Translation of original document

Improvement of sound absorption through application of SONASPRAY

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Client: ASONA
In charge: Dipl.-Ing. Wesemann

deBAKOM GmbH
Bergstr. 36
51519 Odenthal, Germany
Phone 02174 74640
Fax 02174 746420

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1. Introduction and task

During the acoustical examination of a rolling mill, it was ascertained that a substantial part of the noise is due to radiation of sound through a trapezoid tin facade.
The facade shows many leaks, e.g. open joints, smaller holes and so on, so that an adequate sealing procedure and a method to increase sound insulation were required.

It is therefore necessary to test how much of an improvement can be achieved through application of SONASPRAY in the present case.
A comparable piece of facade was examined on a test bench, first in its original state and then with a coating of 5 cm and 10 cm of the material named above.

2. Test object

For testing purposes, a piece of facade of 2.9 m² was built into the test bench in the same manner as it had been found in the wall of the rolling mill:

Trapezoid tin 40 / 207 – 1.0

The overlappings were voluntarily not completely tight and not all holes meant to contain screws or rivets actually contained some.
After performing the first test (original state),

5 cm of SONASPRAY

was applied to the side of the sending room. The next measurements were conducted after the material had dried. Then, another layer of Sonaspray was applied, so that the coating had a total thickness of

10 cm

After the second layer had dried, it came off the wall, floor and ceiling connectors through a process of shrinking. This state was examined first. Then the tears were sealed and new measurements were done.

3. Measurements

3.1 Location and date of the measurements

The measurements were done on

December 18, 1998
January 20, 1999
March 3, 1999

in the company's own laboratory test bench in Odenthal, Germany, Bergstraße 36.

3.2 Test devices

The following devices were used:

-	acoustical two-channel measurement system	Norsonic 823
-	2 condenser microphones	B&K 4165
-	amplifier	Norsonic 215
-	speaker (DodeKaeder)	Norsonic K100/12
-	calibrator	B&K 4231

3.3 Test procedure

The test procedure that was used is described in either DIN 52210 [1] or DIN EN ISO 140-3 [2]. The evaluation was conducted in accordance with DIN EN ISO 717-1 [3]. The sound insulation measure Rw was determined.

4. Results

The results are shown in the tables and images 1 to 4. Table 5 and image 5 show a comparison of the results. This yields the following sound insulation measures:

Table/Image 1	Trapezoid tin original state	Rw = 17 dB
Table/Image 2	Trapezoid tin with 5 cm of SONASPRAY	Rw = 26 dB

Table/Image 3	Trapezoid tin with 10 cm of SONASPRAY	Rw = 28 dB
Table/Image 4	Trapezoid tin with 10 cm of SONAPSRAY, sealed	Rw = 30 dB

Image 1 shows the typical course of the insulation curve for „leaky“ parts, which stops increasing at high frequencies. The slump in the course of the insulation curve, which is peculiar to trapezoid tin constructions, is clearly visible below the area where the acoustical examination is conducted (100 to 3150 Hz).

Image 2 shows a clear increase of sound insulation compared with the first measurements. Especially in the range above 315 Hz a substantial improvement of the insulation is noticeable. There is an improvement of

9 dB

over the original construction.

Image 3 illustrates the effects of the second coating. It leads to another improvement in insulation above 315 Hz. However, given that only undercuttings of the displaced reference curve are taken into account, there is an improvement of only

2 dB

because of the nearly identical course of the insulation curve below 315 Hz. Rw is thus 28 dB.

As shown in **Image 4**, with an additional sealing of the construction the insulation curve runs in parallel to that of the 5 cm coating in the frequency range below 100 Hz. The sealing and thus the tighter linking of the facade element leads to an improvement of the insulation of another

2 dB

and Rw = 30 dB.

5. Summary

The examination of the improvement of the sound insulation of a leaky trapezoid tin facade using SONASPRAY yields these results:

- with a 5 cm coating, a sound insulation of 26 dB,

- with 10 cm coatings, a sound insulation of 30 dB

can be achieved.

- the improvements can be achieved mainly above 315 Hz.

Below 315 Hz, a substantial improvement in sound insulation can be achieved only with a coating of 10 cm; it is then very important that the connectors to other construction parts not be leaky. Furthermore, tears with substantial influence on sound insulation can occur on 10 cm SONASPRAY coatings through shrinking.

6. Literature

[1] DIN 52210, Bauakustische Prüfungen - Luft- und Trittschalldämmung - Meßverfahren, Beuth-Verlag, Berlin, August 1984

[2] DIN EN ISO 140-3, Akustik - Messung der Schalldämmung in Gebäuden und von Bauteilen - Teil 3: Messung der Luftschalldämmung von Bauteilen in Prüfständen, Beuth-Verlag, Berlin, Mai 1995

[3] DIN EN ISO 717-1, Akustik - Bewertung der Schalldämmung in Gebäuden und von Bauteilen - Teil 1: Luftschalldämmung, Beuth-Verlag, Berlin, Januar 1997

Sender: Test bench, room 1
Receiver: Test bench, room 2

Room dimensions: Ground surface: 18.2 m²
(Receiver) Height: 2.54 m
Volume: 46.2 m³

separating surface: trapezoid tin, 2.9 m², **as delivered**

Frequency	Level difference	Reverberation time	equivalent absorption surface	S / A	Sound insulation measure R	Reference val. DIN 52210	displaced reference curve
Hz	dB	s	m²		dB	dB	dB
63	12.4	1.90	4.0	0.7	11.0		
80	6.5	1.75	4.3	0.7	4.8		
100	20.9	1.79	4.2	0.7	19.3	33	-2
125	17.2	2.18	3.5	0.8	16.4	36	1
160	15.8	2.73	2.8	1.1	16.0	39	4
200	10.7	3.30	2.3	1.3	11.7	42	7
250	15.2	2.79	2.7	1.1	15.5	45	10
315	14.1	2.71	2.8	1.0	14.3	48	13
400	13.1	2.51	3.0	1.0	12.9	51	16
500	14.6	2.66	2.8	1.0	14.7	52	17
630	14.2	2.75	2.7	1.1	14.4	53	18
800	16.9	2.71	2.8	1.0	17.1	54	19
1000	18.2	2.61	2.9	1.0	18.2	55	20
1250	18.5	2.56	2.9	1.0	18.4	56	21
1600	20.1	2.60	2.9	1.0	20.1	56	21
2000	19.8	2.61	2.9	1.0	19.8	56	21
2500	19.4	2.24	3.4	0.9	18.8	56	21
3150	18.3	2.00	3.8	0.8	17.2	56	21
4000	22.1	1.75	4.3	0.7	20.4		
5000	24.4	1.55	4.9	0.6	22.2		

evaluated sound insulation measure Rw: **17 dB**
highest unfavorable deviation: **-**
(specified only if > 8.0 dB)

Table 1 – Calculation of sound insulation measure

Sender: Test bench, room 1
Receiver: Test bench, room 2

Room dimensions: Ground surface: 18.2 m²
(Receiver) Height: 2.54 m
Volume: 46.2 m³

separating surface: trapezoid tin, 2.9 m², **with 5 cm of SONASPRAY**

Frequency	Level difference	Reverberation time	equivalent absorption surface	S / A	Sound insulation measure R	Reference val. DIN 52210	displaced reference curve
Hz	dB	s	m²		dB	dB	dB
63	29.9	1.90	4.0	0.7	28.5		
80	14.8	1.75	4.3	0.7	13.1		
100	23.3	1.79	4.2	0.7	21.7	33	7
125	19.3	2.18	3.5	0.8	18.5	36	10
160	15.7	2.73	2.8	1.1	15.9	39	13
200	16.9	3.30	2.3	1.3	17.9	42	16
250	23.1	2.79	2.7	1.1	23.4	45	19
315	15.6	2.71	2.8	1.0	15.8	48	22
400	17.8	2.51	3.0	1.0	17.6	51	25
500	20.1	2.66	2.8	1.0	20.2	52	26
630	21.0	2.75	2.7	1.1	21.2	53	27
800	22.8	2.71	2.8	1.0	23.0	54	28
1000	26.7	2.61	2.9	1.0	26.7	55	29
1250	30.0	2.56	2.9	1.0	29.9	56	30
1600	32.4	2.60	2.9	1.0	32.4	56	30
2000	34.0	2.61	2.9	1.0	34.0	56	30
2500	34.4	2.24	3.4	0.9	33.8	56	30
3150	37.4	2.00	3.8	0.8	36.3	56	30
4000	41.1	1.75	4.3	0.7	39.4		
5000	46.4	1.55	4.9	0.6	44.2		

evaluated sound insulation measure Rw: **26 dB**
highest unfavorable deviation: **-**
(specified only if > 8.0 dB)

Table 2 – Calculation of sound insulation measure

Sender: Test bench, room 1
Receiver: Test bench, room 2

Room dimensions: Ground surface: 18.2 m²
(Receiver) Height: 2.54 m
Volume: 46.2 m³

separating surface: trapezoid tin, 2.9 m², **with 10 cm of SONASPRAY**

Frequency	Level difference	Reverberation time	equivalent absorption surface	S / A	Sound insulation measure R	Reference val. DIN 52210	displaced reference curve
Hz	dB	s	m²		dB	dB	dB
63	28.7	1.90	4.0	0.7	27.3		
80	13.1	1.75	4.3	0.7	11.4		
100	23.5	1.79	4.2	0.7	21.9	33	9
125	17.9	2.18	3.5	0.8	17.1	36	12
160	19.5	2.73	2.8	1.1	19.7	39	15
200	10.5	3.30	2.3	1.3	11.5	42	18
250	22.8	2.79	2.7	1.1	23.1	45	21
315	15.4	2.71	2.8	1.0	15.6	48	24
400	19.5	2.51	3.0	1.0	19.3	51	27
500	21.7	2.66	2.8	1.0	21.8	52	28
630	26.1	2.75	2.7	1.1	26.3	53	29
800	28.6	2.71	2.8	1.0	28.8	54	30
1000	32.5	2.61	2.9	1.0	32.5	55	31
1250	34.9	2.56	2.9	1.0	34.8	56	32
1600	38.5	2.60	2.9	1.0	38.5	56	32
2000	40.7	2.61	2.9	1.0	40.7	56	32
2500	42.9	2.24	3.4	0.9	42.3	56	32
3150	47.3	2.00	3.8	0.8	46.2	56	32
4000	52.0	1.75	4.3	0.7	50.3		
5000	55.3	1.55	4.9	0.6	53.1		

evaluated sound insulation measure Rw: **28 dB**
highest unfavorable deviation: **8.4 dB**
(specified only if > 8.0 dB)

Table 3 – Calculation of sound insulation measure

Sender: Test bench, room 1
Receiver: Test bench, room 2

Room dimensions: Ground surface: 18.2 m²
(Receiver) Height: 2.54 m
Volume: 46.2 m³

separating surface: trapezoid tin, 2.9 m², **with a 6 mm polycarbonate plate inside**

Frequency	Level difference	Reverberation time	equivalent absorption surface	S / A	Sound insulation measure R	Reference val. DIN 52210	displaced reference curve
Hz	dB	s	m²		dB	dB	dB
63	25.6	1.90	4.0	0.7	24.2		
80	17.2	1.75	4.3	0.7	15.5		
100	27.4	1.79	4.2	0.7	25.8	33	11
125	23.4	2.18	3.5	0.8	22.6	36	14
160	18.4	2.73	2.8	1.1	18.6	39	17
200	18.3	3.30	2.3	1.3	19.3	42	20
250	18.2	2.79	2.7	1.1	18.5	45	23
315	19.5	2.71	2.8	1.0	19.7	48	26
400	20.2	2.51	3.0	1.0	20.0	51	29
500	22.7	2.66	2.8	1.0	22.8	52	30
630	27.5	2.75	2.7	1.1	27.7	53	31
800	31.6	2.71	2.8	1.0	31.8	54	32
1000	35.1	2.61	2.9	1.0	35.1	55	33
1250	39.9	2.56	2.9	1.0	39.8	56	34
1600	42.4	2.60	2.9	1.0	42.4	56	34
2000	42.7	2.61	2.9	1.0	42.7	56	34
2500	43.7	2.24	3.4	0.9	43.1	56	34
3150	49.1	2.00	3.8	0.8	48.0	56	34
4000	54.7	1.75	4.3	0.7	53.0		
5000	60.8	1.55	4.9	0.6	58.6		

evaluated sound insulation measure Rw: **30 dB**
highest unfavorable deviation: **9.0 dB**
(specified only if > 8.0 dB)

Table 4 – Calculation of sound insulation measure

Sender: Test bench, room 1
Receiver: Test bench, room 2

Room dimensions: Ground surface: 18.2 m²
(Receiver) Height: 2.54 m
Volume: 46.2 m³

separating surface: trapezoid tin, 2.9 m², **with and without SONASPRAY**

Frequency	Reverberation time	equivalent absorption surface	S / A	1. measurement Sound insulation measure R	2. measurement Sound insulation measure R	3. measurement Sound insulation measure R	4. measurement Sound insulation measure R
Hz	s	m²		dB	dB	dB	dB
63	1.90	4.0	0.7	11.0	28.5	27.3	24.2
80	1.75	4.3	0.7	4.8	13.1	11.4	15.5
100	1.79	4.2	0.7	19.3	21.7	21.9	25.8
125	2.18	3.5	0.8	16.4	18.5	17.1	22.6
160	2.73	2.8	1.1	16.0	15.9	19.7	18.6
200	3.30	2.3	1.3	11.7	17.9	11.5	19.3
250	2.79	2.7	1.1	15.5	23.4	23.1	18.5
315	2.71	2.8	1.0	14.3	15.8	15.6	19.7
400	2.51	3.0	1.0	12.9	17.6	19.3	20.0
500	2.66	2.8	1.0	14.7	20.2	21.8	22.8
630	2.75	2.7	1.1	14.4	21.2	26.3	27.7
800	2.71	2.8	1.0	17.1	23.0	28.8	31.8
1000	2.61	2.9	1.0	18.2	26.7	32.5	35.1
1250	2.56	2.9	1.0	18.4	29.9	34.8	39.8
1600	2.60	2.9	1.0	20.1	32.4	38.5	42.4
2000	2.61	2.9	1.0	19.8	34.0	40.7	42.7
2500	2.24	3.4	0.9	18.8	33.8	42.3	43.1
3150	2.00	3.8	0.8	17.2	36.3	46.2	48.0
4000	1.75	4.3	0.7	20.4	39.4	50.3	53.0
5000	1.55	4.9	0.6	22.2	44.2	53.1	58.6
evaluated sound insulation measure Rw				**17**	**26**	**28**	**30**

Table 5 – Summary of sound insulation measures

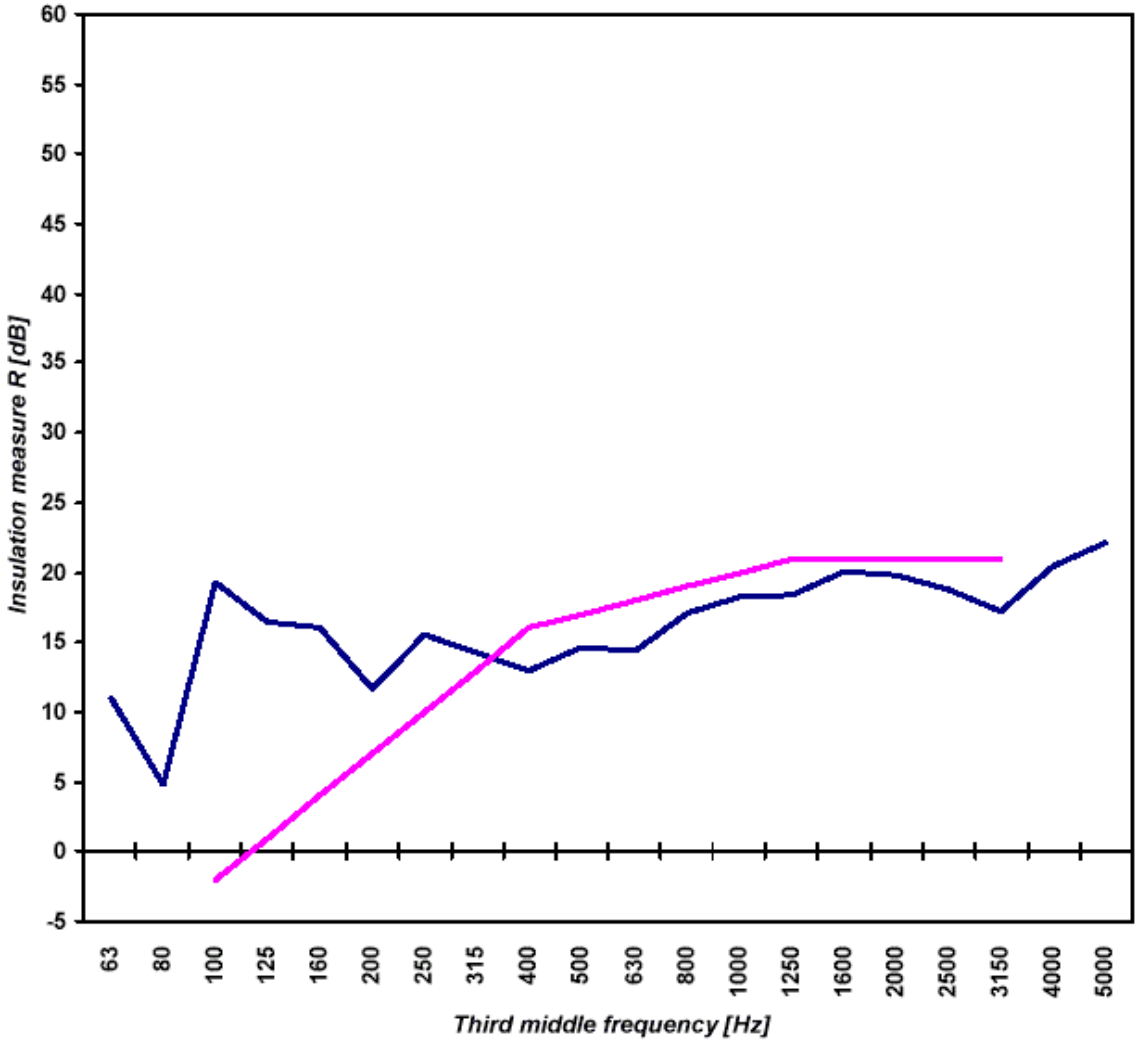

Image 1
Trapezoid tin as delivered

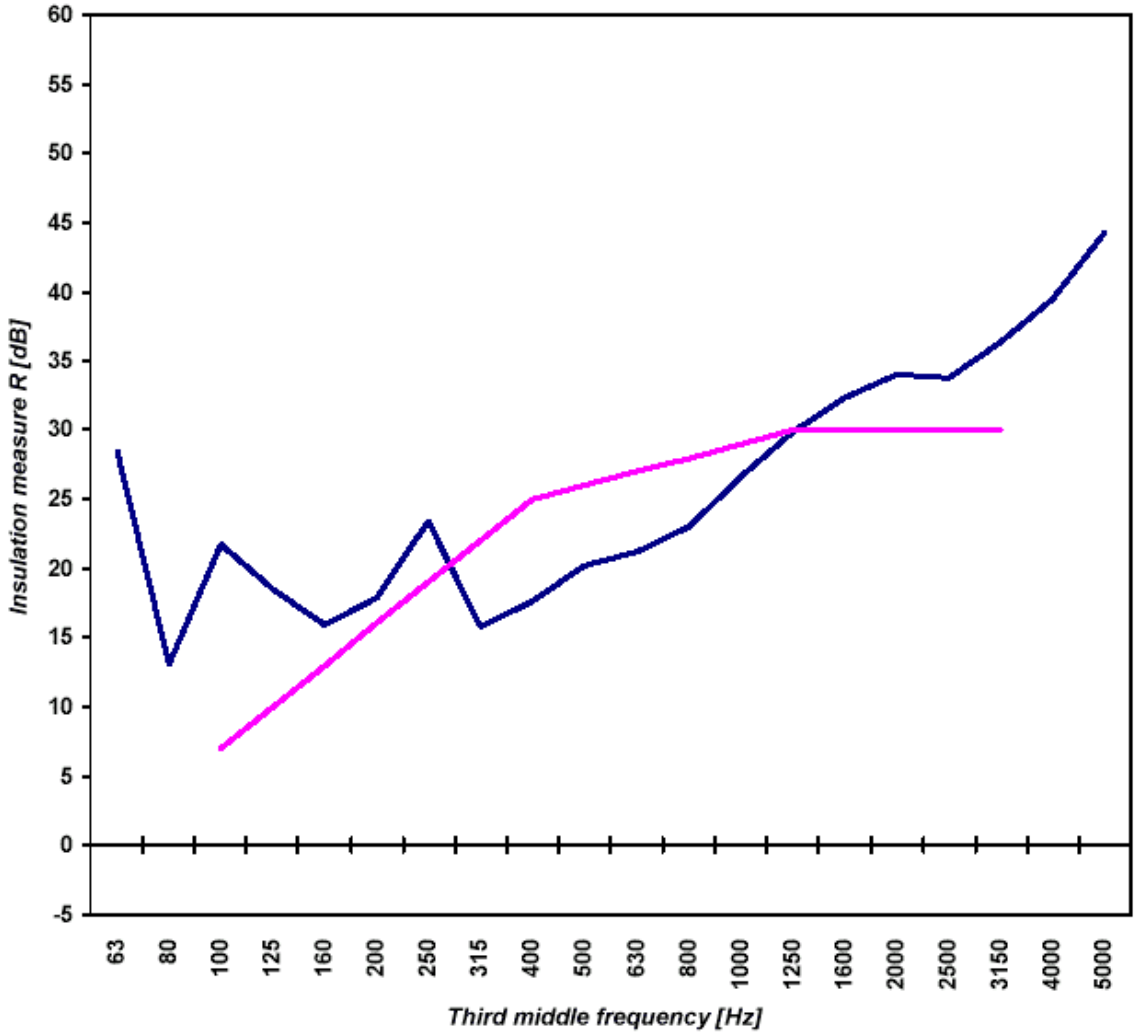

Image 2
Trapezoid tin with SONASPRAY (5 cm)

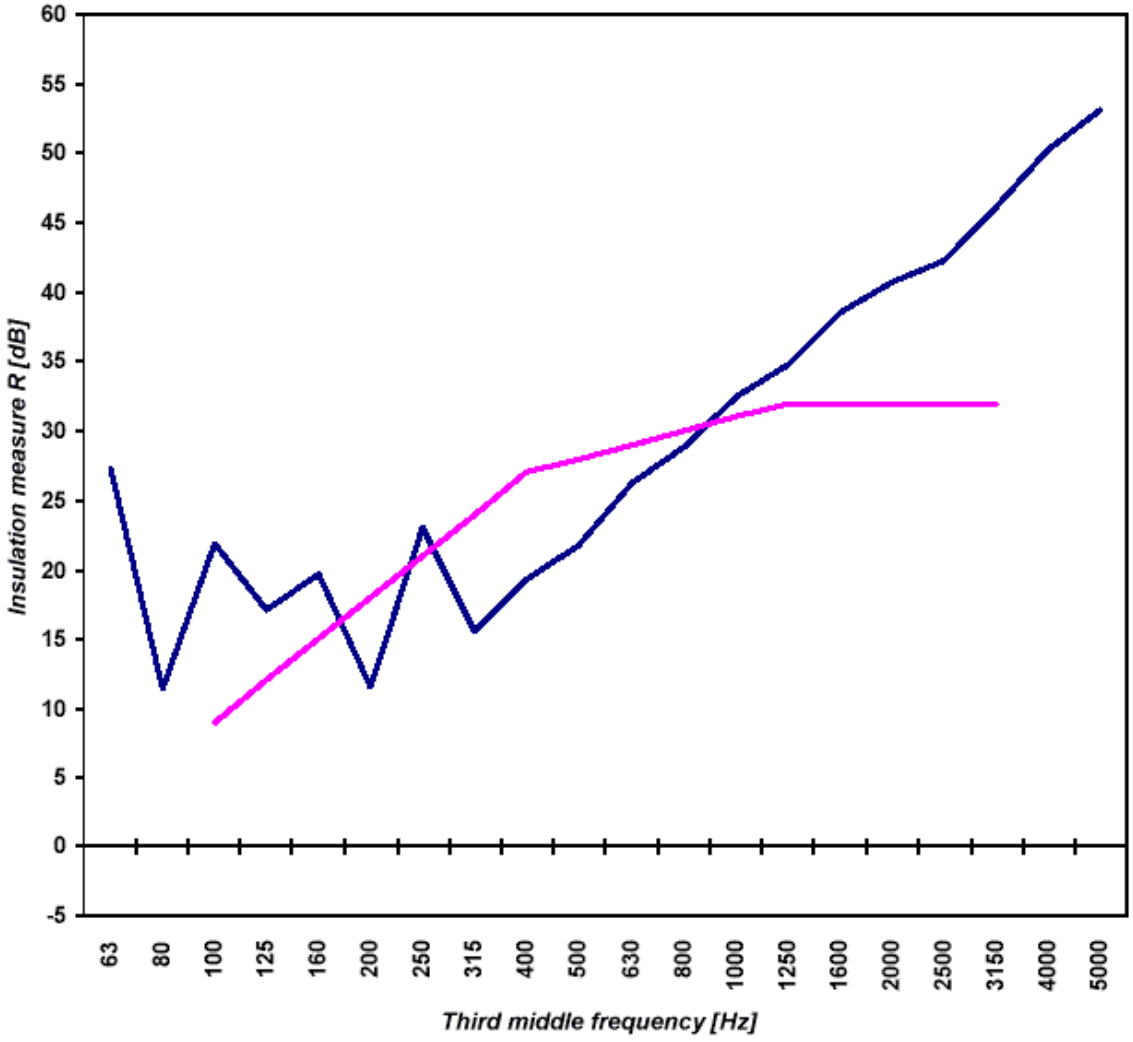

Image 3
Trapezoid tin with SONASPRAY (10 cm)
Spray coating torn, unsealed

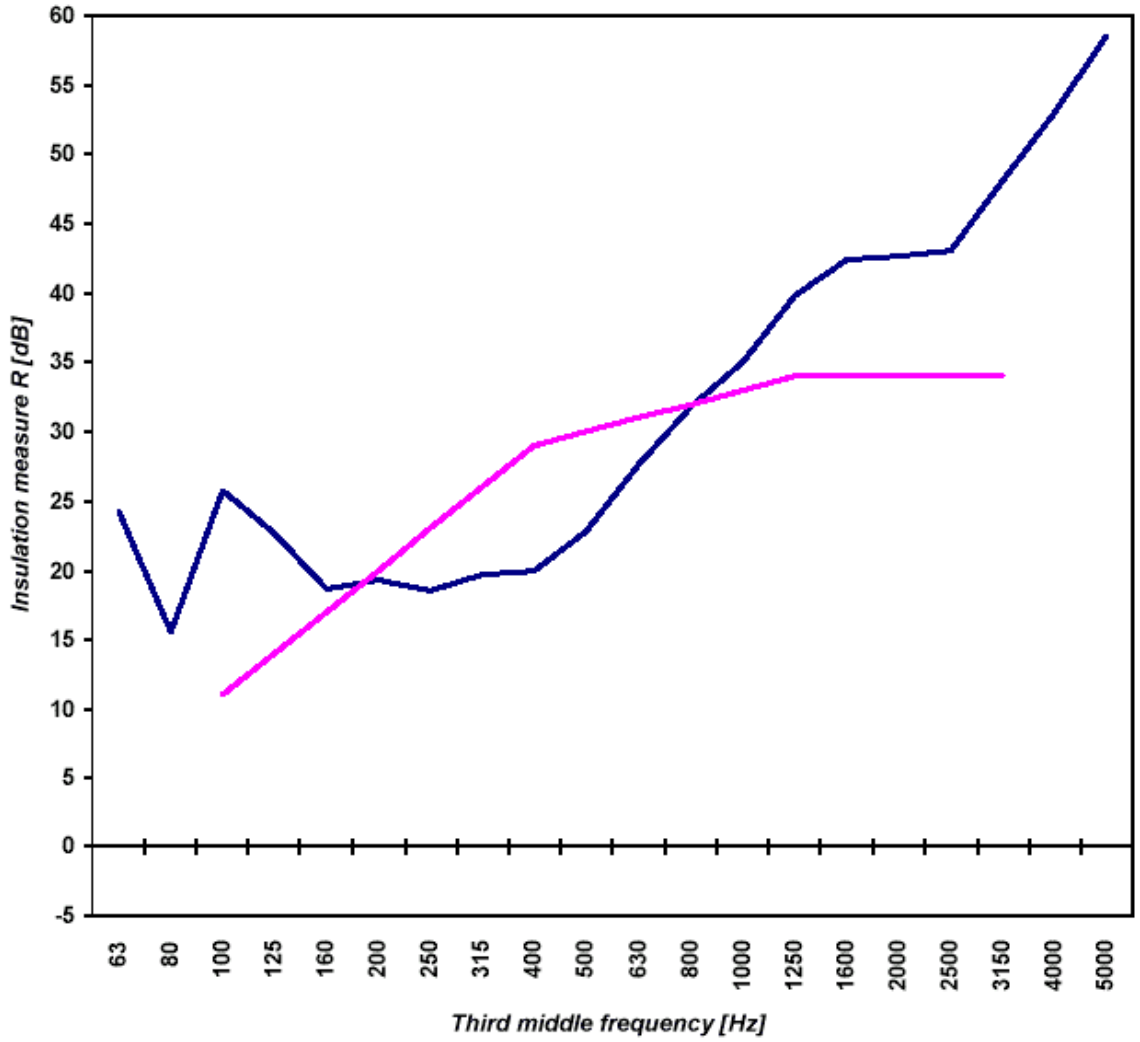

Image 4
Trapezoid tin with SONASPRAY (10 cm)
Spray coating torn, sealed

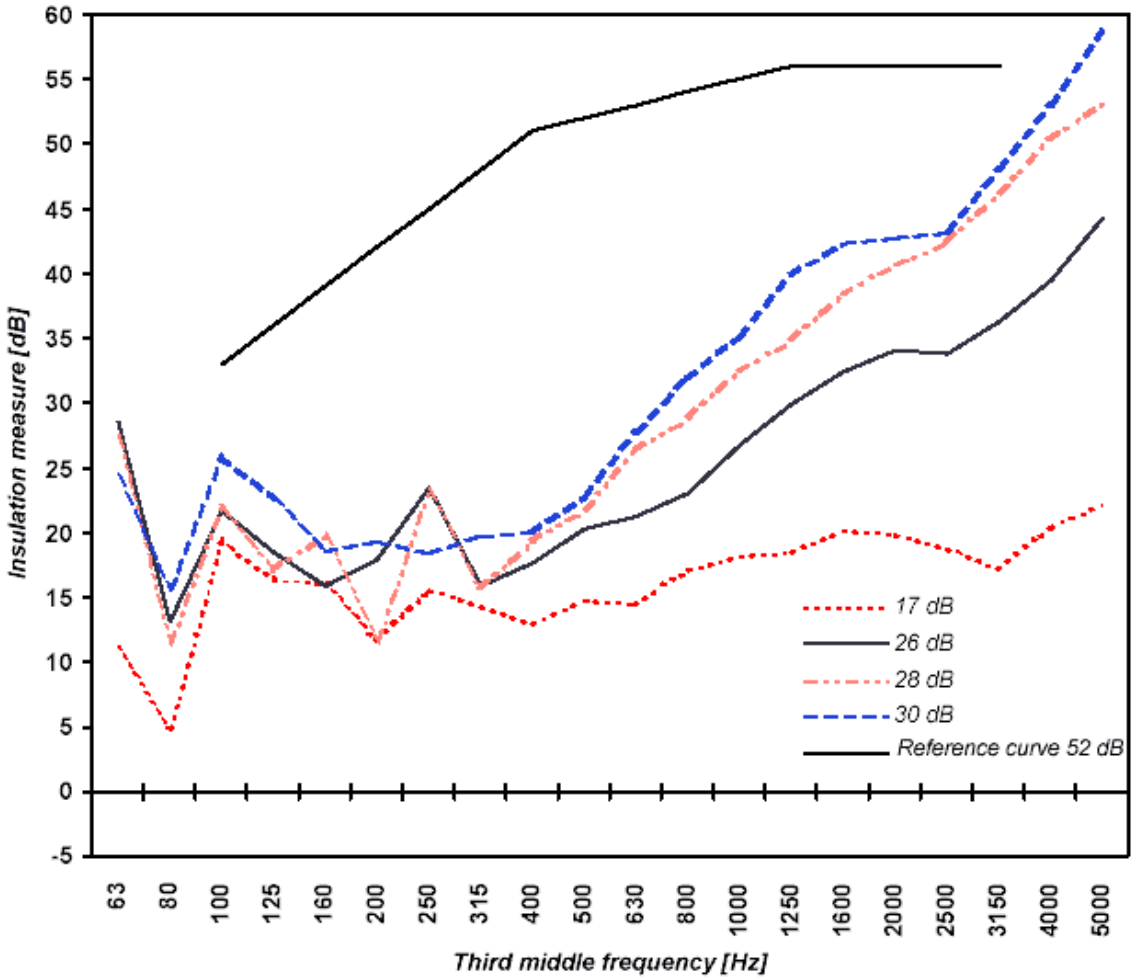

Image 5: Comparison of calculated sound insulation measures
Trapezoid tin without and with different SONASPRAY coatings