T E S T R E P O R T

ASTM E 90: Laboratory Measurement of Airborne Sound Transmission of Building Partitions and Elements
ASTM E 492: Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine

Orfield Laboratories Inc

Design Research Testing
Acoustics / Vibration / Vision / Lighting / Architecture / Market Research

TEST
Client: **Saint-Gobain Performance Plastics**
Report Date: February 14, 2014
Test Date: July 9, 2009
Test Number: OL09-0709

RESULT SUMMARY

STC=62
IIC=55

CLIENT ADDRESS
Saint-Gobain Performance Plastics
Green Glue Division
One Sealants Park
Granville, NY 12832
Phone (800) 724-0883
www.greengluecompany.com

ACCREDITATION
NVLAP
For the scope of accreditation under NVLAP code 200248-0

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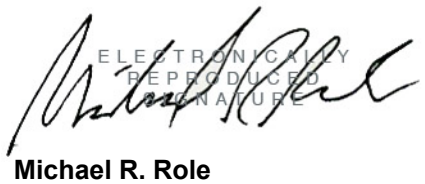


Michael R. Role

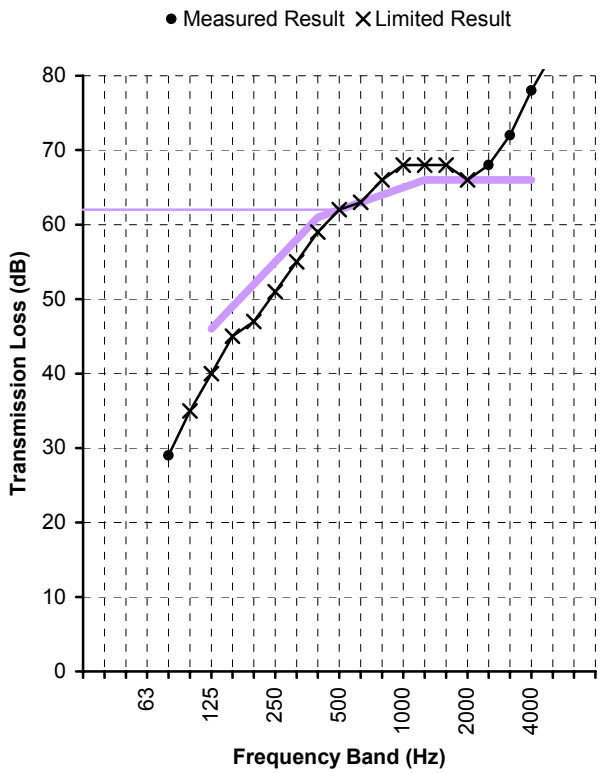
Signatures are required on this document for an official laboratory test report. Copies of this document without signatures are for reference only.

Orfield Laboratories Inc

Test Date July 9, 2009
Specimen Floor / Ceiling

Method ASTM Standard E90
Technician D. Berg

Single Number Rating
STC = 62



Freq. (Hz)	TL (dB)	Def. (dB)
80	29	
100	35*	
125	40*	6
160	45*	4
200	47*	5
250	51*	4
315	55*	3
400	59*	2
500	62*	-
630	63*	-
800	66*	-
1000	68*	-
1250	68*	-
1600	68*	-
2000	66*	-
2500	68	-
3150	72	-
4000	78	-
5000	83*	
Total Deficiencies		24

* Estimate of lower limit

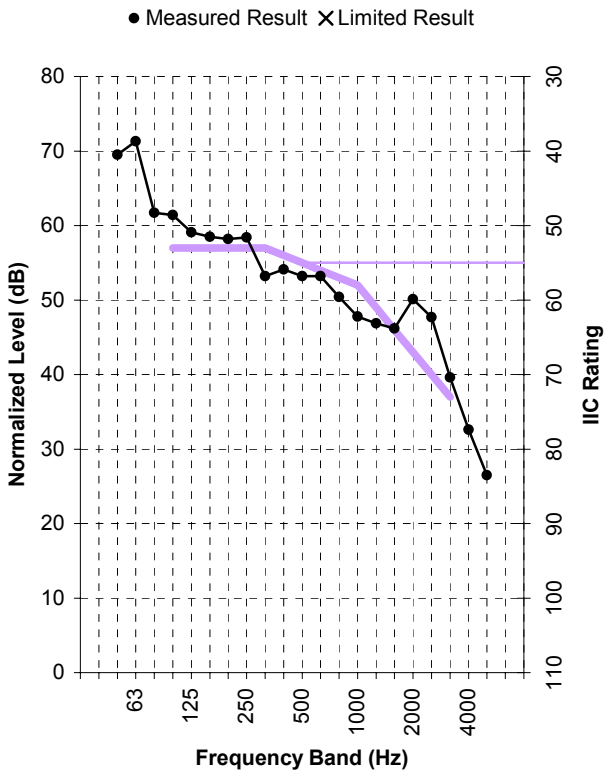
Assembly Elements (listed in order from source room side to receiver room side)

2"x2" ceramic tile raft (187.5 ft.)
with acryllic tile adhesive and sanded grout
0.5" Engineered tile backer-board (187.5 ft.); floating
1.5" (2 x 3/4") OSB GG Sandwich; 2" #9 Screw @ 12" O.C.
2 x 10 wood joists @ 16" O.C.
6.25" R19 kraft-faced CertainTeed glass fiber batt insulation
Deitrich RC Deluxe @ 24" O.C.; 1.25" drywall screw @ 24" O.C.
0.625" Type X gypsum board; 1.625" drywall screw @ 12" O.C.

Orfield Laboratories Inc

Test Date July 9, 2009 **Method** ASTM Standard E492
Specimen Floor / Ceiling

Single Number Rating
IIC = 55



Freq. (Hz)	L_n (dB)	Dev. (dB)
50	69	
63	71	
80	62	
100	61	4
125	59	2
160	59	2
200	58	1
250	58	1
315	53	-
400	54	-
500	53	-
630	53	-
800	50	-
1000	48	-
1250	47	-
1600	46	-
2000	50	7
2500	48	8
3150	40	3
4000	33	
5000	26	
Total Deviations		28

Assembly Elements (listed in order from source room side to receiver room side)

2"x2" ceramic tile raft (187.5 ft.)
with acryllic tile adhesive and sanded grout
0.5" Engineered tile backer-board (187.5 ft.); floating
1.5" (2 x 3/4") OSB GG Sandwich; 2" #9 Screw @ 12" O.C.
2 x 10 wood joists @ 16" O.C.
6.25" R19 kraft-faced CertainTeed glass fiber batt insulation
Deitrich RC Deluxe @ 24" O.C.; 1.25" drywall screw @ 24" O.C.
0.625" Type X gypsum board; 1.625" drywall screw @ 12" O.C.

SPECIMEN DESCRIPTION

The specimen under test was a floor / ceiling assembly. The elements in the assembly are described briefly below the results table and chart on pages 2 and 3. Detailed information regarding the specimen may be found in Appendix C.

Test results pertain to this specimen only.

INSTALLATION AND DISPOSITION

The wood joist floor was originally constructed in early June of 2010. The framing and insulation were retained from previous tests and used for subsequent tests in the series. Independent contractors fabricated the test specimen and sealed it in the specimen opening. Qualified representatives of Orfield Laboratories observed the installation progress, and visually inspected the specimen prior to testing.

TEST METHODS

The methods followed these published standards:

ASTM E90-04*: *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements*

ASTM E413-04: *Classification for Rating Sound Insulation*

ASTM E492-04*: *Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine*

ASTM E1332-90: *Standard Classification for Determination of ImpactInsulation Class (IIC)*

The values presented in this report are from single-direction transmission loss measurements.

** Orfield Laboratories, Inc. has been accredited by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) under their National Voluntary Laboratory Accreditation Program (NVLAP) for this test procedure. This report shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the U.S. Government.*

CONFIDENTIALITY

The client has full control over this information and any release of information will be only to the client. The specific testing results are deemed to be confidential exclusively for the client's use. Reproduction of this report, except in full, is prohibited.

APPENDIX A: MEASUREMENT SETUP

Environment	
Temperature	70°F [21.1°C]
Relative Humidity	55%

Specimen Area	
Specimen Area	176.8 ft² [16.43 m²]

Chamber Volume - Airborne Transmission	
Source Room Volume	2035 ft³ [57.6 m³]
Receiving Room Volume	8123 ft³ [230.0 m³]

Chamber Volume - Impact Transmission	
Source Room Volume	8123 ft³ [230.0 m³]
Receiving Room Volume	2035 ft³ [57.6 m³]

INSTRUMENTATION

Description	Brand	Model	S/N
Calibrator	Brüel & Kjær	Type 4230	584761
Microphone	Brüel & Kjær	Type 4134	558007
Preamplifier	Brüel & Kjær	Type 2639	1202479
Rotating Boom	Brüel & Kjær	Type 3923	2036583
Microphone	Brüel & Kjær	Type 4134	1478843
Preamplifier	Brüel & Kjær	Type 2639	1312237
Rotating Boom	Brüel & Kjær	Type 3923	890569
Analyzer	Brüel & Kjær	Type 2133	1389369

APPENDIX B: CALCULATION RESULTS

Freq. Band (Hz)	Specimen T.L. (dB)	95% Conf. (dB)	Flanking Limit (dB)	STC Defic. (dB)
25				
31.5	**34.4** §		40	
40	**21.4**		47	
50	**22.2**		43	
63	**32.7**		43	
80	**29.2**	±1.63	42	
100	**35.0** §	±1.15	45	
125	**40.4** §	±0.95	46	6
160	**44.9** §	±1.27	52	4
200	**47.2** §	±1.24	53	5
250	**50.9** §	±0.65	56	4
315	**54.9** §	±0.65	60	3
400	**59.3** §	±0.62	61	2
500	**62.0** §	±0.40	65	-
630	**63.2** §	±0.50	66	-
800	**66.2** §	±0.40	69	-
1000	**67.7** §	±0.25	70	-
1250	**68.0** §	±0.25	72	-
1600	**68.5** §	±0.32	72	-
2000	**66.1** §	±0.44	74	-
2500	**67.6**	±0.35	79	-
3150	**72.1**	±0.31	83	-
4000	**78.4**	±0.49		-
5000	**82.5** *	±0.35		
6300	**80.7** *			
8000	**77.2** *			
10000	**70.4** *			
Total deficiencies below STC contour (dB)				24
STC contour [ASTM E413]				**62**

* Actual transmission loss of specimen may be higher than measured at this frequency band. Signal-to-noise in the receiving room less than 5 dB, therefore the result is "an estimate of the lower limit".

§ Actual transmission loss of specimen may be higher than measured at this frequency band. Result within 10 dB of flanking limit found in separate study, therefore the result may be "potentially limited by the laboratory" due to flanking around the specimen.

Note: 95% Confidence from room qualification data. Flanking Limit from chamber flanking measurements. Data available upon request. Extended frequency results below 80Hz and above 5000Hz for reference only.

Freq. Band (Hz)	Normalized Level (L_n) (dB)	95% Confidence (dB)	IIC Deviations (dB)
25			
31.5	**59.9**		
40	**61.9**		
50	**69.5**	±0.5	
63	**71.3**	±0.6	
80	**61.7**	±0.7	
100	**61.4**	±0.4	4
125	**59.1**	±0.2	2
160	**58.5**	±0.8	2
200	**58.2**	±1.1	1
250	**58.4**	±0.5	1
315	**53.2**	±0.5	-
400	**54.1**	±0.4	-
500	**53.2**	±0.3	-
630	**53.2**	±0.2	-
800	**50.4**	±0.1	-
1000	**47.8**	±0.2	-
1250	**46.9**	±0.2	-
1600	**46.2**	±0.1	-
2000	**50.1**	±0.1	7
2500	**47.7**	±0.1	8
3150	**39.6**	±0.2	3
4000	**32.6**	±0.2	
5000	**26.5**	±0.3	
6300	**22.1** *		
8000	**20.3** *		
10000	**20.0** *		
Total deviations above IIC contour			28
IIC contour (ASTM E989)			**55**

* Actual impact isolation of specimen may be higher than measured at this frequency band. Signal-to-noise in the receiving room less than 5 dB, therefore the "background noise level was too high".

Note: 95% Confidence from room qualification data. Data available upon request. Extended frequency results below 50Hz and above 5000Hz for reference only.

APPENDIX C: SPECIMEN ASSEMBLY DESCRIPTION

The following table shows the description of the floor / ceiling assembly.

Overall Mass = 2684.8 lb [1217.8 kg]
Overall Surface Density = 15.18 PSF [74.14 kg/m²]

Element	Mass lb [kg]	Surf. Dens. PSF [kg/m²]
2"x2" ceramic tile raft (187.5 ft.)	901.0 [408.7]	5.10 [24.88]
with acryllic tile adhesive and sanded grout		
0.5" Engineered tile backer-board (187.5 ft.); floating	313.6 [142.2]	1.77 [8.66]
1.5" (2 x 3/4") OSB GG Sandwich; 2" #9 Screw @ 12" O.C.	813.3 [368.9]	4.60 [22.46]
2 x 10 wood joists @ 16" O.C.	183.0 [83.0]	1.04 [5.05]
6.25" R19 kraft-faced CertainTeed glass fiber batt insulation	52.5 [23.8]	0.30 [1.45]
Deitrich RC Deluxe @ 24" O.C.; 1.25" drywall screw @ 24" O.C.	20.0 [9.1]	0.11 [0.55]
0.625" Type X gypsum board; 1.625" drywall screw @ 12" O.C.	401.4 [182.1]	2.27 [11.08]

TILE RAFTS

2”x2” ceramic tiles were attached to 36” x 60” pieces of ½” thick engineered tile-backer board. The tiles were attached to the backer-board with acrylic tile adhesive. The tiles were then grouted with sanded tile grout. The pre-prepared and pre-dried tile rafts were floated (no fasteners) on top of the sub-floor assembly. The seams between the tile rafts were not treated.

FRAMING AND SUB-FLOOR

The laminated Green Glue sub-floor panels were supplied by the client. All other construction materials were acquired by the construction contractors through construction material suppliers. The framing and sub-floor were constructed for previous tests in this series for this client, and portions of this specimen assembly were used in subsequent tests in the series. In order to maximize the volume of the lower reverberation room (impact receiver room, airborne source room), the 2 x10 framing was constructed above the floor test opening and rested on its perimeter. The 2x10 joists were spaced at 16” O.C. The exposed vertical perimeter of the rim joists was covered by several additional layers of materials to prevent airborne flanking through the sides of the test sample. The additional layers consisted of a second 2x10 joist screwed in place and damped with Green Glue damping adhesive. Over that a 1” sandwich (2 x .5”) of Green Glue-damped cement board was attached with screws. All gaps and seams were filled with Green Glue Noiseproofing Sealant.

The sub-flooring was 2 layers of tongue-and-groove OSB laminated with Green Glue. The OSB sandwiches were fastened directly to the joists with 2”, #9 screws spaced 12”. The seams of the sub-floor were sealed with Green Glue Noiseproofing Sealant. The OSB sandwiches were laminated with Green Glue at approximately 1.8 oz per square foot. The panels were pre-assembled and dried longer than the period required by ASTM E90.

INSULATION

6-1/4” Kraft-faced glass fiber insulation batts were friction fit in each joist cavity. The insulation batts had an R-value of R19.

RESILIENT CHANNELS

Resilient Channels were installed perpendicular to the joists at 24” on center. The channels were attached to the joist bottoms with 1-1/4” type W screws. The channel was Dietrich RC Deluxe and was purchased through retail channels.

CEILING

The finished ceiling was Type X gypsum board, fastened to the resilient channel with 1-5/8” screws, spaced 12” on-center. The gypsum board seams were sealed with Green Glue Noiseproofing Sealant. The perimeter of the ceiling was sealed with Green Glue Noiseproofing Sealant and 7/8” dense putty tape.

APPENDIX D: SINGLE-NUMBER CALCULATION TO ISO 717-1

Freq. Band (Hz)	R_i ($R_i \equiv$ TL) (dB)	Ref Curve (dB)	Unfav. Deviat. (dB)	L_{i1} Spectrum (dB)	$L_{i1} - R_i$ Level (dB)	L_{i2} Spectrum (dB)	$L_{i2} - R_i$ Level (dB)
50	**22.2**						
63	**32.7**						
80	**29.2**						
100	**35.0**	43	8.0	-29.0	-64.0	-20.0	-55.0
125	**40.4**	46	5.6	-26.0	-66.4	-20.0	-60.4
160	**44.9**	49	4.1	-23.0	-67.9	-18.0	-62.9
200	**47.2**	52	4.8	-21.0	-68.2	-18.0	-65.2
250	**50.9**	55	4.1	-19.0	-69.9	-15.0	-65.9
315	**54.9**	58	3.1	-17.0	-71.9	-14.0	-68.9
400	**59.3**	61	1.7	-15.0	-74.3	-13.0	-72.3
500	**62.0**	62	-	-13.0	-75.0	-12.0	-74.0
630	**63.2**	63	-	-12.0	-75.2	-11.0	-74.2
800	**66.2**	64	-	-11.0	-77.2	-9.0	-75.2
1000	**67.7**	65	-	-10.0	-77.7	-8.0	-75.7
1250	**68.0**	66	-	-9.0	-77.0	-9.0	-77.0
1600	**68.5**	66	-	-9.0	-77.5	-10.0	-78.5
2000	**66.1**	66	-	-9.0	-75.1	-11.0	-77.1
2500	**67.6**	66	-	-9.0	-76.6	-13.0	-80.6
3150	**72.1**	66	-	-9.0	-81.1	-15.0	-87.1
4000	**78.4**						
5000	**82.5**						
		Sum =	31.4	$R_{A,1}$ =	58.7	$R_{A,2}$ =	52.6
		R_W =	**62**	**C =**	**-3**	**C_{tr} =**	**-9**

$Rw\ (C\ ;\ Ctr) = 62\ (-3\ ;\ -9)$

$Rw\ (C\ ;\ Ctr\ ;\ C\,50\text{-}3150\ ;\ Ctr,\,50\text{-}3150) = 62\ (-3\ ;\ -9\ ;\ -6\ ;\ -18)$

$Rw\ (C\ ;\ Ctr\ ;\ C\,100\text{-}5000\ ;\ Ctr,100\text{-}5000) = 62\ (-3\ ;\ -9\ ;\ -2\ ;\ -9)$

$Rw\ (C\ ;\ Ctr\ ;\ C\,50\text{-}5000\ ;\ Ctr,\,50\text{-}5000) = 62\ (-3\ ;\ -9\ ;\ -5\ ;\ -18)$

Note: The calculations in ISO 717-1 are performed based on assumed equivalency of the ASTM and the corresponding ISO test methods. The test herein is performed according to the ASTM standards. Orfield Laboratories *does not* hold accreditation for ISO 140 or ISO 717 under their NVLAP scope of accreditation.

The spectrum adaptation terms C and C_{tr} characterize performance against two specific sound sources, A-weighted pink noise and A-weighted traffic noise respectively. The standard ISO 717-1 includes a discussion of “Use of Spectrum Adaptation Terms” in Annex A (informative).

Each spectrum adaptation term may additionally be reported with extended frequency bands included. A calculation for the primary frequency range is shown above, but all available extended-frequency calculations were performed to compare against corresponding ratings of other specimens