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TEST REPORT No : 05743 **DATE OF ISSUE : 15 June 2022**

BS EN ISO 10140-2:2010

Acoustics – Laboratory Measurement of Sound Insulation of Building Elements

Part 2: Measurements of Airborne Sound Insulation

Client:	WSBL Ltd
Job Number:	05743
Test Sample:	Various Polymeric Noise Control Barriers
Date of Tests:	24 May 2022

Signed: . . . . . E Kalavsky
Laboratory Assistant

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

Contents

Client Details: WSBL Ltd

Durbar Mill

Hereford Road

Blackburn

Lancashire

BB01 3JU

Manufacturer: Client

Date Order Received: 05 May 2022

1. Test Samples

The following sample was installed in the 3600 × 2400 mm aperture of the transmission suite of the University of Salford Acoustic Test Laboratory.
The test specimen was installed in accordance with Appendix A: Walls of BS EN ISO 10140-1:2016 Part 1: Application rules for specific products.
All information regarding the samples comes from laboratory measurements unless marked with "*cs*" or otherwise stated.

1.1. Description of Test Samples

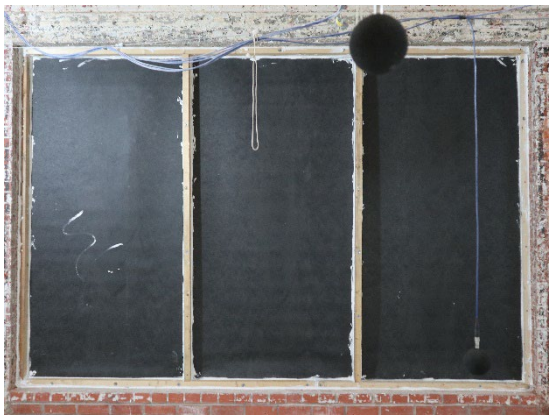
Test Reference: **05743-5505**
Sample Reference *cs*: Revac BM 00488
Sample Description: Polymeric Noise Control Barrier

A timber frame (measured, 94 mm × 44 mm) was installed in the internal periphery of the test aperture. Timber studs were then fitted within the frame at 1200 mm centres. Three sheets of nominal 1200 mm × 2400 mm*cs* Revac BM 00488 polymeric barrier were then installed on the receiver room side of the aperture, fixed to the timber frame and studs with staples.

A secondary timber frame then clamped the receiver room side of the sample to the timber frame. The joins between the aperture, frame and sample were then filled with sealant.

The measured mass per unit area (MPUA) of the polymeric barrier was 5.4 kg/m^2, and the measured thickness was 2.5 mm.






Test Reference: **05743-5506**

Sample Reference [cs]: Revac BM 00244

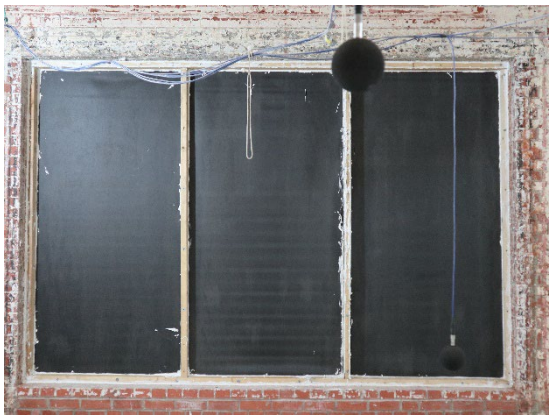
Sample Description: Polymeric Noise Control Barrier

The Revac BM 00488 sample from the previous test, along with the secondary frame, was removed from the test aperture.

Three nominal 1200 mm × 2400 mm[cs] sheets of Revac BM 00244 were fixed to the timber frame and studs with staples, before a secondary timber frame was installed on the receiver room side of the sample to clamp the polymeric barrier in place.

The joins between the timber and sample were then filled with sealant.

The measured mass per unit area (MPUA) of the polymeric barrier was 2.8 kg/m^2, and the measured thickness was 1.2 mm.



Test Reference: **05743-5507**

Sample Reference [cs]: Revac Momentum 50

Sample Description: Polymeric Noise Control Barrier

The Revac BM 00244 sample from the previous test, along with the secondary frame, was removed from the test aperture.

Three nominal 1200 mm × 2400 mm[cs] sheets of Revac Momentum 50 were fixed to the timber frame and studs with staples, before a secondary timber frame was installed on the receiver room side of the sample to clamp the polymeric barrier in place.

The joins between the timber and sample were then filled with sealant.

The measured mass per unit area (MPUA) of the polymeric barrier was 5.0 kg/m^2, and the measured thickness was 2.8 mm.

2. Description of Test Procedure

The test procedure adopted follows that detailed in BS EN ISO 10140-2:2010, "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 (136 m^3) 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: 2010 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 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 5000 Hz.

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 at 32 millisecond intervals 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

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

Source room volume:	136 m^3
Receiving room volume:	222 m^3
Sample sizes:	3600 mm × 2400 mm

Given in the attached tables and computed from the one-third octave band sound reduction indices, is the weighted sound reduction index, R_w, calculated according to ISO 717-1:2013. This evaluation is based on laboratory measurement results obtained by an engineering method.

Also given on separate test sheets are the sound transmission loss, *STL*, values in one-third octave band intervals, which have been used to calculate the sound transmission class, *STC*. This evaluation is also based on laboratory measurement results obtained by an engineering method.

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

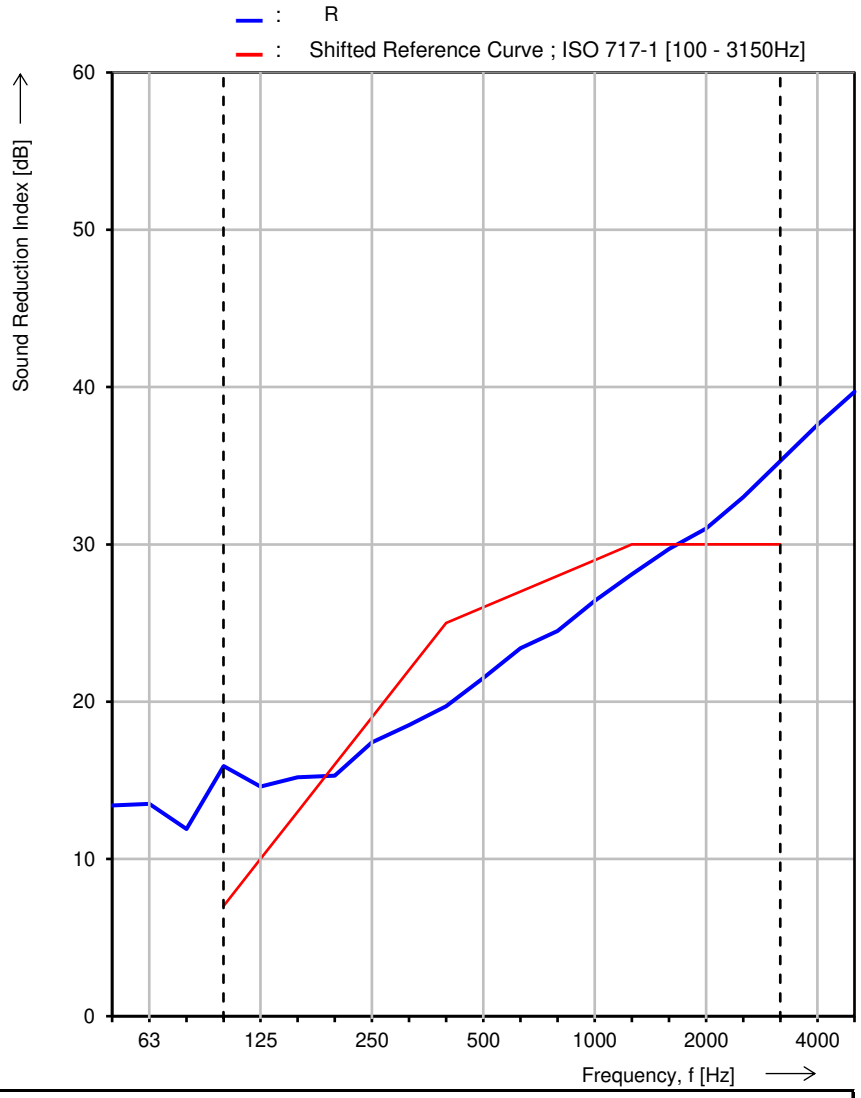
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac BM 00488
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.1 kPa
Source Room Temperature:	20.2 °C	Measured Mass per unit area:	5.4 kg/m^2
Source Room Relative Humidity:	43.3 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	49.4 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	13.4
63	13.5
80	11.9
100	15.9
125	14.6
160	15.2
200	15.3
250	17.4
315	18.5
400	19.7
500	21.5
630	23.4
800	24.5
1000	26.4
1250	28.1
1600	29.7
2000	31.0
2500	33.0
3150	35.3
4000	37.6
5000	39.7



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 26 (-1 ; -3) dB

$C_{50\text{-}3150}$ = 0 dB ; $C_{50\text{-}5000}$ = 0 dB ; $C_{100\text{-}5000}$ = 0 dB

$C_{tr,50\text{-}3150}$ = -4 dB ; $C_{tr,50\text{-}5000}$ = -4 dB ; $C_{tr,100\text{-}5000}$ = -3 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:	05743-5505	Signature:	

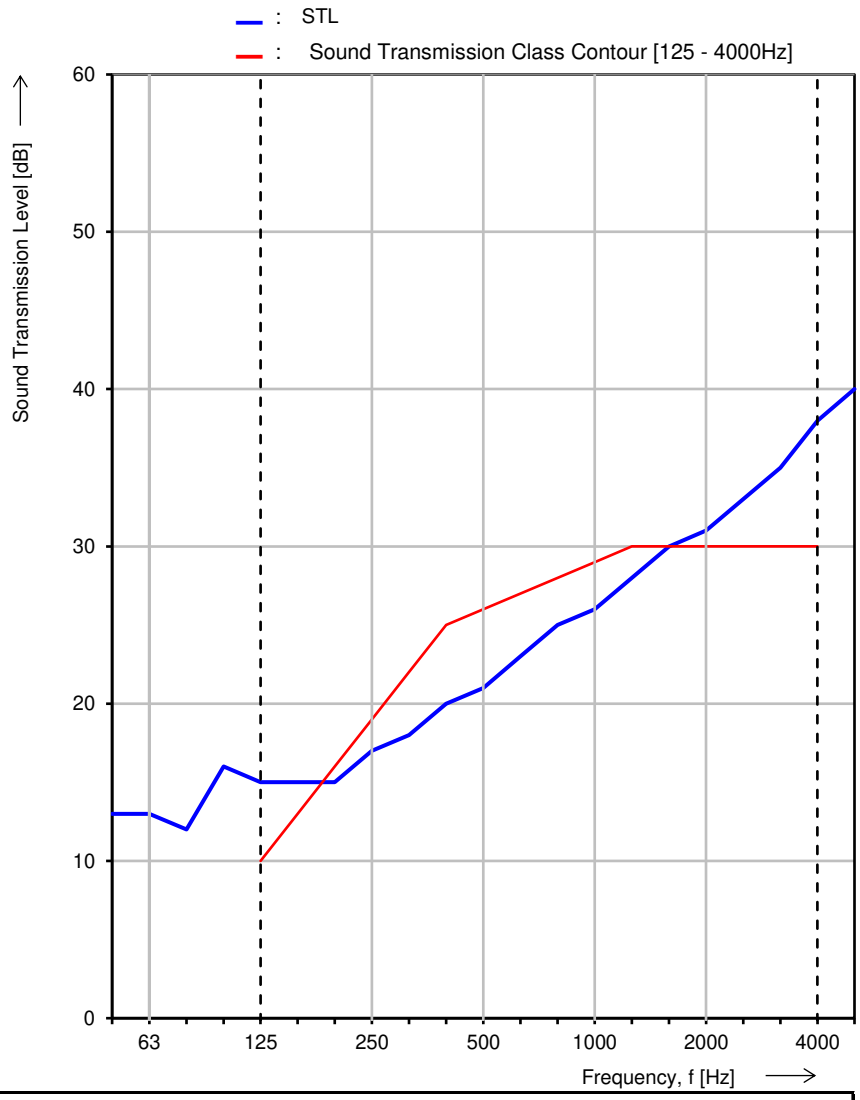
E90 – 09 (Reapproved 2016) Airborne Sound Transmission Loss

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac BM 00488
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.1 kPa
Source Room Temperature:	20.2 °C	Measured Mass per unit area:	5.4 kg/m^2
Source Room Relative Humidity:	43.3 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	49.4 %		

Frequency f [Hz]	STL ⅓ octave [dB]
50	13
63	13
80	12
100	16
125	15
160	15
200	15
250	17
315	18
400	20
500	21
630	23
800	25
1000	26
1250	28
1600	30
2000	31
2500	33
3150	35
4000	38
5000	40



Rating according to ASTM E413-16

STC = 26 dB

The Sound Reduction Index (SRI) figures obtained from testing to BS EN ISO 10140:2 have been used as Sound Transmission Loss (STL) figures to determine the Sound Transmission Class (STC).

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:	05743-5505	Signature:	

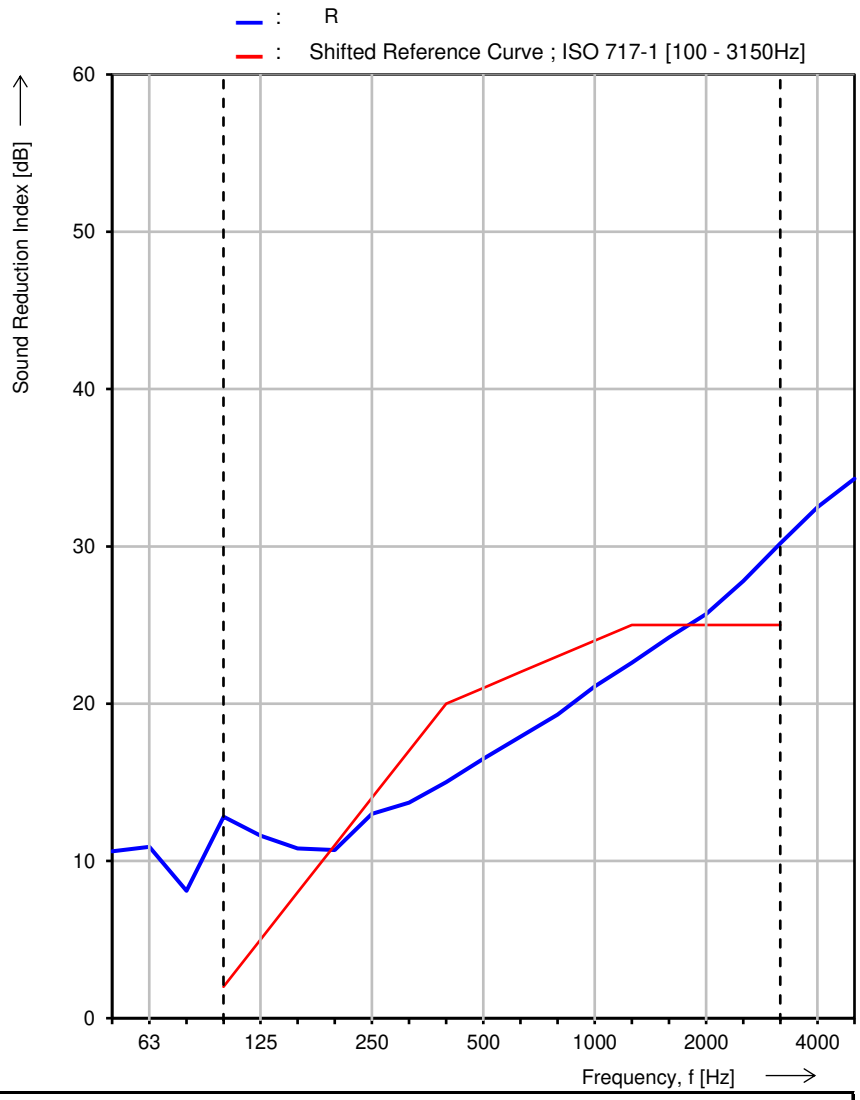
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac BM 00244
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.3 kPa
Source Room Temperature:	20.2 °C	Client Specified Mass per unit area:	2.8 kg/m^2
Source Room Relative Humidity:	42.0 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	48.0 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	10.6
63	10.9
80	8.1
100	12.8
125	11.6
160	10.8
200	10.7
250	13.0
315	13.7
400	15.0
500	16.5
630	17.9
800	19.3
1000	21.1
1250	22.6
1600	24.2
2000	25.7
2500	27.8
3150	30.2
4000	32.5
5000	34.3



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 21 (-1 ; -3) dB

$C_{50\text{-}3150}$ = 0 dB ; $C_{50\text{-}5000}$ = 0 dB ; $C_{100\text{-}5000}$ = 0 dB

$C_{tr,50\text{-}3150}$ = -4 dB ; $C_{tr,50\text{-}5000}$ = -4 dB ; $C_{tr,100\text{-}5000}$ = -3 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:	05743-5506	Signature:	

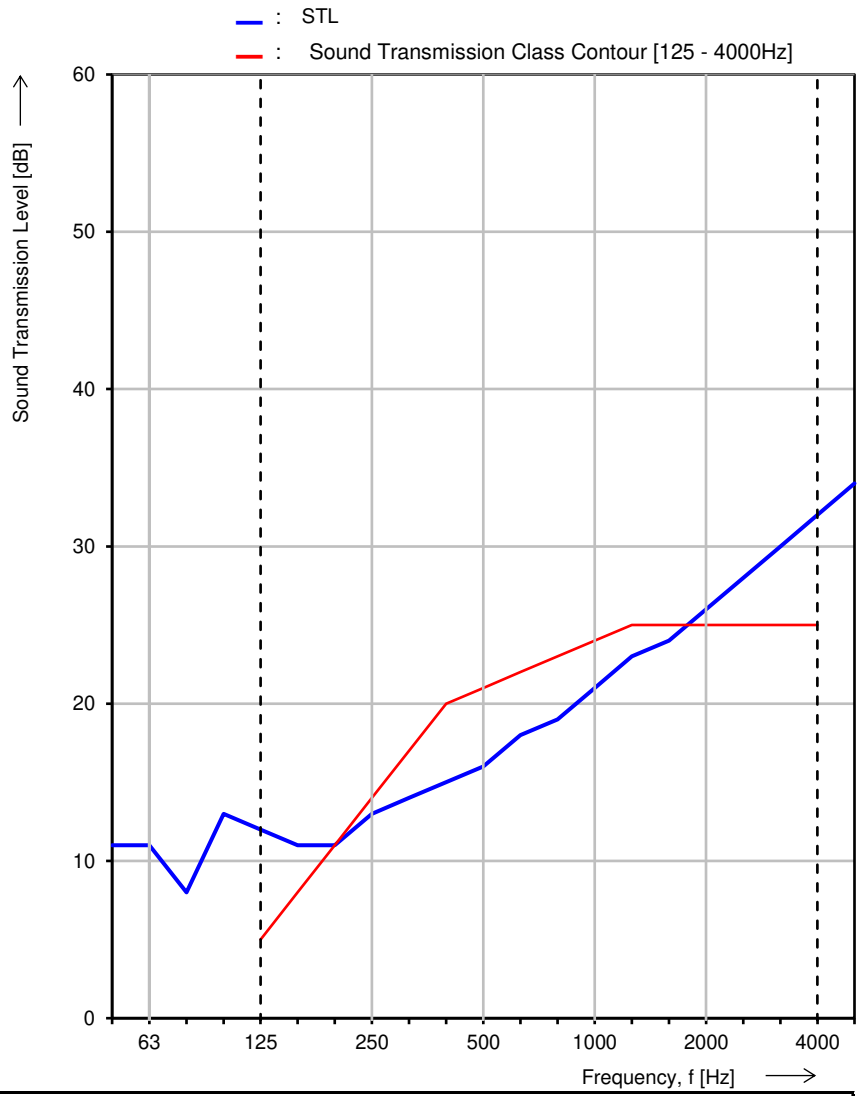
E90 – 09 (Reapproved 2016) Airborne Sound Transmission Loss

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac BM 00244
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.3 kPa
Source Room Temperature:	20.2 °C	Client Specified Mass per unit area:	2.8 kg/m^2
Source Room Relative Humidity:	42.0 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	48.0 %		

Frequency f [Hz]	STL ⅓ octave [dB]
50	11
63	11
80	8
100	13
125	12
160	11
200	11
250	13
315	14
400	15
500	16
630	18
800	19
1000	21
1250	23
1600	24
2000	26
2500	28
3150	30
4000	32
5000	34



Rating according to ASTM E413-16

STC = 21 dB

The Sound Reduction Index (SRI) figures obtained from testing to BS EN ISO 10140:2 have been used as Sound Transmission Loss (STL) figures to determine the Sound Transmission Class (STC).

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:	05743-5506	Signature:	

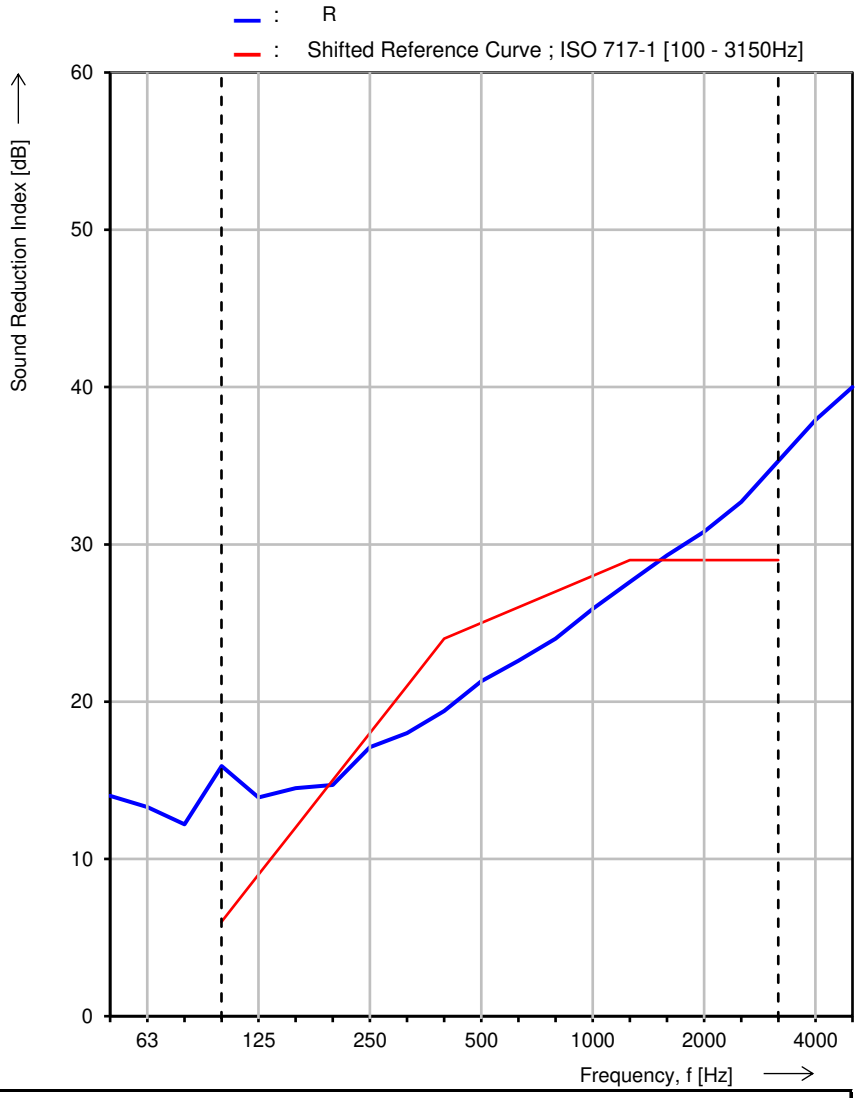
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac Momentum 50
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.4 kPa
Source Room Temperature:	20.2 °C	Client Specified Mass per unit area:	5.0 kg/m^2
Source Room Relative Humidity:	43.7 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	44.1 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	14.0
63	13.3
80	12.2
100	15.9
125	13.9
160	14.5
200	14.7
250	17.1
315	18.0
400	19.4
500	21.3
630	22.6
800	24.0
1000	25.9
1250	27.6
1600	29.3
2000	30.8
2500	32.7
3150	35.3
4000	37.9
5000	40.0



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 25 (0 ; -3) dB

$C_{50\text{-}3150}$ = 1 dB ; $C_{50\text{-}5000}$ = 1 dB ; $C_{100\text{-}5000}$ = 1 dB

$C_{tr,50\text{-}3150}$ = -3 dB ; $C_{tr,50\text{-}5000}$ = -3 dB ; $C_{tr,100\text{-}5000}$ = -3 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:	05743-5507	Signature:	

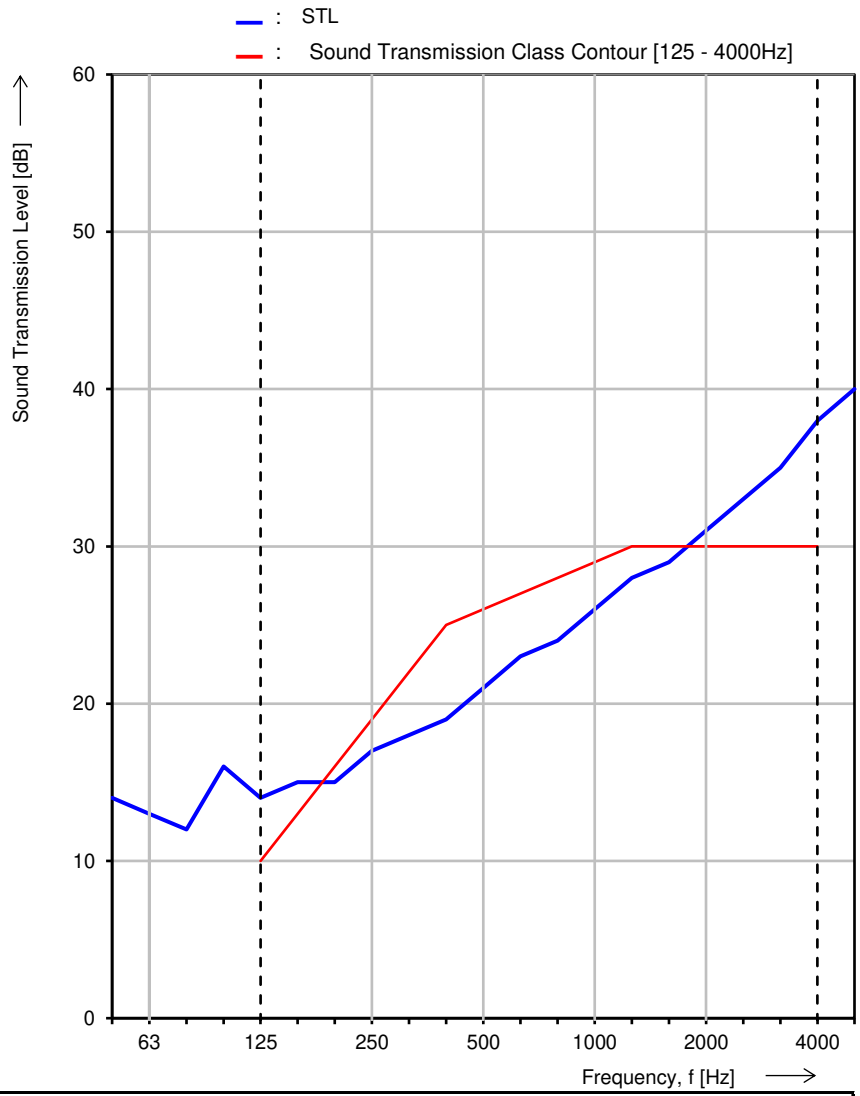
E90 – 09 (Reapproved 2016) Airborne Sound Transmission Loss

Laboratory measurement of sound insulation of building elements

Client:	WSBL Ltd	Product ID:	Revac Momentum 50
Mounted by:	Client		
Sample Size:	8.64 m²	Test Room ID:	Acoustic Transmission Suite
Manufacturer:	Client	Date of Test:	24 May 2022
Description:	Polymeric Noise Control Barrier		

Source Room Volume:	136 m^3	Ambient Pressure:	100.4 kPa
Source Room Temperature:	20.2 °C	Client Specified Mass per unit area:	5.0 kg/m^2
Source Room Relative Humidity:	43.7 %	Curing Time:	Not Applicable
Receiving Room Volume:	222 m^3		
Receiving Room Temperature:	20.3 °C		
Receiving Room Relative Humidity:	44.1 %		

Frequency f [Hz]	STL ⅓ octave [dB]
50	14
63	13
80	12
100	16
125	14
160	15
200	15
250	17
315	18
400	19
500	21
630	23
800	24
1000	26
1250	28
1600	29
2000	31
2500	33
3150	35
4000	38
5000	40



Rating according to ASTM E413-16

STC = 26 dB

The Sound Reduction Index (SRI) figures obtained from testing to BS EN ISO 10140:2 have been used as Sound Transmission Loss (STL) figures to determine the Sound Transmission Class (STC).

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:	05743-5507	Signature:	