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TEST REPORT No : 05896-6012 Rail **DATE OF ISSUE : 20 July 2023**

BS EN 16272-2:2012

Railway Applications – Track – Noise Barriers and Related devices Acting on Airborne Sound Propagation – Test Method for Determining the Acoustic Performance

Part 2: Intrinsic Characteristics - Airborne Sound Insulation Laboratory Under Diffuse Sound Conditions

Client:	Set 6 Ltd
Job Number:	05896
Test Sample:	Mute Acoustic Fence 80
Date(s) of Test:	17 May 2023

Signed: .... L Cambidge
Specialist Acoustics Technician

Approved:..................................... D Wong-McSweeney
Laboratory Manager

Contents

Client Details:

Set 6 Ltd
Unit 5 Birch Court
Grosvenor Grange
Padgate
Warrington
WA1 4GD

Manufacturer: Client

Date Order Received: 06 April 2023

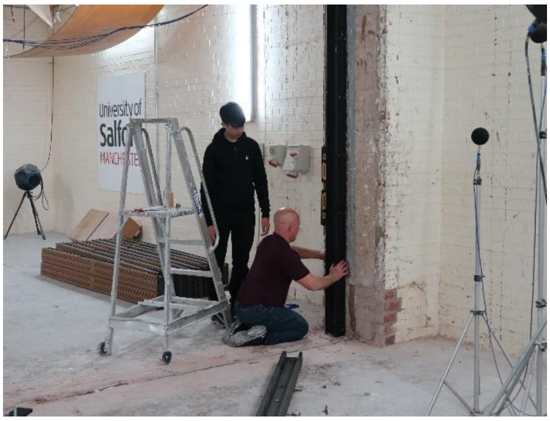
1. Test Samples

The following sample was installed in the 3600 × 2800 mm aperture of the transmission suite of the University of Salford Acoustic Test Laboratory. The test specimen was installed in accordance with Clause 5 of BS EN 16272-2:2012. All information regarding the samples comes from laboratory measurements unless marked with "*cs*" or otherwise stated.

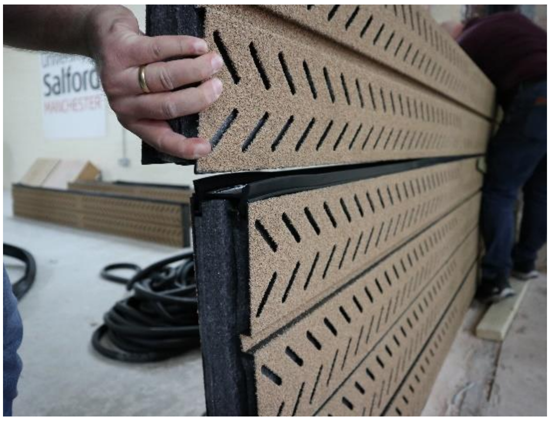
1.1. Description of Test Samples

Test Reference:	**05896-6012**
Sample Reference ***cs*****:**	**Mute Acoustic Fence 80**
Sample Description:	Rail Noise Barrier

A rail noise barrier was installed by the Client, on the receiving room side of the acoustic break in the test aperture. A vertical, prefabricated, H-section, metal post was fixed to the side of the test aperture, using L-brackets and screws. The post consisted of two channel assemblies, welded together back-to-back. The post was fitted with a D-section rubber seals on the receiving room side and screw-adjustable wedges on the source room side. On the side towards the side of the test aperture, the recess in the post was filled with a length of timber.



Nine acoustic panels were slotted into the post, with H-section rubber seals between each panel. Each panel was composed of metal rectangle box section planks filled with different types of plastic absorption. The source room face of each panel was pierced with holes, to expose the infill. Both source and receiving room faces were covered with a layer of rubber and cork granules. A single panel was measured to be 2400 mm × 297 mm × 75 mm, with a mass of 21.3 kg.



A second, intermediate post was fitted over the ends of the acoustic panels. A shorter, second set of acoustic panels and seals was slotted into the intermediate post, at a slight angle; before a third post was fitted over the end of the assembly, the other recess in this post was filled with a length of timber. The end of the barrier assembly was then moved into its correct position in the test aperture and fixed in place, using L-brackets and screws.




Lengths of timber (screwed to the top panel) were added to close the gap between the barrier and the top of the test aperture, on both source room and receiving room faces. More lengths of timber were screwed to the lowest panel, on the source room face only, to close the gap between the barrier and the base of the test aperture.


Silicone sealant was used to seal the perimeter of the barrier and the centre seams of the posts, on both source room and receiving room faces. More silicone sealant was used to fix small pieces of wood over holes in the posts, where wedge adjustment screws were not fitted.

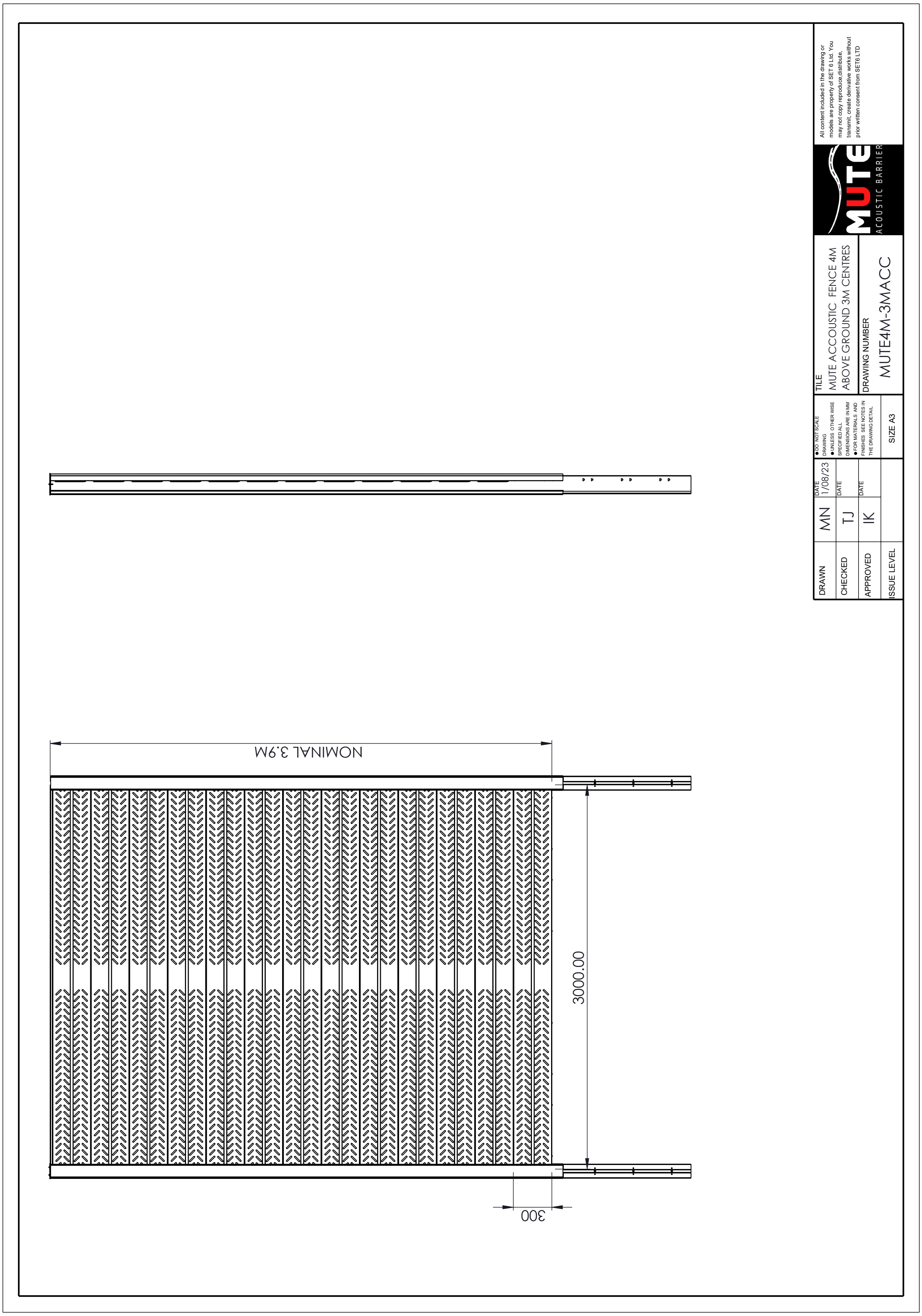
Mass per unit area: 29.9 kg/m^2

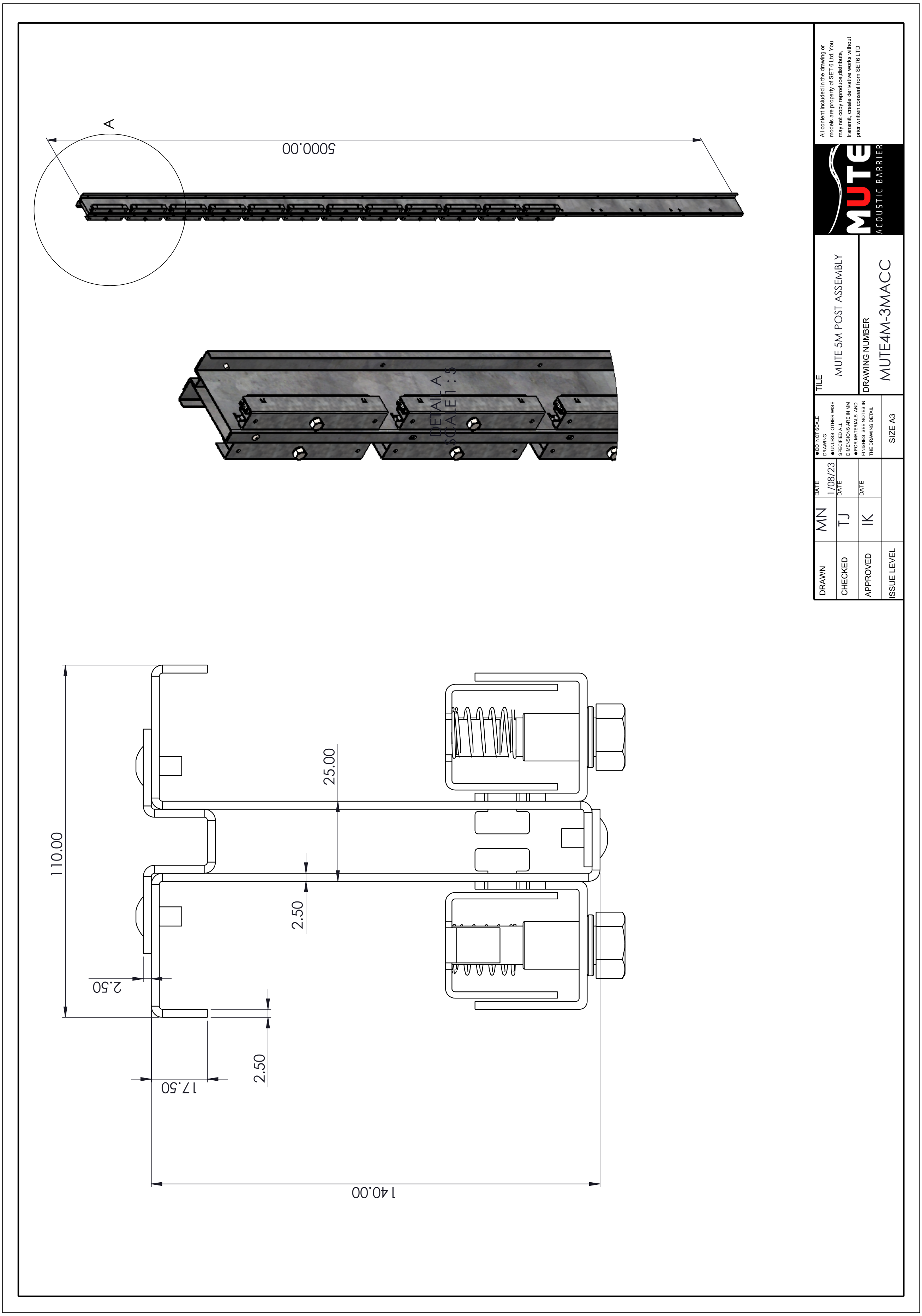
Thickness: 75 mm (plank thickness)

1.2. Sectional Drawings

Sectional drawings, as provided by the client, can be found below.

Test Reference: 05896-6012




A
5000.00
DETAIL A
SCALE 1 : 5
110.00
25.00
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All content included in the drawing or models are property of SET 6 Ltd. You may not copy reproduce,distribute, transmit, create derivative works without prior written consent from SET6 LTD
MUTE
ACOUSTIC BARRIER
TILE
MUTE 5M POST ASSEMBLY
DRAWING NUMBER
MUTE4M-3MACC
DO NOT SCALE DRAWING
UNLESS OTHER WISE SPECIFIED ALL DIMENSIONS ARE IN MM
FOR MATERIALS AND FINISHES SEE NOTES IN THE DRAWING DETAIL
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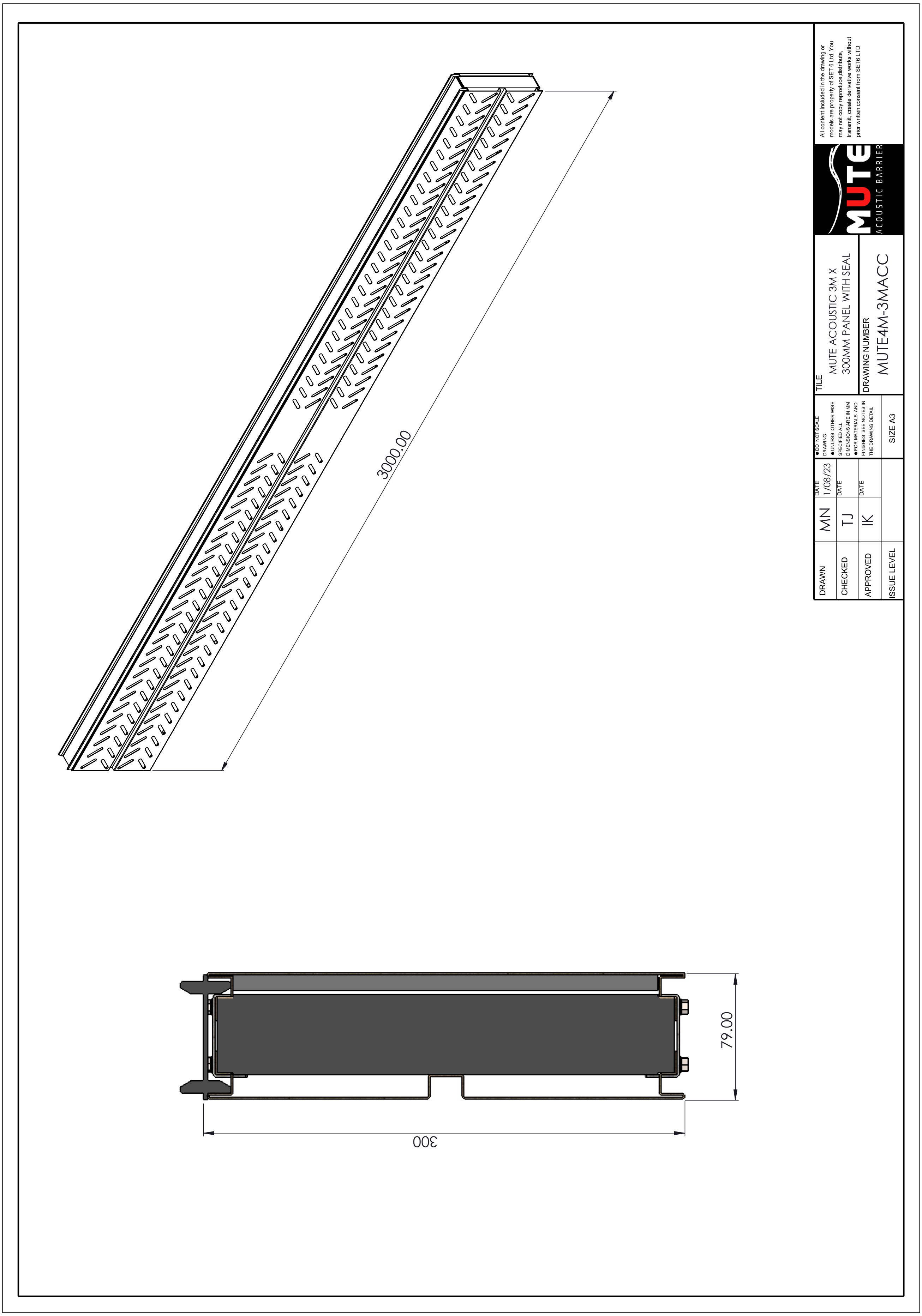
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All content included in the drawing or models are property of SET 6 Ltd. You may not copy reproduce,distribute, transmit, create derivative works without prior written consent from SET6 LTD
MUTE ACOUSTIC BARRIER
TILE
MUTE ACOUSTIC 3M X 300MM PANEL WITH SEAL
DRAWING NUMBER
MUTE4M-3MACC
DO NOT SCALE DRAWING
UNLESS OTHER WISE SPECIFIED ALL DIMENSIONS ARE IN MM
FOR MATERIALS AND FINISHES SEE NOTES IN THE DRAWING DETAIL
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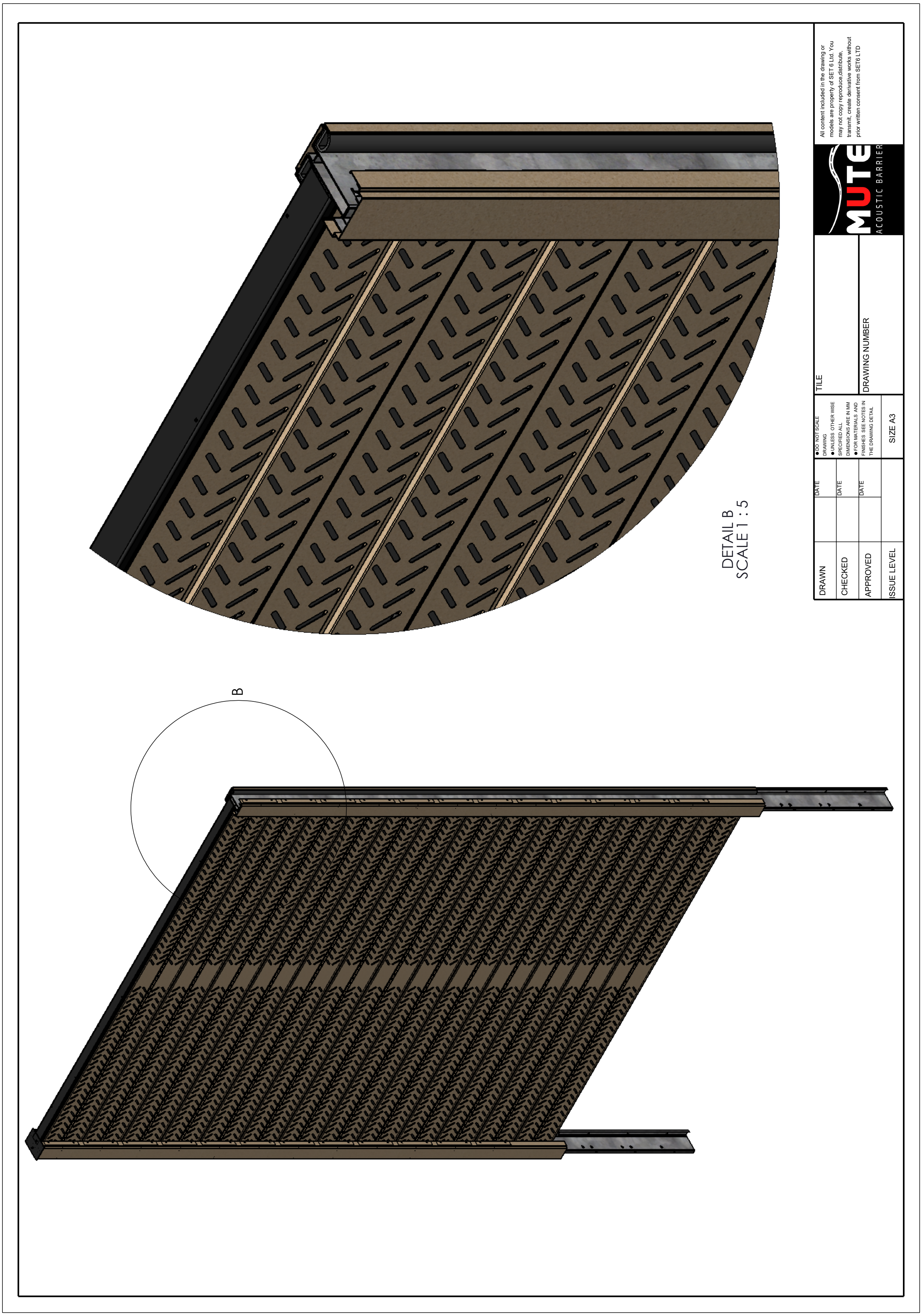

DETAIL B
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B
All content included in the drawing or models are property of SET 6 Ltd. You may not copy reproduce,distribute, transmit, create derivative works without prior written consent from SET6 LTD
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ACOUSTIC BARRIER
TILE
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DO NOT SCALE DRAWING
UNLESS OTHER WISE SPECIFIED ALL DIMENSIONS ARE IN MM
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2. Description of Test Procedure

The test procedure adopted follows that detailed in BS EN 16272-2:2012, conforming to the conditions laid out within BS EN ISO 10140-2:2021, “Acoustics – Laboratory measurements of sound insulation of building elements; Part 2: Measurement of airborne sound insulation”.

The measurements are performed in the large transmission suite at the University of Salford. The suite comprises two structurally isolated reverberant rooms, the source and receiver rooms, with a test opening between them in which the test specimen is installed. The walls of the receiver room are 330 mm thick and made from dense brick, whilst the soffit is made from reinforced concrete. The walls of the source room are 215 mm thick except for the wall adjacent to the receiver room which is 330 mm thick. Both rooms have been designed with hard surfaces and non-parallel walls. The smaller source room has 4 plywood diffusers and the larger receiving room has 18 plywood diffusers, to increase the diffusivity of the sound field in these areas.

The test involves producing a known sound field in the source room and measuring the resultant sound level difference between the source room and the receiving room with the specimen installed in the test aperture. This level difference is then corrected so as to take into account the equivalent absorption area of the receiving room.

The Sound Reduction Index, R (dB), is defined in BS EN ISO 10140-2: 2021 as:

$$R = L_1 - L_2 + 10\,log_{10}\frac{S}{A} \qquad (1)$$

where:

L_1 is the average sound pressure level in the source room (dB)

L_2 is the average sound pressure level in the receiving room (dB)

S is the area of the test specimen (m^2)

A is the equivalent absorption area of the receiving room (m^2)

2.1. Generation of Sound Field in the Source Room

Wide band, random noise from the generator in the real time analyser was amplified and reproduced in the source room using alternately one of three fixed loudspeaker systems, (La and Lb and Lc). Omni-directional loudspeakers were used. The output of the generator was set with the intention that the sound pressure level in the receiving room was at least 15 dB higher than the background level in any frequency band. The loudspeakers were positioned in the corners of the room and at such a distance from the test specimen that the direct radiation upon it was not dominant.

2.2. Frequency Range of Measurements

The sound pressure levels were measured using one-third octave band filters. Measurements covered all the one-third octave bands having centre frequencies in the range from 50 Hz to 5000Hz.

2.3. Measurement of Sound Pressure Levels

Sound pressure levels were measured simultaneously in the source and receiving rooms using loudspeaker La as the sound source. Measurements were recorded at 6 fixed microphone positions in each room, using an averaging time of 16 seconds and the average level in each room was calculated on an energy basis in each one-third octave frequency band. The procedure was then repeated with loudspeakers Lb and Lc as the sound source. The overall average level difference in each frequency band was then calculated as the arithmetic average of the two sets of results.

For each set of microphone/loudspeaker positions, the distances separating microphones from other microphones, room boundaries and diffusers, were greater than 0.7 m and the distances separating microphones from the sound source and the test specimen were greater than 1.0 m.

2.4. Measurement and Evaluation of the Equivalent Absorption Areas

The correction term of equation (1) containing the equivalent absorption area, A, was evaluated from the reverberation time and calculated using Sabine's formula:

$$A = \frac{0.16\ V}{T} \qquad (2)$$

where:

V is the volume of the receiving room (m^3)

T is the reverberation time (s)

The reverberation time of the receiving room was measured using a decay technique. The decays were produced by exciting the room with wide band random noise and stopping the excitation once the room became saturated. The resulting decaying sound field was monitored at 6 fixed microphone positions using a one-third octave band real time analyser. The sound spectrum was sampled and stored in memory. Five decays were measured at each microphone position and averaged. The time taken for the sound to decay by a given amount was measured and then extrapolated to determine the reverberation time. The measurements were repeated using an alternative sound source. The results from each set of positions were averaged (ie 60 reverberation decays at each frequency).

3. Equipment

Equipment	Laboratory Equipment Record No.
2 × Norwegian Electronics 1/3 octave band real time analyser type 850 with in-built random noise generator	RTA3-01 to 12
Quad 510 power amplifier	PA7
Norsonic Sound Calibrator type 1251	C8
2 × Norsonic Dodecahedron Loudspeakers	LS10-LS11
3 × Norsonic Dodecahedron Loudspeakers	LS12-LS14
3 × Bruel & Kjaer random incidence condenser microphones type 4166 in the source room	M2-M4
3 × G.R.A.S. random incidence condenser microphones type 40AP in the source room	M21, M22, M30
2 × Bruel &Kjaer random incidence condenser microphone type 4166 in the receiving room	M9, M18
4 × G.R.A.S. random incidence condenser microphones type 40AP in the receiving room	M20, M31, M19, M32
Environmental sensor data logger, hygrometers and barometer	HL1, HG1, HG2, BM3
Toshiba TECRA R850 119 laptop computer and related peripheral equipment (network switch, printer, monitor etc.)	RTA3-00
Yamaha GQ1031BII graphic equalizer	GEQ1

4. Results

Source room volume:	136 m^3
Receiving room volume:	222 m^3
Sample sizes:	3600 mm × 2800 mm

The sound reduction indices at one-third octave band intervals, R, are given in the tables overleaf.

Also given in the attached tables and computed from the one-third octave band sound reduction indices, is the weighted sound reduction index, DL_R, calculated in accordance with BS EN 16272-3-1:2012. This evaluation is based on laboratory measurement results obtained by an engineering method.

The results here presented relate only to the items tested and described in this report.

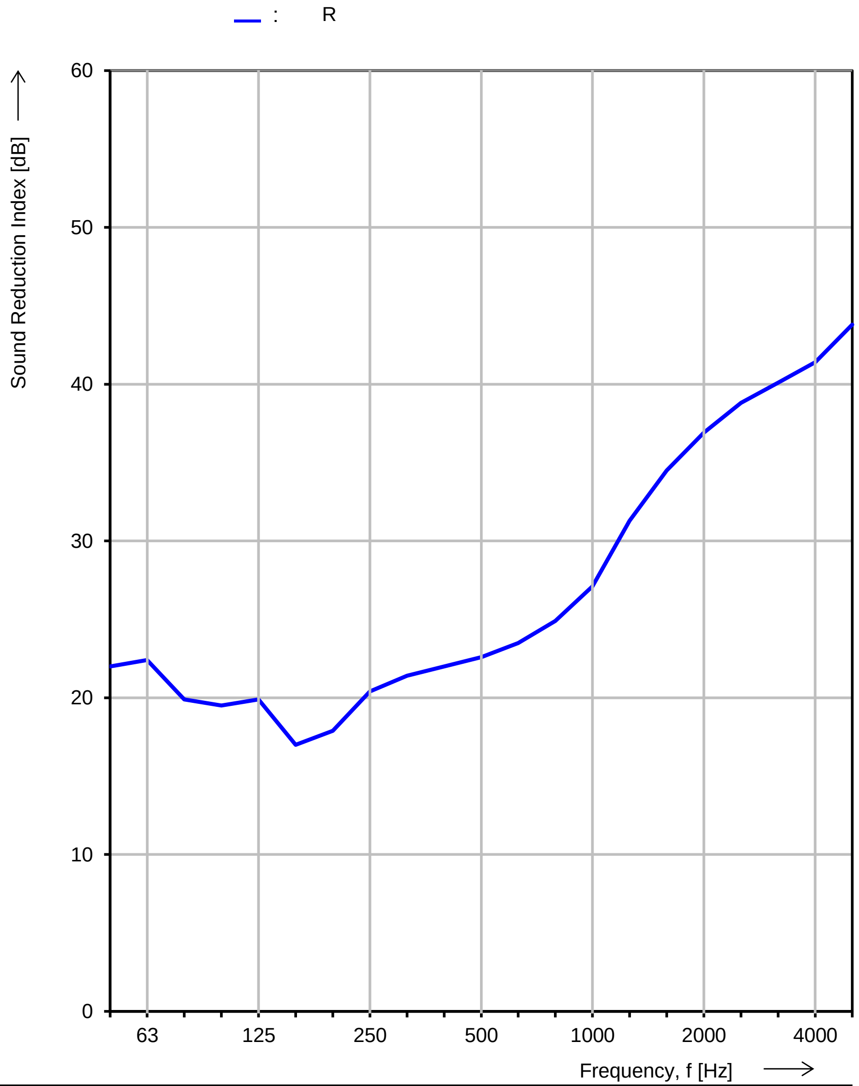
BS EN 16272-2 : 2012, Intrinsic Characteristics of Airborne Sound Insulation

Laboratory measurement of sound insulation of building elements

Client:	Set 6 Ltd	Product ID:	Mute Acoustic Fence 80
Mounted by:	Client		
Sample Size:	10.08 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	17 May 2023
Description:	Rail Noise Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	102.5 kPa
Source Room Temperature:	20.2 °C	Measured Mass per unit area:	29.9 kg/m^2
Source Room Relative Humidity:	44.6 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.6 °C		
Receiving Room Relative Humidity:	44.2 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	22.0
63	22.4
80	19.9
100	19.5
125	19.9
160	17.0
200	17.9
250	20.4
315	21.4
400	22.0
500	22.6
630	23.5
800	24.9
1000	27.1
1250	31.3
1600	34.5
2000	36.9
2500	38.8
3150	40.1
4000	41.4
5000	43.8



Rating according to BS EN 16272-2

DL R = 27 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute:	The University of Salford, Acoustic Test Laboratory		
Test reference:	05896-6012	Signature:	
Date: 17 May 2023		Operator:	D. Wong-McSweeney