

INSULATION TECHNICAL CERTIFICATION ACOUSTIC TO IMPACT NOISE IN WOODEN BUILDING EXPANSION OF THE TIANA INSTITUTE

Report: AA22032-3. v2

HEADLINE: AMB – TIANA TOWN HALL MECHANICAL
APPLICANT: APPLICATIONS OF RUBBER SA AVENIDA
SITE: EDUARD FONTSERÈ s/n,
08391 - TIANA (BARCELONA)

Acoustic Consultant
Jesus Uriol Chavarriga
Industrial Technical Engineer collegiate number 15.385L

July 18, 2022

This document concerns only and exclusively the samples made. Ref: AA21032-3 v2 INTITUT TIANA IMPACT INSULATION Partial reproduction of this document of 19 sheets and 2 plans is prohibited, unless expressly authorized in writing by Acústics Ambient, SL

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1. PREVIOUS DATA

1.1. APPLICANT DETAILS

Applicant: Mechanical Applications of Rubber SA
DNI. / CIF: A-20101150
Tax residence: Industrialdea Zone A. Pab 35
20159 Asteasu (Gipuzkoa)

1.2. ACTIVITY DATA

Type of activity: Extension of Secondary Education Institute
Site: Avenida Eduard Fontserè s/n,
08391 Tiana (Barcelona)
Measurement date: July 14, 2022
File No.: - -

1.3. TECHNICIAN DATA

Technical: Jesus Uriol Chavarriga
Collegiate: 15,385L
Address: Agri-food Science and Technology Park of Lleida Parc de
Gardeny, Building H2, 1st floor, office A3 25003 Lleida

1.4. OBJECT

At the request of Aplicacions Mecánicas del Caucho SA we carry out acoustic insulation measurements and draw up this technical certificate.

The object is to obtain the acoustic insulation of the measurements that have been carried out between:

either Acoustic insulation against impact noise:

- Rehearsal 01: Between Classroom E9 on the 1st floor (large) and Classroom E11 on the 1st floor (small) located immediately next door.
Horizontally adjoining enclosures.
- Rehearsal 02: Between Classroom E11 on the 1st floor (small) and the Dining room on the ground floor located immediately below the classroom.
Vertically adjoining enclosures.

1.5. LOCATION

The activity is located at:

Avenida Eduard Fontserè s/n,
08391 Tiana (Barcelona)

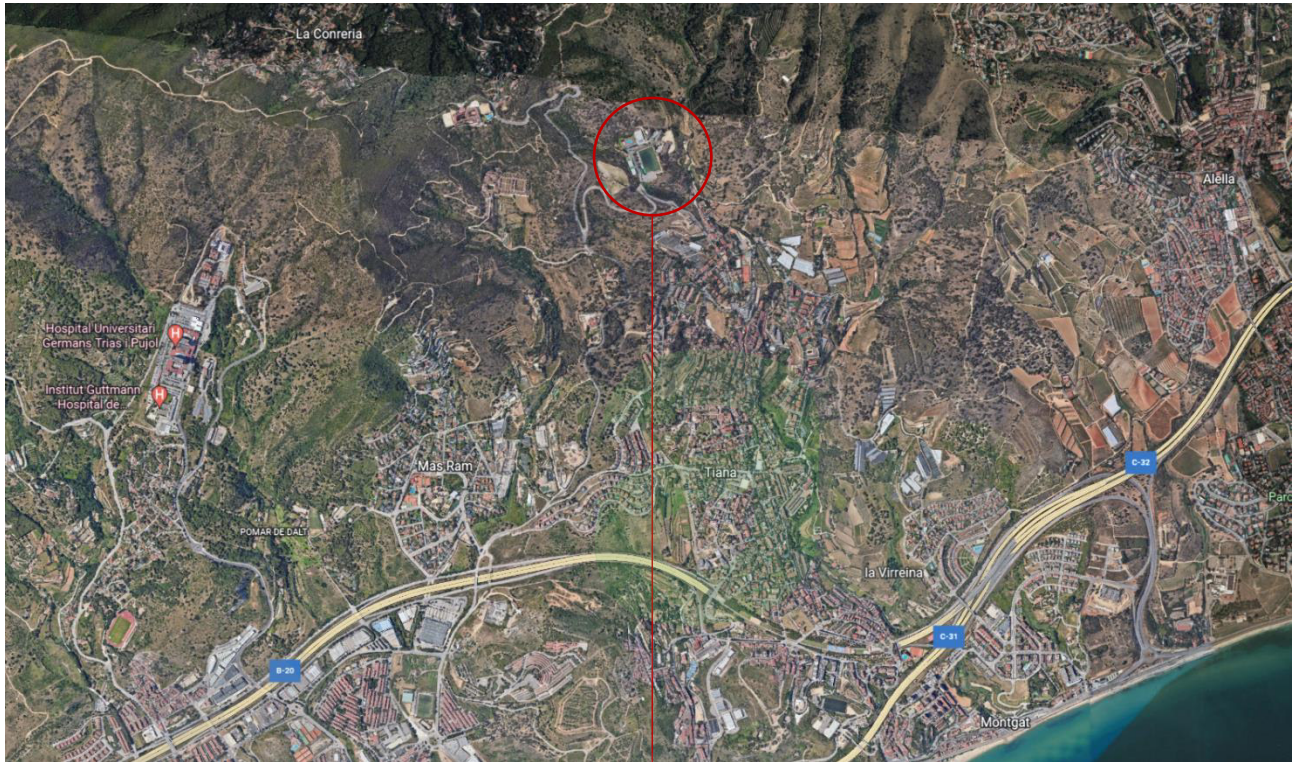


Image 1.5.1. Location general view.

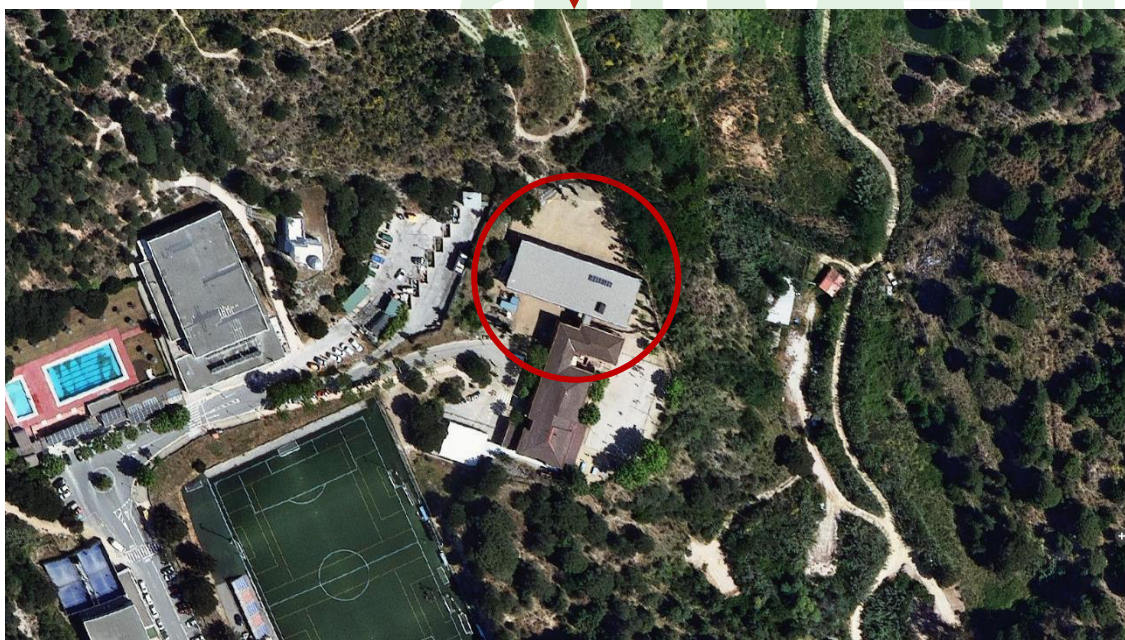


Image 1.5.2. Site.

2. REGULATIONS

This document complies with the following regulations in force:

- Decree 176/2009 of November 10, which approves the Regulation of Law 16/2002, of June 28, on protection against noise pollution, and the annexes are adapted.
- Royal Decree 1367/2007, of October 19, which develops Law 37/2003, of November 17, on Noise, in relation to acoustic zoning, quality objectives and acoustic emissions.
- Royal Decree 1371/2007, of October 19, which approves the basic document "DB-HR Protection against noise" of the Technical Building Code and modifies Royal Decree 314/2006, of March 17, with which approves the Technical Building Code.
- UNE-EN ISO 16283-2. Measurement *on-site* sound insulation in buildings and construction elements. Part 2: Impact noise insulation
- UNE-EN ISO 717-2. Evaluation of acoustic insulation in buildings and construction elements. Part 2: Impact noise insulation
- UNE-EN ISO 3382-2: Measurement of acoustic parameters in enclosures. Part 2: Reverberation time in ordinary rooms.

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3. MEASUREMENT AND EVALUATION PROCEDURE

3.1. ACOUSTIC INSULATION TEST METHOD FOR IMPACT NOISE

3.1.1. CALCULATION OF THE STANDARDIZED SOUND PRESSURE LEVEL OF IMPACT NOISE L'_n

Defined in ISO 16283 as the impact noise sound pressure level, L_i , increased by a correction expressed in decibels, equal to ten times the decimal logarithm of the quotient between the measured equivalent absorption area, A , of the receiving enclosure, and the reference equivalent absorption area, A_0 , which is calculated with the following formula when the noise source is the impact machine:

$$L'_n = L_i + 10 \log (A / A_0)$$

Where:

- A is the absorption area equivalent to the receptor enclosure;
- A_0 is the reference equivalent absorption area; for dwellings, $A_0=10m^2$.

Once the normalized sound pressure level of impact noise L'_n has been calculated for each of the positions of the impact machine, the following calculation is carried out:

$$L'_n = 10 \log [1 / m (\sum 10^{(L'_{n,j} / 10)})]$$

Where:

- m is the number of positions of the impact machine;
- $L'_{n,j}$ is the normalized sound pressure level of impact noise for the j th position of the hitting machine;

3.1.2. CALCULATION OF THE STANDARDIZED SOUND PRESSURE LEVEL OF IMPACT NOISE L'_{nT}

Defined in ISO 16283 as the impact noise sound pressure level, L_i , reduced by a correction expressed in decibels, equal to ten times the decimal logarithm of the quotient of the measured reverberation time, T , and the reference reverberation time, T_0 , which is calculated with the following formula when the noise source is the impact machine:

$$L'_{nT} = L_i + 10 \log (T / T_0)$$

Where:

- T is the reverberation time to the receiving room;
- T_0 is the reference reverberation time; for dwellings, $T_0=0.5s$.

Once the standardized impact sound pressure level L'_{nT} has been calculated for each of the positions of the impact machine, the following calculation is made:

$$L'_{nT} = 10 \log [1 / m (\sum 10^{(L'_{nT,j} / 10)})]$$

Where:

- m is the number of positions of the impact machine;
- $L'_{nT,j}$ is the standardized sound pressure level of impact noise per j th position of the hitting machine;

3.2. POSITIONS OF THE SPEAKER, THE IMPACT GENERATOR AND THE MICROPHONE

Impact generating machine positions:

- At a distance of at least 0.5m from the limits of the enclosure.
- Oriented at 45° with respect to the possible ribs of the unidirectional / waffle slabs.

Microphone positions:

- At a distance between positions of at least 0.7m.
- At a distance of at least 0.5m from the limits of the enclosure.



4. TEST - PREVIOUS DATA

4.1. TEST DAY AND TIME

The measurement date and period are defined below:

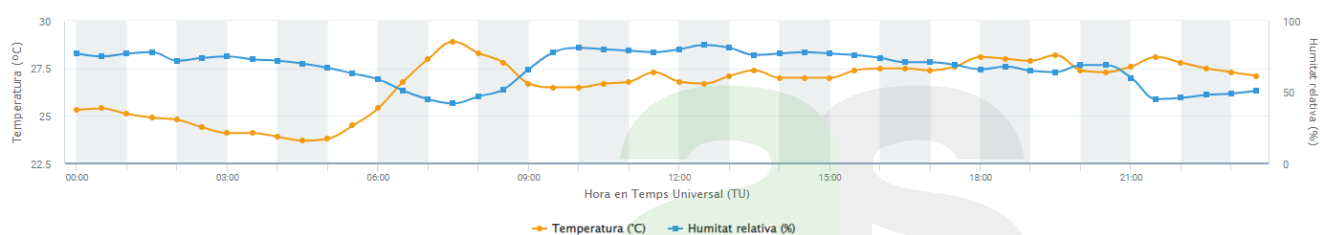
Date: July 14, 2022

Schedule: 12:40 p.m. to 1:40 p.m.

4.2. ENVIRONMENTAL CONDITIONS

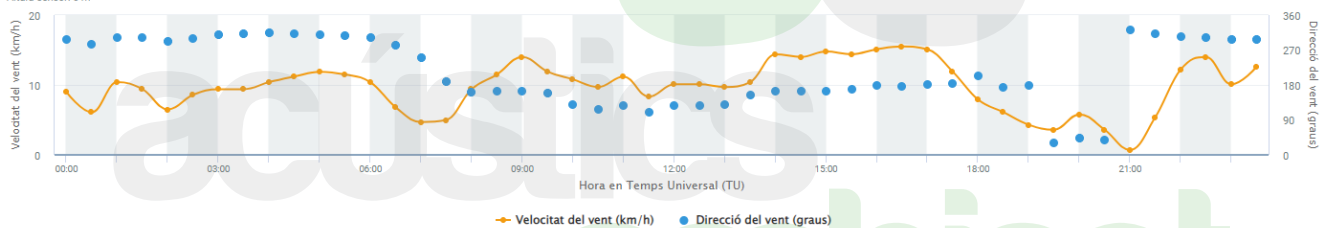
The meteorological conditions existing on the day of the measurements were as follows. We can observe that the climatic conditions could not affect the results obtained.

Temperatura / Humitat relativa



Velocitat i direcció del vent

Altura sensor: 6 m



Precipitació



Image 4.2.1. Weather data on the day of the measurements (source: meteo.cat).

4.3. DESCRIPTION OF THE DEPENDENCIES, PARTITIONS AND VOLUMES

TEST 01: ACOUSTIC INSULATION TO IMPACT NOISE:

- Emission enclosure 01 :

eitherCorresponds to the interior of Classroom E11 (large)

-(First floor)

- Surface: 55.00m^{two}
- Volume: 165.90m³

- Receiving room 01 :

eitherCorresponds to the interior of Classroom E9 (small)

-(First floor)

- Surface: 26.60m^{two}
- Volume: 80.30m³
- Partition area: 22.60m^{two}



Image 4.3.1. First floor, emitting area (in red) and receiving area (in green).

TEST 02: ACOUSTIC INSULATION TO IMPACT NOISE:

- Broadcast enclosure 02 :

eitherCorresponds to the interior of Classroom E9 (small) *-(First floor)*

- Surface: 26.60m^{two}
- Volume: 80.30m³

- Receiving room 02 :

eitherCorresponds to the interior of the dining room *-(Low level)*

- Surface: 109.70m^{two}
- Volume: 320.50m³
- Partition area: 26.60m^{two}



Image 4.3.2.First floor, emitting area (in red).

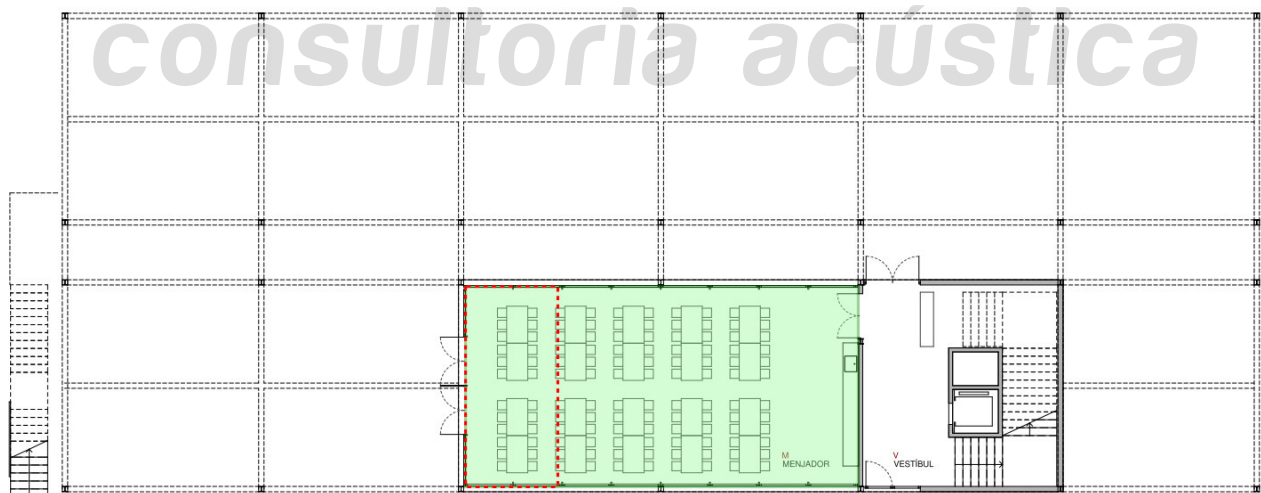


Image 4.3.3.Ground floor, reception area (in green).

4.4. TESTED CONSTRUCTIVE SOLUTION

Several sections of the constructive solution that was projected in the Acoustic Impact Study and that has been executed are attached below:

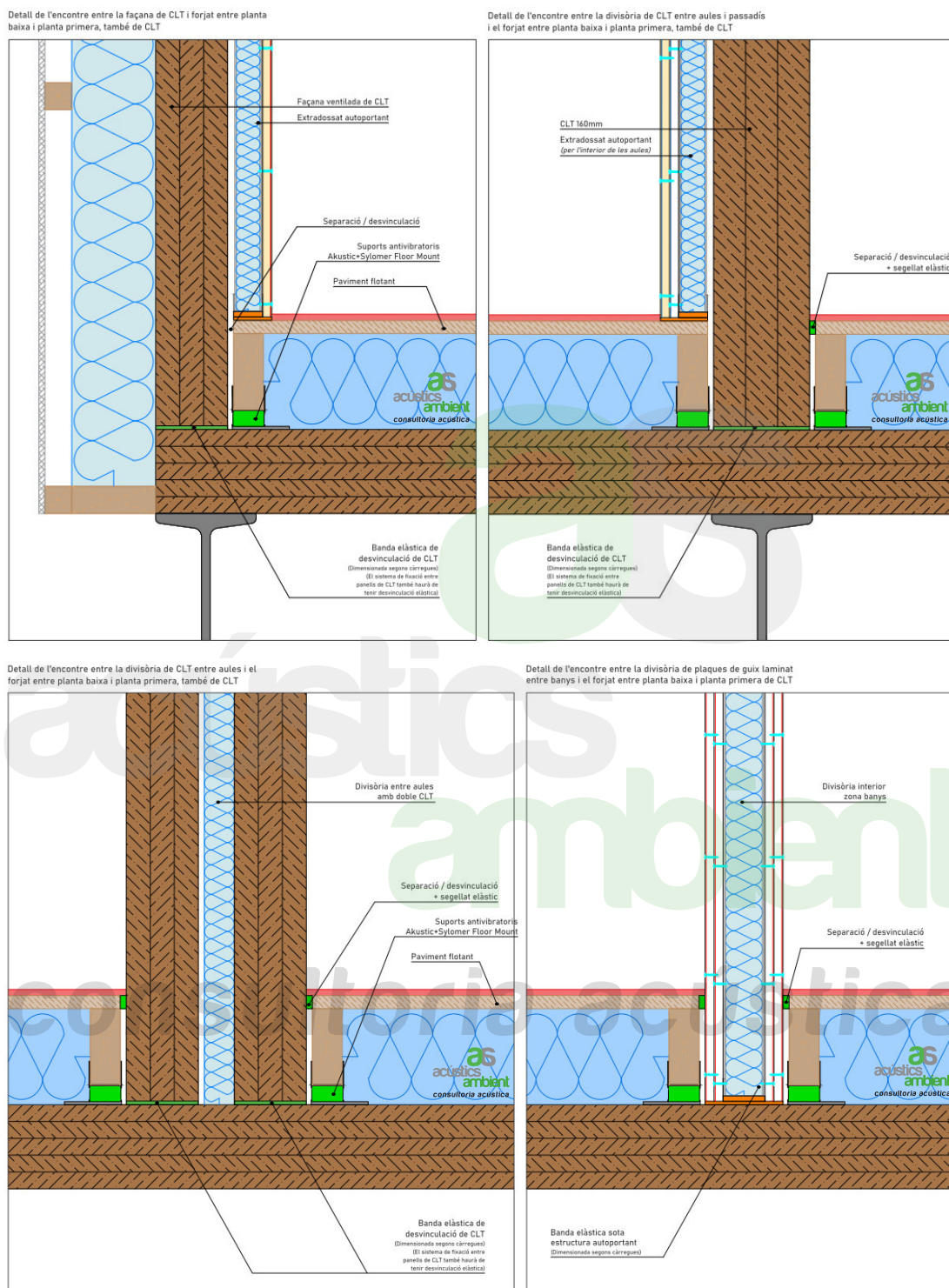


Image 4.4.1.Construction detail Acoustic Impact Study

Classroom E9 (large):



Classroom E11 (small):



Dining room M:



4.5. MEASUREMENT EQUIPMENT

Before and after the measurements, an acoustic verification of the measurement chain must be carried out using an acoustic calibrator that guarantees a deviation margin of no more than 0.5dB(A) with respect to the initial reference value, generally 94dB(A).

SOUND LEVEL METER VERIFICATION					
Brand:	Brüel & Kjær	Model:	2250	Serial number:	3009506
INITIAL CALIBRATION			FINAL CALIBRATION		
Reference level: 94.0dB(A)			Reference level: 94.0dB(A)		
Date:	07/14/2022		Date:	07/14/2022	
Hour:	12:51 p.m.		Hour:	1:37 p.m.	
Result:	93.8dB(A)		Result:	93.8dB(A)	

Table 4.5.1. Sound level meter verification

DESCRIPTION OF THE EQUIPMENT	IMAGE
Brüel & Kjær 2250 SOUND METER Integrating sound level meter and third-octave spectrum analyzer type 1: Brüel & Kjær: 2250 with integration and statistics functions, serial number 2473249 / 3009506. Brüel & Kjær 4189 MICROPHONE Microphone: Brüel & Kjær brand, model 4189, with serial number 2650828 / 2469599.	
IMPACT GENERATING MACHINE CESVA MI005 Impact generating machine: CESVA brand, model MI005, with serial number T224825.	
Brüel & Kjær CALIBRATOR 4231 Brüel & Kjær sound level calibrator: 4231, with serial number 2466236.	
ANEMOMETER Testo brand, model 410-1, with serial number 38412806/002. DISTANCE METER DeWALT brand laser distance measurer, model DW03050, with serial number 1450362011.	
ACCESSORIES Tape measure, tripod, windshield...	

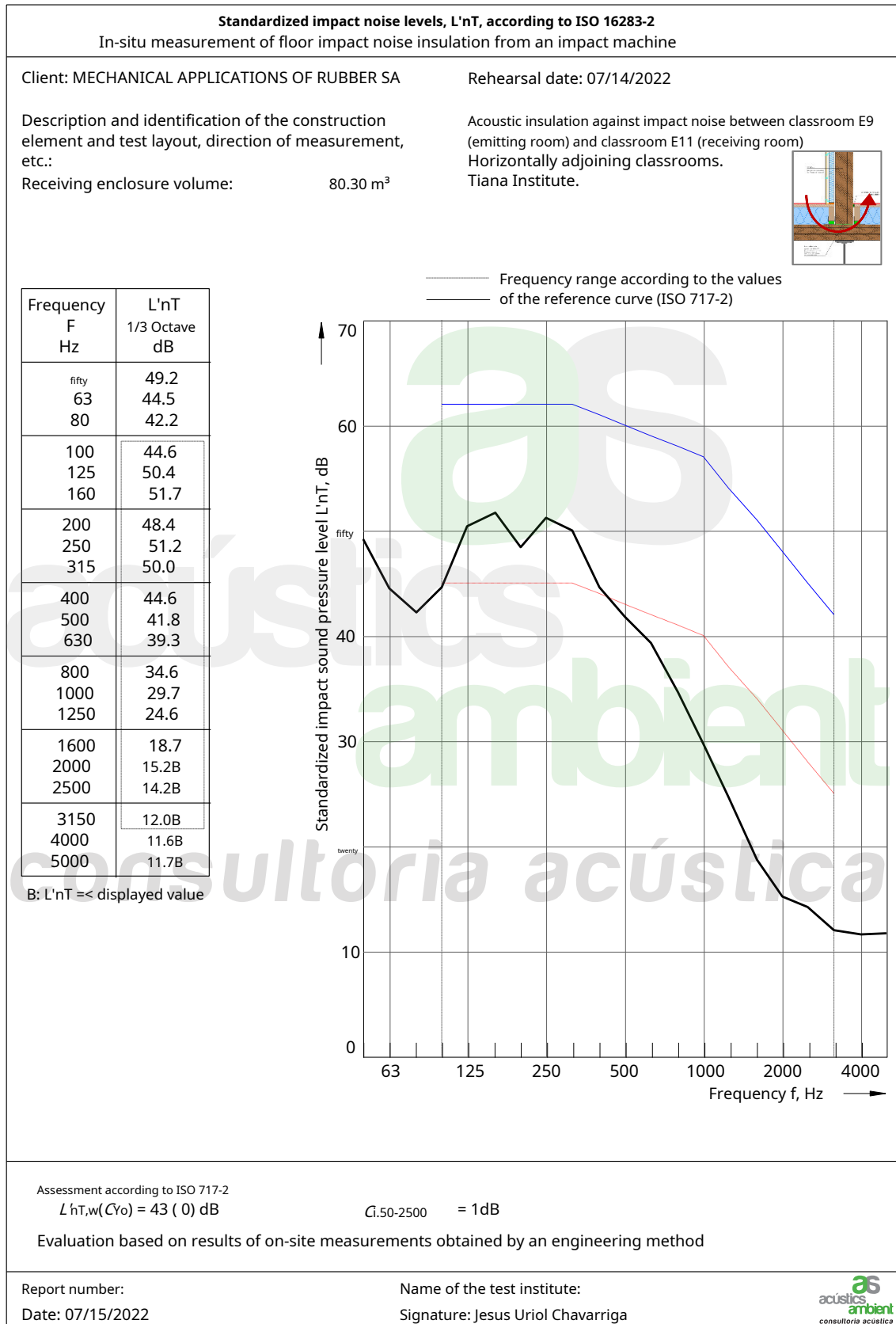
(*) The sound level meter and the calibrator have periodic verification in accordance with the criteria established in the order of September 25, 2007, of the Ministry of Public Works.

Table 4.5.2. Measurement equipment

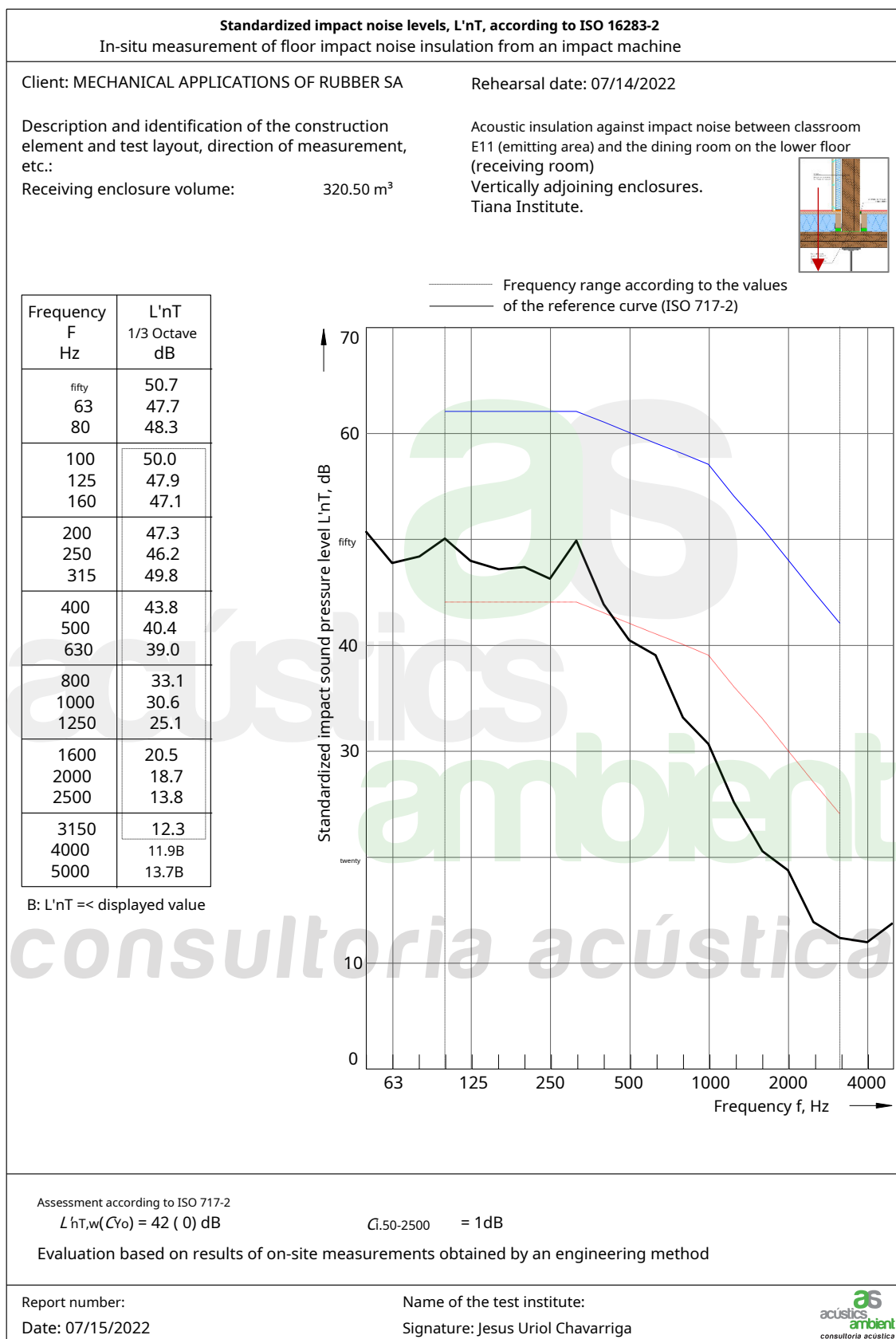
5. TEST - RESULTS

5.1. ACOUSTIC INSULATION AGAINST IMPACT NOISE

5.1.1. ANDNESSAY01:BETWEEN CLASSROOME11INP.1 (GREAT)AND CLASSROOME9INP.1 (SMALL)



5.1.2. ANDNESSAY02:BETWEEN CLASSROOME9INP.1 (SMALL)AND DINING ROOMPBABA.



6. CONCLUSIONS

With the tests carried out, we can conclude that:

The isolation to **impact noise**, measured "in situ", reaches the following levels:

Trial	L'nT,w (Ci)	L'nT,w required CTE DB-HR
Essay 01: Between Classroom E9 on the 1st floor (large) and Classroom E11 on the 1st floor (small). Horizontally adjoining enclosures.	43(0)dB	≤65dB
Essay 01: Between Classroom E11 on the 1st floor (small) and Dining room M on the ground floor. Vertically adjoining enclosures.	42(0)dB	

Lleida, July 18, 2022.

APPLICANT:

MECHANICAL APPLICATIONS OF RUBBER SA

TECHNICAL:

Acoustic Consultant
Jesus Uriol Chavarriga
Industrial Technical Engineer number of
collegiate 15,385L

ANNEX 01. VERIFICATION CERTIFICATES

CERTIFICADO DE VERIFICACIÓN

Número 00503779-V
Página 1 de 1



LGAI Technological Center, S.A. (APPLUS)
OAVM nº 02-OV-0005

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08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

INSTRUMENTO	SONÓMETRO		
SOLICITANTE	ACUSTICS AMBIENT, S.L.		
DIRECCIÓN	Parc Tecnologic de Gardeny, Ed. H2 of 1.3 25071 Lleida (Lleida)		
TIPO DE ACTUACIÓN	Ensayos de verificación periódica según Anexo XIV de la Orden ICT/155/ 2020, de 7 de febrero		
IDENTIFICACIÓN	Marca	Sonómetro BRÜEL & KJÆR	Micrófono BRÜEL & KJÆR
	Modelo	2250 (G4)	4189
	Número de serie	3009506	2469599
			Preamplificador BRÜEL & ZC 0032 2728
CARACTERÍSTICAS METROLÓGICAS	Tipo/Clase	1	Software 4.6.1
	Nivel de referencia	94,0 dB	Firmware --
	Rango de medida	26,5 - 140,7 dB	Checksum -
	Resolución	0,1 dB	
FECHAS	Verificación	Válido hasta	(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)
	2021-12-09	2022-12-09	
RESULTADO VERIFICACIÓN	FAVORABLE		
PRECINTADO	2, tornillo trasero y lateral entre carcasas		
		Entrada --	--

SIGNATARIO/S AUTORIZADO/S:
Responsable Técnico

Salida --
--
Inspector

Juanjo Sanz 09/12/2021 18:01:18
Código Seguro de Verificación (CSV): 516884928CSB5

Jordi Messeguer Morales
09/12/2021 15:12:22

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Este certificado se expide de acuerdo con las condiciones de la acreditación concedida por ENAC, que ha comprobado las capacidades de medida del laboratorio y su trazabilidad metrológica al Sistema Internacional de Unidades (SI).
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CERTIFICADO DE VERIFICACIÓN

Número 00503781-V
Página 1 de 1



LGA Technological Center, S.A. (APPLUS)
OAVM nº 02-OV-0005

Ronda de la Font del Carme, s/n
08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

INSTRUMENTO	CALIBRADOR ACÚSTICO		
SOLICITANTE	ACUSTICS AMBIENT, S.L.		
DIRECCIÓN	Parc Tecnologic de Gardeny, Ed. H2 of 1.3 25071 Lleida (Lleida)		
TIPO DE ACTUACIÓN	Ensayos de verificación periódica según Anexo XIV de la Orden ICT/155/ 2020, de 7 de febrero.		
IDENTIFICACIÓN	Marca	BRÜEL & KJAER	
	Modelo	4231	
	Número de serie	2466236	
CARACTERÍSTICAS METROLÓGICAS	Tipo/Clase	1	Software --
	Nivel/es nominal/es	94,0 / 114,0 dB	Finware --
	Frecuencia nominal	1000, Hz	Checksum -
FECHAS	Verificación	Válido hasta	(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)
	2021-12-09	2022-12-09	
RESULTADO VERIFICACIÓN	FAVORABLE		Entrada 07-OV-0031387 07-OV-0031388
PRECINTADO	2, 1 sobre tapa, 1 lateral		Salida 07-OV-0031387 07-OV-0031388

SIGNATARIO/S AUTORIZADO/S:
Responsable Técnico

Inspector

Juanjo Sanz 09/12/2021 18:01:32
Código Seguro de Verificación (CSV): 908821035JPW6

Jordi Messeguer Morales
09/12/2021 15:12:25

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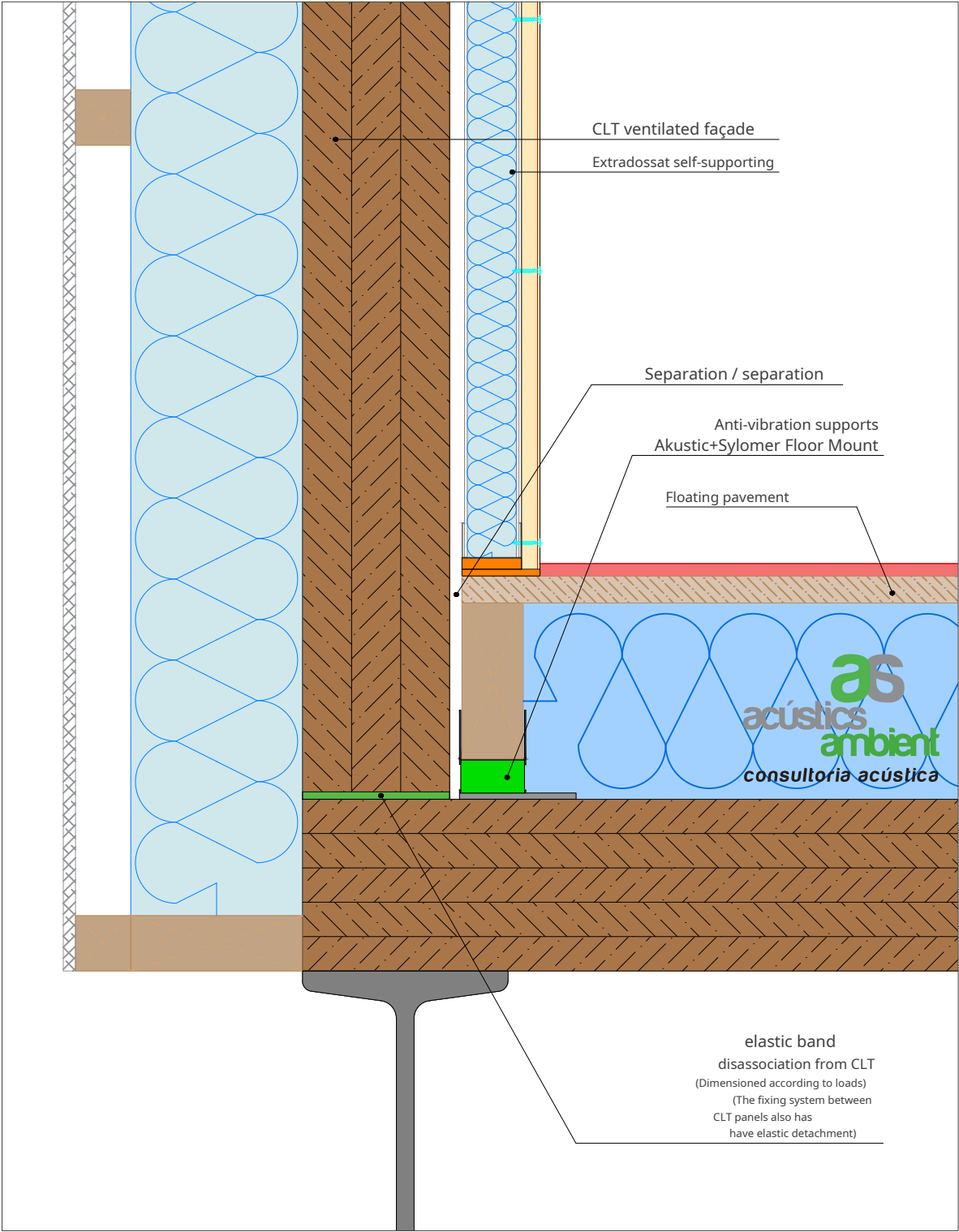


Este certificado se expide de acuerdo con las condiciones de la acreditación concedida por ENAC, que ha comprobado las capacidades de medida del laboratorio y su trazabilidad metrológica al Sistema Internacional de Unidades (SI).
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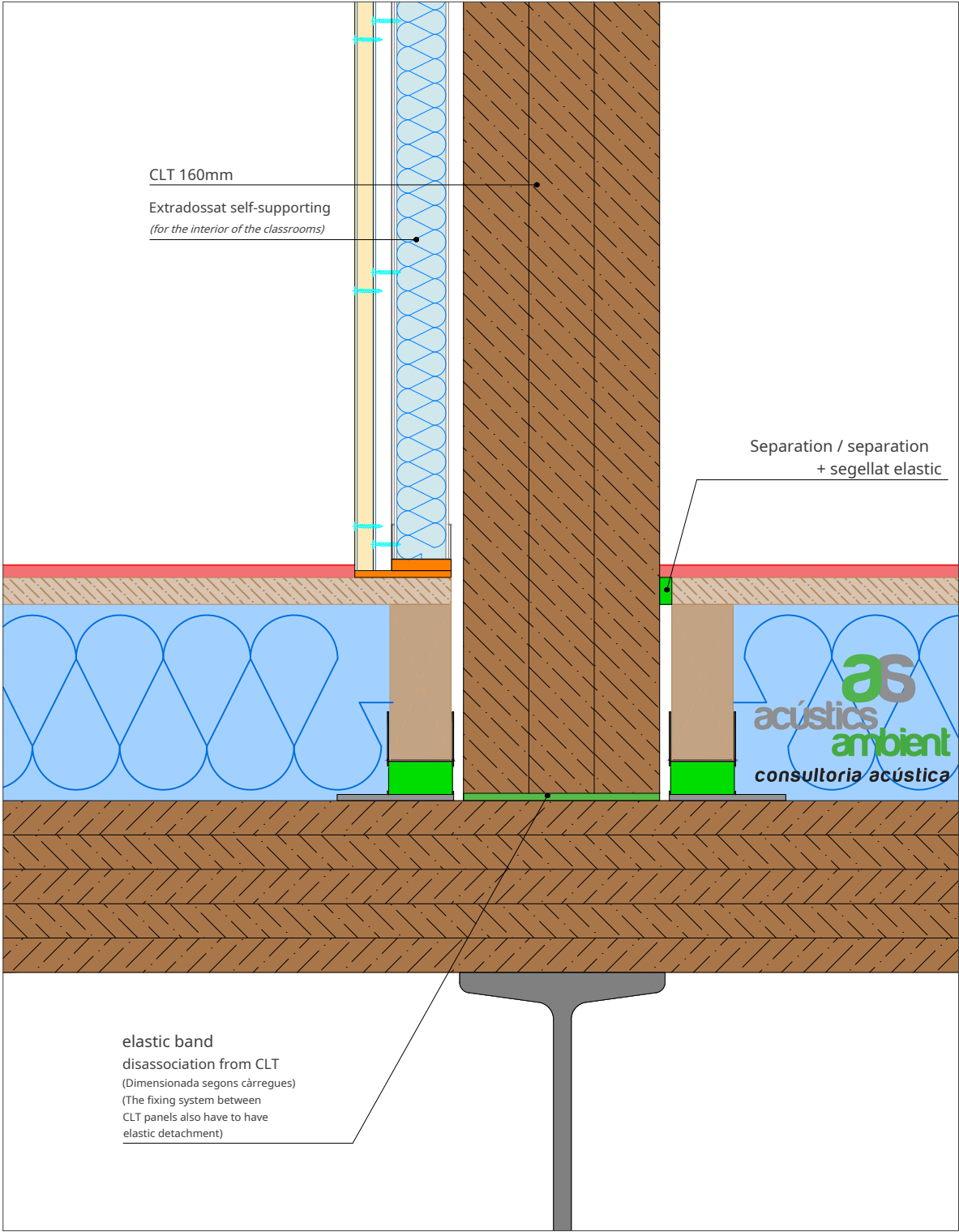
ANNEX 02. CONSTRUCTION DETAIL OF THE PROJECT



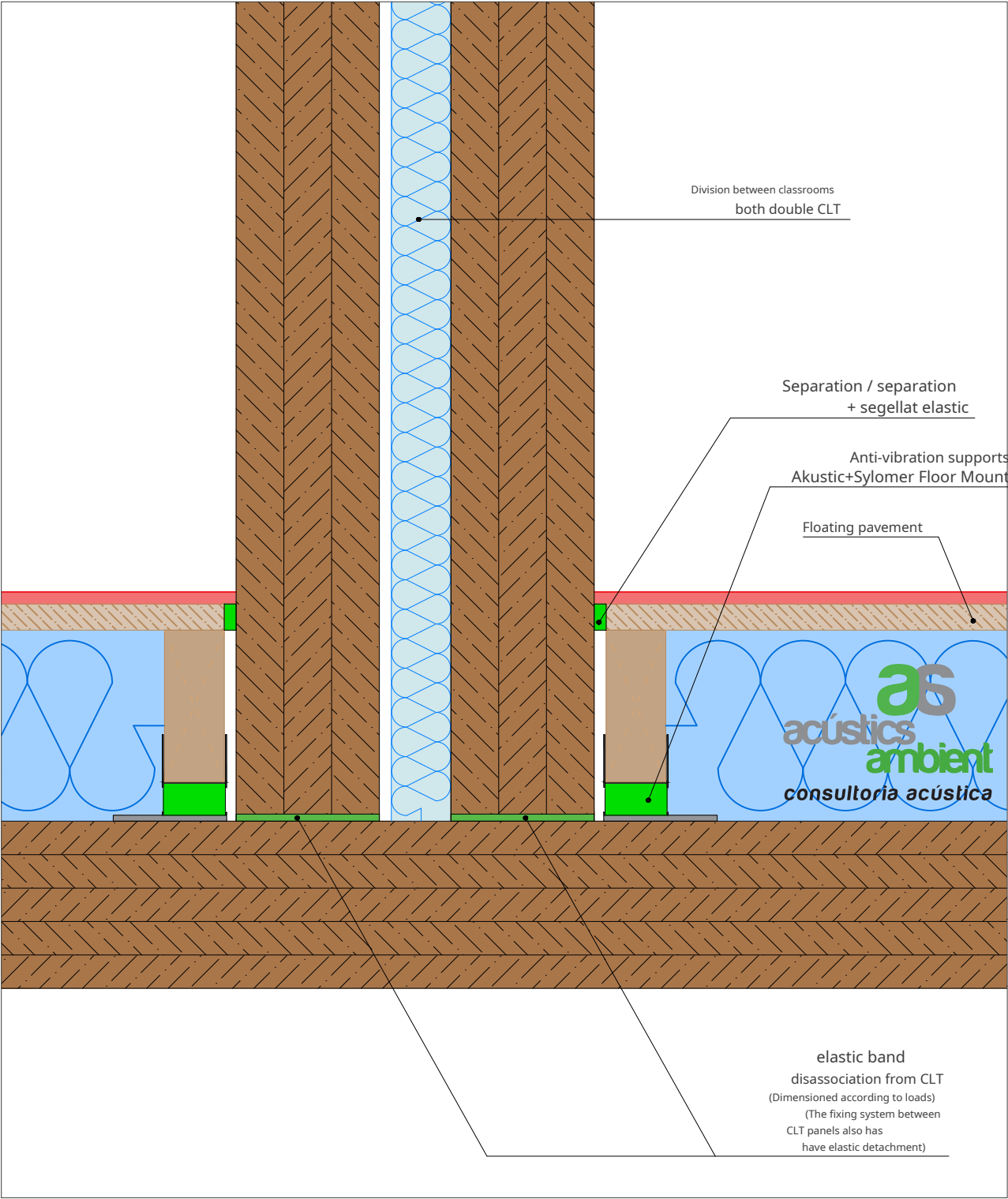
Details of the encounter between the CLT façana and the forjat between the ground floor and the first floor, also of CLT



Details of the encounter between the CLT division between classrooms and hallways and the forge between the ground floor and the first floor, also of CLT



Detail of the encounter between the CLT division between classrooms and the forge between the ground floor and the first floor, also of CLT



Detail of the encounter between the partition of guix laminate plates between banys and the wrought iron between the ground floor and the first floor of CLT

