



Manchester Crown Street Phase 1

Building C2 - Discharge of Planning Condition 22

5 November 2021

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Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	04/11/21	A Morgan	R. Perkins	R. Perkins	First Issue

Document reference: 388752 | 04 | A

Information class: Standard

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1 Introduction

This report has been prepared by Mott MacDonald to discharge Condition 22 (acoustics) of planning permission ref 119806/FO/2018 for Building C2 of the Crown Street development site. The development comprises a mixed-use development comprising residential and commercial uses, underground parking and associated facilities

Condition 22 relates to façade sound insulation from incident noise sources external to the building, predominantly traffic noise. This report supplements the Façade Acoustic Specification report referenced P01 Z1-MMD-A180-Sp-XX-0101 dated June 2018 submitted to discharge the pre-commencement part of Condition 22, and which is referred to in Decision Notice CDN/18/0563.

Planning condition 22 is reproduced below for ease of reference.

“22) Before the development in Area A, as defined by Condition 3, commences a scheme for acoustically insulating the residential accommodation against noise from the Mancunian Way and Chester Road, surrounding road networks, and any other actual or potential sources of noise that require consideration on or near the site, including any local commercial/industrial premises, shall be submitted to and approved in writing by the City Council as local planning authority. The approved noise insulation scheme shall be completed and a post-completion report submitted to and approved in writing by the City Council as local planning authority before any of the dwelling units are first occupied.

Reason - To secure a reduction in noise from the main roads and surrounding road networks and any other potential sources of noise, in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy.”

A Glossary of acoustic terms is presented in Appendix A.

2 Site Location

The site is located in central Manchester. The A57(M) Mancunian Way bounds the site to the south west and the A56 Chester Road forms the site's northern boundary. Vehicular access to the site is via Great Jackson Street to the east.

The site is subject to high levels of road traffic noise from the surrounding road network. Acoustic façade specifications for residential units includes mitigation to provide acceptable internal noise levels. Mitigation includes acoustically rated glazing and mechanical background ventilation.

Building C2 is located on the west section of the site and comprises a 50-storey building with car parking at basement levels. The ground and first floor podium levels include commercial, office and residential uses in addition to plant and service areas (electrical substations, access, refuse, etc.). The upper floor levels comprise residential apartments.

A site plan is provided for reference in Appendix B along with plans showing the residential podium layout and a typical residential floor layout for the towers illustrating typical configurations for bedrooms and living rooms. Note that many living rooms are dual-aspect, and as such have a relatively high façade area exposed to traffic noise.

3 Requirements

Manchester City Council guidance document “Planning and Noise” adopts the following internal ambient noise level criteria for bedrooms and living rooms within residential accommodation:

- Bedrooms (night-time 23:00 – 07:00) 30dB L_{Aeq} (individual noise events should not normally exceed 45dB $L_{Amax,F}$ by more than 15 times)
- Living Rooms (day-time 07:00 – 23:00) 35dB L_{Aeq}

Due to the challenging day-time noise levels incident on some facades of the towers, resulting from the proximity of significant roads, it is not practicable to achieve the above criteria for all living rooms, particularly where they are dual aspect. A dispensation has been sought from and granted by Manchester City Council that daytime noise levels in Living Rooms will be designed to achieve an internal ambient noise level of no greater than 40dB L_{Aeq} .

This limited relaxation is included in the Façade Acoustic Specification report referenced in Decision Notice CDN/18/0563.

4 Noise Levels Incident Upon Site

A noise impact assessment report has been prepared by REC in support of the planning application for the development¹ (hence forward referred to as the “REC report”).

4.1 Measured Noise Levels

Noise levels were measured by REC for four days at a location to the west of the site close to the roundabout junction of the Mancunian Way and A56. A further shorter term measurement undertaken close to the carriageway of the A56 to the north east of the site was also reported by REC.

4.2 Modelled Noise Levels

REC undertook computer noise modelling validated with the reported noise measurements to determine noise levels external to the facades at all floors of Buildings C2. Data is presented for both the daytime period (07:00 – 23:00) and night-time period (23:00 – 07:00) in terms of $L_{Aeq,T}$. These noise levels are presented as broadband values in Tables A3 and A4 of the REC report. External noise levels expressed as $L_{Aeq,T}$ were predicted to be in the following ranges during the day-time and night-time periods:

- Daytime (07:00 – 23:00) $L_{Aeq,T}$ 59-71 dB
- Night-time (23:00 – 07:00) $L_{Aeq,T}$ 48-61 dB

4.2.1 Application of Sound Spectrum to Modelled Noise Levels

In order to most accurately predict noise break-in through façade elements, and therefore to determine sound insulation performance requirements, a standard road traffic spectrum (defined in BS EN ISO 717 Part 1²) was applied to the REC modelled noise levels. The spectral corrections at each octave band frequency are presented in Table 1 below. For a given noise level, the correction factor is added to the broadband number for each frequency to determine relevant spectral noise levels.

Table 1: Correction Terms for Standard Traffic Noise Spectrum

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000
Correction for Broadband Sound level	-18	-14	-10	-7	-4	-6	-11

Source: BS EN ISO 717 - 1

¹ REC, 2017. AC103902-1R2 Noise Impact Assessment Zone 1-Crown Street Manchester.

² BSI, 2013. BS EN ISO 717 Acoustics – Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation (ISO 717-1:2013)

5 Summary of Façade Specification

5.1 Unitised Curtain Walling Façade

Two grades of acoustic performance were specified for unitised curtain wall elements to deal with the prevailing external noise levels for the various facades:

- Type A – Standard acoustic performance (R_w+C_{tr} 36dB).
- Type B – Enhanced acoustic performance (R_w+C_{tr} 40dB).

Details of analysis and noise break-in calculations which support these specifications are presented in the Façade Acoustic Specification report referenced P01 Z1-MMD-A180-Sp-XX-0101.

The specification assumes that adequate ventilation is achieved with facade purge ventilators closed, i.e. by mechanical ventilation with heat recovery (MVHR) units.

5.2 Podium Façade

The above ground podium levels at Crown Street (Ground and Level 01) have residential accommodation on both levels. This comprises:

- dual level townhouses situated on the southern facing façade of building C2 with living rooms on ground floor and bedrooms on first floor;
- one dual level townhouse at the south west corner of the podium with bedroom accommodation on ground floor and living accommodation and further bedrooms on first floor.

The remainder of the podium for Building C2 comprises non-residential ancillary or commercial space.

The building envelope for residences within the podium comprises a masonry outer leaf with an structural framing system (SFS) inner leaf lined with plasterboard. Windows are punched in this façade rather than curtain walling. As the windows are relatively limited in size compared to curtain walling elements, a different sound insulation specification to that developed for the curtain walling is appropriate to achieve the required internal ambient noise levels for the podium levels. The specification has been set out in a Technical Note referenced Z2-MMD-A180-Rp-XX-001, which is appended in Appendix C of this report.

In summary, Table 2 provides the glazing specification for living room and glazing performance for living rooms and bedrooms on the various podium facades (ground and first floor):

Table 2: Required Glazing Specifications

Façade	Room Type	Glazing Specification (R_w+C_{tr}) dB	Door Specification (R_w+C_{tr}) dB
South	Living Room	30 (35-5)	28 (30-2)
South	Bedroom	30 (35-5)	-

The performance applies to the complete window including frame. It is assumed that adequate ventilation is achieved with windows closed (MVHR unit).

Where a particular room has glazing on two facades, the glazing specification relevant to the noisiest façade is applicable for all windows serving that room.

6 Specified Façade Constructions

6.1 Unitised Curtain Walling Façade

In order to achieve the performance specification for the curtain walling zones of the towers, a specification has been developed by curtain walling contractor SIPRAL. This specification is detailed in SIPRAL reports Z1-SIP-G251-Rp-XX-001 and Z1-SIP-G251-Rp-XX-002 which are included in Appendix D. These reports present test data and analysis to demonstrate how each of the curtain walling elements will achieve the required airborne sound insulation performance.

6.2 Podium Façade

In order to achieve the performance requirements for the podium residential accommodation set out in Table 2, specifications have been developed by glazing system specialist Uniform Architectural Limited. The glazing specifications are presented in Appendix E, along with supporting test data. Some further amendments have been made to the glazing specifications in Appendix E to ensure that a margin of sound insulation performance above the requirement of 3-6 dB is achieved to allow for losses in airborne sound insulation resultant from the window framing.

These are detailed in a statement from Uniform which can be found in Appendix F.

7 Conclusion

Specifications for unitised curtain walling and punched window elements, along with supporting evidence has been provided to demonstrate that the internal ambient noise levels required by Manchester City Council will be achieved for residences at Building C2 of Crown Street Phase 1.

This has been provided in order to discharge Condition 22 (acoustics) of planning permission ref. 119806/FO/2018 for the development.

Appendices

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D.	Z1-SIP-G251-Rp-XX-001 and Z1-SIP-G251-Rp-XX-002 SIPRAL Façade Acoustic Reports	15
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A. Glossary of Acoustic Terms

A-weighting	The human ear also has a non-linear frequency response, being most sensitive in the frequency range 1 kHz to 4 kHz and is less sensitive at higher and lower frequencies. The A-weighting is a frequency function commonly applied to the linear output of a microphone to simulate the subjective response of the ear. A-weighted levels are usually indicated by a subscript A or postscript (A).
Ambient noise	This is the total sound for a given scenario where the acoustic field is affected by a variety of sources.
DeciBel	Sound and noise are commonly described using the deciBel (dB) scale, which is logarithmic in nature to relate to the response of the human ear. The range of human hearing commonly varies from the threshold of audibility (0 dB) to the threshold of pain (120 dB). Such limits are seldom experienced in practice and typical levels might vary between 30 dB in a quiet bedroom at night to 90 dB at the kerbside of a busy road.
Equivalent continuous noise level L_{eq}	Time-varying noise such as that from industrial or construction operations may not best be described using the statistical approach described above. The equivalent continuous noise level, $L_{Aeq,T}$, may be used, which is the notional level of a steady sound which, at a given position and over the same period of time (T), would deliver the same sound energy as the fluctuating one.
Façade sound level	The received sound level which is measured or calculated immediately adjacent to a building façade, normally at 1m distance. Sound is reflected by the hard surfaces of a façade producing a slightly higher sound level (2.5 to 3.0 dB) than would occur in the absence of the building.
Free field sound level	The sound level which is measured or calculated within an acoustic field which is free of significantly reflective surfaces (except the ground plane).
Maximum sound pressure level $L_{(max)}$	The highest A-weighted sound level reached within the measurement period. “Fast” denotes that the level is weighted to the response time of the ear (125 ms) instead of to 1 second (denoted “Slow”).
Sound power level	This is a measure of the sound energy radiated by an acoustic source per unit time. It is a characteristic of the source alone and independent of the properties of the acoustic field.
Statistical noise level L_N	Noise which fluctuates with time may be described using a statistical approach. The statistical level L_{AN} is the level in dB exceeded for N % of the overall measurement period. L_{A90} is the noise level exceeded for 90 % of the sampling period and is a measure the lower levels in the absence of higher level transient events. It is commonly used to describe the ambient or background noise. The L_{A10} is the noise level exceeded for 10 % of the sampling period and is a measure the higher levels. In the UK, it is commonly used to describe road traffic noise and, when considered over the 18-hour period 06:00 to 24:00 is referred to as the traffic noise index.

Weighted sound reduction index R_w	Laboratory derived single-number rating for sound insulation performance of building elements obtained by comparing the results of a sound reduction index test with a reference curve allowing a maximum of 2.0dB for the mean unfavourable deviations.
Spectrum adaptation term A-weighted urban traffic noise C_{tr}	– The correction to a sound insulation quantity (such as $D_{nT,w}$) to take account of a specific sound spectra.

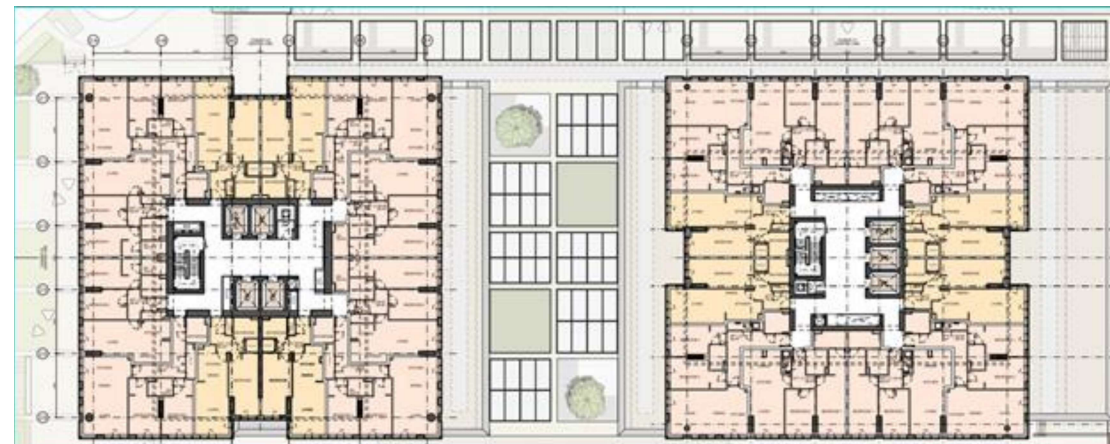
B. Crown Street Drawings

Figure B.1: Site Layout



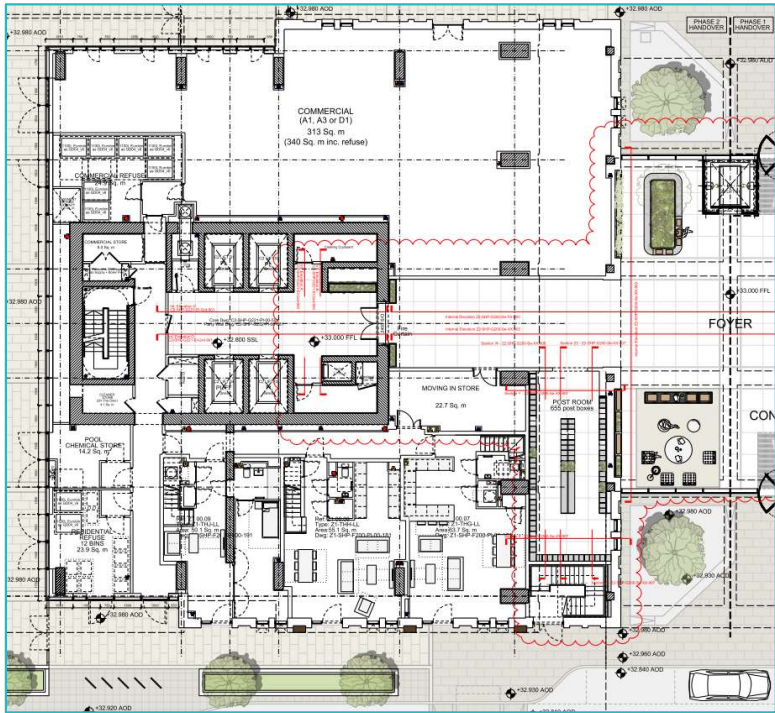
Source: Simpson Haugh and Partners Drawing 7357-Z1-A-B5D8-G000-P-00-002

Figure B.2: Typical Tower Floor Layout



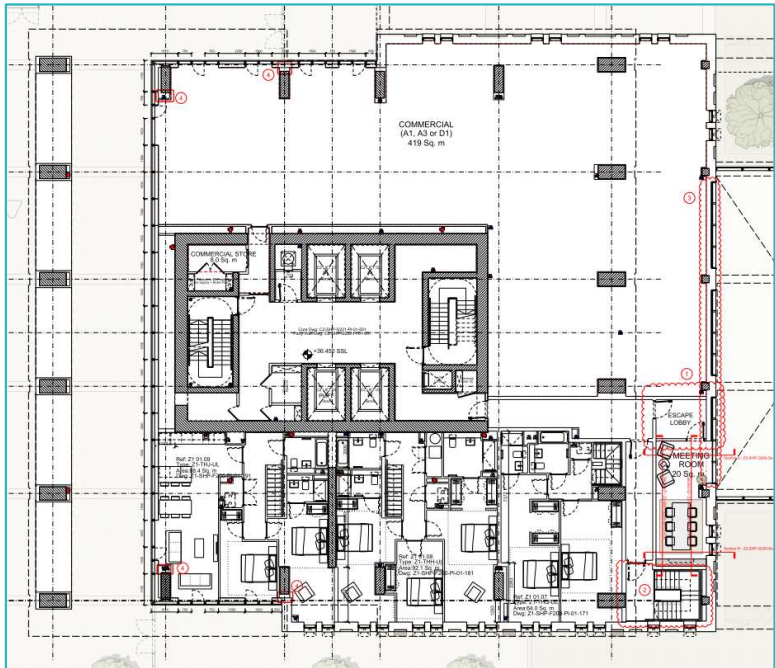
Source: Simpson Haugh and Partners Drawing 7357-Z1-A-B5D8-G100-P-TY-001

Figure B.3: Podium Tower C2 Ground Floor



Source: Simpson Haugh and Partners Drawing 7357-C2-SHP-G200-PI-Grd-001

Figure B.4: Podium Tower C2 First Floor



Source: Simpson Haugh and Partners Drawing 7357-C2-SHP-G200-PI-01-001

C. Z2-MMD-A180-Rp-XX-001 Podium Residential Windows Acoustic Requirements

Project:	Crown Street Manchester		
Our reference:	388752AU03_TN01	Your reference:	Z2-MMD-A180-Rp-XX-001
Prepared by:	Adrian Morgan	Date:	02/10/19
Approved by:	Simon Kahn	Checked by:	Simon Kahn
Subject:	Podium Residential Windows Acoustic Requirements		

1 Introduction

The above ground podium levels at Crown Street (Ground and Level 01) have residential accommodation on both levels. This comprises:

- dual level townhouses situated on the southern facing façade of building C1 and C2 with living rooms and some bedrooms on ground floor and bedrooms on first floor;
- apartments on the east and north facing facades of building C1.

Glazing on levels 2 and above is unitised curtain walling, the acoustics performance of which is considered elsewhere.

It is understood that adequate ventilation will be provided to residences by mechanical means, so that, whilst opening lights are provided to some windows, these are for use at the occupiers' discretion

2 External Noise Levels

External noise levels at the various facades have been defined based upon the data presented in REC report AC103902-1R2 (hence forward referred to as the “REC report”)¹. Relevant levels are reproduced in Table 1.

Table 1: External Noise Levels at Podium Residential Levels

Building	Facade	Floor Level	L _{Aeq,16hour} Daytime (dB)	L _{Aeq, T} Nighttime (dB)
C1	South	Ground	58	47
		1	61	50
	East	1	66	56
	North	1	72	62
C2	South	Ground	59	48

¹ REC, 2017. AC103902-1R2 Noise Impact Assessment Zone 1- Crown Street Manchester

Building	Facade	Floor Level	L _{Aeq,16hour} Daytime (dB)	L _{Aeq,T} Nighttime (dB)
		1	61	50

Source: REC Report

The glazing specification proposed below assumes the worst case noise level on each façade at the level where each room type (bedroom or living room) occurs. In order to facilitate more precise noise break-in predictions, a standard traffic spectrum from BS EN ISO 717-1 has been applied to the broadband sound level from the REC report. The spectrum applied is presented in Table 2.

Table 2: Correction Terms for Standard Traffic Noise Spectrum

Octave Band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000
Correction for Broadband Sound level	-18	-14	-10	-7	-4	-6	-11

Source: BS EN ISO 717 - 1

3 Requirements

Manchester City Council guidance document “planning and Noise”² adopts the following internal ambient noise level criteria for bedrooms and living rooms within residential accommodation based upon the guidance cited above:

- Bedrooms (night time 23:00 – 07:00) 30dB L_{Aeq} (individual noise events should not normally exceed 45dB L_{Amax,F} by more than 15 times);
- Living Rooms (day-time 07:00 – 23:00) 35dB L_{Aeq}.

4 Predictions of Noise Break-in

Noise break-in predictions have been carried out on representative living and bedrooms on each facade using proprietary software package INSUL³. Screenshots of INSUL output are presented in Appendix A.

4.1 Assumptions

The elements considered and the assumptions made in the predictions are set out below.

External wall

- 102.5mm single leaf brickwork
- 55mm open cavity
- 125mm rockwool duo mineral wool
- 100mm SFS zone comprising:
 - 12mm cement bonded particle board

² MANCHESTER CITY COUNCIL, 2015. Planning and Noise Technical Guidance

³ MARSHALL DAY ACOUSTICS, 2017. Insul version 9.0.17

- 25mm mineral wool insulation
- 2x12.5mm standard plasterboard

Door

Assumed to have an R_w 30dB acoustic rating (modelled as a timber doorset)

Glazing

Typical thermal glazing specification (6:12:6) assumed as a starting point.

Sound insulation performances for each of these elements has been predicted using INSUL and are presented in Table 3.

Table 3: Sound Insulation Performance Predictions for Façade Elements

Element	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							R _w +C _{tr} (dB)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
Masonry facade	37	52	57	61	71	75	77	63 (68 -5)
Door	20	24	28	26	27	35	41	28 (30-2)
Thermal Glazing (6:12:6)	23	25	21	35	41	37	39	30 (35-5)

Source: INSUL prediction

For calculation purposes, the assumptions for reverberation time within bedrooms and living rooms are presented in Table 4. These are consistent with a typical residential situation.

Table 4: Assumed Reverberation Time with Frequency for Living Rooms and Bedrooms

Reverberation Time with Octave Band Frequency (s)								
Room Type	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	T _{mf} (s)	
Living Room	1.2	0.9	0.9	0.8	0.7	0.6	0.8	
Bedroom	0.8	0.6	0.5	0.5	0.4	0.4	0.5	

Room dimensions have been determined from Simpsonhaugh drawing reference 7357-C1-SHP-G200-PI-Grd-001 revision P09 for ground floor and 7357-C1-SHP-G200-PI-01-001 revision P08 for first floor. Door and window dimensions have been determined from Simpsonhaugh drawings 7357-Z2-SHP-G321-De-XX-001 revision P01 and 7357-Z2-SHP-G251-E1-XX-001. Ceiling height has been assumed to be 3m for the calculation of room volume. Room and façade element dimensions assumed for the calculations are presented in Appendix A.

4.2 Southern Façade

Predictions have been made for ground floor living room and first floor bedroom in unit Z1.01.05, assuming sound insulation characteristics for external wall, door and windows from Table 3. To be consistent with the Manchester City Council requirements, living rooms are considered against day-time noise levels and bedrooms against night-time noise levels only. The results are reported in Table 5

Table 5: Predicted Noise Break-in Southern Façade

Floor level	Room Type	External Ambient Noise Level (L _{Aeq,T})	Required Internal Ambient Noise Level L _{Aeq,T} (dB)	Predicted Internal; Ambient Noise Level L _{Aeq,T} (dB)
Ground	Living Room	58	35	31
First	Bedroom	50	30	18

4.3 Predicted Noise Break-in Northern Façade.

Noise levels incident upon the northern facade are higher than those incident upon the southern façade due to close proximity to the A56. A more highly sound insulation specification is therefore required for podium residential glazing on this façade. Two levels of performance have been considered; R_w +C_{tr} 35 dB and R_w +C_{tr} 40 dB. Data for Pilkington Glass products had been used for prediction purposes. The sound insulation performances for the glazing considered are reproduced in Table 6.

Table 6: Sound Insulation Performance of Enhanced Glazing Specification

Glazing Build-up	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							R _w +C _{tr} (dB)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
6/6 to 20/10.8 Pilkington Optiphon	18*	23	28	41	47	45	55	35 (42-7)
8.8 Pilkington Optiphon/6 to 20/12.8 Pilkington Optiphon	21*	26	36	46	50	52	63	40 (47-7)

Source: Pilkington Literature
* estimated value as no literature values at 63 Hz

Predictions have been made for first floor bedroom and living rooms in unit Z1.01.11. Predictions for living rooms have considered both glazing performance options shown in Table 6. The results of these predictions are shown in Table 7

Table 7: Predicted Noise Break-in Northern Façade

Glazing Option R _w +C _{tr} (dB)	Room Type	External Ambient Noise Level (L _{Aeq,T})	Required Internal Ambient Noise Level L _{Aeq,T} (dB)	Predicted Internal; Ambient Noise Level L _{Aeq,T} (dB)
35	Living Room	72	35	37
35	Bedroom	62	30	28
40	Living Room	72	35	35

With the R_w+C_{tr} 35 dB glazing option, internal ambient noise level within north facing living rooms is predicted to exceed the MCC requirement of L_{Aeq,T} 35 dB. This specification may be acceptable however if the relaxation to L_{Aeq,T} 40 dB for living rooms currently accepted by MCC for some living rooms situated behind the unitised curtain walling façade higher up the towers. Uprating the glazing to the R_w+C_{tr} 40 dB

glazing option should result in internal ambient noise levels consistent with the MCC requirements, note however that there is no predicted margin beneath the requirement.

4.4 Predicted Break-in Eastern Façade

Noise levels incident upon the eastern facade are intermediate between those on the northern and southern façades, due to the influence of the A56. The standard thermal glazing solution proposed for the southern façade is not therefore suitable for this location. The Pilkington R_w+C_{tr} 35 dB glazing build-up has therefore been used as the basis of calculations for the eastern façade (see Table 6). Predictions have been made for first floor bedroom and living room in unit

Table 8: Predicted Noise Break-n Eastern Facade

Glazing Option R _w +C _{tr} (dB)	Room Type	External Ambient Noise Level (L _{Aeq,T})	Required Internal Ambient Noise Level L _{Aeq,T} (dB)	Predicted Internal; Ambient Noise Level L _{Aeq,T} (dB)
35	Living Room	66	35	32
35	Bedroom	56	30	20

5 Recommended Glazing Specification

In summary Table 9 provides the recommended glazing specification for living room and glazing performance for living rooms and bedrooms on the various podium facades (ground and first floor):

Table 9: Recommended Glazing Specifications

Façade	Room Type	Glazing Specification (R _w +C _{tr}) dB	Door Specification (R _w +C _{tr}) dB
South	Living Room	30 (35-5)	28 (30-2)
South	Bedroom	30 (35-5)	-
North	Living Room	40 (47-7)*	-
North	Bedroom	35 (42-7)	-
East	Living Room	35 (42-7)	-
East	Bedroom	35 (42-7)	-

* 35 (42-7) may be satisfactory if relaxation for living rooms to L_{Aeq,T} 40 dB agreed with MCC

The performance applies to the complete window including frame. It is assumed that adequate ventilation is achieved with windows closed (MVHR unit).

Where a particular room has glazing on two facades, it is recommended that the glazing specification relevant to the noisiest façade is applied for all windows serving that room.

Appendices

A. Room and Façade Element Dimensions

Table 10: Room and Façade Element Dimensions

Room ref	Room type	Room Area (m2)	Room Volume (m3)	Façade glazing Area (m2)	Door Area (m2)	Façade Wall Area (m2)
Z1 00.05 (S)	Living Room (ground)	27	81	5.4	2.7	10.9
Z1 00.05 (S)	Bedroom (1st)	12	36	2.7	-	6.3
Z1.01.11	Living Room	36	110	5.4	-	11.1
Z1 01.11 (N)	Bedroom 1st	12.5	37.5	2.7	-	7.5
Z1.01.14	Living Room	27	81	3.2	-	8.2
Z1.01.14	Bedroom	11	33	3.2	-	5.4

B. INSUL Predictions

Figure 1: 6:12:6 Glazing Specification

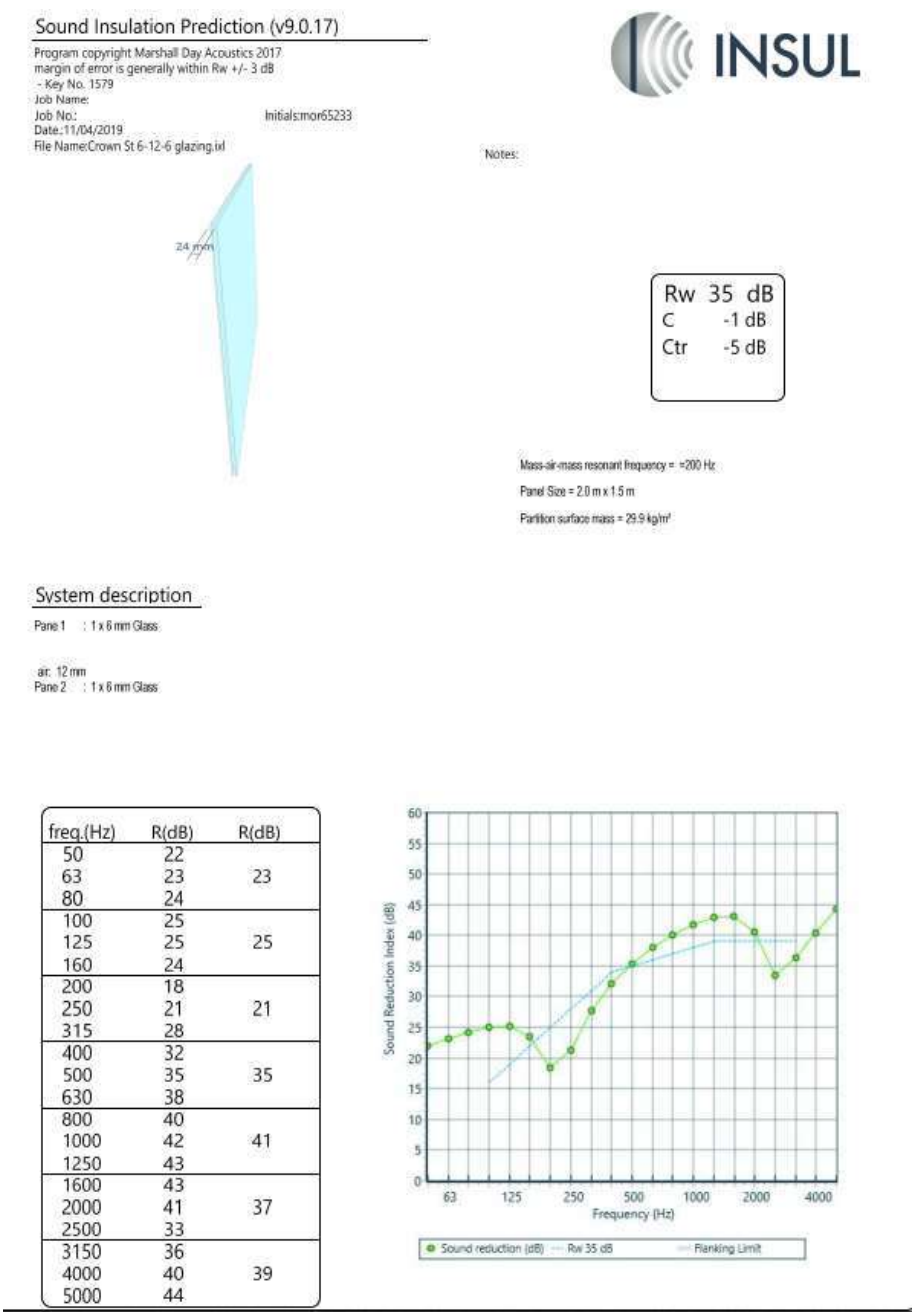


Figure 2: Door Specification

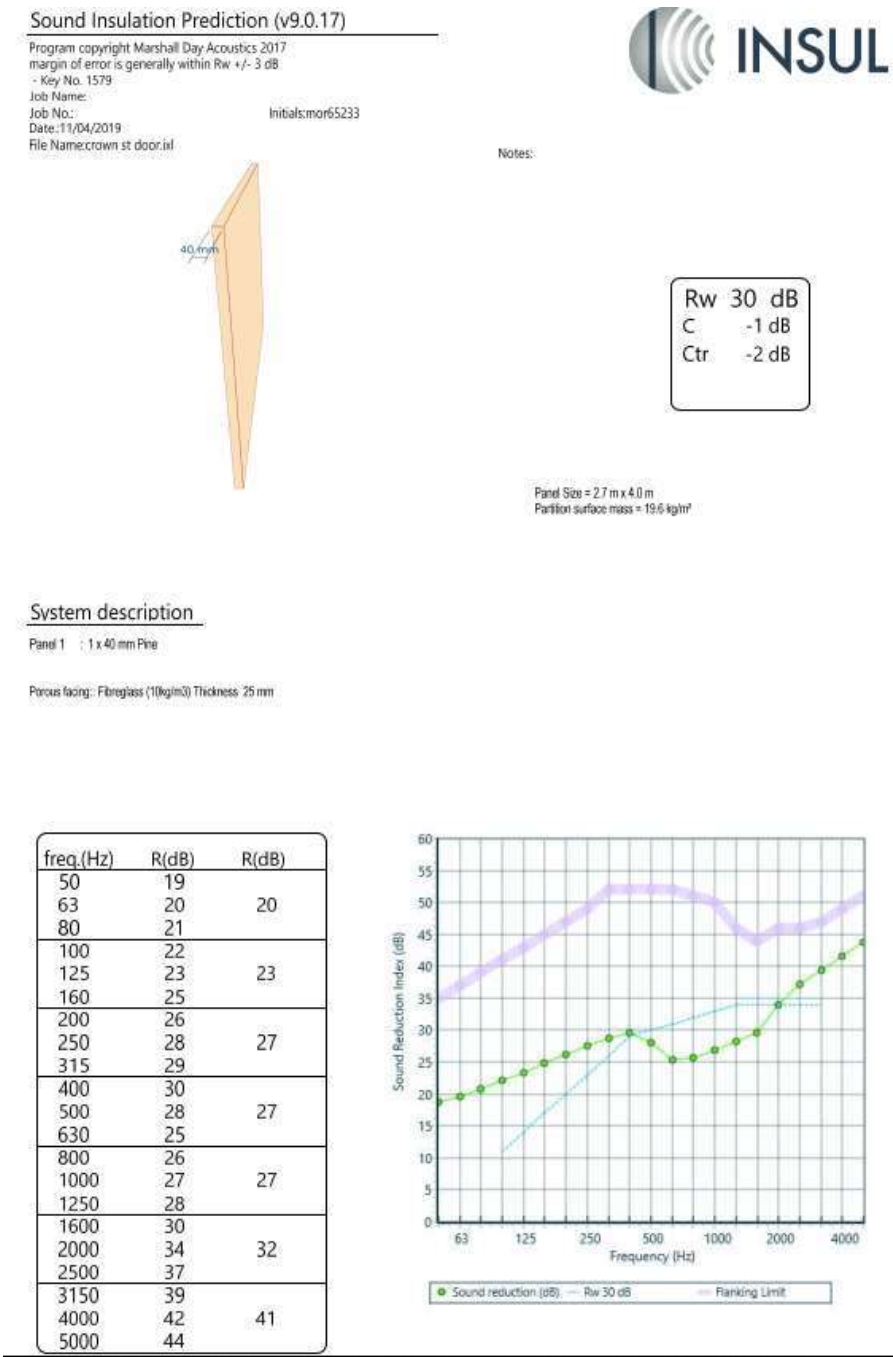
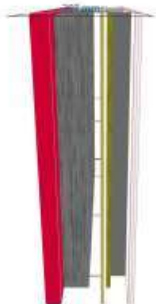


Figure 3: Podium Wall Specification

Sound Insulation Prediction (v9.0.17)
Program copyright Marshall Day Acoustics 2017
margin of error is generally within Rw +/- 3 dB
- Key No. 1579
Job Name:
Job No.: Initials: mor65233
Date: 11/04/2019
File Name: crown st podium wall.dwg



Notes:



Rw 68 dB
C -2 dB
Ctr -5 dB

Mass-air-mass resonant frequency = ~25 Hz, 63 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 164 kg/m²

System description

Panel 1 : 1 x 70 mm Brick

Frame: Butterfly Tie (1.8E2 mm x 45 mm), Stud spacing: 600 mm; Cavity Width: 180 mm, 1 x Rockwool (80kg/m³) Thickness: 125 mm
Panel 2 : 1 x 12 mm RCM CemBoard (cement particle board) + 1 x 50 mm

Frame: Steel Stud (0.55mm) (1E2 mm x 38 mm), Stud spacing: 600 mm; Cavity Width: 100 mm, 1 x Fibreglass (10kg/m³) Thickness: 25 mm
Panel 3 : 2 x 12.5 mm Gyproc Wallboard 12.5mm

freq.(Hz)	R _i (dB)	R _i (dB)
50	34	
63	38	37
80	47	
100	50	
125	53	52
160	54	
200	56	
250	57	57
315	57	
400	58	
500	65	61
630	67	
800	69	
1000	71	71
1250	73	
1600	74	
2000	75	75
2500	75	
3150	73	
4000	82	77
5000	83	

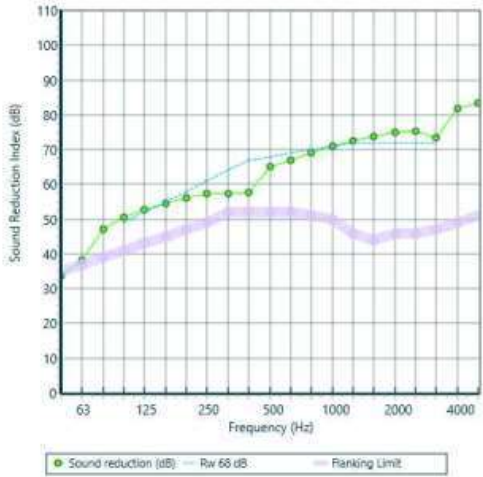


Figure 4: South Façade Living Room

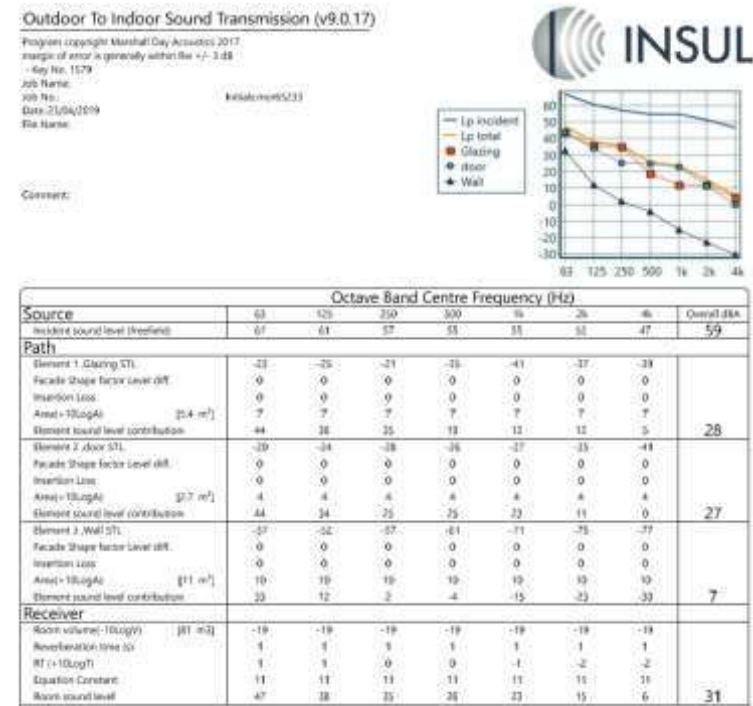


Figure 5: South Façade Bedroom

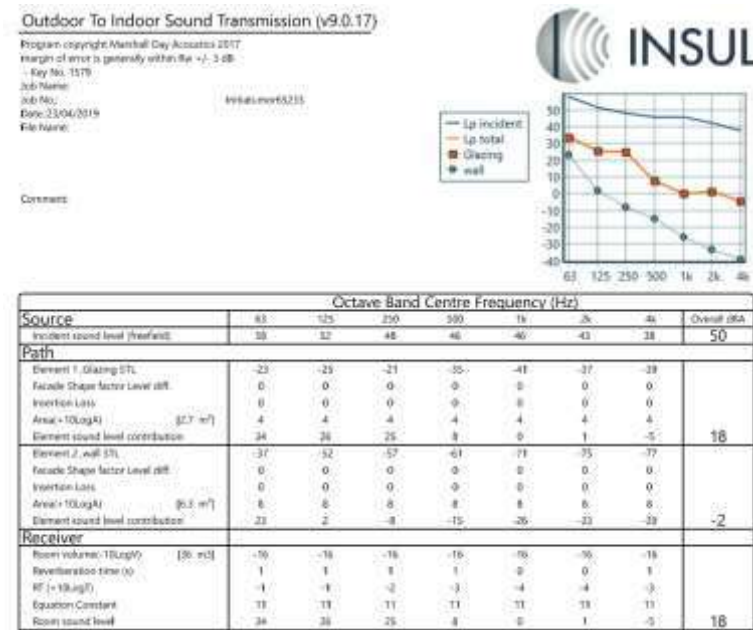


Figure 6: North Façade Living Room R_w+C_{tr} 35 dB Glazing

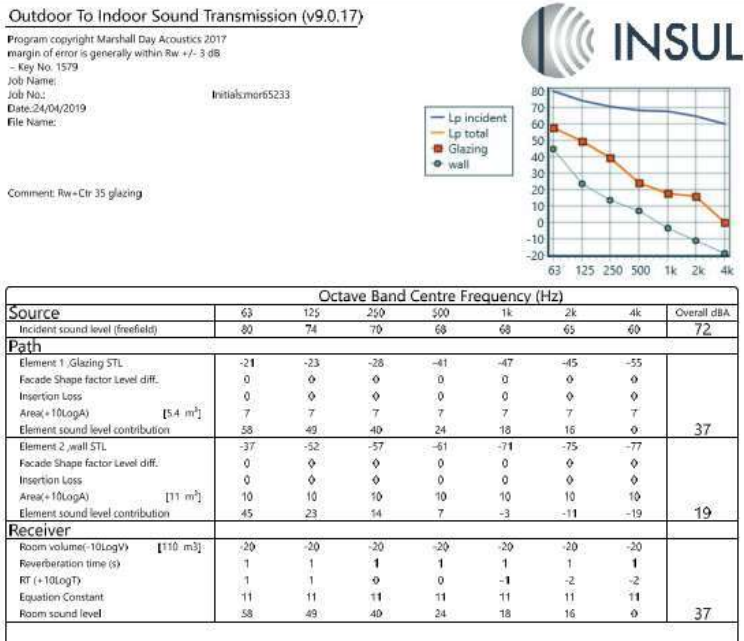


Figure 7: North Façade living Room R_w+C_{tr} 40 dB Glazing

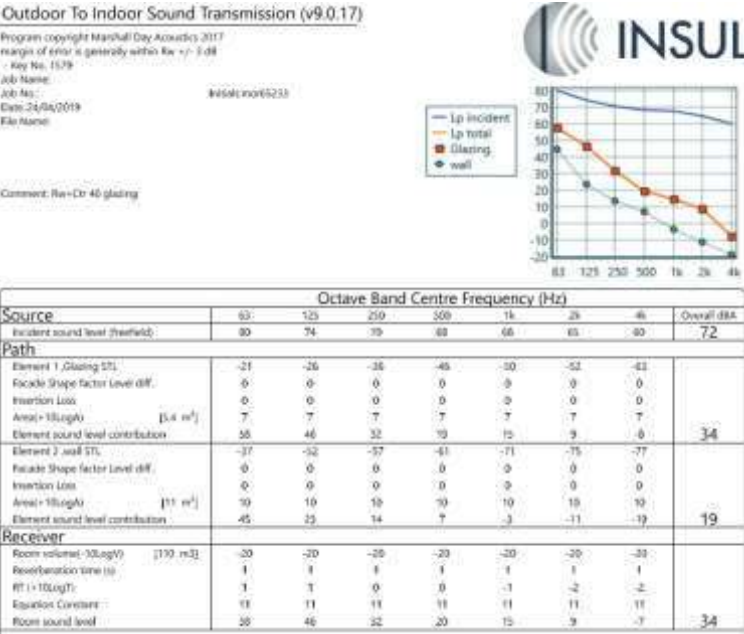


Figure 8: North Façade Bed Room R_w+C_{tr} 35 dB Glazing

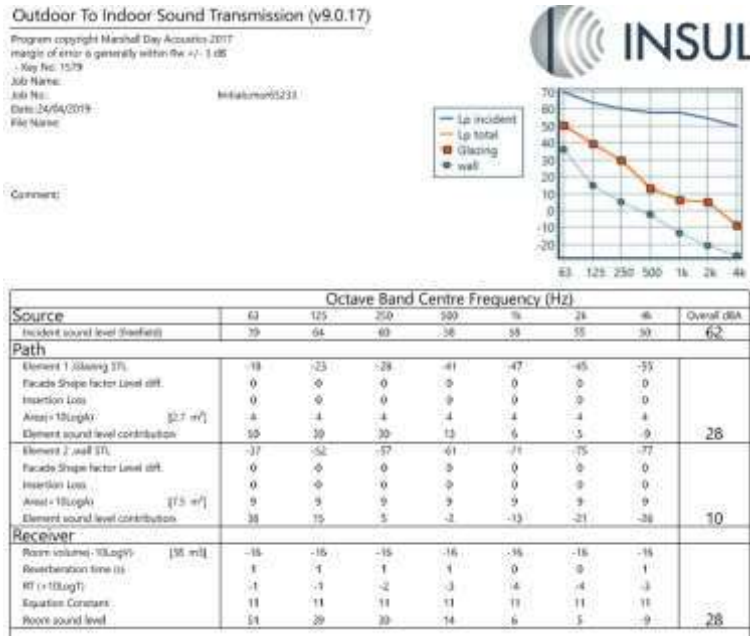


Figure 9: East Façade Living Room R_w+C_{tr} 35 dB Glazing

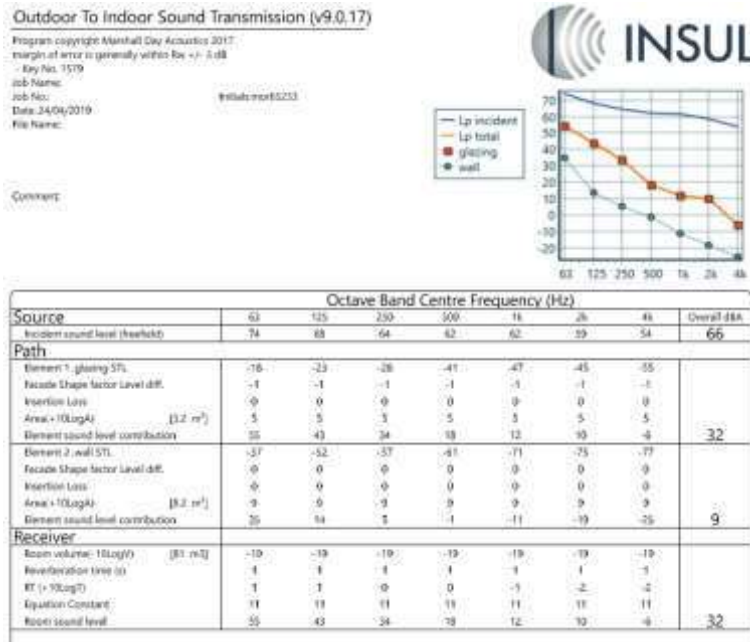
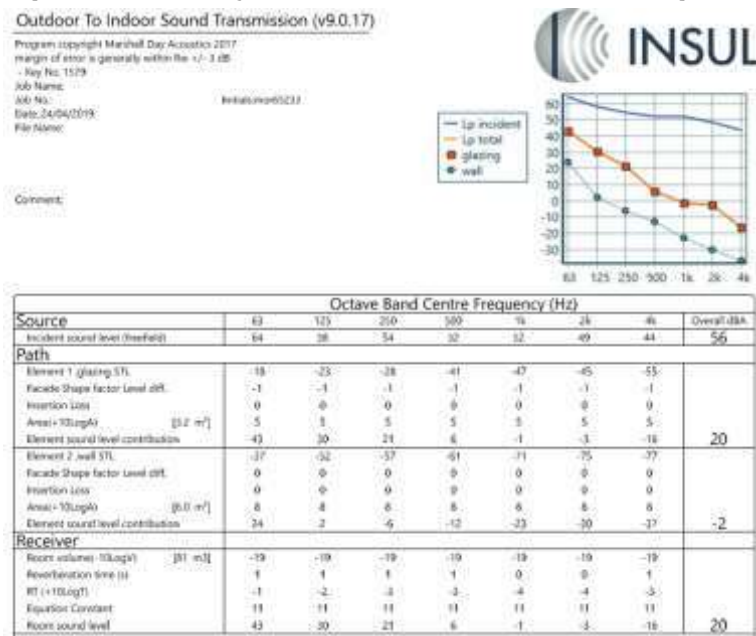


Figure 10: East Façade Bedroom R_w+C_{tr} 35 dB Glazing



D. Z1-SIP-G251-Rp-XX-001 and Z1-SIP-G251-Rp-XX-002 SIPRAL Façade Acoustic Reports



Crown street Manchester

ASSESSMENT OF ACOUSTIC PERFORMANCE OF THE FAÇADE THE REQUIREMENT $R_w + C_{tr}$ 36 dB

Z1-SIP-G251-Rp-XX-001

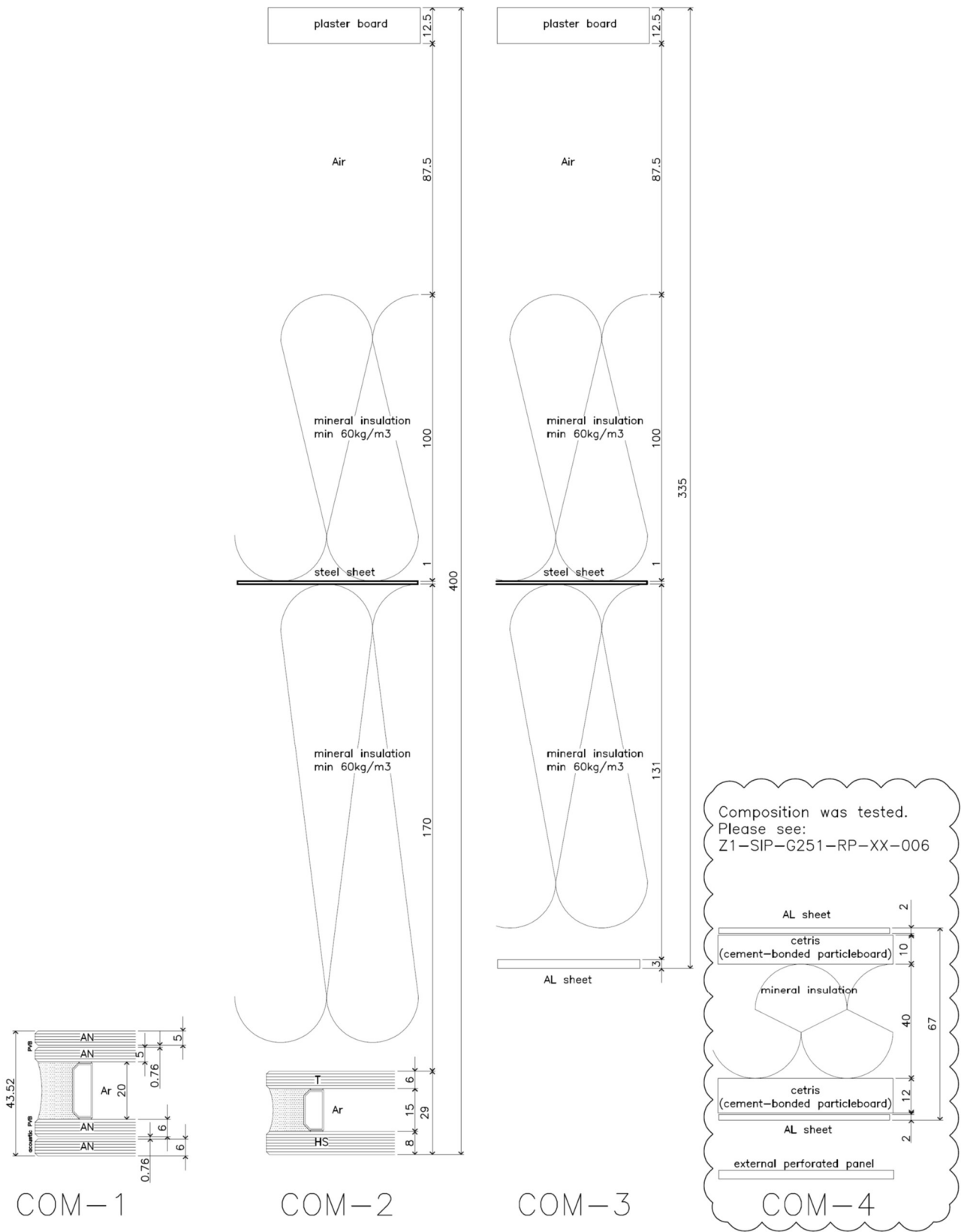
Revision number: P04

05/2019
Jitka Cibulková
Sipral a.s.

1. References

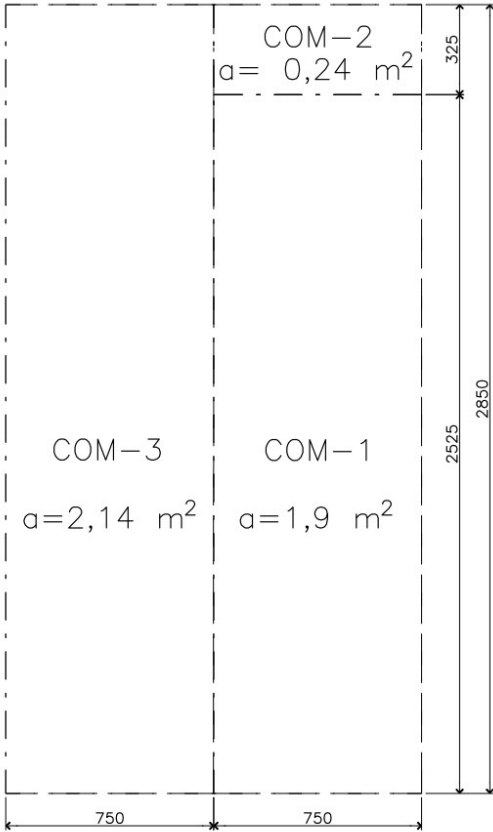
Sound insulation prediction were done in the software Insul (Marshall Day Acoustics)

2. Compositions

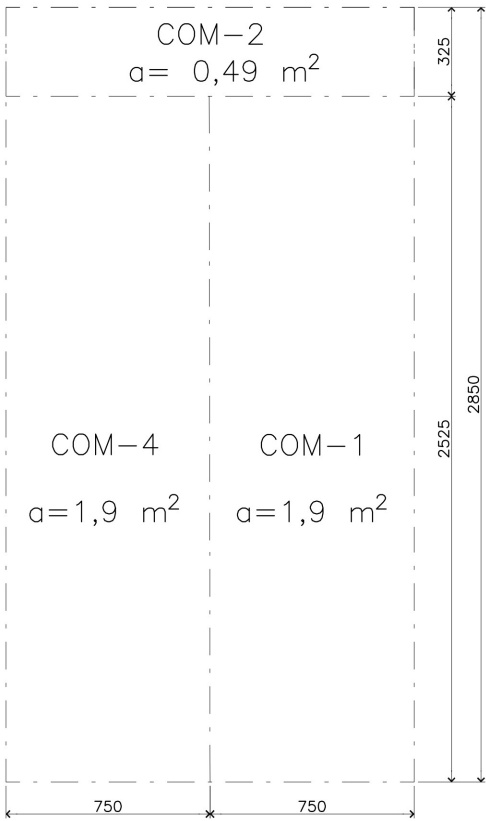


3.Scheme of units

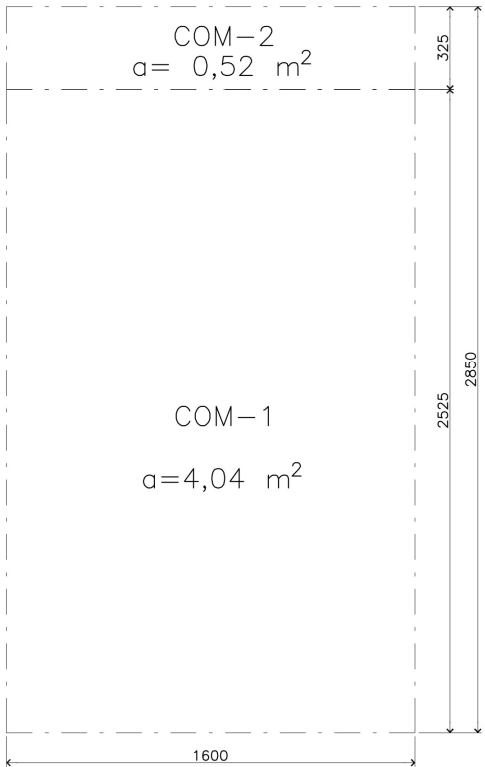
EWS 101



EWS 102



CORNER



Scheme of units to be read with SHP drawings.

- Sound insulation prediction of COM-1**
Based on tested composition 66.2/20/44.2 by producer AGC.



Technical Advisory Service
 AGC Glass Europe
 Avenue Jean Monnet, 4
 1348 Louvain-la-Neuve
 Belgium

Sound reduction indexes according to international standards

Outer glass

Spacer

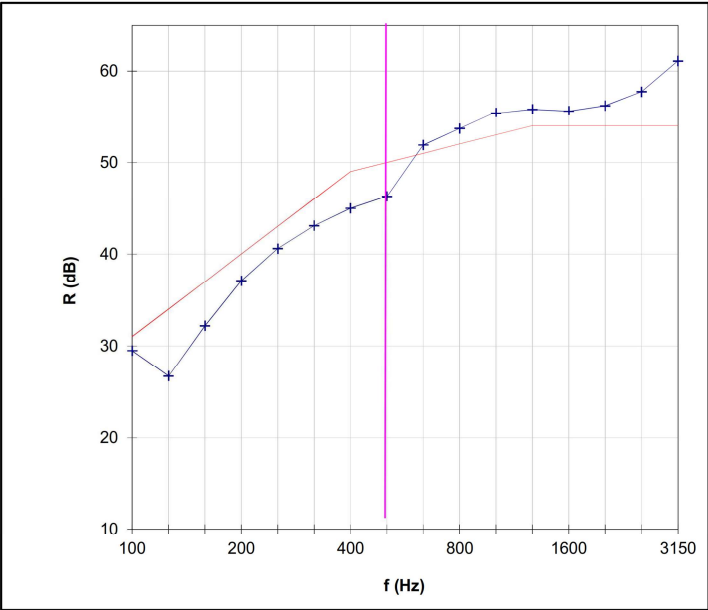
Inner glass

Stratophone 66,2
 20 mm
 Stratophone 44,2

Test reference : IFT (2004)
 Internal reference : 1132

Measurement results

Frequency (Hertz)	1/3 octave (dB)	Octave (dB)
100	29,5	28,9
125	26,7	
160	32,2	
200	37,1	
250	40,6	39,6
315	43,1	
400	45,0	
500	46,3	
630	51,9	46,9
800	53,7	
1000	55,5	
1250	55,9	
1600	55,7	54,9
2000	56,3	
2500	57,8	
3150	61,1	
4000	66,3	63,6
5000	65,3	



Sound reduction indexes

International/European standard EN ISO 717-1 (1996)	
Rw :	50 dB
(C; Ctr) :	(-2; -8) dB

French standard Following EN ISO 717-1	
RA = Rw + C	48 dB
RA,tr = Rw + Ctr	42 dB

Dutch standard NEN 5079 (1989)	
Road noise (Ra) :	42 dB(A)
Railway noise (Ra,r) :	50 dB(A)
Air traffic (Ra,l) :	46 dB(A)

Belgian standard NBN S 01-400 (1977)	
Class :	Va+4 dB

US standard	
ASTM E413 - 16	STC : 50 dB
ASTM E1332 - 16	OITC : 39 dB

These sound reduction indexes correspond to glazings which are 1,23 m by 1,48 m and are tested in laboratory conditions following EN ISO 10140-3. In-situ performances may vary according to the effective glazing dimensions, frame system, noise sources, etc.

The accuracy of the given indexes is not better than +/- 1 dB.