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TEST REPORT No : 06569 SI/R1 **DATE OF ISSUE : 03 April 2024**

This report is an amendment of 06569 SI and replaces it.

BS EN 1793-2:2012

Road Traffic Noise Reducing Devices – Test Method for Determining the Acoustic Performance

Part 2: Intrinsic Characteristics of Airborne Sound Insulation Under Diffuse Sound Field Conditions

Client:	Genwork Ltd
Job Number:	06569
Test Sample:	Road Noise Barriers
Date(s) of Test:	24 January 2024

Signed: . . . . . L Cambidge
Specialist Acoustics Technician

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

Contents

Client Details:

Genwork Ltd
Bromley Street
Lye
Stourbridge
West Midlands
DY9 8HU

Manufacturer: Client

Date Order Received: 14 December 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 sample area used in the calculations does not include the timber edge supports. All information regarding the samples comes from laboratory measurements unless marked with "*cs*" or otherwise stated.

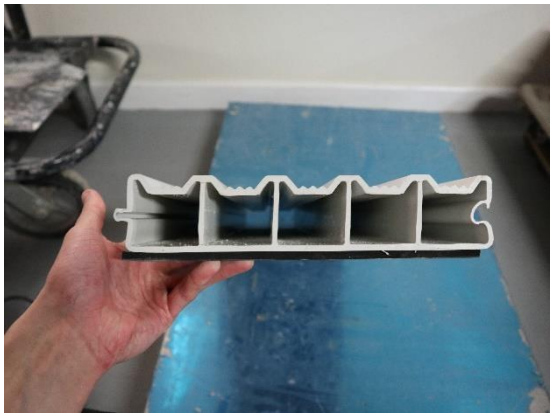
The test specimen was installed in accordance with clause 4 of BS EN 1793-2:2012 and conforming to BS EN ISO 10140-2:2021.

1.1. Description of Test Samples

Test Reference: **06569-6467**
Sample Reference *cs*: Air Reflection
Sample Description: Road Noise Barrier

A steel 'U' post was placed at both sides of the test aperture, and a steel 'I' post was placed approximately two thirds (>2m) across the test aperture. Wall sections, consisting of a recycled PVC housing with hollow channels, were then slotted between the posts to fill the aperture with the grooved side facing the source room. The wall sections fitted together using a tongue and groove mechanism. Timber was used to secure the wall sections into the steel posts and secure the top of the sample into the aperture. A bead of sealant was applied to the top and sides of the aperture. Insulating foam tape was placed at the top and bottom of the sample, and at various points where significant leakage could occur around the periphery.

Thickness: 50 mm (Measured, wall sections only)
Mass Per Unit Area: 17.7 kg/m^2 (Measured)



Test Reference: **06569-6468**

Sample Reference [cs]: Air Absorption

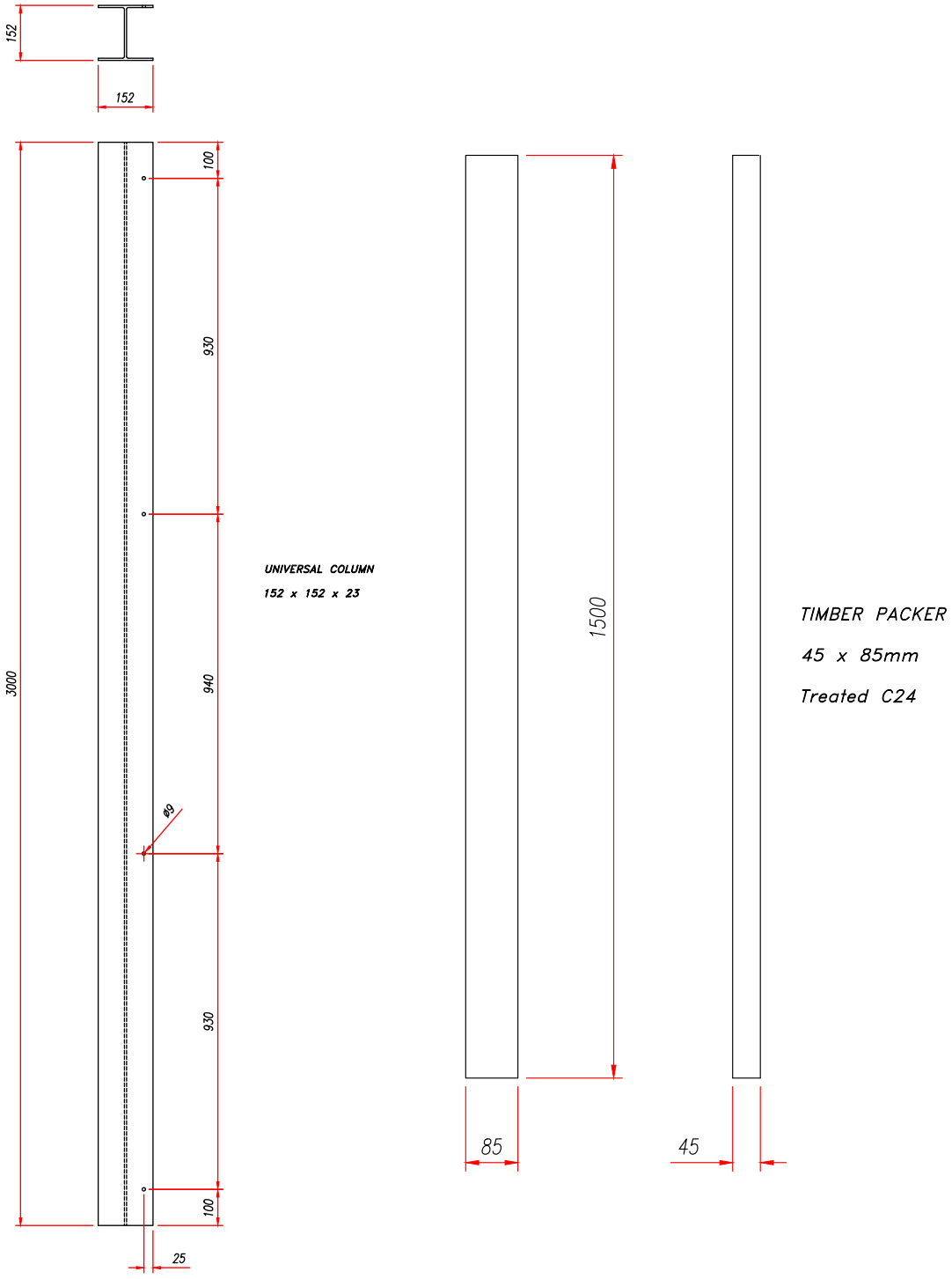
Sample Description: Road Noise Barrier

A steel 'U' post was placed at both sides of the test aperture, and a steel 'I' post was placed approximately two thirds (>2m) across the test aperture. Perforated wall sections, consisting of a recycled PVC housing with channels filled with rock wool, were then slotted between the posts to fill the aperture with the perforated side facing the source room. The nominal 32 mm thick rock wool had a mass density of 60 kg/m^3 with a glass fibre protection tissue. The wall sections fitted together using a tongue and groove mechanism. Timber was used to secure the wall sections into the steel posts and secure the top of the sample into the aperture. A bead of sealant was applied to the top and sides of the aperture. Insulating foam tape was placed at the top and bottom of the sample, and at various points where significant leakage could occur around the periphery.

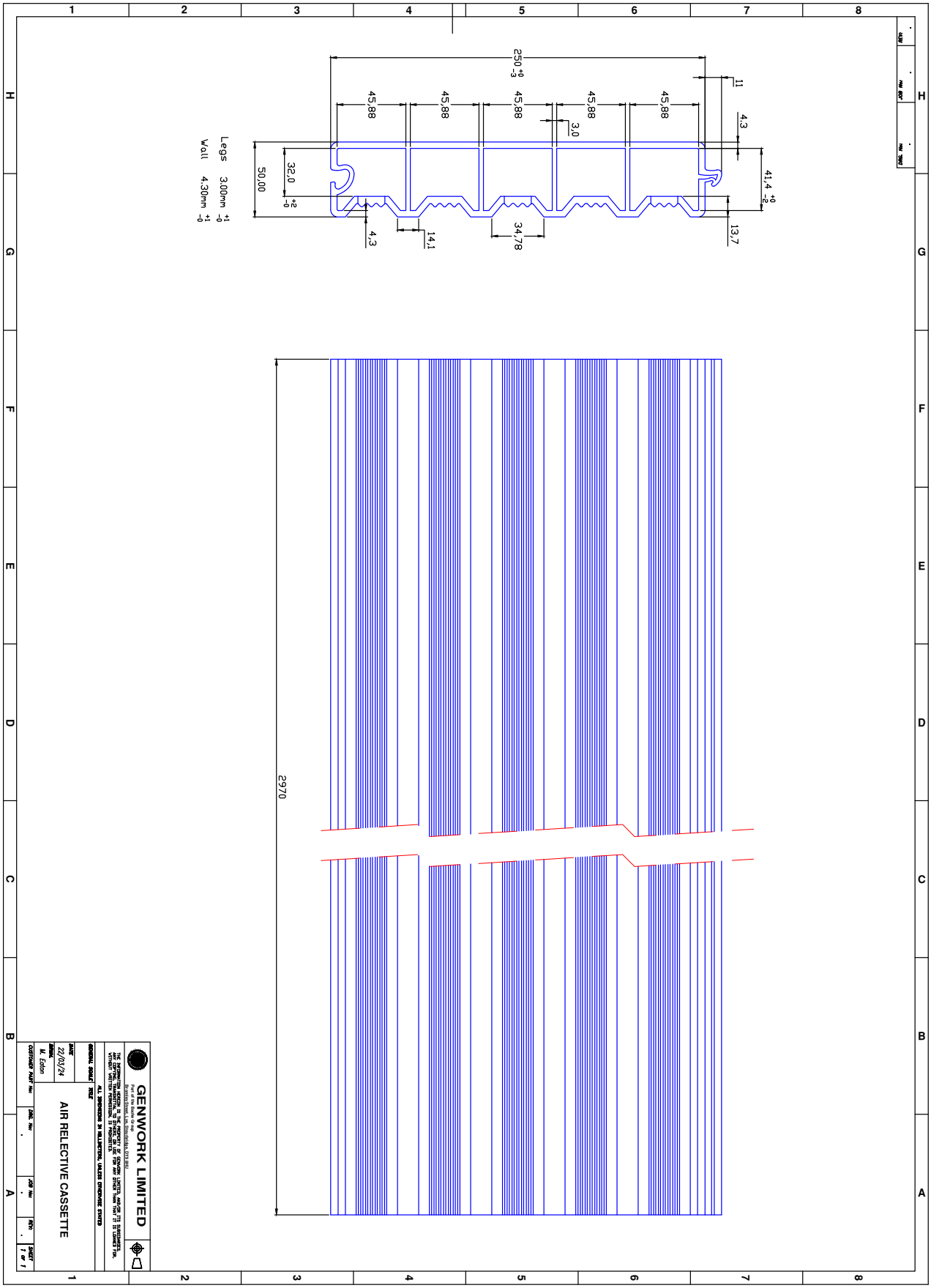
Thickness:	50 mm (Measured, wall sections only)
Mass Per Unit Area:	18.7 kg/m^2 (Measured)

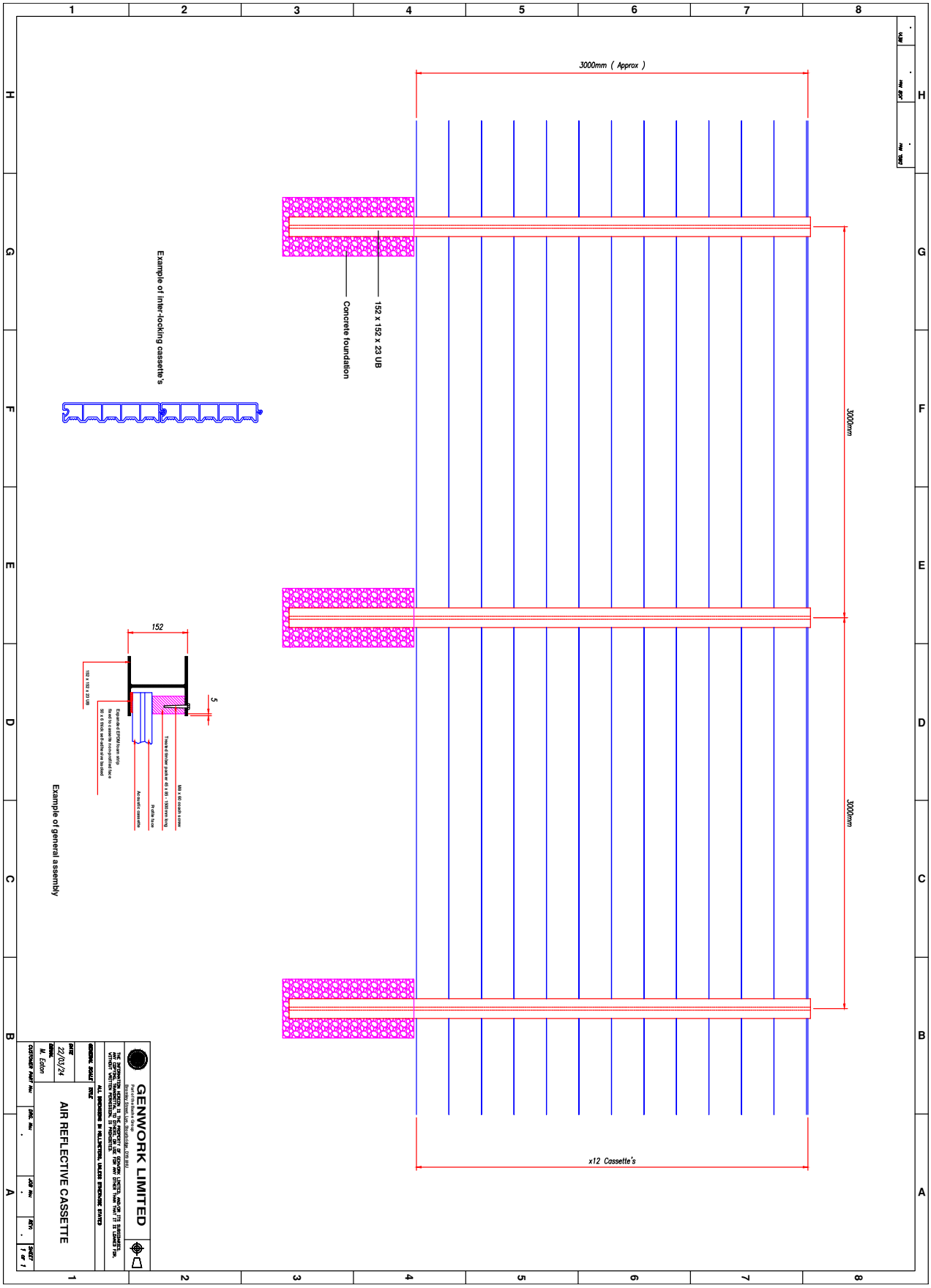
1.2. Sectional Drawings

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

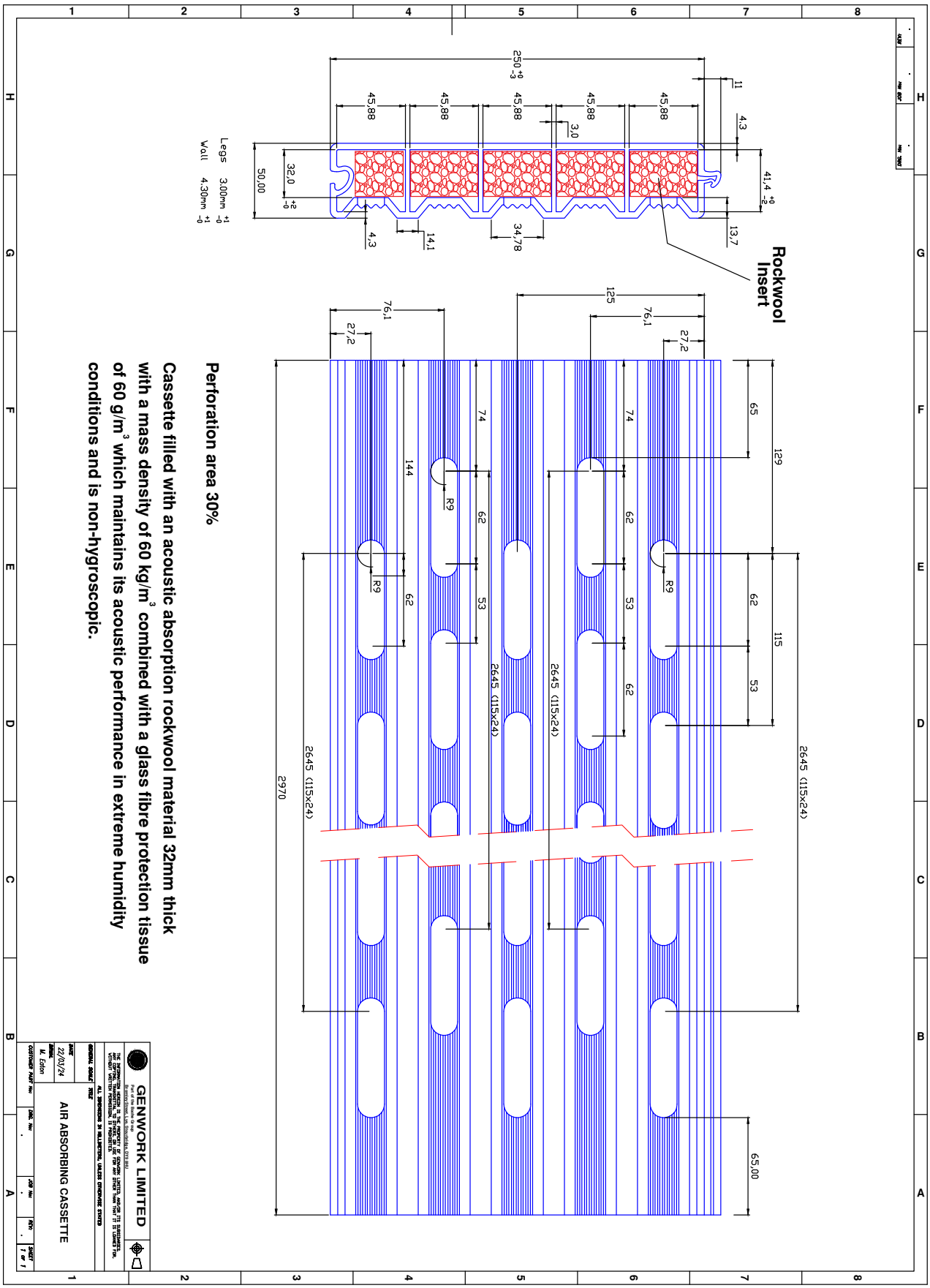


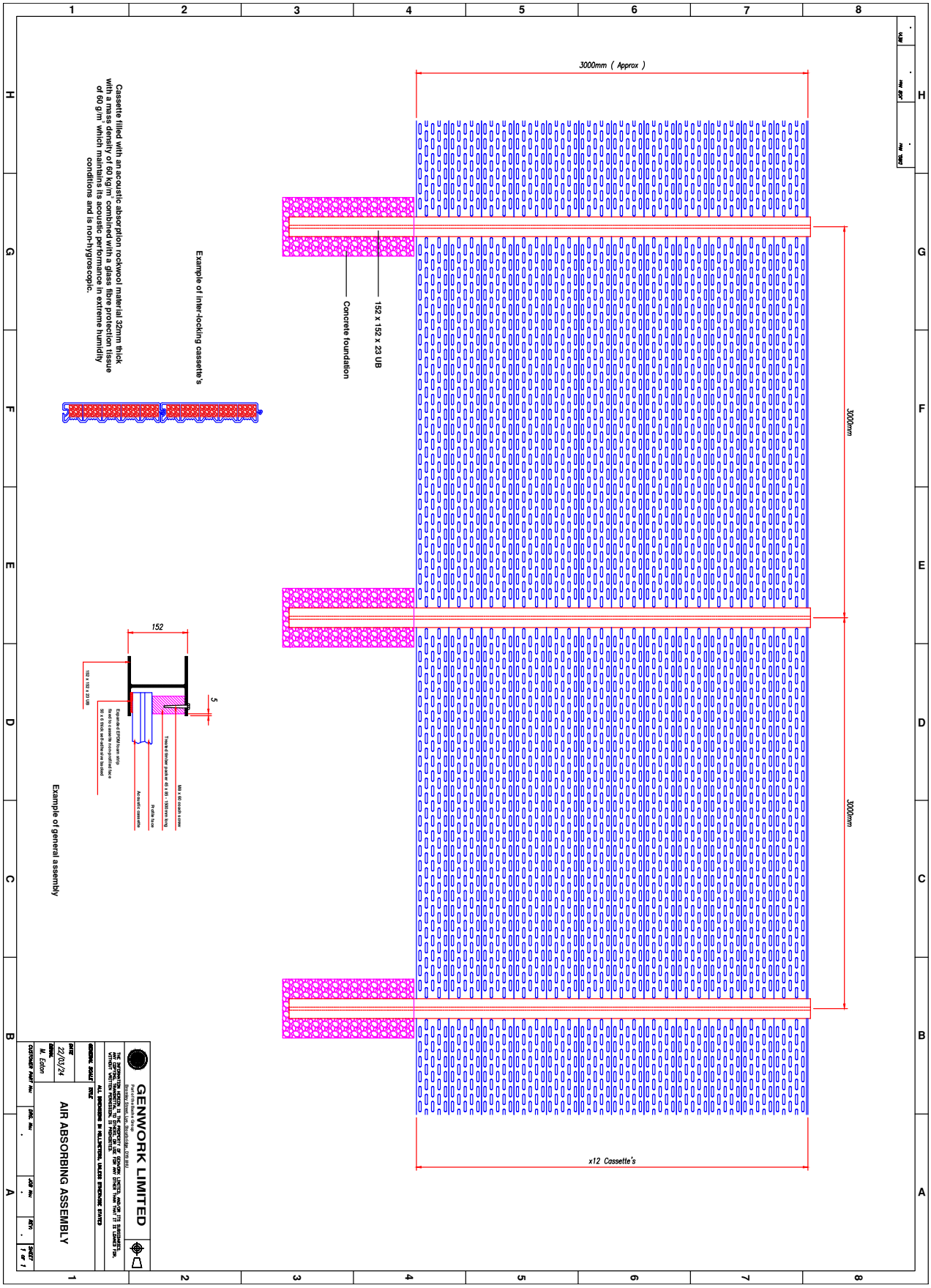
Test Reference: 06569-6467




3000mm (Approx)
Concrete foundation
152 x 152 x 23 UB
Example of inter-locking cassette's
3000mm
3000mm
x12 Cassette's
152
5
Example of general assembly
GENWORK LIMITED
AIR REFLECTIVE CASSETTE
22/03/24
M. Eaton

Test Reference: 06569-6468




3000mm (Approx)
Concrete foundation
152 x 152 x 23 UB
Example of inter-locking cassette's
Cassette filled with an acoustic absorption rockwool material 32mm thick with a mass density of 60 kg/m combined with a glass fibre protection tissue of 60 g/m which maintains its acoustic performance in extreme humidity conditions and is non-hygroscopic.
3000mm
3000mm
x12 Cassette's
152
5
Example of general assembly
GENWORK LIMITED
AIR ABSORBING ASSEMBLY
22/03/24
M. Eaton

2. Description of Test Procedure

The test procedure adopted follows that detailed in BS EN 1793-2:2012, conforming to 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 with a test opening between them in which the test specimen is inserted. The vertical sides of the test aperture are made from dense brick, whilst the soffit is made from reinforced concrete. 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:

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

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 two/three fixed loudspeaker systems, (**La**, **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 loudspeaker **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, M40
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:	221 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 is the single number rating DL_R. This is calculated in from the one third octave sound reduction indices in accordance with BS EN 1793-2:2012 and uses the Normalised Traffic Noise Spectrum described in BS EN 1793-3:1998. 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.

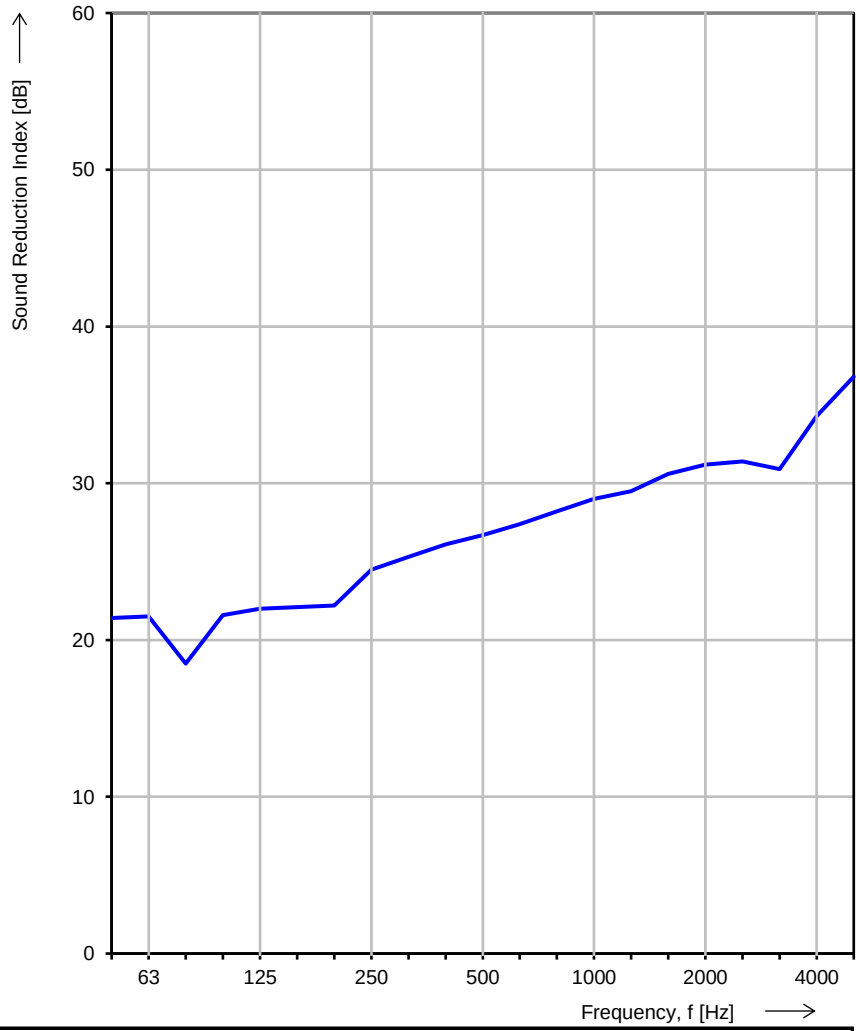
BS EN 1793-2 : 2012, Intrinsic Characteristics of Airborne Sound Insulation

Laboratory measurement of sound insulation of building elements

Client:	Genwork Ltd	Product ID:	Air Reflection
Mounted by:	Client		
Sample Size:	10.08 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 January 2024
Description:	Road Noise Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	102.0 kPa
Source Room Temperature:	21.3 °C	Measured Mass per unit area:	17.7 kg/m^2
Source Room Relative Humidity:	35.2 %	Curing Time:	Not Applicable
Receiving Room Volume:	221 m^3		
Receiving Room Temperature:	20.6 °C		
Receiving Room Relative Humidity:	38.2 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	21.4
63	21.5
80	18.5
100	21.6
125	22.0
160	22.1
200	22.2
250	24.5
315	25.3
400	26.1
500	26.7
630	27.4
800	28.2
1000	29.0
1250	29.5
1600	30.6
2000	31.2
2500	31.4
3150	30.9
4000	34.3
5000	36.8



Rating according to BS EN 1793-2

DL_R = 28 dB **Category: B3**

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:	06569-6467	Signature:	
Date: 24 January 2024		Operator:	L. Cambidge

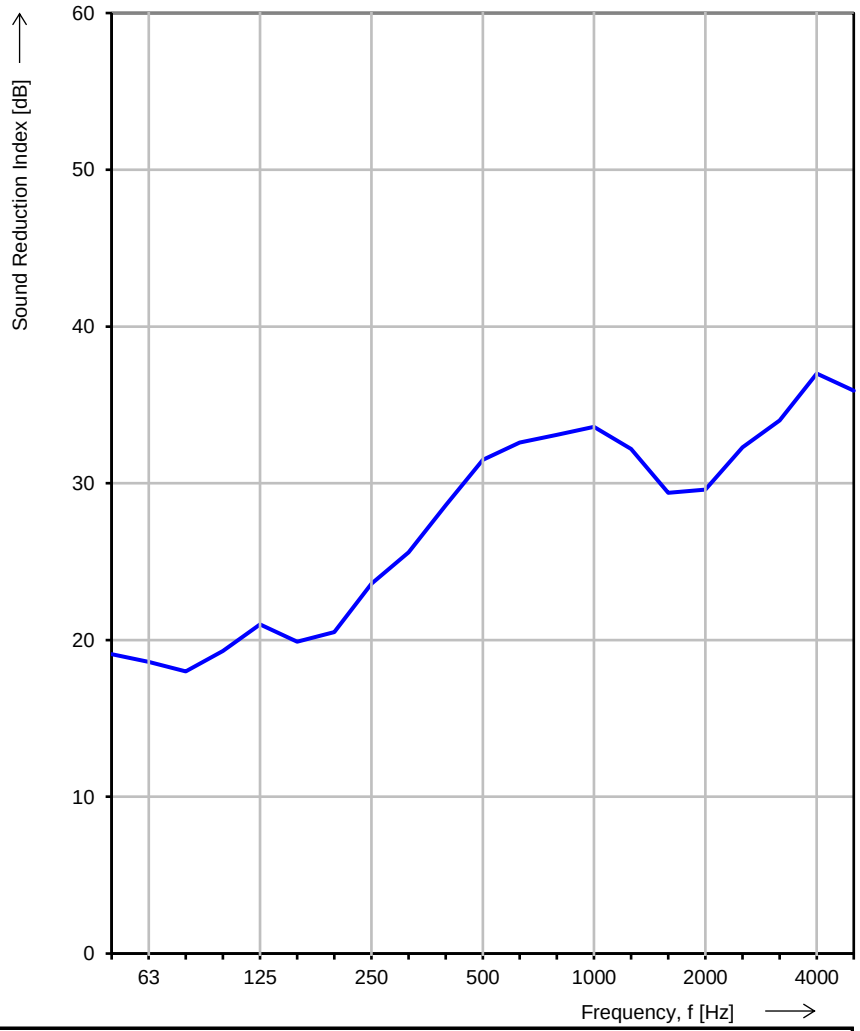
BS EN 1793-2 : 2012, Intrinsic Characteristics of Airborne Sound Insulation

Laboratory measurement of sound insulation of building elements

Client:	Genwork Ltd	Product ID:	Air Absorption
Mounted by:	Client		
Sample Size:	10.08 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 January 2024
Description:	Road Noise Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	102.1 kPa
Source Room Temperature:	20.7 °C	Measured Mass per unit area:	18.7 kg/m^2
Source Room Relative Humidity:	36.6 %	Curing Time:	Not Applicable
Receiving Room Volume:	221 m^3		
Receiving Room Temperature:	20.5 °C		
Receiving Room Relative Humidity:	37.2 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	19.1
63	18.6
80	18.0
100	19.3
125	21.0
160	19.9
200	20.5
250	23.6
315	25.6
400	28.6
500	31.5
630	32.6
800	33.1
1000	33.6
1250	32.2
1600	29.4
2000	29.6
2500	32.3
3150	34.0
4000	37.0
5000	35.9



Rating according to BS EN 1793-2

DL_R = 29 dB **Category: B3**

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:	06569-6468	Signature:	
Date: 24 January 2024		Operator:	L. Cambidge

5. Amendments

Amended and added clarifications in section **1.1.** stating the ‘Thickness’ only considers the wall sections, as well as further detail regarding the rock wool used and application of insulating foam tape.

Sectional drawings within section **1.2.** have been replaced and further added.