Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 14726	**Project Address:** 7119 SE Milwaukie Ave
Hearing Date: 3/8/17	**Appellant Name:** Jennifer Nye
Case No.: B-008	**Appellant Phone:** 5032236693
Appeal Type: Building	**Plans Examiner/Inspector:** Natalie Davis
Project Type: commercial	**Stories:** 4 **Occupancy:** R-2, S-2, A-2, A-3 **Construction Type:** I-A, V-A
Building/Business Name: Sellwood Mixed Use	**Fire Sprinklers:** Yes - throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 16-289044-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5]	**Proposed use:** Mixed Use Apartment Building

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	1207 Sound Transmission
Requires	STC ratings tested in accordance with ASTM E 90 and IIC transmission tested in accordance with ASTM E 492.
Proposed Design	Provide STC and IIC ratings evaluated by a licensed acoustical engineer specific to the floor/wall assemblies proposed. Floor assembly 5, 7, 8; wall assembly 43.
Reason for alternative	The assemblies were based on reaching a 1-hr fire rating but the rated assemblies contain the components that are not proposed in our project (cushioned sheet vinyl) or do not have associated sound test. The analysis provided by the professional acoustical engineer provides an equivalent assurance of sound performance to at tested/listed assembly.

Appeal item 2

Code Section	703.2 Fire-resistive ratings
Requires	The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263 or in accordance with 703.3.

Proposed Design	We have proposed a 3x decking with ½" plywood over the commercial spaces in lieu of a listed 1-hr floor assembly, a fire engineer's letter is attached.
Reason for alternative	For the commercial space we wanted a more open post/beam look with exposed deck while maintaining a 1-hr fire rating. The proposed use of alternative materials provide equivalent fire ratings based the fire engineer's letter.

Appeal item 3

Code Section	1812 Radon Control
Requires	Section 1812.1 Scope. The provisions of this section apply to new Group R-2 and R-3 occupancies constructed in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties for which initial building permits are issued on or after April 1, 2011 Section 1812.3.2 – Subfloor Preparation. A layer of gas permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a sub-slab depressurization system, if needed. Section 1812.3.3 – Soil-gas-retarder. A minimum 6-mil polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. Section 1812.3.6 – Passive subslab depressurization system (basement or slab-on-grade). In basement or slab-on-grade buildings, subslab soil exhaust system ducts complying with Section 1812.3.7 shall be installed during construction… Section 1812.3.7 – Subslab soil exhaust system ducts (SSESD). SSESD's shall be provided in accordance with this section and shall run continuous from below the soil-gas-retarder to the termination point described in section 18.12.3.7.5…
Proposed Design	We have proposed a 4-story apartment building over a basement garage with a section of the building having on-grade commercial space and 3-stories of apartments above. No residential units are slab-on-grade. The basement level is a mechanically ventilated garage and support spaces that are either mechanically ventilated or naturally ventilated meeting the requirements of the OSSC. The unfinished commercial shell space will meet, at a minimum, a ventilation rate per (IMC 403.3). With the proposed system, all spaces between the slab-on-grade conditions and the residential/living areas will be ventilated at a rate that exceeds that which is required for Radon Control with a Passive Subslab depressurization system.
Reason for alternative	The code compliant mechanical ventilation systems for the ground floor uses of retail, restaurant, and support spaces meet the requirements of the mechanical code. We propose that due to the ground floor spaces having ventilation and exhaust rates that exceed that which is required for radon control, that the building meets or exceeds the intention of the code to prevent radon gas impacts to residential spaces.

Appeal item 4

Code Section	510.2 Horizontal building separation allowance
Requires	The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 3 hours.
Proposed Design	We have proposed to separate our residential floor area into two buildings to allow us to have two V-A buildings separated by a fire wall. The fire wall sits on a I-A podium (cast-in-place concrete) with a 3 hour rating using the provision of section 510.2. We have proposed a 3 hour horizontal assembly separating the basement from the upper levels of the building but turned the 3 hour separation down to a wall generally where the basement meets the slab-on-grade area. The two locations where the 3-hour wall does not follow this elevation difference are the exit passageway and NE stair. We made exceptions at these two locations based on wanting the keep the exit passageway within the building it is primarily serving and the NE Stair because it the edge of the concrete enclosure at this edge due to the stair shaft. Section 510.2 allows vertical penetrations through the 3 hour horizontal assembly to be 2-hour rating with 90-minute openings. We have proposed the western stair shafts be 3-hour rated with 180 minute doors. The NE Stair & Exit Passageway will have a 3-hr wall at the building separation line with 180-minute door. The opening separating the Street Lobby and the Lower Lobby will have a 180-minute horizontal sliding, accordion folding fire door. The elevator shafts will be separated from the basement by 3 hour walls with 90-minute doors and separate smoke curtains. The smoke curtains and the horizontal sliding, accordion folding fire door will be connected the fire alarm system. In addition we propose to provide a fire sprinkler head within 5-feet of the elevator doors.
Reason for alternative	The basement level sits below the street grade of the commercial spaces, we needed to transition the fire separation vertically at some location. We considered turning the rating up and encompassing the commercial spaces within the lower building but this posed structural challenges and we did not believe that it created a safer building than what we have proposed. The building has aerial fire apparatus access on the two long sides and four stairs connecting the building vertically, the SE stair provides roof access through a roof hatch. The building has a sprinkler system throughout. The horizontal separation is not being used for additional building height. Based on these considerations we believe the prosed 3-hr wall and associated opening protections provide an equivalent level of fire safety.

APPEAL DECISION

1. Sound transmission rating at wall and floor-ceiling assemblies per Engineered analysis: Granted as proposed for wall assembly and joisted floor assemblies. HOLD for additional clarification of heavy timber floor assembly.

2. Alternate method for determining 1 hour fire resistance rating of exposed floor/ceiling assembly: Granted provided the clear spans are 5'-3" supporting public areas and 6'-9" maximum supporting residential uses.

3. Omission of radon control measures in mixed use building: Granted as proposed and provided mechanical ventilation is installed in all first floor spaces.

4. Discontinuous 3 hour horizontal assembly separating buildings: Denied. Proposal does not provide equivalent separation.

Appellant may contact Catherine Heeb (503-823-7657) for additional information.

For the items granted, the Administrative Appeal Board finds that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 180 calendar days of the date this decision is published. For information on the appeals process and costs, including forms, appeal fee, payment methods and fee waivers, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.

II. Performance Standards

City of Portland Building Code

The City of Portland Development Services Center states that common wall and floor/ceiling assemblies between adjacent units and between dwelling units and adjacent public areas such as halls, corridors, stairs, or services areas have a minimum Sound Transmission Class (STC) of 50 and floor-ceiling assemblies also have a minimum Impact Insulation Class (IIC) of 50.

The designer has three options for documenting required STC and IIC ratings:

1. Detail listed and approved STC and IIC assemblies on the plans from approved list of published assemblies, noted here.
2. Obtain approval from Administrative Appeal Board for an alternative assembly. To be approved, the Appeal must include a detail of the proposed assembly, and an analysis stamped by a qualified state of Oregon licensed professional that concludes that the proposed assembly will provide the required STC and IIC ratings.
3. Specify an assembly to be Field Tested. Be aware there is a risk that an assembly can fail the field test, and require modifications after the building is finished.

International Building Code (IBC)

Section 1207 – Sound Transmission

1207.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as hall, corridors, stairs and service areas.

1207.2 Air-borne sound. Walls, partitions, and floor/ceiling assemblies separating dwelling units from each other or from public or service areas hall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90.

1207.3 Structure-borne sound. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E 492.

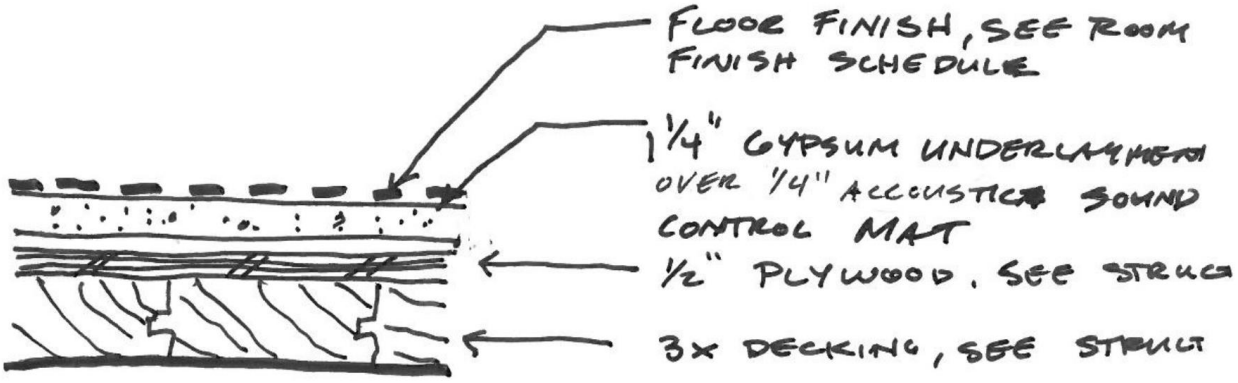
These ASTM standards are the laboratory equivalent of the field tests conducted for finished assemblies.

III. Assembly Description

The following proposed roof-ceiling assembly was evaluated with respect to air-borne sound and footfall noise impact performance to the STC 50 and IIC 50 performance requirements.

Floor-Ceiling Assembly

Luxury Vinyl Tile (LVT) or similar flooring finish
1-1/4” gypsum lightweight concrete (13 psf)
1/4" acoustic underlayment (0.2 psf)
1/2” plywood (1.6 psf)
3” tongue & groove wood decking (5.4 psf)



IV. Predicted Performance

The predicted performance for the heavy timber floor-ceiling assembly is noted below for the pieces evaluated from laboratory test results, independent field tests, and computer modeling software.

Baseline Proposed Assembly Evaluated	Performance
Prediction for assembly: **Laboratory Test Results: NGC Report # 5014082, 7014109 June 2, 2014** (attached to this report) 1. No finished floor 2. 4" concrete 3. 1x6 T&G wood plank 4. 3x6 T&G wood plank 5. 8' on-center wood beams	STC 40 IIC 34
Predicted improvement / reduction from: Plus (+) 1/4" acoustic sound control mat Plus (+) finished floor luxury vinyl tile (LVT) Minus (-) 1-1/4" lightweight gypsum underlayment, instead of 4" concrete	STC 1. Plus (+) 10 to 12 2. Plus (+) 0 to 1 3. Minus (-) 6 to 8 IIC 1. Plus (+) 10 to 12 2. Plus (+) 2 to 4 3. Minus (-) 6 to 8
Predicted Acoustic Performance	STC 44 – 46 IIC 40 – 44

V. Recommendations

Due to limited laboratory performance data for heavy timber construction floor/ceiling assemblies the following recommendations are based on similar projects and laboratory tests that note the performance difference between the recommended options and the tested assemblies.

Option 1 – Code Compliant: *Predicted Lab STC 50 – 52 / IIC 50 – 52*

1. Install 2.0-inches of lightweight concrete on 3/4" to 1” thick acoustic sound control mat below the gypcrete.
    a. Material Options:
        i. 3/4" thickness: Keene Building Products Quiet Qurl 65/075 N MT, Maxxon Acousti-Mat 3 HP
        ii. 1" thickness dimpled recycled rubber: Pliteq GenieMat FF-25, Regupol SonusWave 25-mm, Ecore QTrbm QT3025-7

2. Install 2nd layer of plywood or 1 layer of 1/2” cement board over the plywood sheathing with the 3/4" thick sound control mats; not necessary with 1” thick due to additional material weight for rubber mat.

3. Install hard surface flooring (engineered wood, vinyl, or similar) on 1/8” thick recycled rubber underlayment.
    a. Products: Pliteq GenieMat RST, Regupol Sonus, Ecore QTscu, Durason

Option 2 – Improved Performance: *Predicted Lab STC 52+ / IIC 52+*

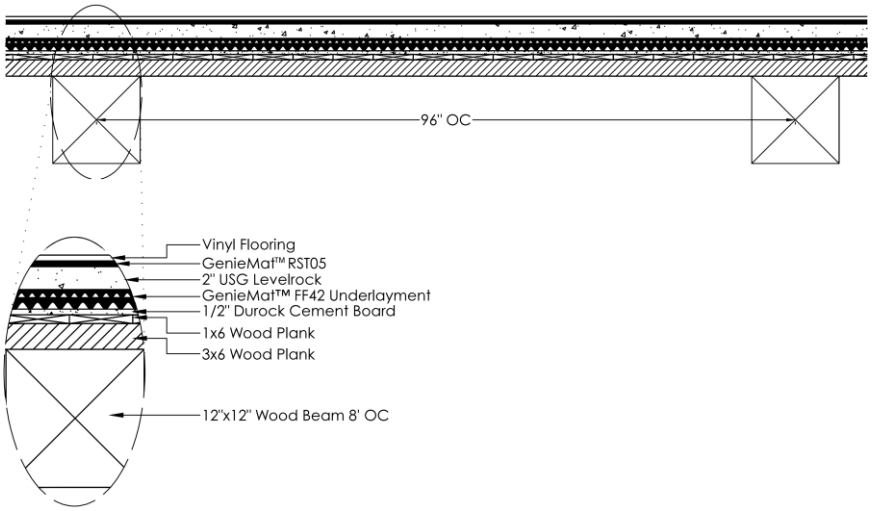
1. Install 2.0-inches of standard concrete or 3.0-inches of lightweight concrete on 1-3/8” thick acoustic sound control mat below the gypcrete.
    a. Material Options:
        iii. 1-3/8" thickness dimpled recycled rubber (1 layer of 1” and 1 layer of 3/8”): Pliteq GenieMat FF-17 and FF-25, Regupol SonusWave 17-mm and 25-mm, Ecore QTrbm QT3017-8 and 3025-7

2. Install 2nd layer of plywood or 1 layer of 1/2” cement board over the plywood sheathing.

3. Install hard surface flooring (engineered wood, vinyl, or similar) on 1/8” thick recycled rubber underlayment.
    a. Products: Pliteq GenieMat RST, Regupol Sonus, Ecore QTscu, Durason

VI. Predicted Performance with code compliant recommendations

Due with respect to sound transmission (STC) and footfall impact noise (IIC), the assembly has been split into parts to evaluate the impact of these materials and installations on the overall predicted performance.

Recommended Assembly Evaluated	Performance
Prediction for overall assembly: **Laboratory Test Results: NGC Testing Services, test # 5014141, #7014194; 9/12/2014**  *Field tests for similar heavy timber construction had STC and IIC ratings greater than STC/IIC 55, but the assembly details were less specific than the above noted laboratory tests.*	STC 53 IIC 52
Predicted improvement / reduction from: Minus (-) 3 mm instead of 5 mm under hard-flooring; 1" instead of 1-3/8" acoustic sound mat below lightweight concrete	STC 1. Minus (-) 0 to 3 IIC 1. Minus (-) 1 to 2
Predicted Acoustic Performance	STC 50 – 53 IIC 50 – 51

VII. Conclusion

The proposed flooring-ceiling assembly will satisfy the International Building Code (IBC) sound transmission requirements of STC 50 and IIC 50 with one of the recommended alternatives.

Please contact us if you have any questions or for additional information.

Sincerely,

Erik Miller-Klein, P.E.
Partner & Acoustical Consultant

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RENEWAL DATE: 12/31/2016

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TEST REPORT

For

Pliteq, Inc.
1370 Don Mills Road, Unit 300
Toronto, ON. Canada M3B 3N7
Wilson Byrick/ 416-449-0049

Sound Transmission Loss Test

ASTM E 90 – 04 / E 413 - 10

On

Wood Beam Factory Style Floor-Ceiling Assembly Overlaid with; 4 Inch Concrete Slab

Report Number: NGC 5014082

Assignment Number: G-877

Test Date: 6/02/2014

Report Approval Date: 6/18/2014

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Menchetti
Director

Revision Summary:

Date	SUMMARY
Approval Date: 6/18/2014	Original issue date. Original NGCTS report: NGC 5014082

Report Number: NGC 5014082

Test Method: This test method conforms explicitly with the American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements - Designation: E 90 - 04 / E 413 - 10.

Specimen Description: Wood Beam Factory Style Floor-Ceiling assembly overlaid with, according to client, 4 inch concrete slab

The test specimen was a floor-ceiling assembly observed to consist of the following:
All measured weights and dimensions are averaged:

- 101.6 mm (4 in.) concrete slab, weighing: 223.30 kg/m^2 (45.74 PSF)

- 1 layer of, according to the client, 1" T&G wood planks. The top layer of subflooring was nailed to the bottom layer of subflooring at random lenths. Subfloor measured dimensions: 3657.60 mm x 149.23 mm x 19.05 mm (144 in. x 5-7/8 in. x 0.75 in.). Subfloors measured weight: 7.37 kg/m^2 (1.51 PSF)

- 1 layer of, according to client, 3" T&G wood planks. The bottom layer of subflooring was nailed to the underlying support beams at random lengths. Subfloor measured dimensions: 4876.8 mm x133.4 mm x 57.15 mm (192 in. x 5-1/4 in. x 2-1/4 in) Subfloor measured weigh: 26.32 kg/m^2 (5.39 PSF)

- Two (2), 3505.2 mm x 304.8 mm x 304.8 mm (138 in. x 12 in. x 12 in.) Support beams placed 2438.4 mm (96 in.) O.C, allowing 1219.2 mm (48 in.) of space from each end of the test frame.
  Measured weight of the beams: 206.95 kg/m^2 (5.07 PSF)

The overall weight of the test assembly: 281.74 kg/m2 (57.71 PSF)

The perimeter of the test frame was sealed with a rubber gasket and a sand filled trough. The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)
Conditioning: All materials were tested as received. Concrete cured a minimum of 28 days.
Test Results: The results of the tests are given on pages 4 and 5 of the report.

Sound Transmission Loss Test Data

Test: ASTM E 90 - 04 / ASTM E 413 - 10

Test Report: NGC5014082 Date: 6/2/2014
Specimen Size [m²]: 17.8

Source room		Receiving room	
Volume [m³]:	53.2	Volume [m³]:	69.3
Rm Temp [°C]:	22.5	Rm Temp [°C]:	21.5
Humidity [%]:	54	Humidity [%]:	59

Sound Transmission Class STC [dB]: 40

Sum of Unfavorable Deviations [dB]: 26
Max. Unfavorable Deviation [dB]: 5 at 315 Hz

Frequency [Hz]	STL [dB]	L1 [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔSTL
100	24	101.9	82.7	29.2	4.8		1.61
125	24	101.2	83.3	23.8	6.1		2.58
160	24	100.9	82.9	22.7	6.0	3	2.28
200	26	100.9	80.9	24.6	6.0	4	1.44
250	31	101.7	76.2	29.6	5.5	2	0.93
315	31	98.3	72.3	28.8	5.0	5	1.72
400	35	99.3	69.8	29.6	5.5	4	0.57
500	36	98.5	67.6	30.4	5.1	4	1.21
630	40	99.9	64.9	34.2	5.0	1	0.55
800	39	99.6	64.4	37.9	3.8	3	0.58
1000	43	96.1	57.3	40.3	4.2		0.91
1250	48	95.3	51.1	40.7	3.7		0.90
1600	53	95.5	46.5	39.2	3.9		1.05
2000	56	97.7	45.1	39.6	3.4		0.74
2500	60	98.5	42.1	39.7	3.6		0.74
3150	63	97.2	38.0	43.6	3.8		0.92
4000	64	94.1	32.8	52.2	2.6		0.62
5000	66	86.4	22.4	55.6	1.9		0.94

STL = Sound Transmission Loss, dB
L1 = Source Room Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
Δ STL = Uncertainty for 95% Confidence Level

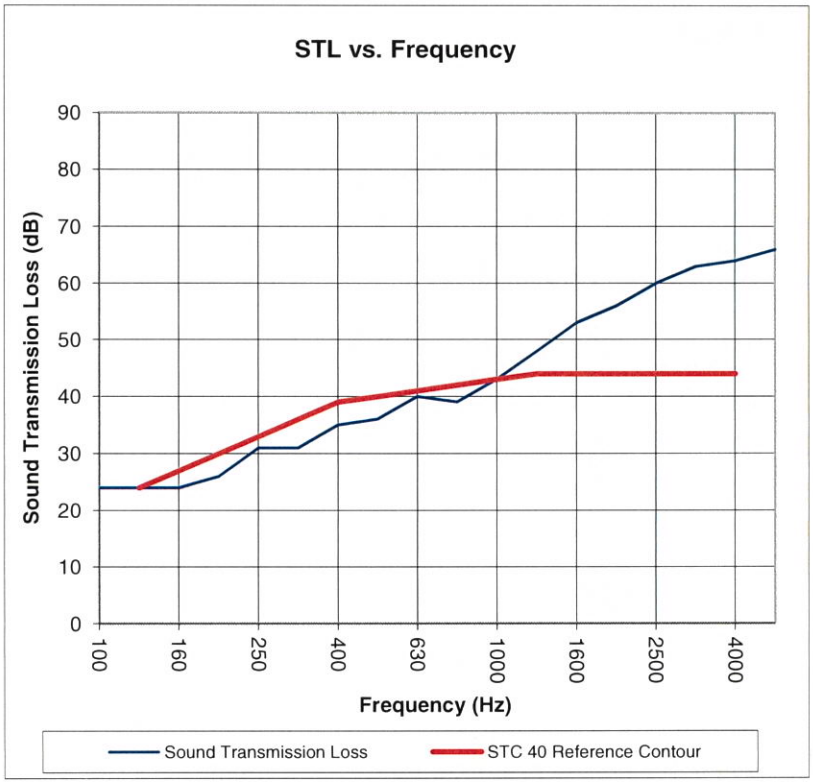
Sound Transmission Loss Test Data

Per: ASTM E 90 - 04 / ASTM E 413 - 10

Test Report: NGC5014082
Test Date: 6/2/2014
Specimen Size [m²]: 17.8

Sound Transmission Class STC = 40 dB

Frequency [Hz]	STL [dB]	ΔSTL
100	24	1.61
125	24	2.58
160	24	2.28
200	26	1.44
250	31	0.93
315	31	1.72
400	35	0.57
500	36	1.21
630	40	0.55
800	39	0.58
1000	43	0.91
1250	48	0.90
1600	53	1.05
2000	56	0.74
2500	60	0.74
3150	63	0.92
4000	64	0.62
5000	66	0.94



* Due to high insulating value of specimen, background levels limit results at these frequencies.

STL = Sound Transmission Loss, dB
Δ STL = Uncertainty for 95% Confidence Level

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TEST REPORT

for

Pliteq, Inc.
1370 Don Mills Road, Unit 300
Toronto, ON. Canada M3B 3N7
Wilson Byrick/ 416-449-0049

Impact Sound Transmission Test

ASTM E 492 – 09 / ASTM E 989 – 06

On

Wood Beam Factory Style Floor-Ceiling Assembly Overlaid with; 4 Inch Concrete Slab

Report Number:	NGC 7014109
Assignment Number:	G-877
Test Date:	6/02/2014
Report Approval Date:	6/18/2014

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Menchetti
Director

Revision Summary:

Date	SUMMARY
Approval Date: 6/18/2014	Original issue date. Original NGCTS report: NGC 7014109

Report Number: NGC 7014109

Test Method: This test method is in accordance with American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine - Designation: E 492-09/ E 989-06.

The uncertainty limits of each tapping machine location met the precision requirements of section A1.4 of ASTM E 492-09.

Specimen Description: Wood Beam Factory Style Floor-Ceiling assembly overlaid with, according to client, 4 inch concrete slab.

The test specimen was a floor-ceiling assembly observed to consist of the following:
All measured weights and dimensions are averaged:

- 101.6 mm (4 in.) concrete slab, weighing: 223.30 kg/m^2 (45.74 PSF)

- 1 layer of, according to the client, 1" T&G wood planks. The top layer of subflooring was nailed to the bottom layer of subflooring at random lenths. Subfloor measured dimensions: 3657.60 mm x 149.23 mm x 19.05 mm (144 in. x 5-7/8 in. x 0.75 in.). Subfloors measured weight: 7.37 kg/m^2 (1.51 PSF)

- 1 layer of, according to client, 3" T&G wood planks. The bottom layer of subflooring was nailed to the underlying support beams at random lengths. Subfloor measured dimensions: 4876.8 mm x133.4 mm x 57.15 mm (192 in. x 5-1/4 in. x 2-1/4 in) Subfloor measured weigh: 26.32 kg/m^2 (5.39 PSF)

- Two (2), 3505.2 mm x 304.8 mm x 304.8 mm (138 in. x 12 in. x 12 in.) Support beams placed 2438.4 mm (96 in.) O.C, allowing 1219.2 mm (48 in.) of space from each end of the test frame.
  Measured weight of the beams: 206.95 kg/m^2 (5.07 PSF)

The overall weight of the test assembly: 281.74 kg/m^2 (57.71 PSF)

The perimeter of the test frame was sealed with a rubber gasket and a sand filled trough. The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)
Conditioning: All materials were tested as received.
Test Results: The results of the tests are given on pages 4 and 5 of the report.

Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC7014109 Date: 6/2/2014

Specimen Size [m²]: 17.8

Source room

Rm Temp [°C]: 22.5

Humidity [%]: 54

Receiving room

Volume [m³]: 69.3

Rm Temp [°C]: 21.5

Humidity [%]: 59

Impact Insulation Class IIC [dB]: 34

Sum of Unfavorable Deviations [dB]: 31

Max. Unfavorable Deviation [dB]: 8 at 3150 Hz

Frequency [Hz]	L_n [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔL_n
100	66	68.3	31.7	-2.3		2.78
125	64	67.3	22.5	-3.3		0.89
160	69	73.5	21.2	-4.5		1.24
200	74	76.9	24.5	-2.9		1.36
250	74	76.9	29.9	-2.9		0.75
315	75	78.0	29.0	-3.0		0.41
400	76	78.9	29.8	-2.9		0.38
500	75	77.6	29.7	-2.6		0.44
630	76	77.8	34.2	-1.8	1	0.40
800	76	77.3	38.1	-1.3	2	0.62
1000	75	76.1	40.7	-1.1	2	0.20
1250	73	73.9	40.0	-0.9	3	0.32
1600	70	71.6	38.8	-1.6	3	0.30
2000	69	70.5	38.5	-1.5	5	0.21
2500	68	69.0	39.7	-1.0	7	0.29
3150	66	67.4	43.3	-1.4	8	0.32
4000	67	66.7	52.2	0.3		0.51
5000	61	60.6	55.5	0.4		0.62

L_n = Normalized Sound Pressure Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
ΔL_n = Uncertainty for 95% Confidence Level

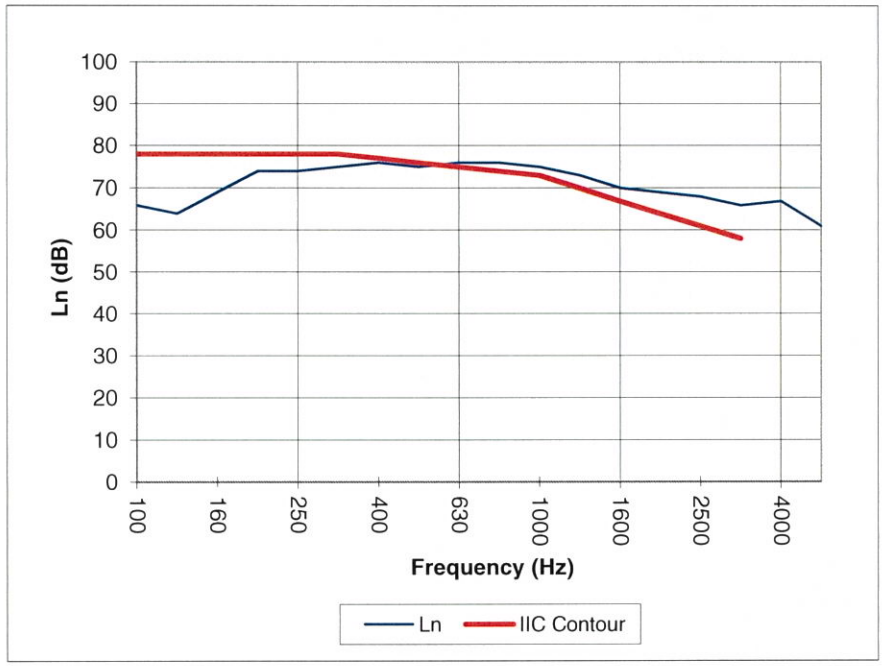
Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC7014109
Test Date: 6/2/2014
Specimen Size [m²]: 17.8

Impact Insulation Class IIC [dB]: 34

Frequency [Hz]	L_n [dB]
100	66
125	64
160	69
200	74
250	74
315	75
400	76
500	75
630	76
800	76
1000	75
1250	73
1600	70
2000	69
2500	68
3150	66
4000	67
5000	61



* Due to high insulating value of specimen, background levels limit results at these frequencies.

L_n = Normalized Sound Pressure Level, dB

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TEST REPORT

For

Pliteq, Inc.
1370 Don Mills Road, Unit 300
Toronto, ON. Canada M3B 3N7
Matthew Golden/ 202-714-0600

Sound Transmission Loss Test

ASTM E 90 – 04 / E 413 - 10

On

2 Inch USG LEVELROCK® Poured Floor Underlayment Over GenieMat™ FF17 Over GenieMat™ FF25 On USG DUROCK® Cement Board Adhered To Wood Beam Factory Style Floor-Ceiling Assembly

Report Number: NGC 5014141

Assignment Number: G-877

Test Date: 8/27/2014

Report Approval Date: 9/12/2014

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Menchetti
Director

Revision Summary:

Date	SUMMARY
Approval Date: 9/12/2014	Original issue date. Original NGCTS report: NGC 5014141

Report Number: NGC 5014141

Test Method: This test method conforms explicitly with the American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements – Designation: E 90 - 04 / E 413 - 10.

Specimen Description: Wood Beam Factory Style Floor-Ceiling assembly overlaid with, according to client, USG LEVELROCK® 2500 poured floor underlayment on GenieMat™ FF17 on GenieMat™ FF25 over USG DUROCK® Cement board.

The test specimen was a floor-ceiling assembly observed to consist of the following:
All measured weights and dimensions are averaged:

- 1 layer of, according to client, USG LEVELROCK® 2500 poured floor underlayment. The USG LEVELROCK® 2500 poured floor underlayment was poured directly onto the The GenieMat™ FF17.
  Measured thickness: 50.8 mm (2in.) Measured weight: 100.67 kg/m^2 (20.62PSF)
- 1 layer of, according to client, GenieMat™ FF17. The GenieMat™ FF17 was floating over The GenieMat™ FF25.
  Measured thickness: 15.88 mm (0.625 in.) Measured weight: 7.42 kg/m^2 (1.52 PSF)
- 1 layer of, according to client, GenieMat™ FF25. The GenieMat™ FF25 was floating over the USG DUROCK® cement board. Measured thickness: 24.30 mm (0.957 in.) Measured weight: 10.06 kg/m^2 (2.06 PSF)
- 1 layer of, according to client, USG DUROCK® Cement board. The USG DUROCK® cement board was screwed and adhered to the factory floor with, a latex mortar, using a 6.35 mm x 6.35 mm x 6.35 mm (1/4 in. x 1/4 in. x 1/4 in.) Square notch trowel, and secured with 31.75 mm (1-1/4 in.) Type W screws spaced 203.20 mm (8 in.) o.c.
  Measured thickness: 12.45 mm (0.49 in.) Measured weight: 14.84 kg/m^2 (3.04 PSF)
- 1 layer of, according to the client, 1" T&G wood planks. The top layer of subflooring was nailed to the bottom layer of subflooring at random lenths. Subfloor measured dimensions: 3657.60 mm x 149.23 mm x 19.05 mm (144 in. x 5-7/8 in. x 0.75 in.). Subfloors measured weight: 7.37 kg/m^2 (1.51 PSF)
- 1 layer of, according to client, 3" T&G wood planks. The bottom layer of subflooring was nailed to the underlying support beams at random lengths. Subfloor measured dimensions: 4876.8 mm x133.4 mm x 57.15 mm (192 in. x 5-1/4 in. x 2-1/4 in) Subfloor measured weigh: 26.32 kg/m^2 (5.39 PSF)
- Two (2), 3505.2 mm x 304.8 mm x 304.8 mm (138 in. x 12 in. x 12 in.) Support beams placed 2438.4 mm (96 in.) o.c, allowing 1219.2 mm (48 in.) of space from each end of the test frame.
  Measured weight of the beams: 206.95 kg/m^2 (5.07 PSF)

The overall weight of the test assembly: 191.42 kg/m^2 (39.21 PSF)

The perimeter of the test frame was sealed with a rubber gasket and a sand filled trough/ Curb to compensate for test frame height.
The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)
Conditioning: All materials were tested as received.Poured underlayment cured a minimum of 14 days.
Mortar cured minimum 7 days. Adhesives cured a minimum 24 hours.
Test Results: The results of the tests are given on pages 4 and 5 of the report.

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Sound Transmission Loss Test Data

Test: ASTM E 90 - 04 / ASTM E 413 - 10

Test Report: NGC 5014141 Date: 8/27/2014
Specimen Size [m²]: 17.8

Source room
Volume [m³]: 53.2
Rm Temp [°C]: 24
Humidity [%]: 57

Receiving room
Volume [m³]: 69.3
Rm Temp [°C]: 22
Humidity [%]: 51

Sound Transmission Class STC [dB]: 53
Sum of Unfavorable Deviations [dB]: 26
Max. Unfavorable Deviation [dB]: 8 at 315 Hz

Frequency [Hz]	STL [dB]	L1 [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔSTL
100	31	103.9	79.5	20.7	6.6		2.64
125	38	104.9	73.1	21.7	6.2		1.64
160	40	104.5	71.9	18.2	7.4		2.63
200	41	104.5	70.3	20.2	6.8	2	1.46
250	42	104.6	69.2	23.6	6.6	4	1.13
315	41	102.0	66.8	22.8	5.8	8	0.54
400	45	102.4	63.3	25.4	5.9	7	0.64
500	49	102.6	59.5	27.1	5.9	4	0.73
630	53	102.6	54.3	30.5	4.7	1	0.38
800	56	102.9	51.2	32.3	4.3		0.40
1000	58	99.3	46.0	33.6	4.7		0.55
1250	58	96.9	43.1	35.4	4.2		0.55
1600	63	97.0	38.3	34.9	4.3		0.39
2000	67	99.2	36.6	35.9	4.4		0.23
2500	70	99.7	34.0	37.9	4.3		0.73
3150	73	98.6	28.7	42.0	3.1		1.03
4000	76	95.7	22.1	50.1	2.5		1.25
5000	78	88.8	13.2	54.8	2.5		1.51

STL = Sound Transmission Loss, dB
L1 = Source Room Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
Δ STL = Uncertainty for 95% Confidence Level

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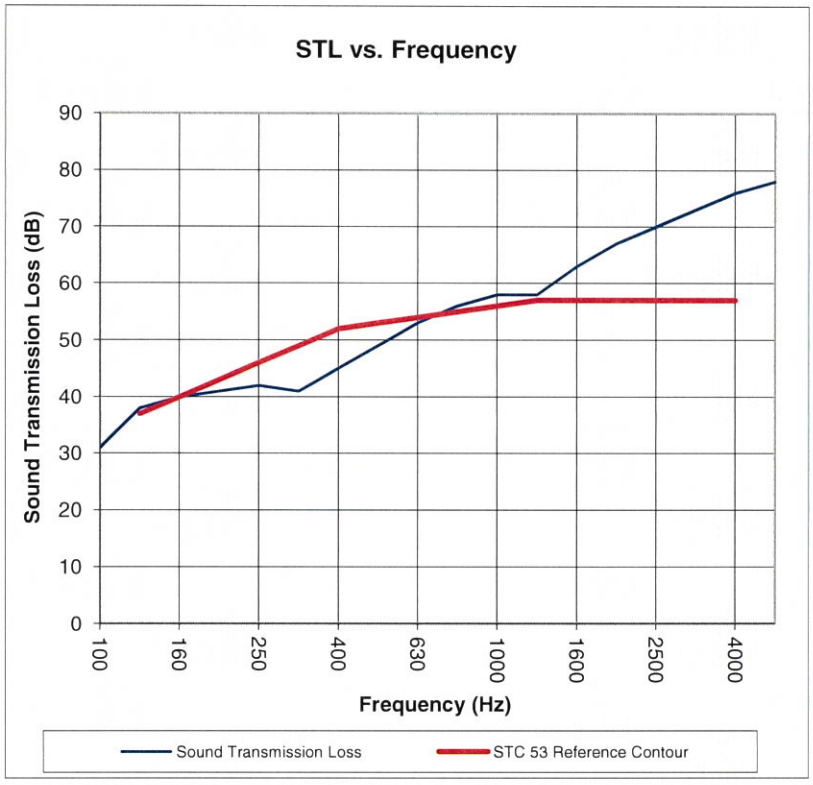
Sound Transmission Loss Test Data

Per: ASTM E 90 - 04 / ASTM E 413 - 10

Test Report: NGC 5014141
Test Date: 8/27/2014
Specimen Size [m²]: 17.8

Sound Transmission Class STC = 53 dB

Frequency [Hz]	STL [dB]	ΔSTL	
100	31	2.64	
125	38	1.64	
160	40	2.63	
200	41	1.46	
250	42	1.13	
315	41	0.54	
400	45	0.64	
500	49	0.73	
630	53	0.38	
800	56	0.40	
1000	58	0.55	
1250	58	0.55	
1600	63	0.39	
2000	67	0.23	
2500	70	0.73	
3150	73	1.03	
4000	76	1.25	
5000	78	1.51	*



* Due to high insulating value of specimen, background levels limit results at these frequencies.

STL = Sound Transmission Loss, dB
Δ STL = Uncertainty for 95% Confidence Level

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TEST REPORT

for

Pliteq, Inc.
1370 Don Mills Road, Unit 300
Toronto, ON. Canada M3B 3N7
Matthew Golden/ 202-714-0600

Impact Sound Transmission Test

ASTM E 492 – 09 / ASTM E 989 – 06

On

2 Inch USG LEVELROCK® Poured Floor Underlayment Over GenieMat™ FF17 Over GenieMat™ FF25 On USG DUROCK® Cement Board Adhered To Wood Beam Factory Style Floor-Ceiling Assembly Overlaid with; Shaw Click LVT on GenieMat™ RST-05 Underlayment.

Report Number: NGC 7014194

Assignment Number: G-877

Test Date: 8/27/2014

Report Approval Date: 9/12/2014

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Menchetti
Director

Revision Summary:

Date	SUMMARY
Approval Date: 9/12/2014	Original issue date. Original NGCTS report: NGC 7014194

Report Number: NGC 7014194

Test Method: This test method is in accordance with American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine - Designation: E 492-09/ E 989-06.
The uncertainty limits of each tapping machine location met the precision requirements of section A1.4 of ASTM E 492-09.

Specimen Description: Wood Beam Factory Style Floor-Ceiling assembly overlaid with, according to client, Shaw Click LVT Flooring on GenieMat™ RST-05 underlayment over USG LEVELROCK® 2500 poured floor underlayment on GenieMat™ FF17 on GenieMat™ FF25 over USG DUROCK® Cement board.

The test specimen was a floor-ceiling assembly observed to consist of the following:
All measured weights and dimensions are averaged:

- 1 layer of, according to client, Shaw Click LVT. The Shaw Click LVT was floating on the GenieMat™ RST-05 underlayment. Measured dimensions: 184.15 mm x 1212.85 mm (7-1/4 in. x 47-3/4 in.) Measured thickness: 5.08 mm (0.20 in.) Measured weight: 8.20 kg/m^2 (1.68 PSF)
- 1 layer of, according to client, GenieMat™ RST-05 underlayment. The GenieMat™ RST-05 was floating on the USG LEVELROCK® 2500 poured floor underlayment. Measured thickness: 4.95 mm (0.195 in.) Measured weight: 4.20 mm (0.86 PSF)
- 1 layer of, according to client, USG LEVELROCK® 2500 poured floor underlayment. The USG LEVELROCK® 2500 poured floor underlayment was poured directly onto the The GenieMat™ FF17. Measured thickness: 50.8 mm (2in.) Measured weight: 100.67 kg/m^2 (20.62PSF)
- 1 layer of, according to client, GenieMat™ FF17. The GenieMat™ FF17 was floating over The GenieMat™ FF25. Measured thickness: 15.88 mm (0.625 in.) Measured weight: 7.42 kg/m^2 (1.52 PSF)
- 1 layer of, according to client, GenieMat™ FF25. The GenieMat™ FF25 was floating over the USG DUROCK® cement board. Measured thickness: 24.30 mm (0.957 in.) Measured weight: 10.06 kg/m^2 (2.06 PSF)
- 1 layer of, according to client, USG DUROCK® Cement board. The USG DUROCK® cement board was screwed and adhered to the factory floor with, a latex mortar, using a 6.35 mm x 6.35 mm x 6.35 mm (1/4 in. x 1/4 in. x 1/4 in.) Square notch trowel, and secured with 31.75 mm (1-1/4 in.) Type W screws spaced 203.20 mm (8 in.) o.c. Measured thickness: 12.45 mm (0.49 in.) Measured weight: 14.84 kg/m^2 (3.04 PSF)
- 1 layer of, according to the client, 1" T&G wood planks. The top layer of subflooring was nailed to the bottom layer of subflooring at random lenths. Subfloor measured dimensions: 3657.60 mm x 149.23 mm x 19.05 mm (144 in. x 5-7/8 in. x 0.75 in.). Subfloors measured weight: 7.37 kg/m^2 (1.51 PSF)
- 1 layer of, according to client, 3" T&G wood planks. The bottom layer of subflooring was nailed to the underlying support beams at random lengths. Subfloor measured dimensions: 4876.8 mm x133.4 mm x 57.15 mm (192 in. x 5-1/4 in. x 2-1/4 in) Subfloor measured weigh: 26.32 kg/m^2 (5.39 PSF)
- Two (2), 3505.2 mm x 304.8 mm x 304.8 mm (138 in. x 12 in. x 12 in.) Support beams placed 2438.4 mm (96 in.) o.c, allowing 1219.2 mm (48 in.) of space from each end of the test frame. Measured weight: 24.75 kg/m^2 (5.07 PSF)

The overall weight of the test assembly: 203.82 kg/m^2 (41.75 PSF)
The perimeter of the test frame was sealed with a rubber gasket and a sand filled trough.
The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)
Conditioning: All materials were tested as received. Poured underlayment cured a minimum 14 days. Mortar cured a minimum 7 days and adhesives cured a minimum 24 hours.
Test Results: The results of the tests are given on pages 4 and 5 of the report.

Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC 7014194 Date: 8/25/2014
Specimen Size [m²]: 17.8

Source room

Rm Temp [°C]: 23
Humidity [%]: 55

Receiving room
Volume [m³]: 69.3
Rm Temp [°C]: 22
Humidity [%]: 51

Impact Insulation Class IIC [dB]: 52

Sum of Unfavorable Deviations [dB]: 29
Max. Unfavorable Deviation [dB]: 7 at 100 Hz

Frequency [Hz]	L_n [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔL_n
100	67	71.8	20.0	-4.8	7	2.95
125	63	67.4	21.7	-4.4	3	1.87
160	64	68.2	18.3	-4.2	4	2.45
200	65	69.0	20.5	-4.0	5	1.95
250	64	67.4	23.0	-3.4	4	0.96
315	63	67.0	22.4	-4.0	3	0.88
400	62	64.9	25.3	-2.9	3	0.82
500	52	54.9	26.5	-2.9		0.64
630	42	44.1	30.1	-2.1		0.60
800	33	35.8	31.6	-2.8		0.65
1000	25	29.2	33.1	-4.2		0.66
1250	21	25.0	35.2	-4.0		0.69
1600	19	22.9	34.3	-3.9		1.01
2000	16	19.8	36.4	-3.8		1.15
2500	13	16.9	38.0	-3.9		1.18
3150	11	14.2	42.2	-3.2		0.71
4000	9	11.6	49.5	-2.6		0.67
5000	8	9.6	54.7	-1.6		0.52

L_n = Normalized Sound Pressure Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
ΔL_n = Uncertainty for 95% Confidence Level

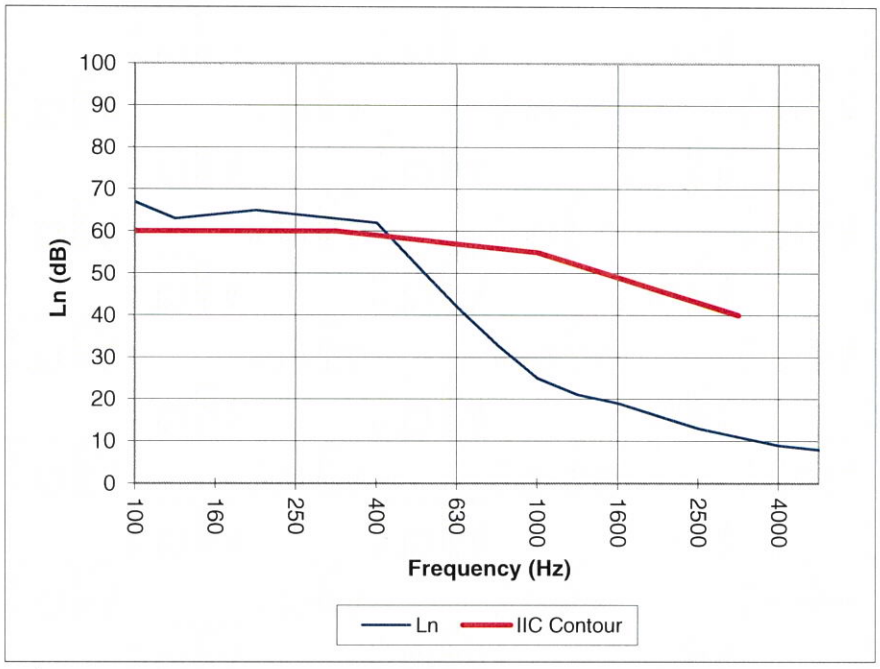
Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC 7014194
Test Date: 8/25/2014
Specimen Size [m²]: 17.8

Impact Insulation Class IIC [dB]: 52

Frequency [Hz]	L_n [dB]	
100	67	
125	63	
160	64	
200	65	
250	64	
315	63	
400	62	
500	52	
630	42	
800	33	
1000	25	*
1250	21	*
1600	19	*
2000	16	*
2500	13	*
3150	11	*
4000	9	*
5000	8	*



* Due to high insulating value of specimen, background levels limit results at these frequencies.

L_n = Normalized Sound Pressure Level, dB

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Test Number : NGC 7014194

Test Date: 8/27/2014

Extended Frequency Measurements

The following is the extended frequency range test data during the subject test.

Frequency	L_n	L2	d	Corr.	u.Dev.	ΔL_n
[Hz]	[dB]	[dB]	[dB/s]	[dB]	[dB]	
50*	53	58.5	14.4	- 5.5		2.5
63*	53	57.8	18.9	- 4.8		2.7
80	63	67.6	16.8	- 4.6		2.9

*Note: Test data measured in the 50 Hz and 63 Hz bandwidths are not qualified and have higher uncertainties.

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February 21, 2017

Jennifer Nye
William Wilson Architects PC
1022 SW Salmon St.
Portland, OR 97205

Predicted Acoustic Performance for the Sellwood Apartments Proposed Assemblies

Dear Ms. Nye,

This letter presents our results from our acoustic analysis of the proposed floor-ceiling assemblies and wall types to ensure they meet the City of Portland Building Code STC 50 and IIC 50 performance for the Sellwood Apartments. The airborne sound and footfall transmission performance have been calculated using existing laboratory test data, computer modeling software, and based on our previous experiences with floor-ceiling assemblies.

I. Predictive Methods

This performance prediction is based on laboratory test results from the California *Catalog of STC and IIC Ratings for Wall and Floor/Ceiling Assemblies*, the Gypsum Association *Fire Resistance Design Manual Sound Control*, and *National Research Council of Canada*; predictions of each piece of the total assembly with the Marshall Day Acoustics INSUL sound insulation prediction tool for floor/ceilings; field test results from similar assemblies. The laboratory test results used for this prediction were completed per ASTM E 90 *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements* and E 492 *Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor Ceiling Assemblies Using the Tapping Machine*. Sound Transmission Class (STC) and Impact Insulation Class (IIC) ratings are not directly equivalent to decibel values, but the ratings are based on the exponential decibel scale.

II. Performance Standards

City of Portland Building Code

The City of Portland Development Services Center states that common wall and floor/ceiling assemblies between adjacent units and between dwelling units and adjacent public areas such as halls, corridors, stairs, or services areas have a minimum Sound Transmission Class (STC) of 50 and floor-ceiling assemblies also have a minimum Impact Insulation Class (IIC) of 50.

The designer has three options for documenting required STC and IIC ratings:

1. Detail listed and approved STC and IIC assemblies on the plans from approved list of published assemblies, noted here.
2. Obtain approval from Administrative Appeal Board for an alternative assembly. To be approved, the Appeal must include a detail of the proposed assembly, and an analysis stamped by a qualified state of Oregon licensed professional that concludes that the proposed assembly will provide the required STC and IIC ratings.
3. Specify an assembly to be Field Tested. Be aware there is a risk that an assembly can fail the field test, and require modifications after the building is finished.

International Building Code (IBC)

Section 1207 – Sound Transmission

1207.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as hall, corridors, stairs and service areas.

1207.2 Air-borne sound. Walls, partitions, and floor/ceiling assemblies separating dwelling units from each other or from public or service areas hall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90.

1207.3 Structure-borne sound. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E 492.

These ASTM standards are the laboratory equivalent of the field tests conducted for finished assemblies.

III. Assembly Description & Predicted Performance

The following proposed roof-ceiling assembly was evaluated with respect to air-borne sound and footfall noise impact performance to the STC 50 and IIC 50 performance requirements. When assemblies were noted to perform below the requirements remediation measures are noted and the improved performance documented to show compliance.

Floor-Ceiling Assembly – 5A

Floor Finish - Vinyl
1-1/4” gypsum lightweight concrete (13 psf)
1/4" acoustic underlayment (0.2 psf)
3/4” plywood (1.6 psf)
9-1/2” TJI Joists
3-1/2” batt insulation (3A); fill cavity for 3B
1/2" resilient channel
2 layers of 5/8” GWB (4.4 psf)

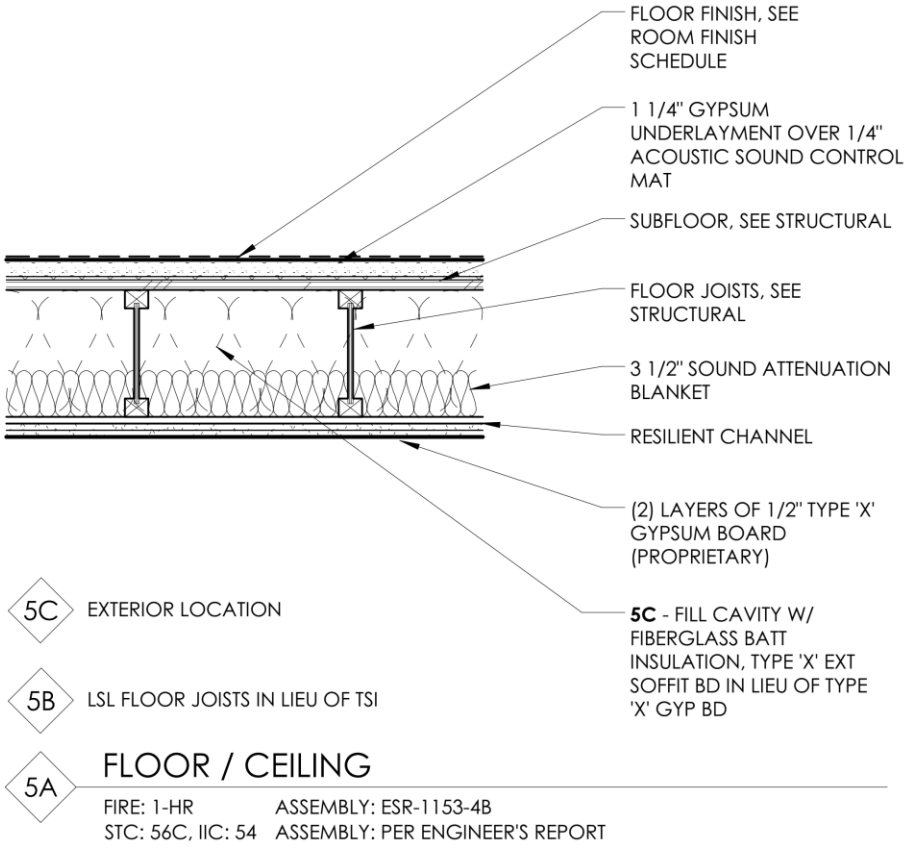


Table 1: Floor/Ceiling Assembly 5A / 5C

Proposed Assembly Evaluated	Performance
Comparable Lab Test **Laboratory Test Results: NGC 5012050** (STC) / **NGC 7012109** (IIC) (attached to this report) 1. Finished Floor – Vinyl 2. 1" gypcrete 3. Maxxon AcoustiMat II (1/4" thick sound control mat) 4. 23/32" OSB a. Acoustically equivalent to proposed plywood subfloor 5. 9-1/2" wood I-Joists 6. 3-1/2" batt insulation a. 5C includes additional 6-inches of insulation (+ STC 0 / IIC 2) 7. 1/2" resilient channel 8. 2 layers of 5/8" GWB	STC 58 IIC 53

Floor-Ceiling Assembly – 5B

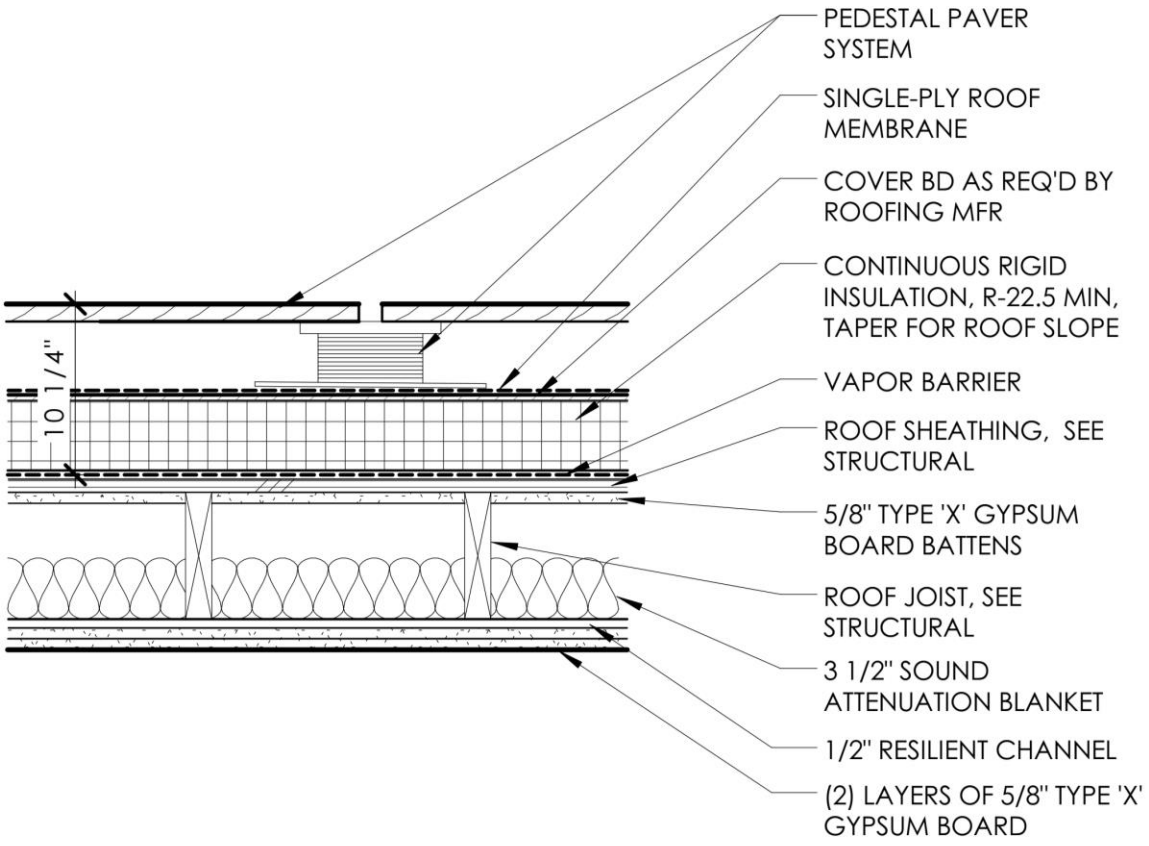
9-1/2" LSL Wood Joists, instead of TJI

Table 2: Floor/Ceiling Assembly 5A / 5B

Proposed Assembly Evaluated	Performance
Comparable Lab Test **Laboratory Test Results: Intertek 10033655CRT-001g** (STC) / **Intertek 100336557CRT-001m** (IIC) (attached to this report) 1. Finished Floor – Sheet Vinyl 2. 1" gypsum lightweight concrete 3. Maxxon AcoustiMat II (1/4" thick sound control mat) 4. 5/8" Plywood 5. 9-1/2" sold wood joists 6. 3-1/2" batt insulation 7. 1/2" resilient channel 8. 1 layer of 5/8" GWB	STC 52 IIC 53
Predicted Improvement Differences (calculated with INSUL 8.0 Sound Insulation Predictor) 1. Additional 1/4" of lightweight concrete (1-1/4" total) 2. Additional layer of 5/8" GWB	STC +4 to +8 IIC +1 to +3
Predicted Laboratory Measured Performance	STC 56 – 60 IIC 53 – 55

Roof Deck Assembly 7A

Cement pedestal paver (13 - 20 psf)
AWS Pedestal System (ABS & PVC Plastic)
Roofing Membrane (1.75 psf)
R-20 Rigid Insulation (<0.5 psf)
5/8” Plywood Sheathing (1.8 psf)
5/8” Type X gypsum board battens
9-1/2” LVL wood joists
3-1/2” batt insulation
1/2” Resilient Channel
2 Layers of 5/8” Type X gypsum board (4.4 psf)



7A ROOF DECK ASSEMBLY

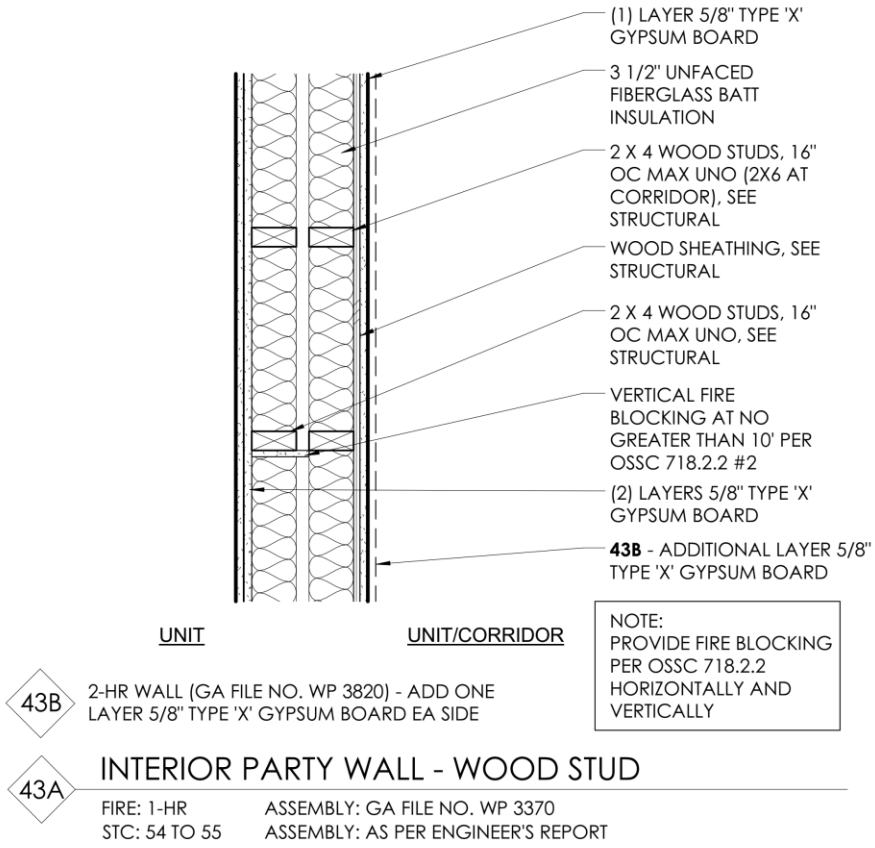
FIRE: 1-HR ASSEMBLY: GA FILE NO. FC 5532
STC: 55, IIC 50 ASSEMBLY: AS PER ENGINEER'S REPORT

Laboratory data for similar roof deck assemblies was published in January 2017.

Table 3: Roof Deck Assembly 7A

Proposed Assembly Evaluated	**Performance**
Prediction for overall assembly **Laboratory Test Results: Architectural Testing, Inc. G6527.13-113-11 (01/17/17)** 1. 2” Stone Pavers 2. 2” adjustable deck supports 3. 2” Owens Corning FOAMULAR 250 R-10 Insulation Sheathing 4. 1/2" Plywood Sheathing 5. 3/4" Oriented Strand Board Sheathing 6. 9-1/2” Owens Corning R-30 Fiberglass Insulation 7. 12” TJI Joist 8. 1/2" Resilient Channel (ClarkDietrich RC Deluxe) 9. 2 Layers of 5/8” GWB	STC 59 IIC 63
Predicted Improvement Differences (calculated with INSUL 8.0 Sound Insulation Predictor) 1. 3-1/2” batt insulation instead of 9-1/2” 2. 3/4" OSB is equivalent to 5/8” GWB battens 3. 9-1/2” LSL instead of 12” TJI	STC -4 IIC -5
Predicted Measured Performance *(includes corrections for installed conditions based on field tests completed for similar conditions and buildings)*	STC 55 IIC 58

Interior Party Wall Assembly – 43A



43A
1 layer of 5/8” GWB on one side (2.2 psf)
2x4 Double Studs (16” on-center with 1-inch gap between studs)
2 layers of 3-1/2 batt insulation
2 layers of 5/8” GWB on one side (4.4 psf)

43B
2 layers of 5/8” GWB on each side (4.4 psf)
2x4 Double Studs (16” on-center with 1-inch gap between studs)
2 layers of 3-1/2 batt insulation

Table 4: Interior Party Wall Assemblies 43A & 43B

Proposed Assemblies Evaluated	Performance
Prediction for assembly 43A: **Laboratory Test Results: NRCC TL-93-267** (attached to this report) 1. 1 layer of 5/8" GWB on one side 2. 2 layers of 3-1/2" insulation 3. Double Stud (2x4, 16" on-center) with 1" gap 4. Sealed at the bottom and top track 5. 2 layers of 5/8" GWB on one side	STC 62
Prediction for assembly 43B: **Laboratory Test Results: NRCC TL-93-269** (attached to this report) 1. 2 layers of 5/8" GWB on each side 2. 2 layers of 3-1/2" insulation 3. Double Stud (2x4, 16" on-center) with 1" gap 4. Sealed at the bottom and top track	STC 67

IV. Conclusion

The proposed flooring-ceiling assemblies will satisfy the International Building Code (IBC) sound transmission requirements of STC 50 and IIC 50 with one of the recommended alternatives.

Please contact us if you have any questions or for additional information.

Sincerely,

Erik Miller-Klein, P.E.
Partner & Acoustical Consultant

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RENEWAL DATE: 12/31/2018

NGC Testing Services

Acoustical Testing Laboratory

NVLAP®
Accredited by the National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code 200291

TEST REPORT

for

Weyerhaeuser
2910 East Amity Road
Boise, ID 83716

Sound Transmission Loss Test
ASTM E 90 – 04 / E 413 - 10

On

Cushioned Vinyl on 1 Inch Gypcrete over Acousti-Mat® II – Side 1
Single Layer of 5/8 Inch Wallboard over RC1 Channel (24 Inch o.c.) – Side 2
on 9-1/2 Inch I Joists and 23/32 Inch OSB
with 3-1/2 Inch Fiberglass Insulation

Reissued 10/22/12

Report Number: NGC 5012050

Assignment Number: G-780

Test Date: 8/1/2012

Report Date: 9/12/2012

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Menichetti
Director

1650 Military Road • Buffalo, NY 14217-1198
(716) 873-9750 • Fax (716) 873-9753 • www.ngctestingservices.com

Report Number: NGC 5012050

Test Method: This test method conforms explicitly with the American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements - Designation: E 90 - 04 / E 413 - 10.

Specimen Description: Wood floor-ceiling assembly, including a gypsum board ceiling, overlaid with, according to client, Cushioned Vinyl on Gypcrete Underlayment over Acousti-Mat® II with 3-1/2 inch Fiberglass Insulation.

The test specimen was a floor-ceiling assembly consisting of the following:

- 1 layer of, according to client, 1.7 mm (.065 in.) thick Cushioned Vinyl Flooring. Sample weight was 1.46 kg/m^2 (0.30 PSF).

- 25.4 mm (1 in.) direct pour gypcrete underlayment, weighing 49.32 kg/m^2 (10.1 PSF).

- 1 layer of, according to client, 6.2 mm (.245 in.) thick Acousti-Mat® II sound control system. Sample weight was 1.46 kg/m^2 (0.30 PSF).

- 1 layer of 18.3 mm (23/32 in.) OSB. The subfloor was screwed perpendicular to wood joists. Screws were spaced 152.4 mm (6 in.) o.c. at the perimeter and 304.8 mm (12 in.) o.c. in the field. The OSB weight was 10.69 kg/m^2 (2.19 PSF).

- 9-1/2 in. I Joists spaced 609.6 mm (24 in.) o.c. The joists were attached to rim boards, doubled on each side. The I Joist weight was 6.0 kg/m^2 (1.23 PSF). The rim board weight was 5.71 kg/m^2 (1.17 PSF).

- 1 layer of 88.9 mm (3-1/2 in.) un-faced fiberglass insulation, friction fit into joist cavities. The sample weight was 0.78 kg/m^2 (0.16 PSF).

- RC1 Channel spaced 609.6 mm (24 in.) o.c. The channels attached perpendicular to the joists with 31.8 mm (1-1/4 in.) type W drywall screws. The weight was 0.54 kg/m^2 (0.11 PSF).

- 1 layer of 15.9 mm (5/8 in.) gypsum board. The board was attached using 31.8 mm (1.25 in.) Type S drywall screws 304.8 mm (12 in.) on center. The board joints were taped. Gypsum board weight was 11.23 kg/m^2 (2.3 PSF).

The overall weight of the test assembly was 87.21 kg/m^2 (17.86 PSF).

The perimeter of the assembly was sealed with a rubber gasket and a sand filled trough. The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)

Test Results: The results of the tests are given on pages 3 and 4.

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Sound Transmission Loss Test Data

Test: ASTM E 90 - 04 / ASTM E 413 - 04

Test Report: NGC5012050 Date: 8/1/2012

Specimen Size [m²]: 17.8

Source room		Receiving room	
Volume [m³]:	53.2	Volume [m³]:	61.2
Rm Temp [°C]:	23.5	Rm Temp [°C]:	23.5
Humidity [%]:	53	Humidity [%]:	53

Sound Transmission Class STC [dB]: 58

Sum of Unfavorable Deviations [dB]: 27

Max. Unfavorable Deviation [dB]: 5 at 315 Hz

Frequency [Hz]	STL [dB]	L1 [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔSTL
100	38	105.7	74.6	22.0	6.9		2.82
125	44	104.7	67.9	21.6	7.3		3.35
160	47	106.6	67.1	18.5	7.5		2.11
200	44	106.2	69.8	17.5	7.6	4	1.11
250	47	106.1	66.9	19.3	7.8	4	1.17
315	49	102.7	61.0	21.8	7.4	5	0.35
400	52	102.9	57.9	22.0	7.0	5	1.27
500	56	103.3	53.9	26.0	6.6	2	0.46
630	59	102.1	49.7	27.0	6.5		0.32
800	59	101.8	48.3	27.8	5.5	1	0.48
1000	57	98.2	46.8	29.7	5.7	4	0.51
1250	60	97.2	43.1	31.1	5.8	2	0.75
1600	64	96.3	37.3	33.0	5.1		0.77
2000	67	99.0	36.5	35.5	4.5		0.60
2500	68	100.6	37.3	39.8	4.6		0.73
3150	72	99.6	31.4	42.6	3.8		1.07
4000	76	97.1	25.1	47.0	4.0		1.22
5000	79	90.5	15.0	52.6	3.5		1.55

STL = Sound Transmission Loss, dB
L1 = Source Room Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
Δ STL = Uncertainty for 95% Confidence Level

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(716) 873-9750 • Fax (716) 873-9753 • www.ngctestingservices.com

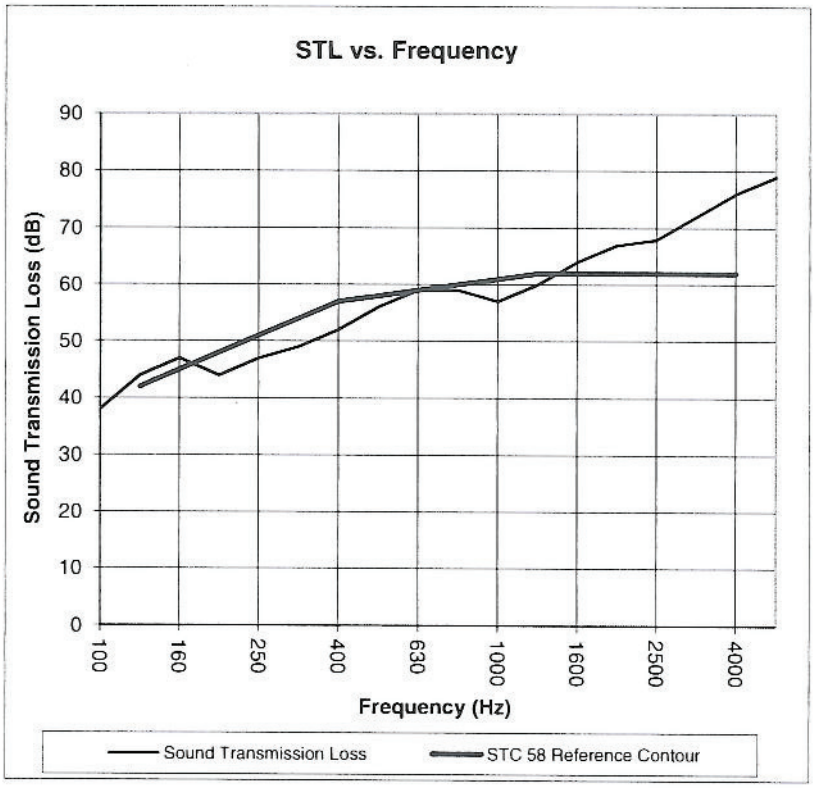
Sound Transmission Loss Test Data

Per: ASTM E 90 - 04 / ASTM E 413 - 04

Test Report: NGC5012050
Test Date: 8/1/2012
Specimen Size [m²]: 17.8

Sound Transmission Class STC = 58 dB

Frequency [Hz]	STL [dB]	ΔSTL
100	38	2.82
125	44	3.35
160	47	2.11
200	44	1.11
250	47	1.17
315	49	0.35
400	52	1.27
500	56	0.46
630	59	0.32
800	59	0.48
1000	57	0.51
1250	60	0.75
1600	64	0.77
2000	67	0.60
2500	68	0.73
3150	72	1.07
4000	76	1.22
5000	79	1.55



* Due to high insulating value of specimen, background levels limit results at these frequencies.

STL = Sound Transmission Loss, dB
Δ STL = Uncertainty for 95% Confidence Level

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TEST REPORT

for

Weyerhaeuser
2910 East Amity Road
Boise, ID 83716

Impact Sound Transmission Test
ASTM E 492 – 09 / ASTM E 989 – 06

On

Cushioned Vinyl on 1 Inch Gypcrete over Acousti-Mat® II – Side 1
Single Layer of 5/8 Inch Wallboard over RC1 Channel (24 Inch o.c.) – Side 2
on 9-1/2 Inch I Joists and 23/32 Inch OSB
with 3-1/2 Inch Fiberglass Insulation

Reissued 10/22/12

Report Number: NGC 7012109

Assignment Number: G-780

Test Date: 8/1/2012

Report Date: 9/12/2012

Submitted by: _____
Andrew E. Heuer
Senior Test Engineer

Reviewed by: _____
Robert J. Merchetti
Director

Report Number: NGC 7012109 **Reissued 10/22/12**

Test Method: This test method is in accordance with American Society for Testing and Materials Standard Test Method for Laboratory Measurement of Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine - Designation: E 492-09/ E 989-06.

The uncertainty limits of each tapping machine location met the precision requirements of section A1.4 of ASTM E 492-09.

Specimen Description: Wood floor-ceiling assembly, including a gypsum board ceiling, overlaid with, according to client, Cushioned Vinyl on Gypcrete Underlayment over Acousti-Mat® II with 3-1/2 inch Fiberglass Insulation.

The test specimen was a floor-ceiling assembly consisting of the following:

- 1 layer of, according to client, 1.7 mm (.065 in.) thick Cushioned Vinyl Flooring. Sample weight was 1.46 kg/m^2 (0.30 PSF).
- 25.4 mm (1 in.) direct pour gypcrete underlayment, weighing 49.32 kg/m^2 (10.1 PSF).
- 1 layer of, according to client, 6.2 mm (.245 in.) thick Acousti-Mat® II sound control system. Sample weight was 1.46 kg/m^2 (0.30 PSF).
- 1 layer of 18.3 mm (23/32 in.) OSB. The subfloor was screwed perpendicular to wood joists. Screws were spaced 152.4 mm (6 in.) o.c. at the perimeter and 304.8 mm (12 in.) o.c. in the field. The OSB weight was 10.69 kg/m^2 (2.19 PSF).
- 9-1/2 in. I Joists spaced 609.6 mm (24 in.) o.c. The joists were attached to rim boards, doubled on each side. The I Joists weight was 6.0 kg/m^2 (1.23 PSF). The rim board weight was 5.71 kg/m^2 (1.17 PSF).
- 1 layer of 88.9 mm (3-1/2 in.) un-faced fiberglass insulation, friction fit into joist cavities. The sample weight was 0.78 kg/m^2 (0.16 PSF).
- RC1 Channel spaced 609.6 mm (24 in.) o.c. The channels attached perpendicular to the joists with 31.8 mm (1-1/4 in.) type W drywall screws. The weight was 0.54 kg/m^2 (0.11 PSF).
- 1 layer of 15.9 mm (5/8 in.) gypsum board. The board was attached using 31.8 mm (1.25 in.) Type S drywall screws 304.8 mm (12 in.) on center. The board joints were taped. Gypsum board weight was 11.23 kg/m^2 (2.3 PSF).

The overall weight of the test assembly was 86.21 kg/m^2 (17.86 PSF).

The perimeter of the assembly was sealed with a rubber gasket and a sand filled trough. The test assembly was structurally isolated from the receiving room.

Specimen size: 3657.6 mm x 4876.8 mm (12 ft. x 16 ft.)

Test Results: The results of the tests are given on pages 3 and 4.

Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC7012109 Date: 8/1/2012
Specimen Size [m²]: 17.8

Source room

Rm Temp [°C]: 27.5
Humidity [%]: 53

Receiving room

Volume [m³]: 61.2
Rm Temp [°C]: 23.5
Humidity [%]: 53

Impact Insulation Class IIC [dB]: 53

Sum of Unfavorable Deviations [dB]: 27
Max. Unfavorable Deviation [dB]: 7 at 100 Hz

Frequency [Hz]	L_n [dB]	L2 [dB]	d [dB/s]	Corr. [dB]	u.Dev. [dB]	ΔL_n
100	66	70.4	24.5	-4.4	7	2.22
125	61	65.4	22.6	-4.4	2	1.53
160	66	71.0	17.6	-5.0	7	1.69
200	65	70.4	17.0	-5.4	6	0.93
250	64	69.0	19.7	-5.0	5	0.62
315	59	64.0	21.4	-5.0		0.42
400	55	59.2	22.3	-4.2		0.34
500	50	53.6	25.5	-3.6		0.24
630	42	45.8	27.4	-3.8		0.33
800	35	38.5	27.8	-3.5		0.17
1000	34	36.8	29.5	-2.8		0.36
1250	28	30.9	31.4	-2.9		0.39
1600	17	20.6	32.9	-3.6		0.42
2000	16	19.3	35.7	-3.3		0.61
2500	16	18.8	39.7	-2.8		0.33
3150	12	15.3	42.3	-3.3		0.45
4000	10	12.6	47.5	-2.6		0.54
5000	8	10.9	52.6	-2.9		0.58

L_n = Normalized Sound Pressure Level, dB
L2 = Receiving Room Level, dB
d = Decay Time, dB/second
ΔL_n = Uncertainty for 95% Confidence Level

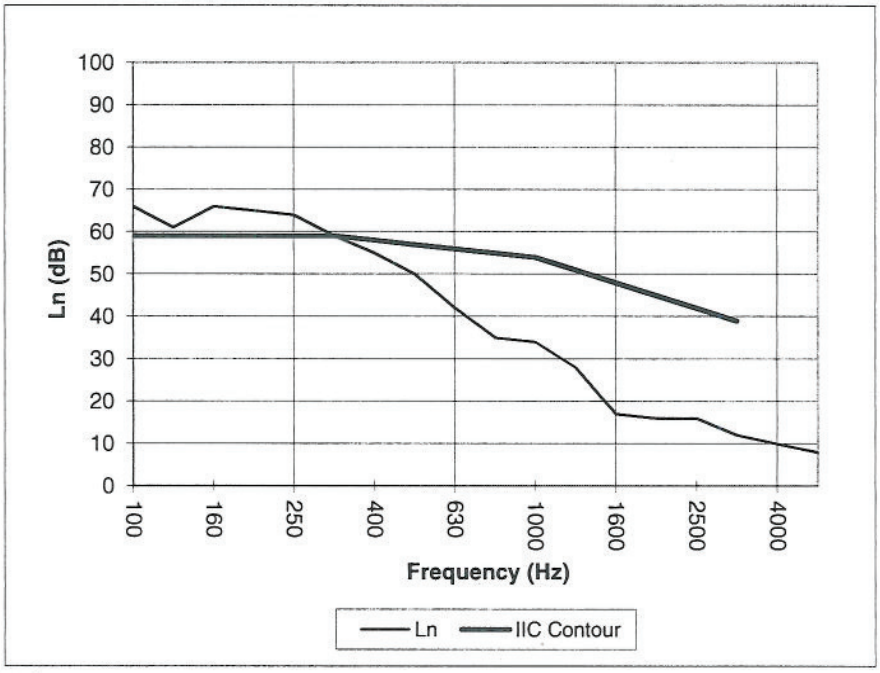
Normalized impact sound pressure level

Test: ASTM E 492 - 09 / ASTM E 989 - 06

Test Report: NGC7012109
Test Date: 8/1/2012
Specimen Size [m²]: 17.8

Impact Insulation Class IIC [dB]: 53

Frequency [Hz]	L_n [dB]	
100	66	
125	61	
160	66	
200	65	
250	64	
315	59	
400	55	
500	50	
630	42	
800	35	
1000	34	
1250	28	
1600	17	
2000	16	
2500	16	
3150	12	*
4000	10	*
5000	8	*



* Due to high insulating value of specimen, background levels limit results at these frequencies.

L_n = Normalized Sound Pressure Level, dB

REPORT

3933 US ROUTE 11 CORTLAND, NEW YORK 13045

Order No. 100336557 Date: June 24, 2011

REPORT NO. 100336557CRT-001g

**SOUND TRANSMISSION LOSS TEST
AND CLASSIFICATION OF MAXXON GYPSUM UNDERLAYMENT
OVER A SOUND CONTROL MAT
ON A WOOD JOIST FLOOR/CEILING ASSEMBLY**

**MAXXON CORPORATION
920 HAMEL ROAD, P. O. BOX 253
HAMEL, MN 55340-9610**

INTRODUCTION

This report gives the results of a Sound Transmission Loss Test and Classification of Maxxon Gypsum Underlayment over a Sound Control Mat on a wood joist floor/ceiling assembly. The floor/ceiling assembly was supplied and installed by Intertek. The gypsum topping and the acoustical mat underlayment were supplied and installed by a representative of Maxxon Corporation. The sample appeared to be in a new, unused condition.

AUTHORIZATION

Signed Quote No. 500285443.

TEST METHOD

The specimen was tested in general accordance with the American Society for Testing and Materials designation ASTM E90-09, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements", and classified in accordance with the American Society for Testing and Materials designation ASTM E413-04, “Classification for Rating Sound Insulation". The size of the source room for the measurements is smaller than the minimum recommended of 125m^3. This leads to slightly elevated uncertainties in the measurement data at low frequencies and does not allow microphones to be placed in full accordance with section A.2.

GENERAL

The sound-insulating property of a partition element is expressed in terms of the sound transmission loss. The procedure for determining this quantity is to mount (and perimeter seal) the test specimen as a partition between two reverberation rooms. Sound is introduced in one of the rooms (the source room) and measurements are made of the noise reduction between source room and receiving room. The rooms are so arranged and constructed that the only significant sound transmission between them is through the test specimen.

The purpose of the Sound Transmission Class (STC) is to provide a single figure rating that can be used for comparing the sound-insulating properties of partition elements used for general building design purposes. The higher the rating (STC) the greater the sound insulating properties of the partition.

DESCRIPTION OF THE FLOOR/CEILING ASSEMBLY

The test floor is a 100 sq. ft. opening that forms the horizontal separation of the two rooms, one directly above the other. The materials used in the assembly from top to bottom are:

- Nominal 1 inch thick Maxxon Gypsum Underlayment (poured March 10, 2011)
- Acousti-Mat II Sound Control Mat
- 5/8 inch thick T & G OSB nailed 6 inches on perimeter and 12 inches in field and glued to the joists using OSI PL400 adhesive
- 10 inch high nominal 2 X 10 lumber joists spaced 16 inches on center.
- R-11 unfaced batt insulation installed in the top of the cavities
- Dietrich RC Deluxe (dog bone) resilient channels spaced 24 inches on center
- One layer of 5/8 inch thick Type “X” gypsum board fastened to the channels with 1 inch screws 12 inches on center. Joint compound was applied at screw holes and joints.

RESULTS OF MEASUREMENTS

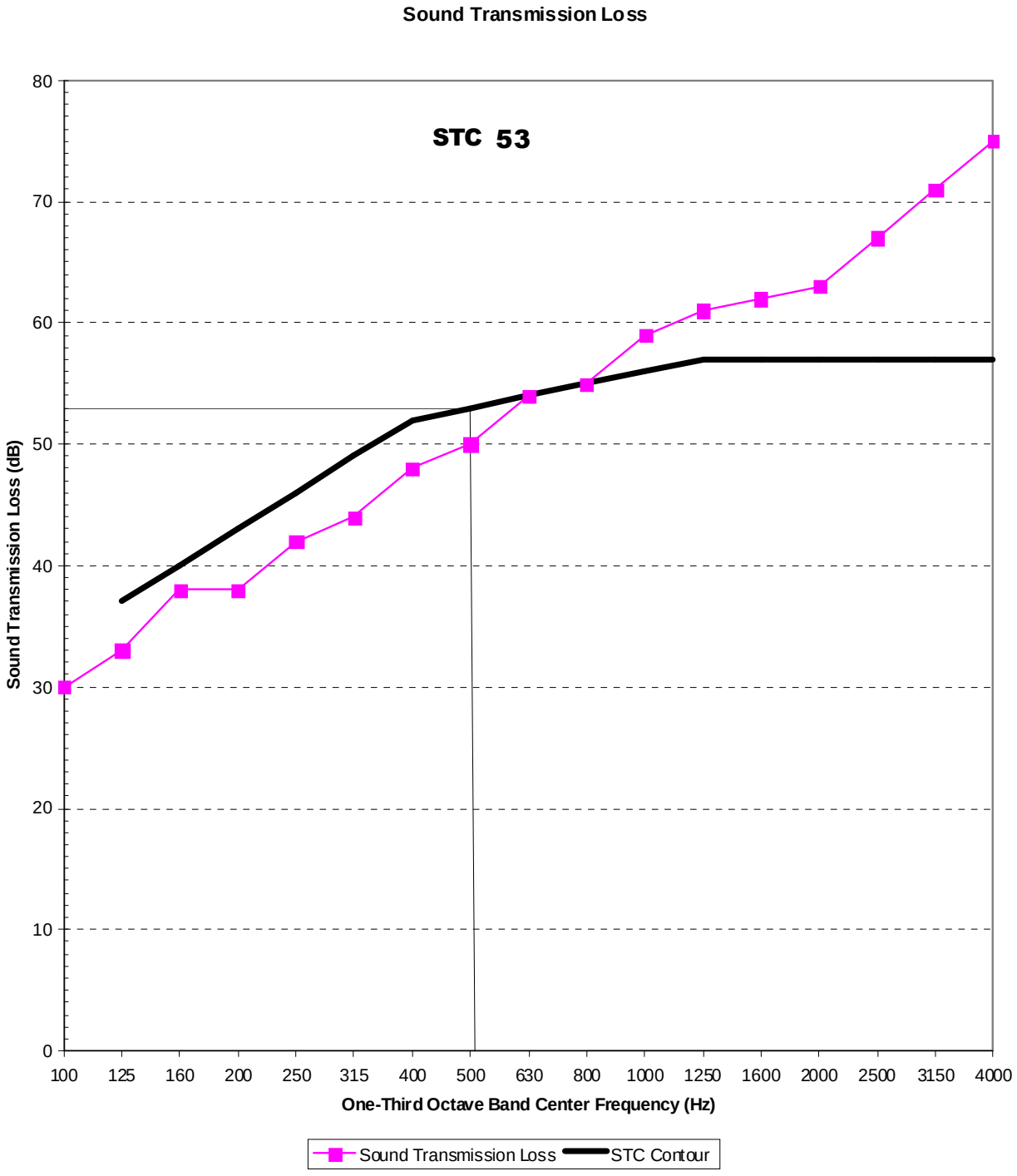
1/3 Octave Band Center Frequency Hz	Sound Transmission Loss in dB Test #1
80	24
100	30
125	33
160	38
200	38
250	42
315	44
400	48
500	50
630	54
800	55
1000	59
1250	61
1600	62
2000	63
2500	67
3150	71
4000	75
5000	77
Sound Transmission Class	53

PRECISION

For the Intertek flooring test facility, the 95% confidence interval ΔTL, is as follows:

Range of One-Third Octave Bands	Transmission Loss 95% Confidence Uncertainty, dB
125 and 200	<4
250 and 315	<2
400 - 4000	<1.5

Test #1



MAXXON CORPORATION

REMARKS

1. Ambient Temperature: 70℉
2. Relative Humidity: 23%

CONCLUSION

The test method employed for this test has no pass-fail criteria, therefore, the evaluation of the test results is left to the discretion of the client.

Date of Test: March 22, 2011

Report Approved by:

Brian Cyr
Engineer
Acoustical Testing

Report Reviewed By:

James R. Kline
Engineer/Quality Supervisor
Acoustical Testing

Attachments: None

FOR THE SCOPE OF ACCREDITATION
UNDER NVLAP LAB CODE 100402-0.

REPORT

3933 US ROUTE 11 CORTLAND, NEW YORK 13045

Order No. 100336557 June 24, 2011

REPORT NO. 100336557CRT-001m

IMPACT SOUND TRANSMISSION TEST AND CLASSIFICATION OF SHEET VINYL OVER MAXXON GYPSUM UNDERLAYMENT OVER A SOUND CONTROL MAT ON A WOOD JOIST FLOOR/CEILING ASSEMBLY

RENDERED TO

MAXXON CORPORATION
920 HAMEL ROAD, P. O. BOX 253
HAMEL, MN 55340-9610

INTRODUCTION

This report gives the results of an Impact Sound Transmission Loss Test and Classification Sheet Vinyl over Maxxon Gypsum Underlayment over a Sound Control Mat on a wood joist floor/ceiling assembly. The floor/ceiling assembly was supplied and installed by Intertek. The gypsum topping and the acoustical mat underlayment were supplied and installed by a representative of Maxxon Corporation. The sample appeared to be in a new, unused condition.

AUTHORIZATION

Signed Quote No. 500285443.

TEST METHOD

The specimen was tested in accordance with the American Society for Testing and Materials designation ASTM E492-09, “Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine”. It was classified in accordance with ASTM E989-2006, entitled, “Standard Classification for Determination of Impact Insulation Class (IIC)”.

GENERAL

The method is designed to measure the impact sound transmission performance of a floor-ceiling assembly, in a controlled laboratory environment. A standard tapping machine (Bruel & Kjaer Type 3207) was placed at four positions on a test floor that forms the horizontal separation between two rooms, one directly above the other. The data obtained was normalized to a reference room absorption of 10 square meters in accordance with the test method.

The standard also prescribes a single-figure classification rating called “Impact Insulation Class, IIC” which can be used by architects, builders and code authorities for acoustical design purposes in building construction.

The IIC is obtained by matching a standard reference contour to the plotted normalized one-third octave band sound pressure levels at each test frequency. The greater the IIC rating, the lower the impact sound transmission through the floor-ceiling assembly

DESCRIPTION OF THE FLOOR/CEILING ASSEMBLY

The test floor is a 100 sq. ft. opening that forms the horizontal separation of the two rooms, one directly above the other. The materials used in the assembly from top to bottom are:

- Nominal 1 inch thick Maxxon Gypsum Underlayment (poured March 10, 2011)
- Acousti-Mat II Sound Control Mat
- 5/8 inch thick T & G OSB nailed 6 inches on perimeter and 12 inches in field and glued to the joists using OSI PL400 adhesive
- 10 inch high nominal 2 X 10 lumber joists spaced 16 inches on center.
- R-11 unfaced batt insulation installed in the top of the cavities
- Dietrich RC Deluxe (dog bone) resilient channels spaced 24 inches on center
- One layer of 5/8 inch thick Type “X” gypsum board fastened to the channels with 1 inch screws 12 inches on center. Joint compound was applied at screw holes and joints.

Test #1 – Armstrong Memories Sheet Vinyl – full glued

RESULTS OF TEST

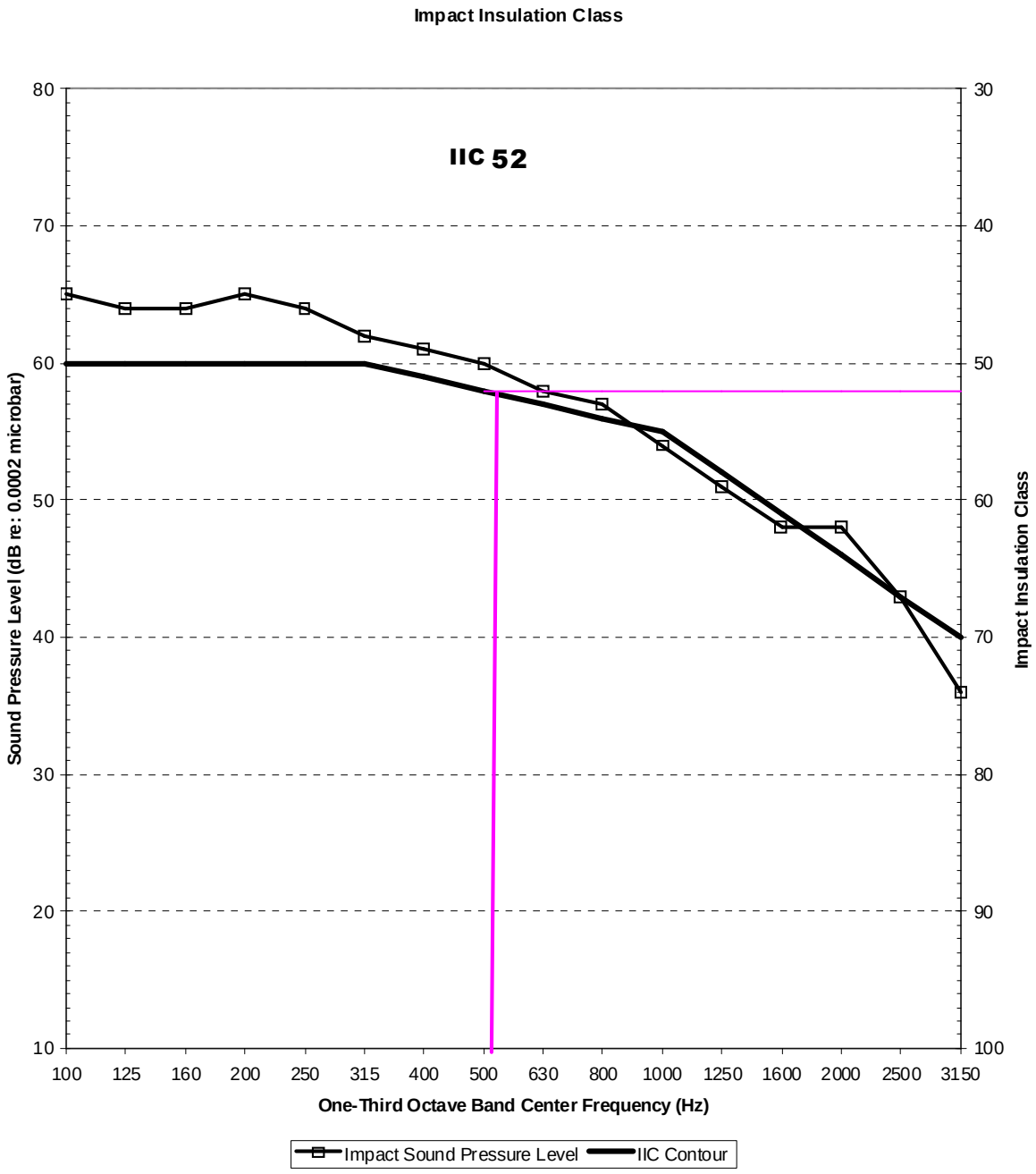
The data obtained in the room below the panel normalized to A_o = 10 square meters, is as follows:

1/3 Octave Band Center Frequency Hz	1/3 Octave Band Sound Pressure Level dB re 0.0002 Microbar
	Test #1
100	65
125	64
160	64
200	65
250	64
315	62
400	61
500	60
630	58
800	57
1000	54
1250	51
1600	48
2000	48
2500	43
3150	36
Impact Insulation Class (IIC)	52

The 95% uncertainty level for each tapping machine location is less than 3 dB for the 1/3 octave bands centered in the range from 100 to 400 Hz and less than 2.5 dB for the bands centered in the range from 500 to 3150 Hz.

For the floor/ceiling construction, the 95% uncertainty limits (ΔL_n) for the normalized sound pressure levels were determined to be less than 2 dB for the 1/3 octave bands centered in the range from 100 to 3500.

TEST #1



MAXXON CORPORATION

FOR THE SCOPE OF
ACCREDITATION UNDER NVLAP
LAB CODE 100402-0.

REMARKS

1. Ambient Temperature: 71 ℉
2. Relative Humidity: 53 %

CONCLUSION

The test method employed for this test has no pass-fail criteria, therefore, the evaluation of the test results is left to the discretion of the client.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Date of Test: April 26, 2011

Report Approved by:

Brian Cyr
Engineer
Acoustical Testing

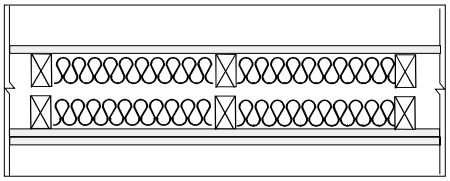
Report Reviewed By:

James R. Kline
Engineer/Quality Supervisor
Acoustical Testing

Attachments: None

G16_WS90(406)_GFB90_AIR25_WS90(406)_GFB90_2G16

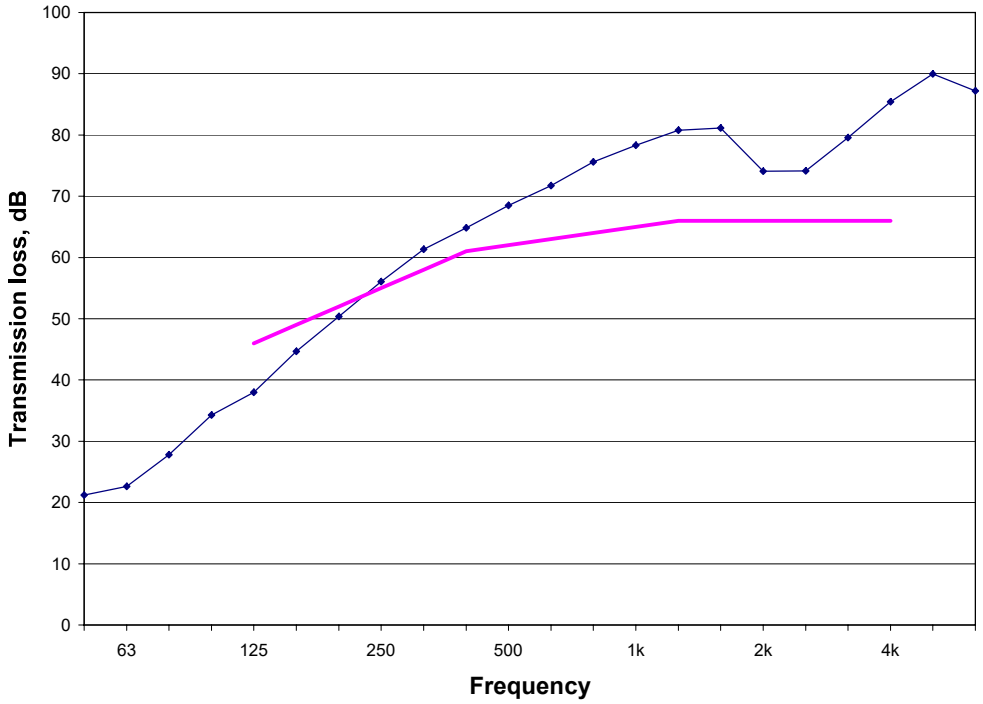
Element	Description:
1	single layer of 16 mm type X gypsum board
2	90 mm wood studs at 406 mm on centre
3	90 mm of glass fibre insulation in cavity
4	25 mm gap filled with air
5	90 mm wood studs at 406 mm on centre
6	90 mm of glass fibre insulation in cavity
7	single layer of 16 mm type X gypsum board
8	single layer of 16 mm type X gypsum board



TestID	TL-93-267
STC	62
50 Hz	21.2
63 Hz	22.6
80 Hz	27.8
100 Hz	34.3
125 Hz	38.0
160 Hz	44.7
200 Hz	50.4
250 Hz	56.1
315 Hz	61.3
400 Hz	64.8
500 Hz	68.5
630 Hz	71.7
800 Hz	75.6
1000 Hz	78.3
1250 Hz	80.8
1600 Hz	81.1
2000 Hz	74.1
2500 Hz	74.2
3150 Hz	79.6
4000 Hz	85.4
5000 Hz	90.0
6300 Hz	87.2

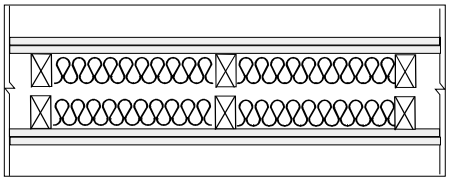
TL-93-267	element 1	element 2	element 3	element 4	element 5	element 6	element 7	element 8
type	gypsum board	stud	insulation	gap	stud	insulation	gypsum board	gypsum board
material	CX	wood	G1	air	wood	G1	CX	CX
thickness mm	16	90	90	25	90	90	16	16
gauge								
spacing mm		406			406			
surface density kg/m^2	11.5		1.1			1.1	11.4	11.4
linear density kg/m		1.4			1.4			
total weight kg	85.6	37.0	7.1		37.9	7.1	84.4	84.7
fastener spacing - edge mm	406						610	406
fastener spacing - field mm	406						610	406
fastener top track pattern	c						c	c
fastener base track pattern	c						c	c
stud attached to top track		yes			yes			
double header								
orientation	vertical						vertical	vertical

TL-93-267
STC 62



2G16_WS90(406)_GFB90_AIR25_WS90(406)_GFB90_2G16

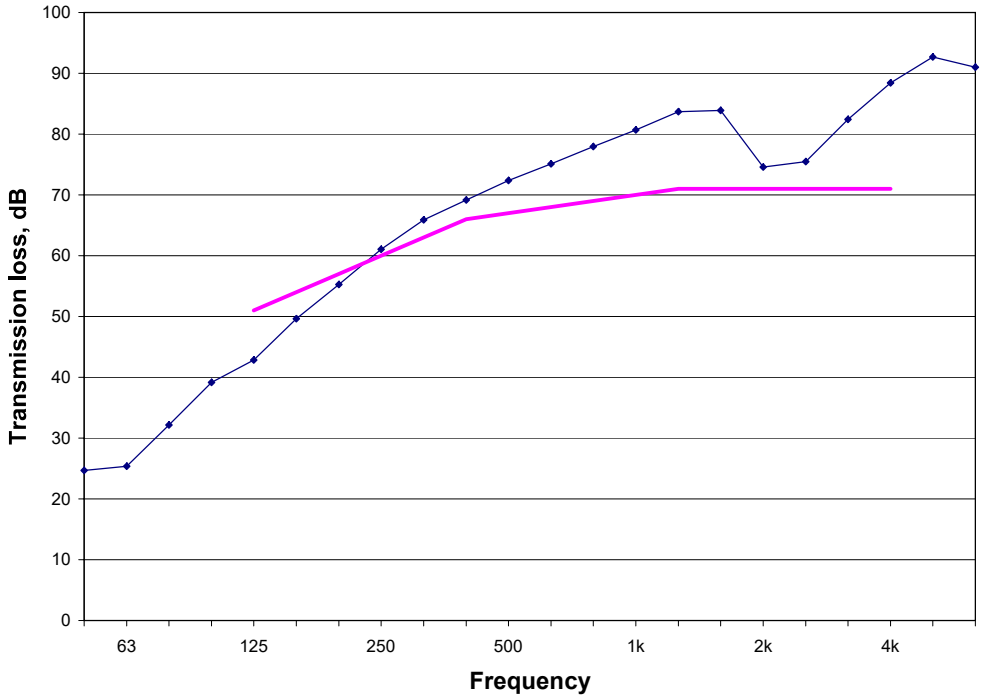
Element	Description:
1	single layer of 16 mm type X gypsum board
2	single layer of 16 mm type X gypsum board
3	90 mm wood studs at 406 mm on centre
4	90 mm of glass fibre insulation in cavity
5	25 mm gap filled with air
6	90 mm wood studs at 406 mm on centre
7	90 mm of glass fibre insulation in cavity
8	single layer of 16 mm type X gypsum board
9	single layer of 16 mm type X gypsum board



TestID	TL-93-269
STC	67
50 Hz	24.7
63 Hz	25.4
80 Hz	32.2
100 Hz	39.1
125 Hz	42.8
160 Hz	49.6
200 Hz	55.3
250 Hz	61.1
315 Hz	65.9
400 Hz	69.1
500 Hz	72.4
630 Hz	75.1
800 Hz	77.9
1000 Hz	80.7
1250 Hz	83.7
1600 Hz	83.9
2000 Hz	74.6
2500 Hz	75.5
3150 Hz	82.4
4000 Hz	88.4
5000 Hz	92.7
6300 Hz	91.0

TL-93-269	element 1	element 2	element 3	element 4	element 5	element 6	element 7	element 8	element 9
type	gypsum board	gypsum board	stud	insulation	gap	stud	insulation	gypsum board	gypsum board
material	CX	CX	wood	G1	air	wood	G1	CX	CX
thickness mm	16	16	90	90	25	90	90	16	16
gauge									
spacing mm			406			406			
surface density kg/m^2	11.6	11.5		1.1			1.1	11.4	11.4
linear density kg/m			1.4			1.4			
total weight kg	85.9	85.6	37.0	7.1		37.9	7.1	84.4	84.7
fastener spacing - edge mm	406	610						610	406
fastener spacing - field mm	406	610						610	406
fastener top track pattern	c	c						c	c
fastener base track pattern	c	c						c	c
stud attached to top track			yes			yes			
double header									
orientation	vertical	vertical						vertical	vertical

TL-93-269
STC 67



G6527.13-113-11-R0
ACOUSTICAL PERFORMANCE TEST REPORT
ASTM E 90 AND ASTM E 492

Rendered to

PLITEQ INC.

Series/Model: Stone Pavers on Pillar System - Owens Corning FOAMULAR 250

Specimen Type: Weyerhauser TJI Assembly - 305 mm (12")

Overall Size: 3023 mm by 3632 mm (119" by 143")

STC	**59**
IIC	**63**

Test Specimen Identification:
Floor Topping: 50.8 mm (2") Stone Pavers
Supports: 50.08 mm (1.97") Bison Low Adjustable Deck Supports
Floor Underlayment: 50.8 mm (2") Owens Corning FOAMULAR 250 R-10 Insulation Sheathing
Subfloor Topping: 12.7 mm (0.5") Plywood Sheathing
Subfloor: 18.8 mm (0.74") Oriented Strand Board Sheathing
Insulation: 241.3 mm (9.5") Owens Corning Unfaced R-30 Fiberglass Insulation
Joist: 301.63 mm (11.88") Weyerhaeuser TrusJoist® 360 TJI Joist
Ceiling Isolation: 12.7 mm (0.5") ClarkDietrich RC Deluxe™ Resilient Channel
Ceiling: 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel
Ceiling: 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel

Reference should be made to Intertek-ATI Report G6527.13-113-11 for complete test specimen description. This page alone is not a complete report.

Acoustical Performance Test Report

PLITEQ INC.
1370 Don Mills Road, Unit 300
Toronto, Ontario M3B 3N7
CANADA

Report	G6527.13-113-11
Test Date	12/22/16
Report Date	01/17/17

Project Scope

Architectural Testing, Inc., an Intertek company (Intertek-ATI), was contracted to conduct airborne sound transmission loss and impact sound transmission tests. The complete test data is included as attachments to this report. The full test specimen was assembled on the day of testing by Intertek-ATI. All materials provided by the client were installed on an existing Intertek-ATI assembly (Weyerhauser TJI Assembly - 305 mm (12")) utilizing Intertek-ATI-supplied materials.

Test Methods

The acoustical tests were conducted in accordance with the following standards. The equipment listed in the attachments meets the requirements of the following standards.

ASTM E 90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 413-10, Classification for Rating Sound Insulation
ASTM E 492-09(2016)e1, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
ASTM E 989-06 (2012), Classification for Determination of Impact Insulation Class (IIC)
ASTM E 2235-04 (2012) Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods

Test Procedure

All testing was conducted in the VT test chambers at Intertek-ATI located in York, Pennsylvania. The microphones were calibrated before conducting the tests.

The airborne transmission loss test was conducted in accordance with the ASTM E 90 test method using the single direction method. Two background noise sound pressure level and five sound absorption measurements were conducted at each of five microphone positions. Four sound pressure level measurements were made simultaneously in both rooms, at each of five microphone positions.

Test Procedure (Continued)

The impact sound transmission test was conducted in accordance with the ASTM E 492 test method. Two background noise sound pressure level, two sound pressure level measurements with the tapping machine operating at each position specified by ASTM E 492, and five sound absorption measurements were conducted at each of five microphone positions.

The air temperature and relative humidity conditions were monitored and recorded during all measurements.

Test Conditions

Source Room		Receive Room	
Average Temperature	19.6°C (67.3°F)	Average Temperature	20.9°C (69.7°F)
Average Relative Humidity	46%	Average Relative Humidity	38%

Test Calculations

The STC (Sound Transmission Class) and IIC (Impact Insulation Class) ratings were calculated in accordance with ASTM E 413 and ASTM E 989, respectively.

Test Specimen Materials and Installation Details

Material	Dimensions (mm/inch)	Thickness (mm/inch)	Manufacturer and Series	Quantity	Average Weight
Stone Pavers	603.3 by 603.3 23.8 by 23.8	50.8 / 2	N/A	10.98 m² 118.19 ft²	119.58 kg/m² 24.49 lb/ft²
	Note: Laid on the supports with one on each of the four corners of the square pavers.				
Deck Supports	203.2 by 203.2 8 by 8	50.1 / 1.97	Bison Low Adjustable	42 units	3.27 kg/unit 7.21 lb/unit
	Note: Extended to maximum height, placed on the floor slab to create a 610 mm by 610 mm (24" by 24") grid.				
Insulation Sheathing	1219 by 2438 48 by 96	50.8 / 2	Owens Corning FOAMULAR 250 R-10	10.98 m² 118.19 ft²	1.6 kg/m² 0.33 lb/ft²
	Note: Loose laid				
Plywood Sheathing	1219 by 2438 48 by 96	12.7 / 0.5	N/A	10.98 m² 118.19 ft²	6.72 kg/m² 1.38 lb/ft²
	Note: Fastened to subfloor with 305 mm (12") centers along the joists				
Oriented Strand Board Sheathing	1219 by 2438 48 by 96	18.8 / 0.74	N/A	10.98 m² 118.19 ft²	10.25 kg/m² 2.1 lb/ft²
	Note: Fastened to joists with 76 mm by 3 mm (3" by 0.12") framing nails on 203 mm (8") centers along perimeter and 305 mm (12") centers in the field.				
Fiberglass Insulation	2438 by 609.6 96 by 24	241.3 / 9.5	Owens Corning Unfaced R-30	10.98 m² 118.19 ft²	1.61 kg/m² 0.33 lb/ft²
	Note: Installed in the cavity between trusses flush with the subfloor				
TJI Joist	57.2 by 3023 2.3 by 119	301.6 / 11.88	Weyerhaeuser TrusJoist® 360	21.2 lin m 69.4 lin ft	4.46 kg/m 3 lb/ft
	Note: Fastened to perimeter frame on 610 mm (24") centers				

Test Specimen Materials and Installation Details (Continued)

Material	Dimensions (mm/inch)	Thickness (mm/inch)	Manufacturer and Series	Quantity	Average Weight
Resilient Channel	68.6 by 3454 2.7 by 136	12.7 / 0.5	ClarkDietrich RC Deluxe™	27.6 lin m 90.5 lin ft	0.33 kg/m 0.22 lb/ft
	Note: Installed on 406 mm (16") centers perpendicular to the trusses. The measured thickness of the metal was 0.7 mm (0.03").				
Gypsum Panel	1219 by 3023 48 by 119	15.9 / 0.63	National Gypsum Gold Bond® Fire-Shield® Type X	10.98 m² 118.19 ft²	11.23 kg/m² 2.3 lb/ft²
	Note: Fastened to resilient channels on 305 mm (12") centers with 25.4 mm (1") type S screws. Seams and perimeter sealed with SikaFlex Construction Sealant and covered with pressure-sensitive tape.				
Gypsum Panel	1219 by 3023 48 by 119	15.9 / 0.63	National Gypsum Gold Bond® Fire-Shield® Type X	10.98 m² 118.19 ft²	11.23 kg/m² 2.3 lb/ft²
	Note: Fastened to resilient channels on 305 mm (12") centers with 41.3 mm (1.63") type S screws. Seams and perimeter sealed with SikaFlex Construction Sealant and covered with pressure-sensitive tape.				

Comments

The total weight of the floor/ceiling assembly was 2022 kg / 4458.4 lbs. Intertek-ATI will store samples of the test specimen for four years. A photograph of the test specimen is included in the attachments. The client did not supply drawings of the test specimen.

Intertek-ATI will service this report for the entire test record retention period. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained by Intertek-ATI for the entire test record retention period. The test record retention period ends four years after the test date.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen tested. This report is intended to help in the client's quality assurance program, but it does not represent a continuous or exhaustive evaluation of the specimen tested or of other products or materials that were not evaluated. The statements and data provided herein do not constitute approval, disapproval, certification, or acceptance of performance or materials.

FOR INTERTEK-ATI:

Digitally Signed by: Daniel Mohler

Digitally Signed by: Jordan Strybos

Daniel B. Mohler	Jordan Strybos
Project Lead - Acoustical Testing	Project Manager - Acoustical Testing

Attachments (6 pages): This report is complete only when all attachments listed are included.

- Instrumentation (1)
- Airborne Sound Transmission Loss Data (2)
- Impact Sound Transmission Data (2)
- Photographs (1)

** Stated by Client/Manufacturer*

N/A - Non Applicable

Revision Log

Revision	Date	Page(s)	Description
R0	01/17/17	N/A	Original Report Issue

Attachments

Instrumentation

Instrument	Manufacturer	Model	ATI Number	Date of Calibration
Data Acquisition Unit	National Instruments	PXI-1033	65124	06/17 *
Microphone Calibrator	Norsonic	1251	INT00127	01/16
Receive Room Microphone	PCB Piezontronics	378B20	63748	06/16
Receive Room Microphone	PCB Piezotronics	378B20	63744	06/16
Receive Room Microphone	PCB Piezotronics	378B20	63745	06/16
Receive Room Microphone	PCB Piezotronics	378C20	65617	06/16
Receive Room Microphone	PCB Piezotronics	378B20	63747	06/16
Receive Room Environmental Indicator	Comet	T7510	63810	10/16
			63811	10/16
Source Room Microphone	PCB Piezotronics	378B20	63738	05/16
Source Room Microphone	PCB Piezotronics	378B20	63739	05/16
Source Room Microphone	PCB Piezotronics	378B20	63740	05/16
Source Room Microphone	PCB Piezotronics	378B20	63742	05/16
Source Room Microphone	Scantek	378B20	63741	05/16
Source Room Environmental Indicator	Comet	T7510	63812	11/16
Tapping Machine	Look Line s.r.l.	EM50 (TM50)	65351	02/16

** The calibration frequency for this equipment is every two years per the manufacturer's recommendation.*

Test Chambers

VT Receive Room Volume	157.31 m³ (5555.47 ft³)
VT Source Room Volume	190 m³ (6709.79 ft³)

Intertek | Architectural Testing

G6527.13-113-11-R0

ACCREDITED Testing Laboratory

AIRBORNE SOUND TRANSMISSION LOSS

ASTM E 90

Test Date	12/22/16
Data File No.	G6527.13
Client	Pliteq Inc.
Description	50.8 mm (2") Stone Pavers, 50.08 mm (1.97") Bison Low Adjustable Deck Supports, 50.8 mm (2") Owens Corning FOAMULAR 250 R-10 Insulation Sheathing, 12.7 mm (0.5") Plywood Sheathing, 18.8 mm (0.74") Oriented Strand Board Sheathing, 241.3 mm (9.5") Owens Corning Unfaced R-30 Fiberglass Insulation, 301.63 mm (11.88") Weyerhaeuser TrusJoist® 360 TJI Joist, 12.7 mm (0.5") ClarkDietrich RC Deluxe™ Resilient Channel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel
Specimen Area	10.98 m²
Technician	Daniel B. Mohler

Freq (Hz)	**Background SPL** (dB)	**Absorption** (m²)	**Source SPL** (dB)	**Receive SPL** (dB)	**Specimen TL** (dB)	**95% Confidence Limit**	**Number of Deficiencies**
50	47.2	37.6	103	63	34	3.70	-
63	45.3	29.0	100	66	30	3.30	-
80	33.7	16.1	108	70	36	4.00	-
100	35.4	12.7	105	69	35	2.10	-
125	35.4	10.5	104	66	38	1.10	5
160	30.1	9.3	104	65	40	1.10	6
200	25.9	10.0	102	57	46	1.20	3
250	28.9	10.0	100	52	49	1.00	3
315	26.8	9.5	105	52	53	0.70	2
400	22.4	8.2	102	49	54	0.60	4
500	23.7	7.8	101	45	57	0.50	2
630	25.1	7.4	101	43	59	0.30	1
800	23.1	7.5	101	42	60	0.40	1
1000	21.5	7.6	100	42	59	0.40	3
1250	21.1	7.9	98	38	62	0.40	1
1600	15.9	8.1	99	37	64	0.50	0
2000	9.4	9.2	99	36	64	0.40	0
2500	6.3	10.2	95	31	64	0.40	0
3150	5.2	11.3	97	27	69	0.50	0
4000	5.2	13.6	97	24	72	0.30	0
5000	5.6	16.6	94	19	73	0.60	-
6300	6.2	20.5	91	11	78	0.50	-
8000	6.6	28.6	92	9	79	0.60	-
10000	6.8	36.0	90	7	78	0.60	-

STC Rating	**59**	*(Sound Transmission Class)*
Deficiencies	31	*(Sum of Deficiencies)*
Rw Rating	**58**	*(Sound Reduction Index)*

Notes: *1) Receive Room levels less than 5 dB above the Background levels are highlighted in yellow.*
2) Specimen TL levels listed in red are potentially limited by the laboratory flanking limit.
2) Specimen TL levels listed in blue indicate the lower limit of the transmission loss.
3) Specimen TL levels listed in green indicate that there has been a filler wall correction applied

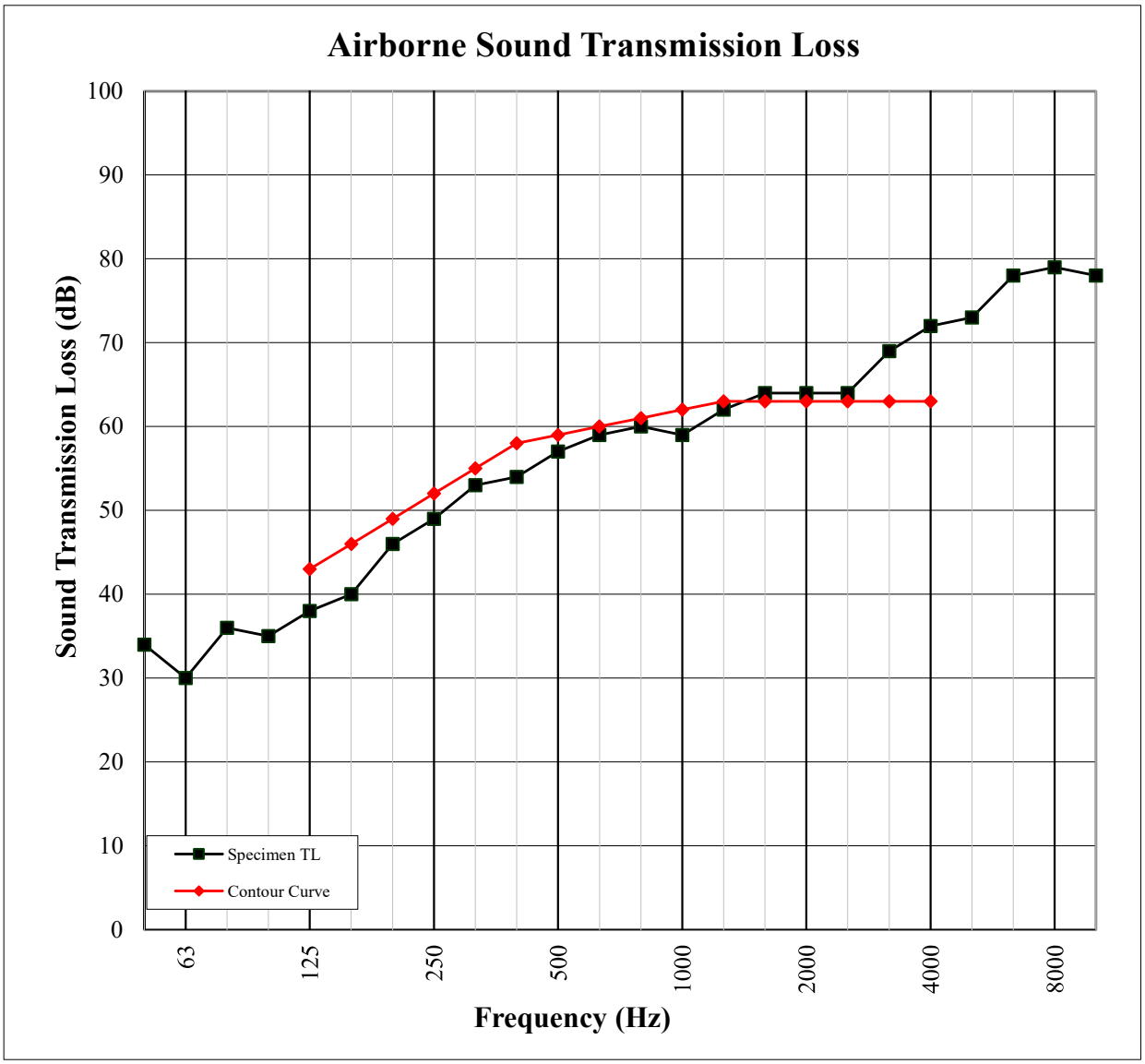
Architectural Testing

ACCREDITED Testing Laboratory

AIRBORNE SOUND TRANSMISSION LOSS

ASTM E 90

Test Date	12/22/16
Data File No.	G6527.13
Client	Pliteq Inc.
Description	50.8 mm (2") Stone Pavers, 50.08 mm (1.97") Bison Low Adjustable Deck Supports, 50.8 mm (2") Owens Corning FOAMULAR 250 R-10 Insulation Sheathing, 12.7 mm (0.5") Plywood Sheathing, 18.8 mm (0.74") Oriented Strand Board Sheathing, 241.3 mm (9.5") Owens Corning Unfaced R-30 Fiberglass Insulation, 301.63 mm (11.88") Weyerhaeuser TrusJoist® 360 TJI Joist, 12.7 mm (0.5") ClarkDietrich RC Deluxe™ Resilient Channel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel
Specimen Area	10.98 m²
Technician	Daniel B. Mohler



Intertek | Architectural Testing

ACCREDITED Testing Laboratory

IMPACT SOUND TRANSMISSION

ASTM E 492

Test Date	12/22/16
Data File No.	G6527.13
Client	Pliteq Inc.
Description	50.8 mm (2") Stone Pavers, 50.08 mm (1.97") Bison Low Adjustable Deck Supports, 50.8 mm (2") Owens Corning FOAMULAR 250 R-10 Insulation Sheathing, 12.7 mm (0.5") Plywood Sheathing, 18.8 mm (0.74") Oriented Strand Board Sheathing, 241.3 mm (9.5") Owens Corning Unfaced R-30 Fiberglass Insulation, 301.63 mm (11.88") Weyerhaeuser TrusJoist® 360 TJI Joist, 12.7 mm (0.5") ClarkDietrich RC Deluxe™ Resilient Channel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel
Specimen Area	10.98 m²
Technician	Daniel B. Mohler

Freq (Hz)	**Background SPL** (dB)	**Absorption** (m²)	**Normalized Impact SPL** (dB)	**95% Confidence Limit**	**Number of Deficiencies**
50	43.8	34.7	52	3.1	-
63	40.9	36.9	55	2.5	-
80	34.5	16.4	54	3.3	-
100	35.9	12.2	48	1.5	0
125	33.4	10.2	51	2.0	2
160	25.8	9.2	47	2.8	0
200	23.2	10.0	38	1.2	0
250	27.8	10.3	37	1.0	0
315	22.7	9.4	40	1.0	0
400	19.7	8.2	39	1.2	0
500	22.9	7.7	45	0.8	0
630	24.7	7.3	44	0.7	0
800	21.5	7.4	49	0.4	4
1000	21.1	7.6	41	0.7	0
1250	20.9	7.8	44	0.2	3
1600	16.2	8.0	46	0.7	8
2000	10.0	9.1	35	0.3	0
2500	7.1	10.3	40	0.7	8
3150	6.3	11.3	29	0.3	0
4000	6.0	13.7	23	0.3	-
5000	6.9	16.6	15	1.0	-
6300	9.2	20.7	10	0.7	-
8000	8.8	28.5	10	0.7	-
10000	9.2	35.3	11	0.8	-

IIC Rating **63** *(Impact Insulation Class)*

Deficiencies 25 *(Sum of Deficiencies)*

Note: *Receive Room levels less than 5 dB above the Background levels are highlighted in yellow.*

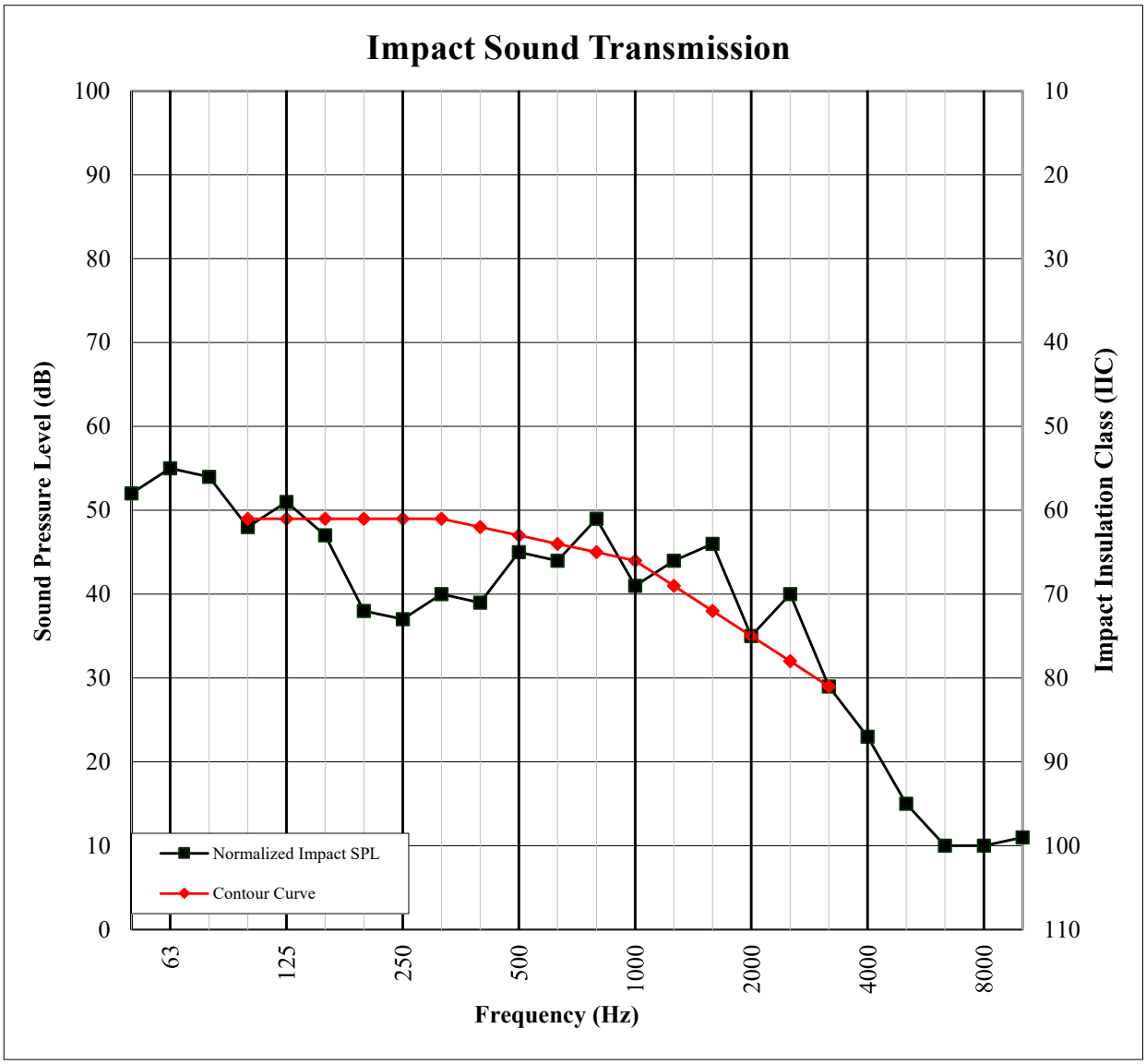
Architectural Testing

ACCREDITED Testing Laboratory

IMPACT SOUND TRANSMISSION

ASTM E 492

Test Date	12/22/16
Data File No.	G6527.13
Client	Pliteq Inc.
Description	50.8 mm (2") Stone Pavers, 50.08 mm (1.97") Bison Low Adjustable Deck Supports, 50.8 mm (2") Owens Corning FOAMULAR 250 R-10 Insulation Sheathing, 12.7 mm (0.5") Plywood Sheathing, 18.8 mm (0.74") Oriented Strand Board Sheathing, 241.3 mm (9.5") Owens Corning Unfaced R-30 Fiberglass Insulation, 301.63 mm (11.88") Weyerhaeuser TrusJoist® 360 TJI Joist, 12.7 mm (0.5") ClarkDietrich RC Deluxe™ Resilient Channel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel, 15.9 mm (0.63") National Gypsum Gold Bond® Fire-Shield® Type X Gypsum Panel
Specimen Area	10.98 m²
Technician	Daniel B. Mohler



Photograph

Construction of Test Specimen

BUILDING LEGEND

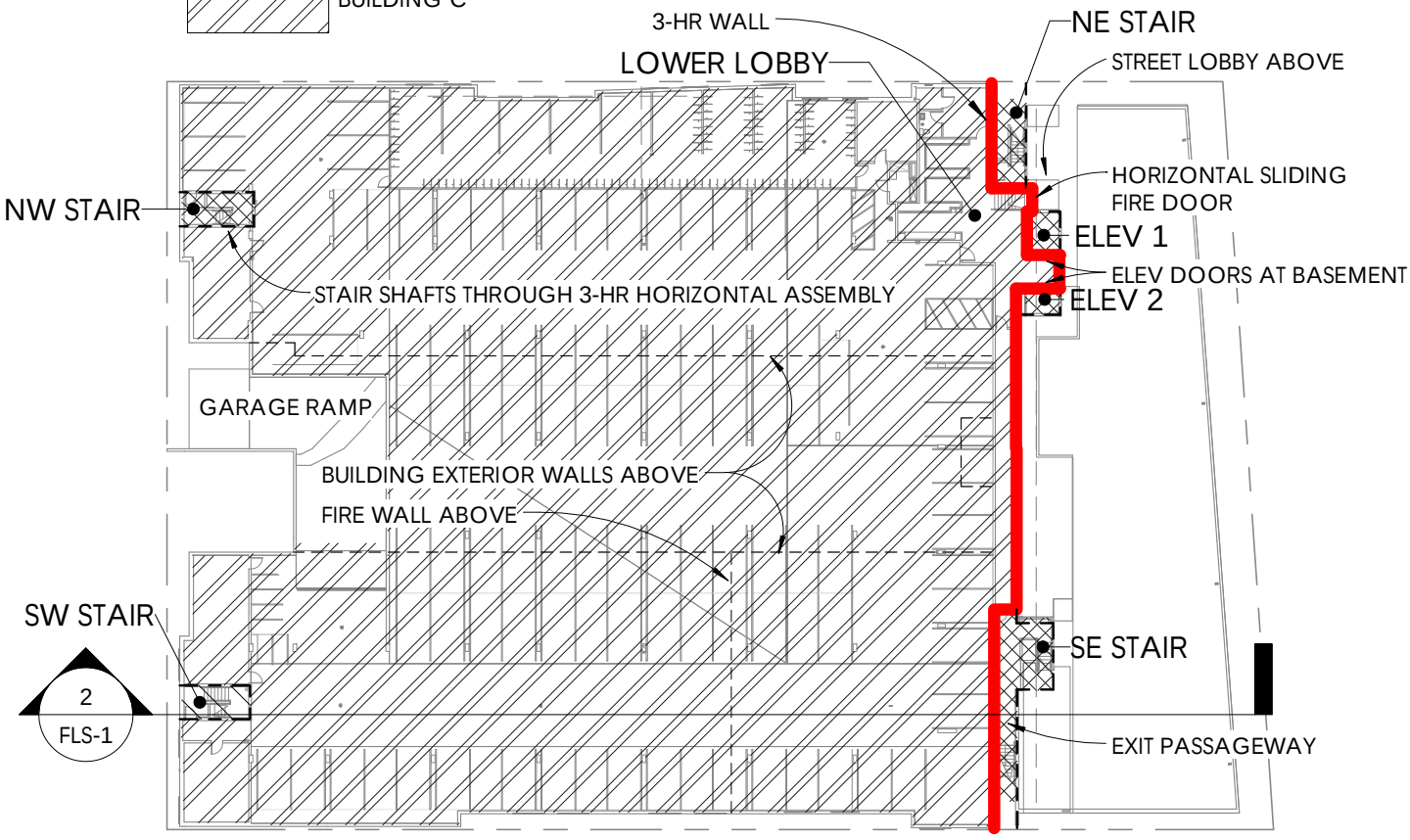
BUILDING A

BUILDING B

BUILDING C

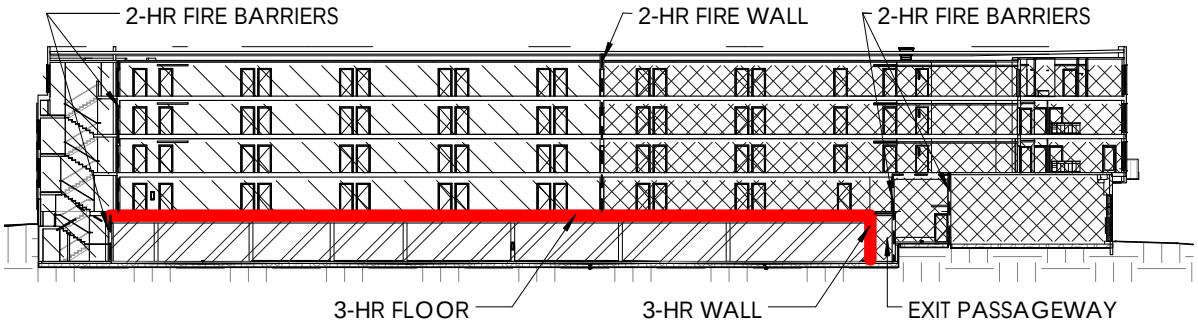
BUILDING A	
A-2	8,155 SF
A-3	7,612 SF
B	1,459 SF
R-2	102,853 SF
S-2	1,791 SF
	121,870 SF

BUILDING B	
R-2	37,647 SF
	37,647 SF
BUILDING C	
B	237 SF
S-2	38,230 SF
	38,467 SF
	197,984 SF



BASEMENT FLOOR - BUILDING KEY

1" = 50'-0"



FLS EW SECTION

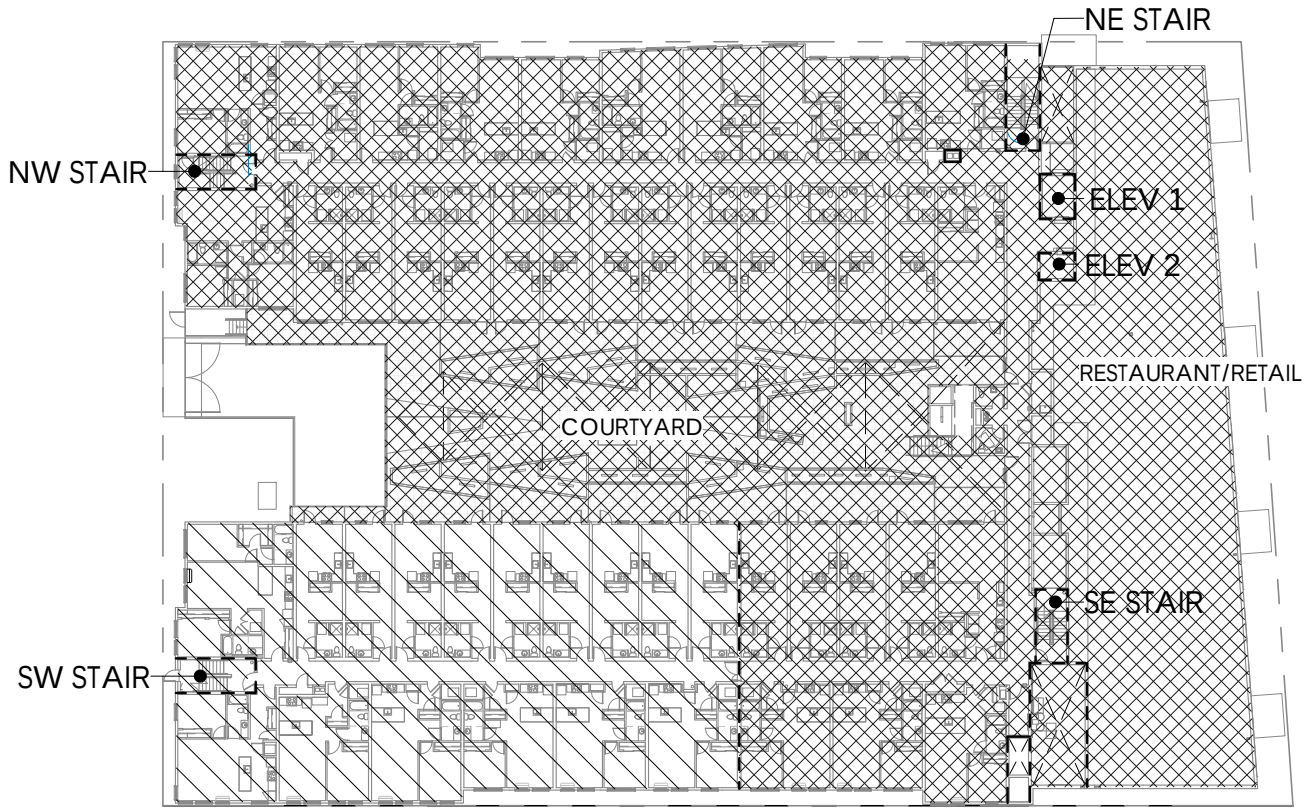
1" = 50'-0"

Sellwood Mixed Use

Path Development

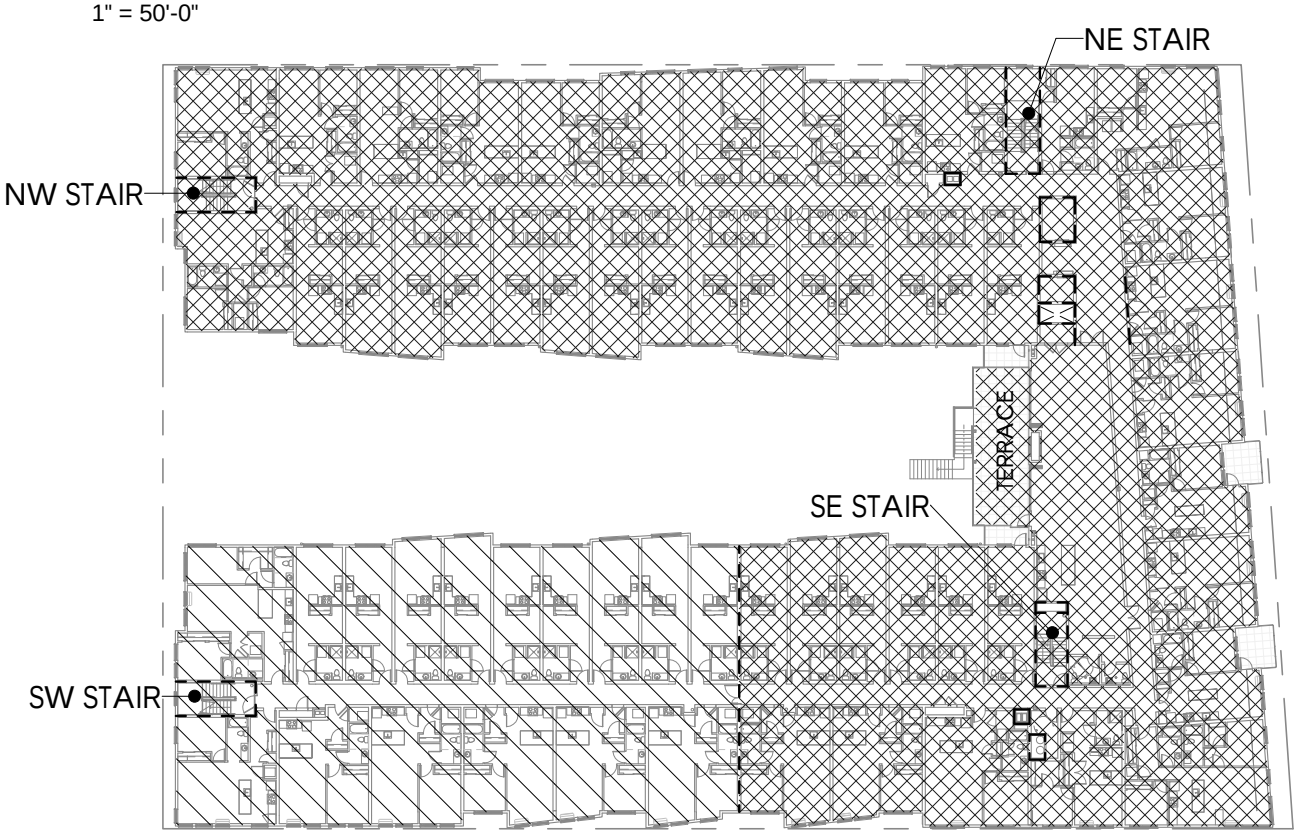
02/28/17

FLS-1



1ST FLOOR - FIRE & LIFE SAFETY PLAN

1" = 50'-0"



2ND FLOOR - BUILDING KEY

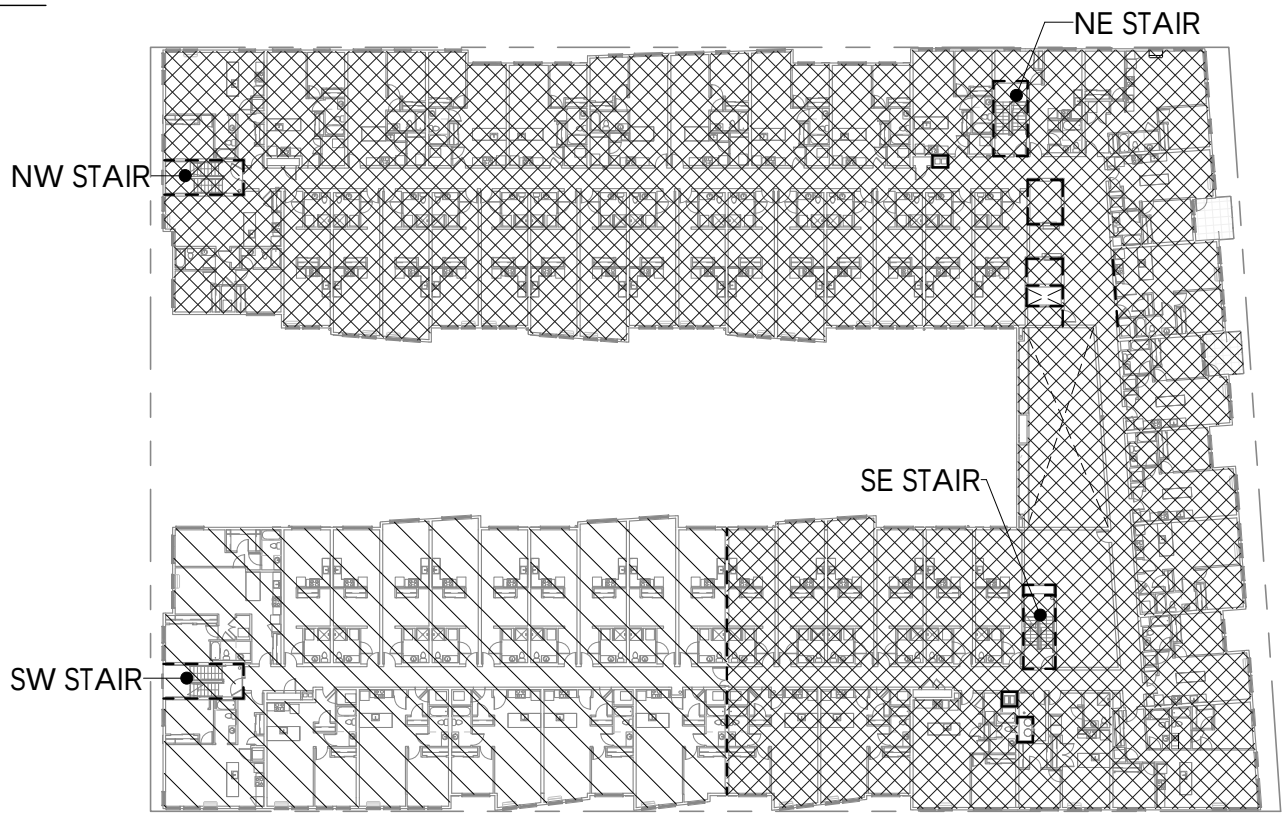
1" = 50'-0"

Sellwood Mixed Use

Path Development

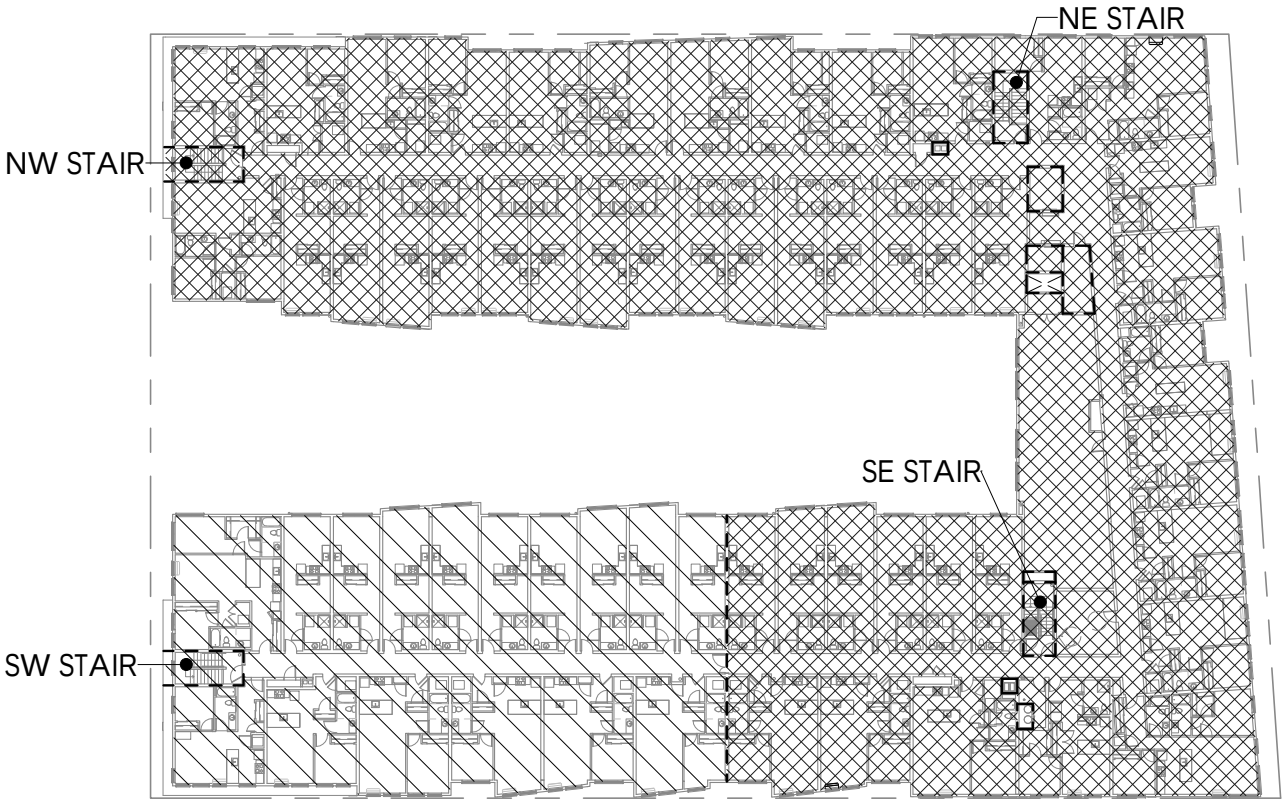
02/28/17

FLS-2



3RD FLOOR - BUILDING KEY

1" = 50'-0"



4TH FLOOR - KEY PLAN

1" = 50'-0"

Sellwood Mixed Use

Path Development

02/28/17

FLS-3

FIRE PROTECTION CONSULTING
3115 NW 132nd Place, Portland, OR 97229-7037
Phone 503-531-8717 Fax 503-531-8564 e-mail dgessert@frontier.com

Letter

Date:	February 27, 2017
To:	William Wilson Architects PC 1022 SW Salmon St Portland, OR 97205 Sent via email
Attention:	Jennifer Nye, AIA
From:	David Gessert, P. E. Fire Protection Engineer
Subject/Project:	Sellwood Mixed Use 7119 SE Milwaukie Ave Portland, OR 97202 Three Building Assemblies Opinion of Fire Resistance
Job No.:	2017-01.16

Total Pages: 3

Executive Summary

This engineer has been requested to provide an opinion of the fire resistance of three building assemblies for the Sellwood Mixed Use project. This project is also referred to as the Sellwood Apartments. The three details have been analyzed and each shows at least 60 minutes (1-hour) of fire resistance.

Sellwood Mixed Use – Fire Resistance of Three Building Assemblies

See Drawing A1.01 Sellwood Mixed Use

Detail 8 Floor/Ceiling shows the following layers from top to bottom:

Floor Finish
1/8 inch Rubber Underlayment
2 inch Gypsum Underlayment Over ¾ inch Acoustic Sound Control Mat
½ inch Plywood
½ inch Plywood
3X (2½ inch actual) Decking

Detail 9A & 9B Roof Deck Assembly

Pedestal Paver System, Flush with Interior Floor Finish
Single-Ply Roof Membrane with Cover BD as Req'd by Roofing Mfr
Continuous Rigid Insulation
Vapor Barrier as Req'd
½ inch Plywood – Omitted on Detail 9B
¾ inch Acoustic Sound Control Mat – Omitted on Detail 9B
½ inch Plywood – Omitted on Detail 9B
½ inch Plywood, See Structural
3X (2½ inch actual) Decking

Detail 12 Roof @ Terrace shows the following layers from top to bottom:

Roof Membrane
Cover Board as Req'd by Roofing Mfr
Tapered Rigid Insulation
Sheathing
3X (2½ inch actual) Decking

To determine if 60 minutes of fire resistance is present in subject floor/ceiling assembly analysis of sacrificial wood char is selected. Published data shows wood chars at a rate of 1.4-1.5 inches per hour. Moreover this char rate has been written into Code for fastener protection. Code Reference: OSSC 2014 722.6.3.3 There is variation in char rates of specific species of wood and actual char is non-linear but these variations are minor.

Wood is a poor conductor of heat. While the bottom surface of the wood deck is hot, the interior of the wood deck remains cool and retains its load bearing capability.

After one hour of fire exposure the 3X T&G wood decking has been reduced to a thickness of 1 inch.

These three reduced section assemblies have been analyzed by the project structural engineer and using reasonable assumptions the assembly would remain in place. The structural engineer used a char rate of 1.8 inches per hour. See the February 24, 2017 letter to Ms. Jennifer Nye from Nishkian Dean. The letter is sealed by Robert A. Aman, P. E. (Structural Engineer).

Conclusion

The three building assemblies analyzed for the Sellwood Mixed Use project show least one-hour of fire resistance.

I will be pleased to address your questions and comments.

References

Calculating the Fire Resistance of Exposed Wood Members, Technical Report 10, 2003, American Forest & Paper Association, American Wood Council, Washington, DC

Drawing A1.01, Construction Assemblies, Sellwood Mixed Use, 12/15/16, William Wilson Architects, Portland, Oregon

SFPE Handbook of Fire Protection Engineering, Fifth Edition, 2016, Springer International Publishing AG, Cham, Switzerland

Oregon Structural Specialty Code, 2014 Edition, International Code Council, Country Club Hills, Illinois

Dean, Nishkian, letter dated February 24, 2017 to Ms. Jennifer Nye, William Wilson Architects, Portland, Oregon, Re: Project: Sellwood Apartments, Reference: 1-Hour Fire Rating of Exposed 3x Tongue & Groove Decking, Nishkian Dean, Portland, Oregon (Letter sealed by Robert A. Aman, P. E. (Structural Engineer))

End of Report

NISHKIAN DEAN
CONSULTING AND STRUCTURAL ENGINEERS

February 24, 2017

Ms. Jennifer Nye
William Wilson Architects
1022 SW Salmon St., Suite 350
Portland, OR 97205

Project: Sellwood Apartments - 7119 SE Milwaukie Ave, Portland, OR

NDI Project No.: 31601.00

Reference: 1-Hour Fire Rating of Exposed 3x Tongue & Groove Decking

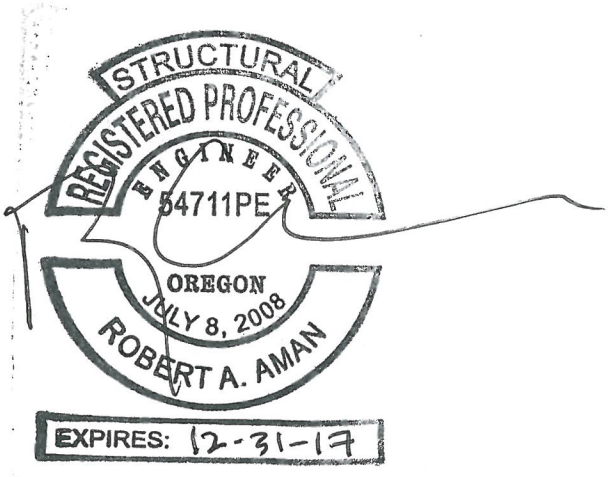
Dear Jennifer:

We are writing in regards to the structural adequacy of the exposed 3x tongue and groove decking after 1 hour of char from a fire event for the subject project. There are two specific areas above the retail space, a public area (above the western side of the retail space) and a residential area (above the eastern side of the retail space). The dead loads applied to the decking in both areas is the same. The live load to each area is 100 psf and 40 psf, respectively. The decking also occurs at a roof deck condition which has a reduced dead load compared to that of the floor. The floor and roof assemblies are shown on architectural drawing sheet A1.01.

The attached structural calculations confirm that the exposed 3x decking would still be adequate to handle the design loading after being exposed to 1 hour of fire (using a char rate of 1.8" per hour).

If you have any questions please call.

Sincerely,
NISHKIAN DEAN



Robert A. Aman, PE, SE
Associate

h:\nd31601 sellwood apts\01 admin\1.1 letters\nd31602 sellwood apartments - 3x deck for 1-hr letter 20170224.docx

NISHKIAN DEAN
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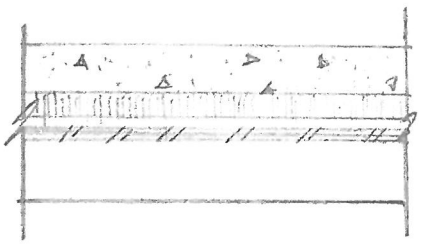
JOB SELLWOOD NO. 31602
SHEET NO. 1 OF 4
CALCULATED BY DKB DATE
CHECKED BY DATE
SCALE

FIRE RATING VERIFICATION - 1 HOUR RATED DECK



FINISH FLOOR	2.0 PSF
2" LIGHT-WEIGHT CONC.	16.0 PSF
ACCOUSITIC BOARD	2.0 PSF
½" NON STRUCT PLY	1.7 PSF
½" PLYWOOD	1.7 PSF
3x DECKING	7.6 PSF
DEAD	31.0 PSF

AT RESIDENTIAL AREA

DEAD LOAD = 31.0 PSF
LIVE LOAD = 40.0 PSF

TOTAL LOAD = 71.0 PSF

MAX CLEAR SPAN = 7'-9" − 12" (BEAM WIDTH) = 6'-9" = 6.75'

- CHECK DECK FOR NORMAL LOAD LOADING

$$M_{MAX} = \frac{wl^2}{8} = \frac{(71.0\ psf)(6.75')^2}{8} = 404\ ft.lb \quad \text{(PER FOOT)}$$

$$S_s = \frac{1}{6} b d^2 = \frac{1}{6}\left(\frac{12\ in}{ft}\right)(2.5\ in)^2 = 12.5\ in^3 \quad \text{(PER FOOT)}$$

$$F'_{bs} = (F_b C_r) C_D C_M C_t C_F$$
$$= (2000\ psi)(1.0)(1.0)(1.0)(1.0) = 2000\ psi$$

$$M_s' = F'_{bs} S_s = (2000\ psi)(12.5\ in^3) \times \frac{1\ ft}{12\ in}$$
$$= 2083\ ft.lb$$

$M'_s \geq M_{MAX}$

$2083\ ft.lb \geq 404\ ft.lb$ ∴ 3x DECKING OK FOR NORMAL LOADING

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JOB SELLWOOD NO. 31602
SHEET NO. 2 OF 4
CALCULATED BY DKB DATE
CHECKED BY DATE
SCALE

AT RESIDENTIAL AREA (CONTINUED)

- CHECK DECK FOR LOADING DURING FIRE

$M_{max} = 404$ ft·lb

$S_f = \frac{1}{6} b d^2 = \frac{1}{6}(12\text{ in})(2.5" - 1.8\text{ in})^2 = 0.98\text{ in}^3$

$F'_{bf} = (2.85)(F_b C_r) C_f$
$= (2.85)(2000\text{ psi})(1.0)$
$= 5700$ psi

$M'_f = F'_{bf} S_f = (5700\text{ psi})(0.98\text{ in}^3)\left(\frac{1\text{ ft}}{12\text{ in}}\right)$
$= 466$ ft·lb

$M'_f \geq M_{MAX}$

466 ft·lb ≥ 404 ft·lb

∴ 3x DECKING OK AT RESIDENTIAL AREA WITH A CLEAR SPAN OF 6'-9" MAX (7'-9" CENTER TO CENTER OF BEAMS)

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JOB SELLWOOD NO. 31602
SHEET NO. 3 OF 4
CALCULATED BY DKB DATE
CHECKED BY DATE
SCALE

AT PUBLIC AREA

DEAD LOAD = 31.0 PSF
LIVE LOAD = 100.0 PSF

TOTAL LOAD = 131.0 PSF

MAX CLEAR SPAN = 6'-3" − 12" (BEAM WIDTH (MIN)) = 5'-3" = 5.25'

- CHECK DECK FOR NORMAL LOADING

$$M_{MAX} = \frac{wl^2}{8} = \frac{(131.0\ PSF)(5.25')^2}{8} = 451\ ft.lb$$

$$S_s = \frac{1}{6} b d^2 = \frac{1}{6}(12\ in)(2.5\ in)^2 = 12.5\ ft.lb$$

$$F'_{bs} = (F_b C_r) C_D C_M C_t C_F$$
$$= (2000\ psi)(1.0)(1.0)(1.0)(1.0) = 2000\ psi$$

$$M_s' = F'_{bs} S_s = (2000\ psi)(12.5\ in^3) \times \frac{1\ ft}{12\ in}$$
$$= 2083\ ft.lb$$

$M'_s \geq M_{MAX}$

$2083\ ft.lb \geq 451\ ft.lb$

∴ 3x DECKING OK FOR NORMAL LOADING

- CHECK DECK FOR LOADING DURING FIRE

$M_{MAX} = 451\ ft.lb$

$$S_f = \frac{1}{6} b d^2 = \frac{1}{6}(12\ in)(2.5" - 1.8")^2 = 0.98\ in^3$$

$$F'_{bf} = (2.85)(F_b C_r) C_F$$
$$= (2.85)(2000\ psi)(1.0)$$
$$= 5700\ psi$$

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JOB SELLWOOD NO. 31602
SHEET NO. 4 OF 4
CALCULATED BY DKB DATE
CHECKED BY DATE
SCALE

AT PUBLIC AREA (CONTINUED)

$M'_f = F'_{b1} S_f = (5700\ psi)(0.98\ in^3)\frac{1\ ft}{12\ in}$

$= 466\ ft \cdot lb$

$M'_f > M_{max}$

$466\ ft \cdot lb > 451\ ft \cdot lb$

∴ 3x DECKING OK AT PUBLIC AREA WITH A MAX CLEAR SPAN OF 5'-3" (6'-3" CENTER TO CENTER OF BEAMS - MIN. WIDTH OF BEAM 12")