ACOUSTICS AND LIGHTING DEPARTMENT

Acoustics Test Laboratory

TEST REPORT N° AC08-26013432 CONCERNING TWO FLOORS AND A FLOATING COVERING

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This Test Report certifies only the characteristics of the object submitted for testing and does not prejudge the characteristics of similar products. So it does not constitute a product certification in the sense of Article L 115-27 of the Consumer Code and of the Law of June 3, 1994.

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It comprises fourteen pages.

REQUESTED BY: **TECNASFALTI s.r.l.**
Via Umbria 8
I-20098 SAN GIULIANO MILANESE (MI)
ITALIA

Our/Ref.: BR-70011253
26013432
TB/GA

PURPOSE

Determine the airborne sound insulation R of two floors and the improvement of the impact sound insulation ΔL of a floating covering.

REFERENCE TEXTS

The measurements were carried out:

- For the airborne sound insulation R, according to standards NF EN ISO 140-1 (1997), NF EN 20140-2 (1993) et NF EN ISO 140-3 (1995), supplemented by standard NF EN ISO 717/1 (1997) and associated amendments,
- For the improvement of the impact sound insulation ΔL, according to standards NF EN ISO 140-1 (1997), NF EN 20140-2 (1993), NF EN ISO 140-8 (1997) and NF EN ISO 140-6 (1998) supplemented by standard NF EN ISO 717/2 (1997) and associated amendments.

The measurements of dynamic stiffness of the underlay are carried out according to standard NF EN 29052-1 (1992).

OBJECT SUBMITTED FOR THE TEST

Date of reception in the laboratory : July 10th 2008
Origin : TECNASFALTI
Installation : CSTB

SUMMARY LIST OF TEST

Test No.	Sample tested	Type of test
1	Floor with floating covering	R
2	Bearing floor	R
3	Floating covering	ΔL

Made at Marne-la-Vallée, September 24th 2008

Responsible for the test	The head of division
Thibaut BLINET	Jean-Baptiste CHÉNÉ

DESCRIPTION OF FLOOR AND FLOATING COVERING

Test	**1 to 3**
Date	**11 & 15/06/08**
Station	**DELTA**

REQUESTER **TECNASFALTI**

MANUFACTURER **ISOLMANT (underlay)**
CSTB (Bearing floor and floating covering)

FITNESS FOR PURPOSE **Unchecked**

DESCRIPTION (The dimensions are given in mm)

Bearing floor	- Nature: Reinforced concrete - Useful dimensions: 4200 x 3600 x 140 - Weight per unit area: 325 kg/m²
Underlay	- Name: ISOLMANT UNDERSLIM - Nature: Sample consists of plastic foam (polyethylene foam with closed cell) of thickness 2, high density 50 kg/m^3 with no-woven (special fibre with polyester 200 g/m^2) of thickness 3. - Thickness: 5 - Weight per unit area: 300 g/m² - Overview: Roll of dimensions 50 000 x 1500 (with recovery to 80) - Date of manufacture: week 8 of the year 2008 - Dynamic stiffness: • s' = 59 MN/m^3 under load of 8 kg • s' = 52 MN/m^3 under load of 4 kg (for indication)
Shore strip	- Nature: Strip of polyethylene foam with closed cell, with an adhesive on one side and a tightness strip. - Thickness: 5 - Overview: Roll with width of 120
Floating covering	- Nature: Mortar cement not reinforced - Dimensions: 4200 x 3600 x 40 - Weight per unit area: 90 kg/m²

INSTALLATION OF THE FLOATING COVERING

Test 1 to 3
Date 11 & 15/06/08
Station DELTA

REQUESTER TECNASFALTI

MANUFACTURER ISOLMANT (underlay)
CSTB (Bearing floor and floating covering)

FITNESS FOR PURPOSE Unchecked

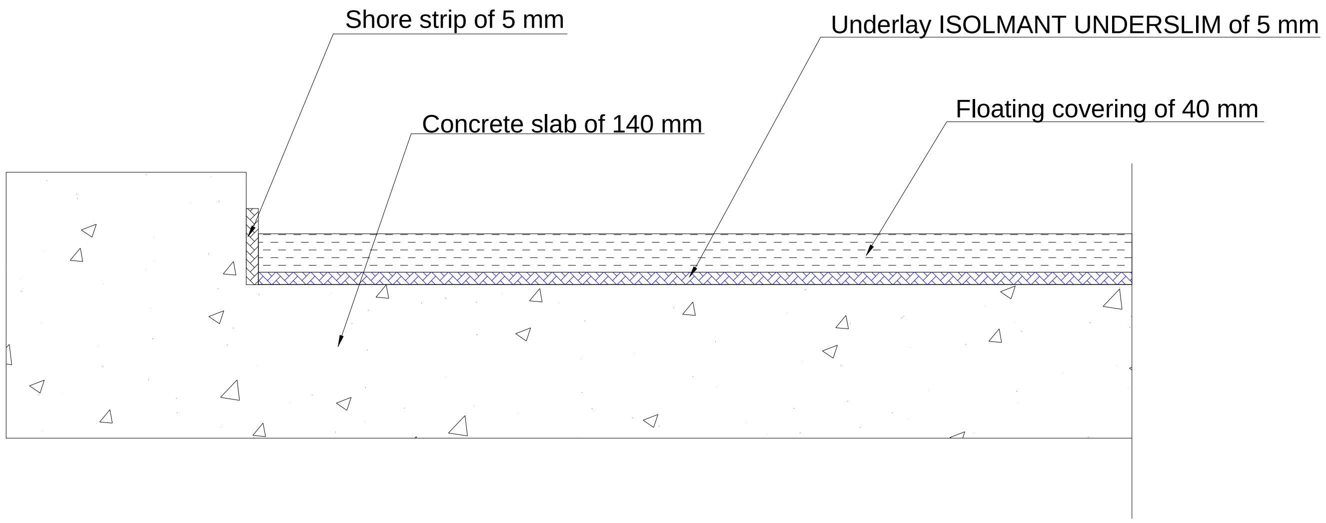
INSTALLATION

Shore strip is stuck on the bearing floor edges.
The underlay strips are put edge to edge with fibrous face on the floor.
An adhesive made tightness:

- between underlay strip, by stuck of the recovery strip,
- between underlay and shore strip

The floating covering is cast as usual precautions. The drying period of the floating covering is one month.

The floating covering is not charged.



MEASUREMENT CONDITIONS

	Emission room	Reception room
Test 1 :	Temperature: 26.5 °C Relative humidity: 74 %	Temperature: 25.5 °C Relative humidity: 63 %
Test 2 :	Temperature: 25 °C Relative humidity: 52 %	Temperature: 25 °C Relative humidity: 66 %
Test 3 :	Temperature: 25 °C Relative humidity: 52 %	Temperature: 25.5 °C Relative humidity: 63 %

AIRBORNE SOUND INSULATION R OF A FLOOR WITH AND WITHOUT FLOATING COVERING

AD43

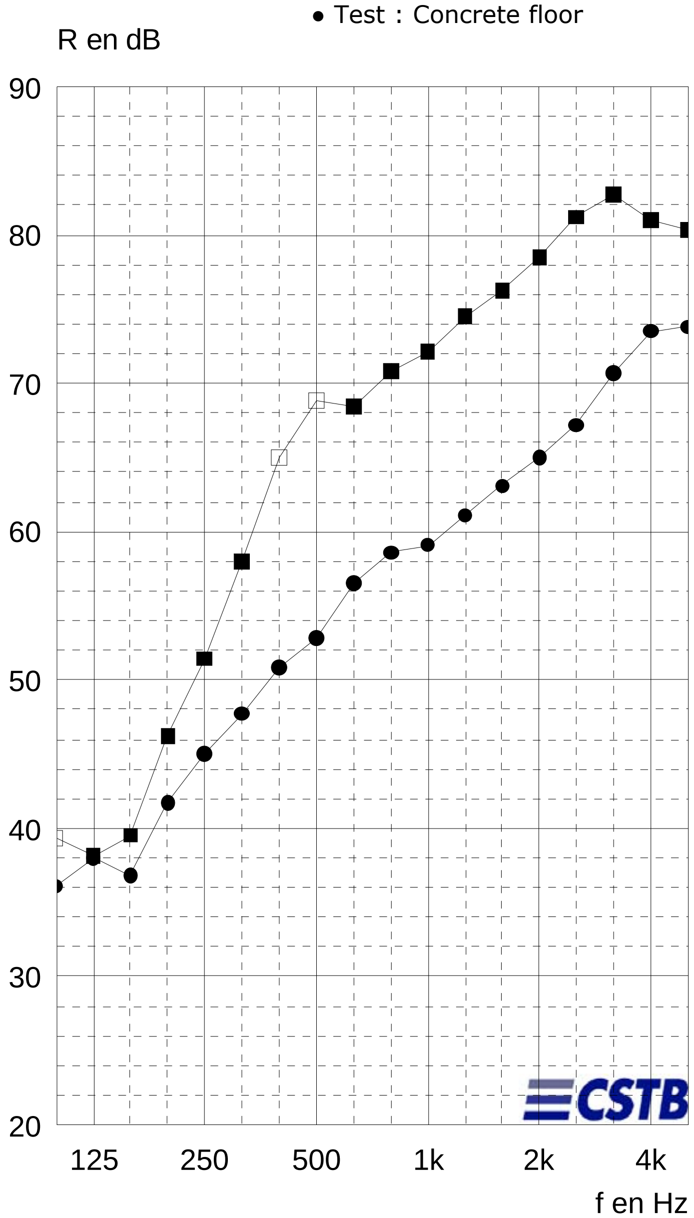
Test 1 and 2
Date 11 & 15/06/08
Station DELTA

REQUESTER **TECNASFALTI**

	UNDERLAY	FLOATING COVERING
MANUFACTURER	TECNASFALTI	CSTB
NAME	ISOLMANT UNDERSLIM	
CHARACTERISTICS		
Nature	Polyester fibre with closed cell	Mortar cement covering
Thickness in mm	5	40
Weight per unit area in kg/m²	0.3	90
Dynamic stiffness in MN/m³	59 under load of 8 kg 52 under load of 4 kg (for indication)	
Installation	Laid	Cast
FITNESS FOR PURPOSE	Unchecked	
BEARING FLOOR	Floor ledge in reinforced concrete of dimensions 4200 x 3600 x 140 mm, and of Weight per unit area 325 kg/m²	

RESULTS

- ■ Test : Concrete floor + underlay + floating covering
- ● Test : Concrete floor



Code	■	●
f	R	R
100	39,3+ (51,6)	36,1
125	38,1	38,0
160	39,5	36,8
200	46,2	41,7
250	51,4	45,0
315	58,0	47,7
400	65,0+ (79,8)	50,8
500	68,8+ (82,1)	52,8
630	68,4	56,5
800	70,8	58,6
1k	72,1	59,1
1,25k	74,5	61,1
1,6k	76,2	63,1
2k	78,5	65,0
2,5k	81,2	67,2
3,15k	82,7	70,7
4k	81,0	73,5
5k	80,3	73,8
Hz	dB	dB

(∗) : valeur corrigée. (+) : limite de poste.

■	$R_w (C;C_{tr}) \geq 62(-4;-9)$ dB Pour information : $R_A = R_w+C \geq 58$ dB $R_{A,tr} = R_w+C_{tr} \geq 53$ dB
●	$R_w (C;C_{tr}) = 56(-2;-7)$ dB Pour information : $R_A = R_w+C = 54$ dB $R_{A,tr} = R_w+C_{tr} = 49$ dB

TEST REPORT N° AC08-26013432

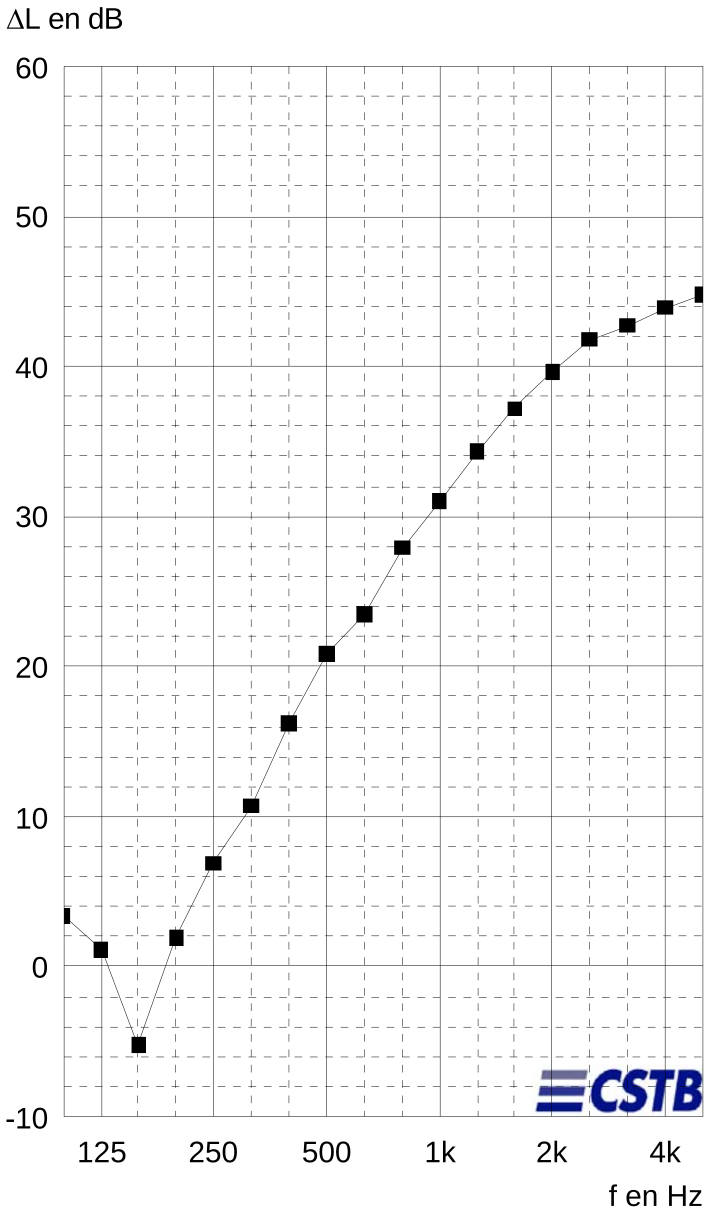
IMPROVEMENT OF THE IMPACT SOUND INSULATION ΔL OF A FLOATING COVERING

CD66

Test 3
Date 11 & 15/06/08
Station DELTA

REQUESTER	**TECNASFALTI**	
	UNDERLAY	**FLOATING COVERING**
MANUFACTURER	TECNASFALTI	CSTB
NAME	ISOLMANT UNDERSLIM	
CHARACTERISTICS		
Nature	Polyester fibre with closed cell	Mortar cement covering
Thickness in mm	5	40
Weight per unit area in kg/m²	0.3	90
Dynamic stiffness in MN/m³	59 under load of 8 kg 52 under load of 4 kg (for indication)	
Installation	Laid	Cast
FITNESS FOR PURPOSE	Unchecked	
BEARING FLOOR	Floor ledge in reinforced concrete of dimensions 4200 x 3600 x 140 mm, and of Weight per unit area 325 kg/m²	

RESULTS



f	ΔL
100	3,4
125	1,1
160	-5,2
200	1,9
250	6,9
315	10,7
400	16,2
500	20,8
630	23,5
800	27,9
1000	31,0
1250	34,3
1600	37,2
2000	39,6
2500	41,8
3150	42,7
4000	43,9
5000	44,8
Hz	dB

(*) : valeur corrigée. (+) : limite de poste.

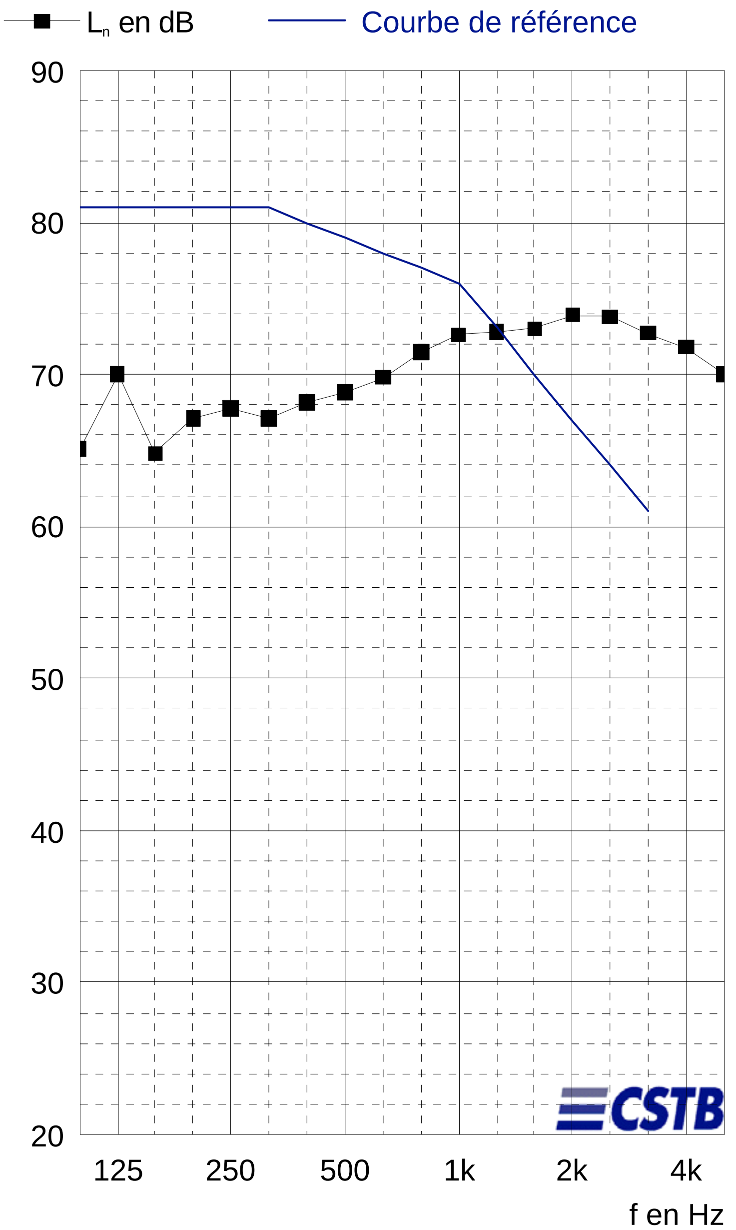
ΔL_w = 20 dB

Pour information :
$C_{I\Delta}$ = -13 dB
ΔL = 20 dB(A)

APPENDIX 1 – STANDARDIZED IMPACT SOUND LEVEL L_n OF THE BEARING FLOOR

Date	15/07/08
Station	DELTA

RESULTS



f	L_n
100	65,1
125	70,0
160	64,8
200	67,1
250	67,8
315	67,1
400	68,2
500	68,8
630	69,8
800	71,5
1000	72,6
1250	72,8
1600	73,0
2000	73,9
2500	73,8
3150	72,7
4000	71,8
5000	70,0
Hz	dB

(*) : valeur corrigée. (+) : limite de poste.

$L_{n,w}$ = 79 dB

Pour information :

C_I = -12 dB

L_n = 83 dB(A)

APPENDIX 2
METHOD OF EVALUATION & EXPRESSION OF THE RESULTS

AIRBORNE SOUND INSULATION R

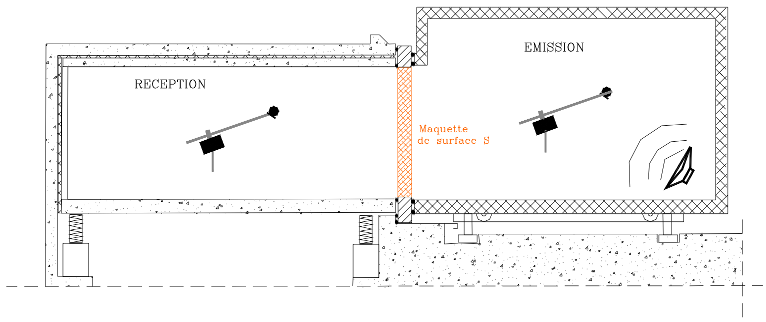
➢ ***Method of evaluation : NF EN ISO 140-3 (1995)***

The standard NF EN ISO 140-3 (1995) is the method of evaluation of the airborne sound insulation of the building elements like walls, floors, doors, windows, façade element, façades, …

The measurement must be run into a test laboratory without any flanking transmissions. The test facility is composed of two rooms: one fixed room where we put onto the concrete frame with the sample to be tested and a moving box, creating a couple "emission room – reception room ». Those rooms and the concrete frame are separated (neoprene seals) and are in accordance to the standard NF EN ISO 140-1 (1997). The conception of rooms (box in the box) gets a strong soundproofing towards the outside and allows to measure very weak levels of background noise.

Measurement by 1/3 of octave, from 100 to 5000 Hz:

- Of the background noise level in the reception room L_{BdF}
- Of the insulation: $L_E - L_R$
- Of the reverberation time of the reception room T



Calculation of the airborne sound insulation R in dB for any 1/3 of octave:

$$R = L_E - L_R + 10 \log (S/A)$$

L_E: Sound level in the emission room in dB
L_R: Sound level in the reception room, corrected with the background sound in dB
S: surface of the sample to be tested in m²
A: Equivalent absorption area in the reception room in m²
$A = (0.16 \times V)/T$ with V the volume of the reception room in m^3 and T the reverberation time of this room in s.

The more R is high, the more insulating the element is.

➢ ***Expression of the results: Calculation of the overall weighted index $R_w(C;C_{tr})$ according to the standard NF EN ISO 717-1 (1997)***

Consideration of the values of R by third (third party) of octave between 100 and 3150 Hz with a precision in the 1/10th of dB.

Vertical movement of a reference curve by jump of 1 dB until the sum of the unfavourable distances is the biggest while remaining lower or equal to 32.0 dB.

Rw dB is the value given then by the curve of reference to 500 Hz.
The terms of adaptation to a spectre (C and Ctr) are calculated by means of reference spectres to obtain:

RA,tr = RW + Ctr dB The terms of adaptation to a spectrum (C and C_{tr}) are calculated with reference spectrum to obtain:

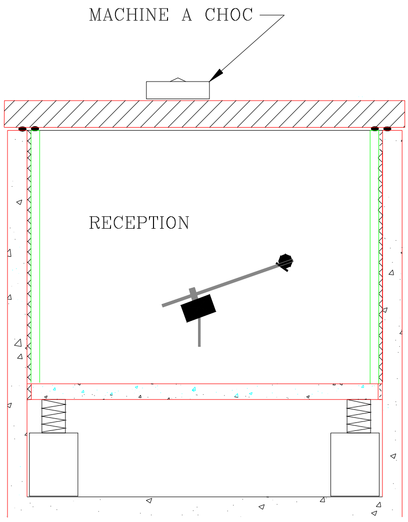
- The insulation towards noises of airport or industrial neighbourhood, activities:
  $R_A = R_w + C$ en dB
- The isolation towards the noise of infrastructure of ground transport: **$R_{A,tr} = R_W + C_{tr}$ en dB**

APPENDIX 2
METHODS OF ÉVALUATION AND EXPRESSIONS OF THE RESULTS

IMPROVEMENT OF THE IMPACT SOUND INSULATION DL

Determination of the improvement of the impact sound insulation by the floor coverings on a heavy standardized concrete floor with a standardized tapping machine.
The measurements must be run into a test laboratory.

- ***Method of evaluation: NF EN ISO 140-8 (1997)***



Measurement by 1/3 of octave, from 100 to 5000 Hz:
- Of the impact sound level L_i into the reception room
- Of the background noise level
- Of the reverberation time of the reception room T

Calculation of the standardized impact sound level L_n in dB for any 1/3 of octave:
$L_n = L_i + 10 \log (A_0 / A)$

L_i : impact sound level measured into the reception room and eventually corrected by the background sound level
A_0: Reference area equal to 10 m² in laboratory
A : Equivalent absorption area in the reception room in m²
A = (0.16 x V)/T with V the volume of the reception room in m^3 and T the reverberation time of this room in s

Calculation of the improvement of the impact sound insulation ΔL in dB for any 1/3 of octave:

$DL = L_{n0} - L_n$

L_{n0}: Standardized impact sound level of the standardized heavy concrete floor without any floor covering,
L_n : Standardized impact sound level of the standardized heavy concrete floor with the floor covering.

- ***Expression of the results:***

Calculation of the of the standardized impact sound level of the reference floor covered by the floor covering submitted to the test in 1/3 of octave from 100 to 3150 Hz:
$L_{n,r} = L_{n,r,o} - \Delta L$
- $L_{n,r,o}$ = Impact sound level of the reference floor,
- ΔL = Improvement of the impact sound level

Calculation of the ΔL_w:
$\Delta L_w = L_{n,r,o} - L_{n,r,w} = 78$ dB $- L_{n,r,w}$.
For the calculation of the $L_{n,r,w}$, consideration of the $L_{n,r}$ by 1/3 of octave from 100 to 3150 Hz with a 1/10th of dB precision.

Vertical movement of a reference curve by jump of 1 dB until the sum of the unfavourable distances is the biggest while remaining lower or equal to 32.0 dB.

$L_{n,r,w}$ is the value given then by the curve of reference to 500 Hz.

APPENDIX 3 – APPARATUS | STATION DELTA

Emission room: HALL

DÉSIGNATION	BRAND	TYPE	CSTB N°
Impact machine	Bruël & Kjær	3204	CSTB 98 0182

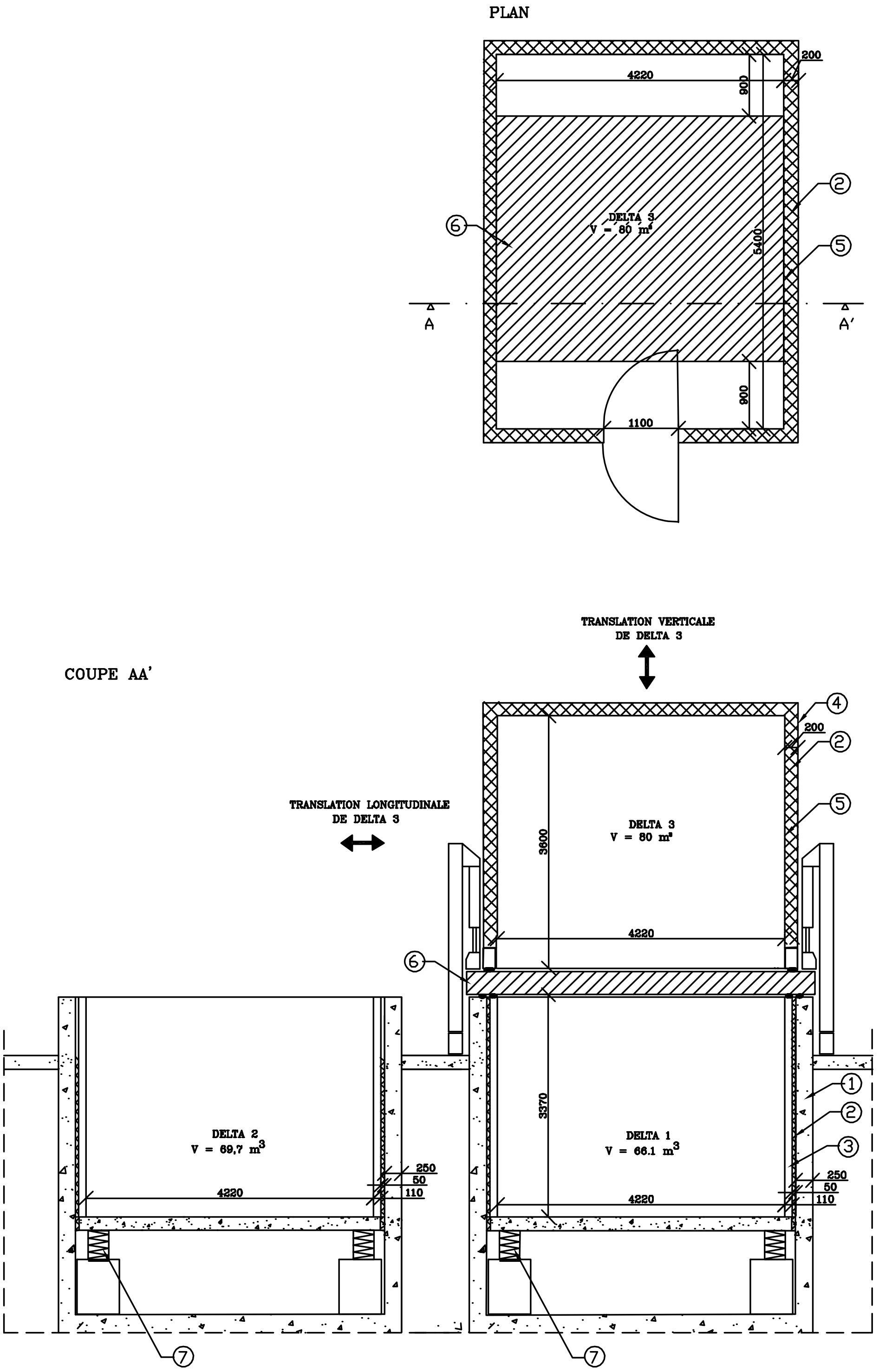
Reception room: DELTA 2

DÉSIGNATION	MARQUE	TYPE	N° CSTB
Microphone network	Bruël & Kjær Bruël & Kjær	Microphone 4166 Preamplifier 2669	CSTB 01 0208
Rotating arm	Bruël & Kjær	3923	CSTB 90 0089
Amplifier	CARVER	PM600	CSTB 91 0116
Speaker	CSTB-ELECTRO VOICE	Pyramid	CSTB 97 0203

Control room

DÉSIGNATION	BRAND	TYPE	CSTB N°
Real time analyser	Bruël & Kjær	2144	CSTB 96 0176
Micro-computer	DELL	OPTIPLEX GX 270	
Calibrator	Bruël & Kjær	4231	CSTB 95 0145

APPENDIX 4 – DRAWING OF THE TESTS STATION | STATION DELTA



dimensions en mm

REP	DESIGNATION
7	Boîte à ressort
6	Surface de l'ouverture S=15 m²
5	Tôle acier 6mm
4	Tôle acier 2mm
3	Bloc de béton plein e=100 mm
2	Laine minérale
1	Béton e=200 mm

échelle:	1/100
POSTE DELTA	
ACOUSTIQUE	

APPENDIX 5 – DETERMINATION OF THE DYNAMIC STIFFNESS S' OF AN UNDERLAY

REQUESTER, FABRICANT **TECNASFALTI**

RESULTS

DYNAMIC STIFFNESS RESULT										
DYNAMIC STIFFNESS TEST										
Test number :	R08-26013432/1					Date the sealing:				10/07/2008
Requester name :	TECNASFALTI					Date of the test:				11/07/2008
Sample reference:	Underslim									
						Temperature in °C :				22
Type:	Layered bituminous + fiber					Relative humidity in %:				53
Report AC08-26013432	Test without vaseline under 4kg					Test without vaseline under 8kg				
SAMPLE IDENTIFICATION	R08-26013432/1-A	R08-26013432/1-B	R08-26013432/1-C	MEAN	Uncertainty	R08-26013432/1-A	R08-26013432/1-B	R08-26013432/1-C	MEAN	Uncertainty
Weight per unit of area of the system mass loading the sample in kg/m²	104	108	106	**106**	**± 1,08**	204	208	206	**206**	**± 2,09**
Thickness of the sample in mm	5,2	4,9	4,9	**5,0**	**± 0,19**	4,9	4,7	4,6	**4,7**	**± 0,18**
Thickness of the sample porous part in mm	3,1	2,8	2,9	**2,9**	**± 0,11**	2,8	2,6	2,7	**2,7**	**± 0,10**
fr in Hz	56,0	57,5	57,5	**57,0**	**± 2,56**	46,0	47,0	48,0	**47,0**	**± 2,11**
η in %	7,1	7,2	7,7	**7,3**	**± 0,57**	6,3	6,7	7,2	**6,7**	**± 0,52**
S't in MN/m³	12,8	14,1	13,9	**13,6**	**± 0,88**	17,0	18,1	18,8	**18,0**	**± 1,16**
S'a in MN/m³	36,3	39,2	38,9	**38,1**	**± 2,13**	39,8	42,0	41,9	**41,2**	**± 2,31**
S' in MN/m³	**49,1**	**53,3**	**52,8**	**52**	**± 3,01**	**56,8**	**60,1**	**60,7**	**59**	**± 3,46**

APPENDIX 6 – MEASUREMENT FACILITY FOR THE DYNAMIC STIFFNESS

DÉSIGNATION	MARQUE	TYPE	N° CSTB
Balance	Précia	Quartz 3	CSTB 9300131
Comparator	Digico		CSTB 06 0168
Thermo - hygrometer	Testo Therm	Thermo – hygromètre 6100	CSTB 91 0110
Analyser	Bruël & Kjær	PULSE	CSTB 04 1501
Head of impedance	Bruël & Kjær	8001	CSTB 05 0371
Load amplifier	Bruël & Kjær	2635	CSTB 04 1502
Load amplifier	Bruël & Kjær	2635	CSTB 04 1503
Vibrations excitator	Bruël & Kjær	4809	CSTB 85 0008
Power amplifier	Bruël & Kjær	2718	CSTB 05 0369
Calibrator	Bruël & Kjær	4294	CSTB 89 0064

PRINCIPLE:

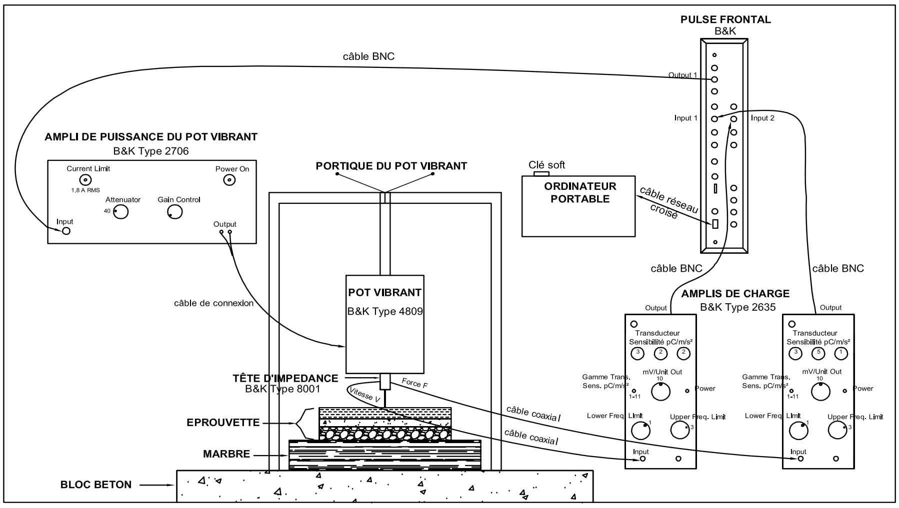
The determination of the system mass / spring / mass resonance frequency fr allows to obtain the apparent dynamic stiffness per unit of area s't of the sample according to the equation:

$$fr = \frac{1}{2\pi}\sqrt{\frac{s'_t}{m'_t}}$$

with: m't the total Weight per unit area used during the test

The measurement setup used by the laboratory is constituted by a Pulse analyser system which manages an excitation signal called "white noise", amplified by a power amplifier before being transmitted to an electro-dynamic shaker.
An impedance head measures the injected force injected as well as the velocity of the system mass / spring / mass.
These signals are then amplified by pre-amplifiers before being passed on to the Pulse analyser system to be treated and analyzed.

Drawing of principle



APPENDIX 7 – EXPRESSION OF THE RESULTS FOR THE DYNAMIC STIFFNESS

- Dynamic stiffness per unit of area s', in MN/m^3:

s' = s'$_t$ + s'$_a$

with: • s'$_t$: apparent dynamic stiffness per unit of area of the sample, in MN/m^3

$$s'_t = 4\pi^2 \cdot m_t \cdot f_r^{\,2}$$

where: m_t is the Weight per unit area of the system mass loading the sample in kg/m²,
f_r is the resonance frequency in Hz of the system Mass – Spring – Mass

• s'$_a$: dynamic stiffness per unit of area of the captive gas, in MN/m^3

$$s'_a = \frac{Po}{d_t.\varepsilon}$$

where: Po is the atmospheric pressure, in MPa
d_t the thickness of the porous part of the sample under the static load, in mm
ε is the material porosity

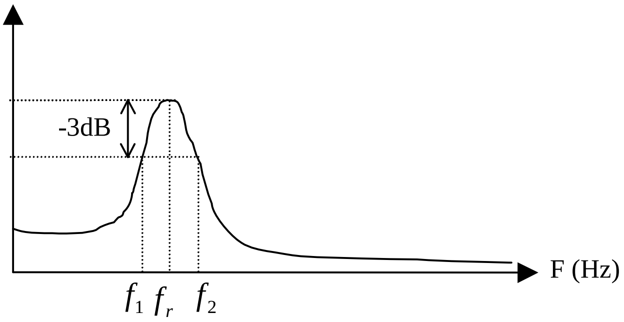
$$\varepsilon = 1 - \frac{M}{\rho \cdot d_t}$$

where: M is the Weight per unit area of the fiber material of the sample, in kg/m²
ρ is the volumic weight of the solid part of the fiber material, in kg/m^3

- Loss factor, in %:

$$\eta = \frac{\Delta f}{f_r}.100$$

with $$\Delta f = \frac{f_2 - f_1}{f_r}$$



END OF REPORT