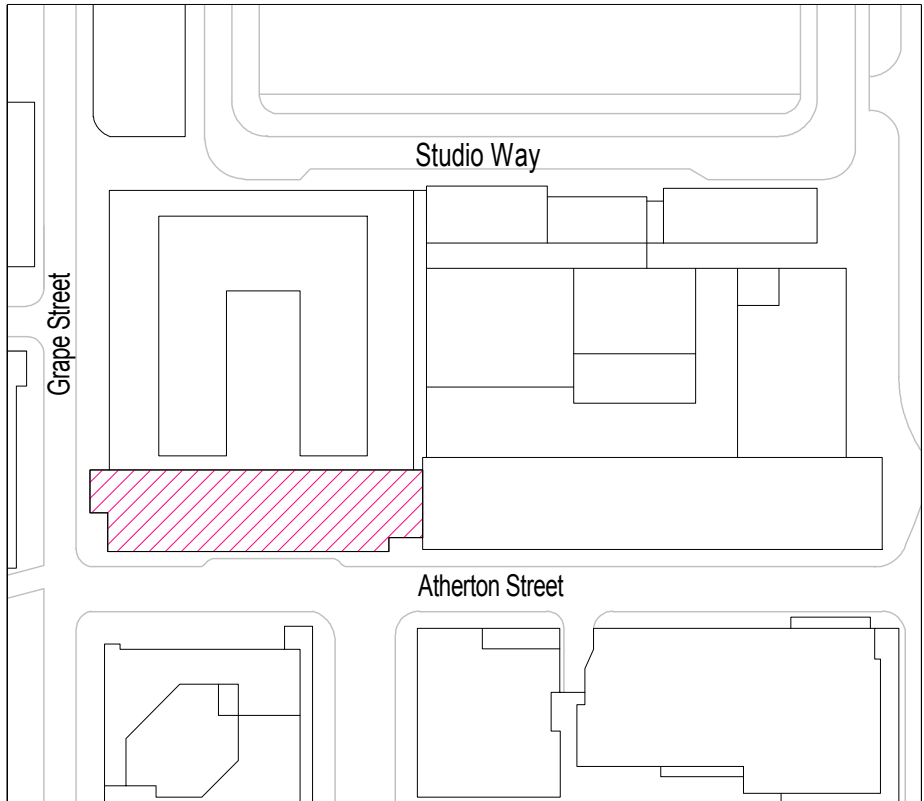
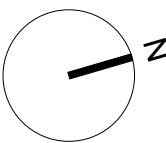


Notes

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G	08/07/19	Tender issue	GL
F	02/07/19	New scheme design	LP
E	05/04/19	Issue for Workstage 4	MM
D	29/03/19	Updated issue	AV
C	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.	CH
B	18/01/19	Issued for information	HEM
A	10/12/18	Issued for Workstage 3	HEM

Revisions

Status

TENDER

Client

Manchester Quays Ltd

Project

OGS
Manchester

Title

Zone 6 - GA Plan - Level 08

Scale	Size	Date	Drawn	Checked
1 : 100	A1	10/12/18	AT	NS

Drawing No.	Rev.
180146-3DR-Z6-08-DR-20608	G

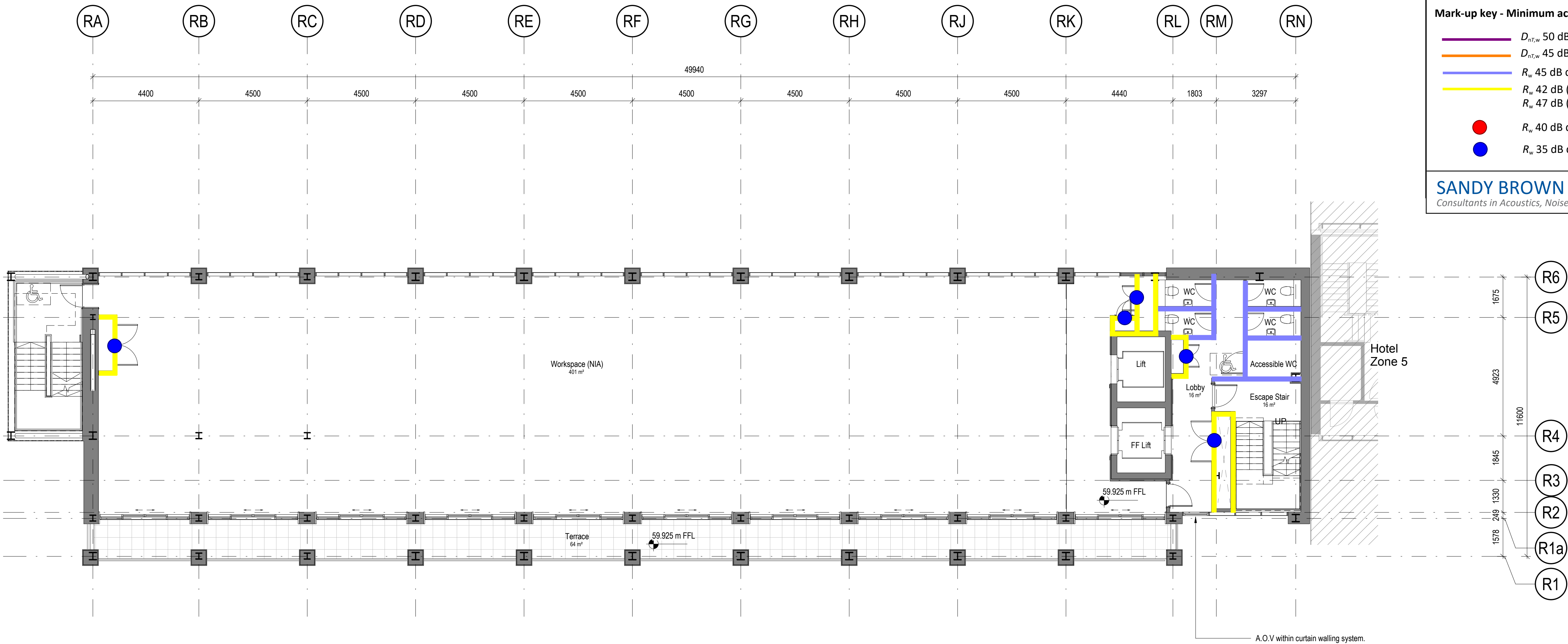
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REID**

Title	Internal sound insulation mark-ups
Project	Old Granada Studios
Project no.	15037
Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

- Mark-up key - Minimum acoustic ratings**
- $D_{nT,w}$ 50 dB partition
 - $D_{nT,w}$ 45 dB partition
 - R_w 45 dB drywall
 - R_w 42 dB (electrical riser)
 R_w 47 dB (mechanical riser)
 - R_w 40 dB door
 - R_w 35 dB door

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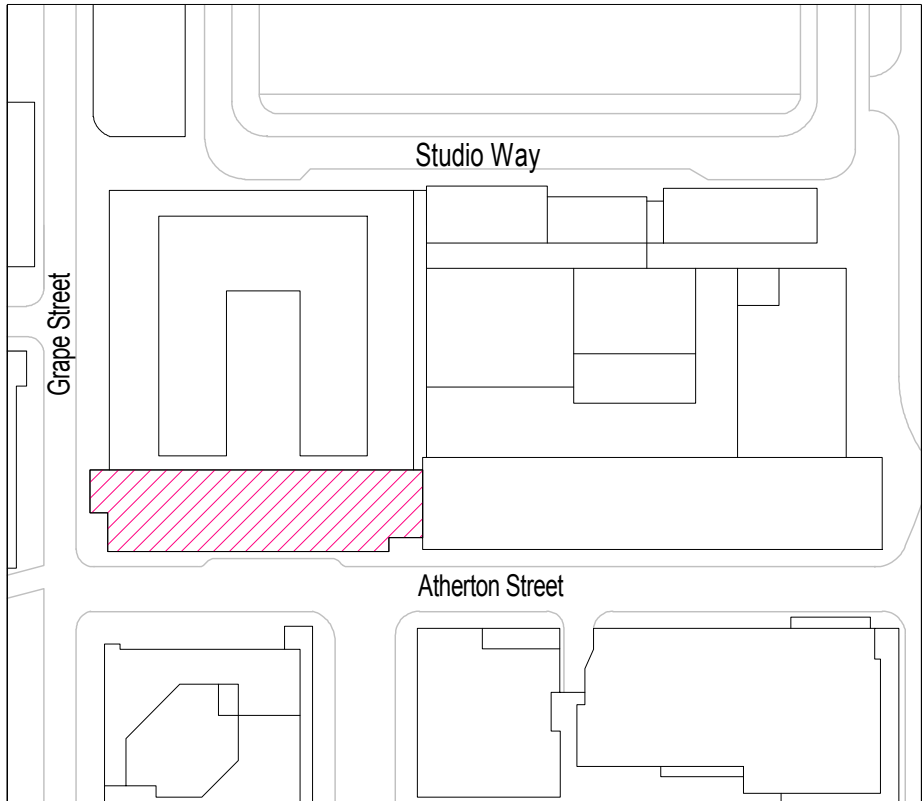


Notes

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I	08/07/19	Tender issue	GL
H	02/07/19	New scheme design	LP
G	14/05/19	On-suites and kitchens updated.	CH
F	14/05/19	Apartment kitchens, WCs and wardrobes updated	CH
E	05/04/19	Issue for Workstage 4	MM
D	29/03/19	Updated issue	AV
C	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.	CH
B	18/01/19	Issued for information	HEM
A	10/12/18	Issued for Workstage 3	HEM

Revisions

Status

TENDER

Client

Manchester Quays Ltd

Project

OGS
Manchester

Title

Zone 6 - GA Plan - Level 09

Scale	Size	Date	Drawn	Checked
1 : 100	A1	10/12/18	AT	NS

Drawing No.	Rev.
180146-3DR-Z6-09-DR-20609	I

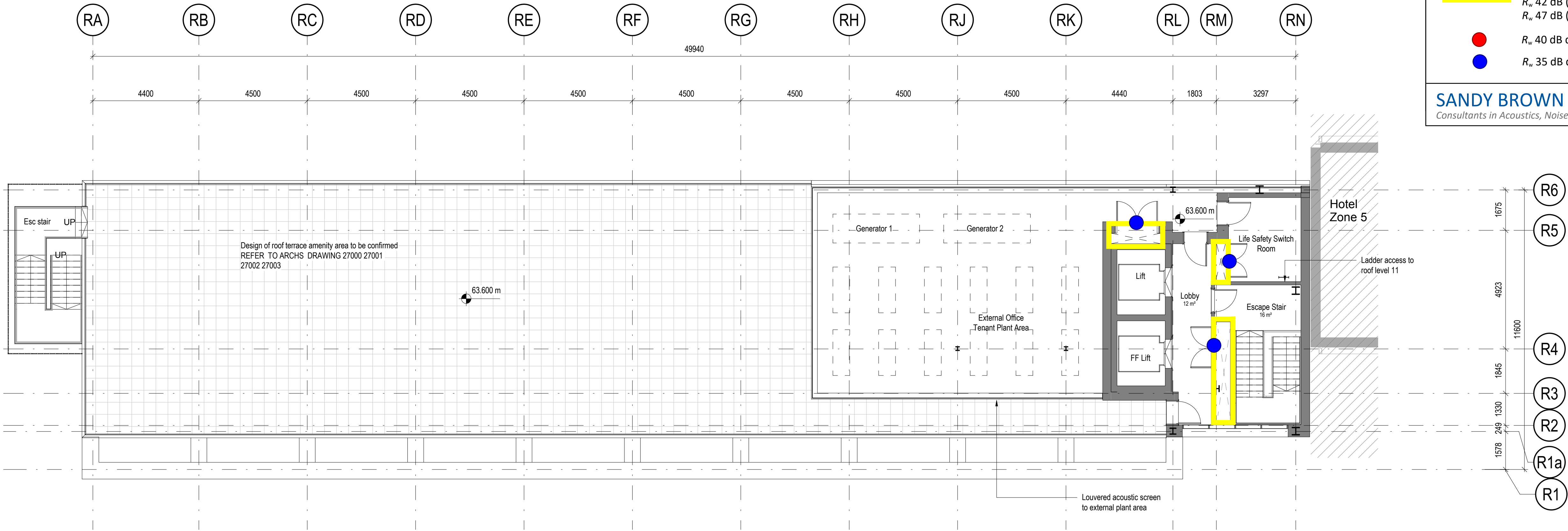
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Title	Internal sound insulation mark-ups
Project	Old Granada Studios
Project no.	15037
Version	A
Marked-up by	Jessica Wright
Reviewed by	James Atha
Date	11 July 2019

- Mark-up key - Minimum acoustic ratings**
- $D_{nT,w}$ 50 dB partition
 - $D_{nT,w}$ 45 dB partition
 - R_w 45 dB drywall
 - R_w 42 dB (electrical riser)
 R_w 47 dB (mechanical riser)
 - R_w 40 dB door
 - R_w 35 dB door

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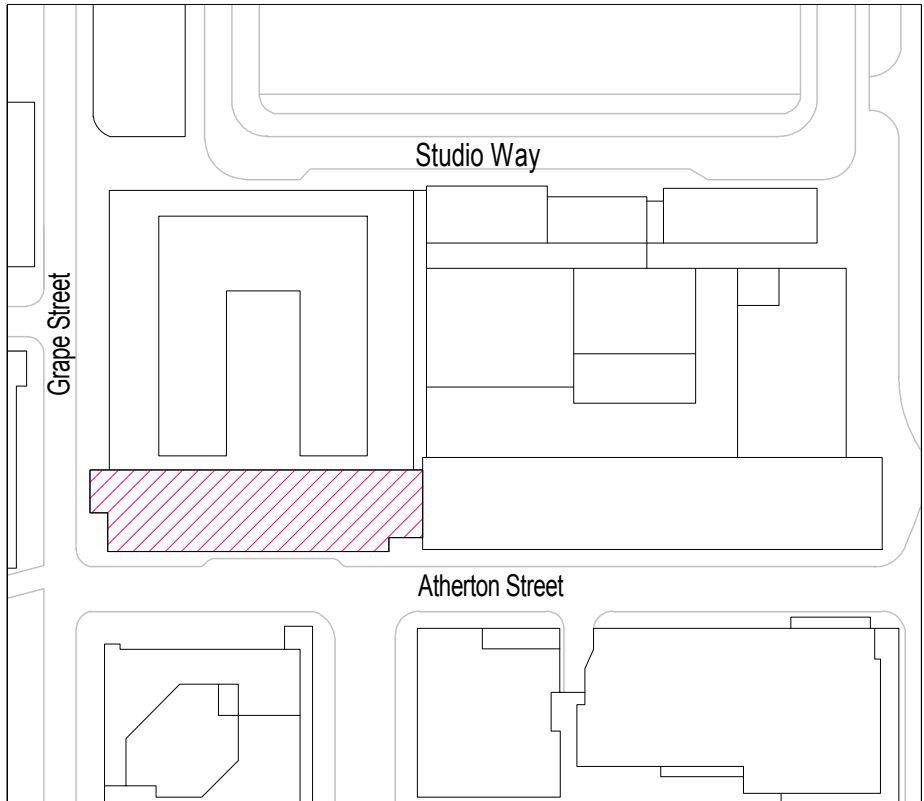


Notes

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I	08/07/19	Tender issue
H	02/07/19	Plant areas updated
G	01/07/19	New office scheme
F	05/04/19	Issue for Workstage 4
E	29/03/19	Updated issue
D	21/02/19	Third lift removed. New riser added. Glazing changed to solid panels at stair.
C	13/02/19	Tenant plant area added
B	18/01/19	Issued for information
A	10/12/18	Issued for Workstage 3

Revisions

GL
CH
CH
MM
AV
CH
CH
HEM
HEM

Status
TENDER

Client
Manchester Quays Ltd

Project
OGS Manchester

Title
Zone 6 - GA Plan - Level 10

Scale	Size	Date	Drawn	Checked
1 : 100	A1	10/12/18	AT	NS

Drawing No.	Rev.
180146-3DR-Z6-10-DR-20610	I

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