LISTEN ACOUSTICS™
acoustical and audio/visual systems engineering

Acoustical Wall and Floor/Ceiling Report

38th and SE Belmont Apartments
June 1, 2013

Wall and Floor/Ceiling Review and Recommendations:
This report presents design criteria, drawing review, and recommendations for architectural acoustics for demising wall and floor/ceiling assemblies for the 38th and SE Belmont Project. The recommendations were developed with available information regarding the assemblies and layouts.

I. STC and IIC Performance

The International Building Code (IBC) specifies a minimum Sound Transmission Class (STC) rating of not less than 50 (45 if field tested) for walls, partitions, and floor / ceiling assemblies separating dwelling places. The Impact Insulation Class (IIC) of floor / ceiling assemblies separating dwelling units shall be 50 (45 if field-tested). It is important to note that these represent the bare minimum requirements, and may lead to complaints from residents due to noticeable sound transfer between units.

For this project, STC/IIC 55 is recommended as the minimum. For reference, typical market rate apartments are STC 55 and IIC 55, and quality condominiums have minimum STC 60 and IIC 60 ratings.

A. Floor/Ceiling STC/IIC

NOTE: It is very difficult to eliminate impact noise in wood framing with relatively thin (3" or less) concrete toppings. The occupant may hear a booming sound and may also feel the vibration of people walking overhead, even with a carpeted floor. Long spans and wide joist spacing contribute to the low frequency booming. To minimize this, spans should be less than 25 ft and joist spacing may need to be decreased to 12".

NOTE: Resilient channels are frequently installed improperly by screwing through the "resilient" leg of the channel into the framing. This renders the resilient channel ineffective because the GWB is hard-attached to the stud. It is very difficult to ensure correct installation of resilient channels at all acoustically sensitive partitions in the field. If RC channels must be used, we recommend Dietrich RC Deluxe for the best performance, plus field verification from Listen Acoustics' inspection team.

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www.listenacoustics.com

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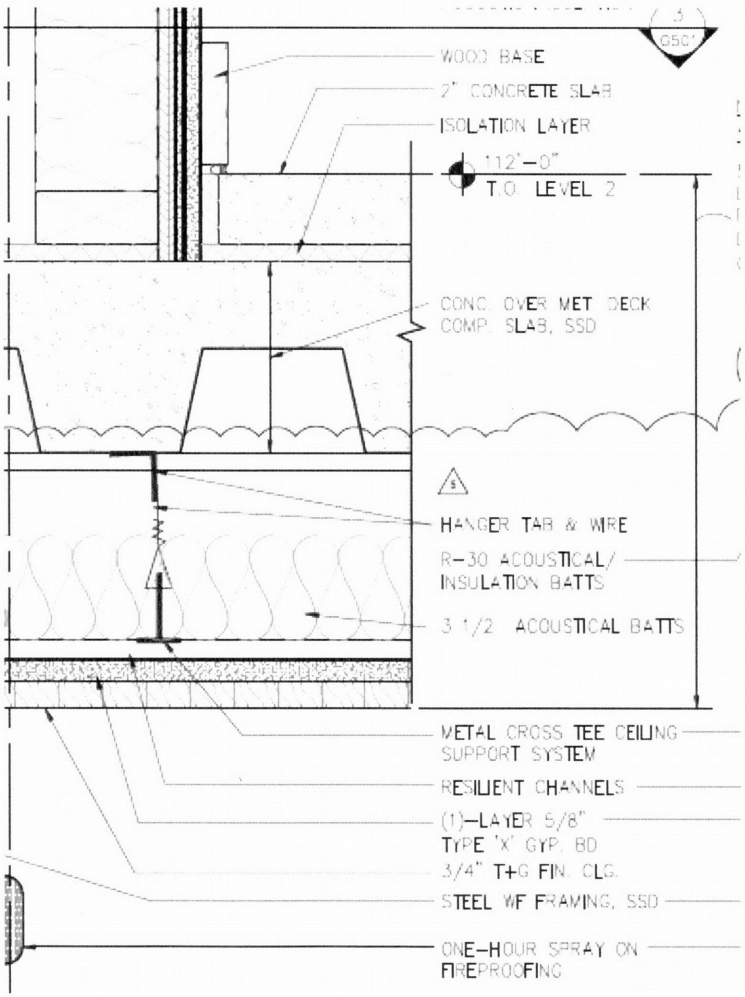
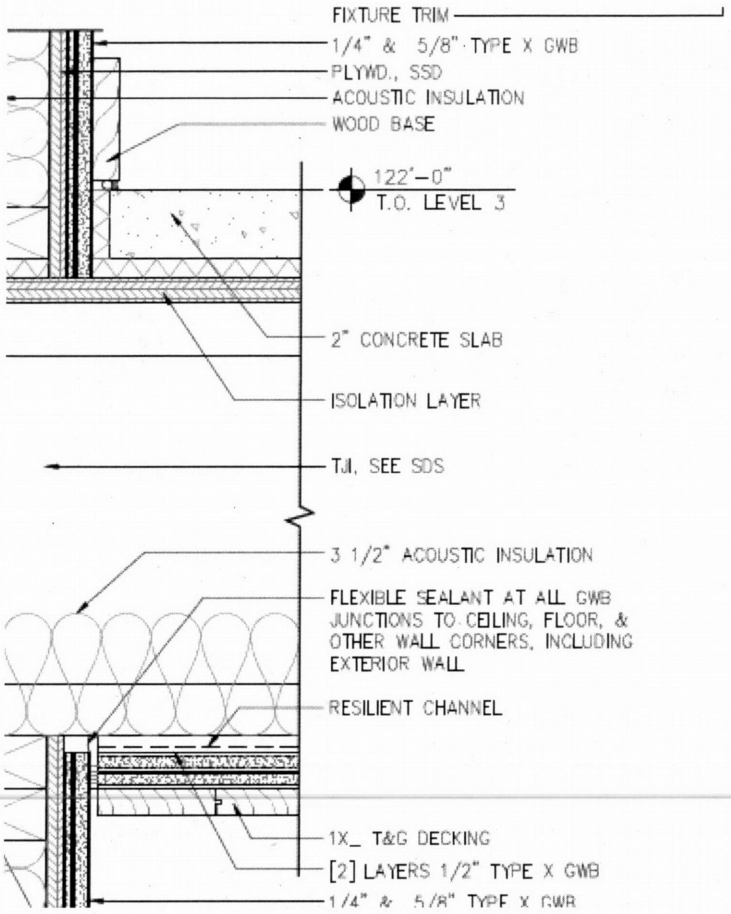
1. As Designed:

a. Floor/Ceiling OPTION 1: 2" topping slab, acoustical mat, 2-1/2" concrete over 3" metal deck, wire hangers, 3" minimum air gap, 3-1/2" acoustical batts, RC channels, one layer 5/8" gwb, 3/4" nominal T&G ceiling face. This is a non-standard flooring system with no tested lab ratings for STC or IIC. Based on our models and on similar lab rated assemblies the STC is approximately 54-57 and the IIC is 54-57. This assembly is predicted to be at or above the target STC and IIC, and well above code minimums.



b. Floor/Ceiling OPTION 2: 2" topping slab, acoustical mat, 3/4" plywood decking, 12" air gap, 6" batts in cavity, 2 layers 5/8" gwb on RC channels. Based on our models and on similar lab rated assemblies the STC is

approximately 58-62 and the IIC is 54-58. This assembly is predicted to be at or above the target STC and IIC, and well above code minimums.



2. Caution: Underlayments only work by creating a totally floating upper slab, with concrete not connected at the edges of each unit at the demising wall. If this cannot be accomplished for structural reasons, the underlayment should be moved and located between the slab and floor surface. In this case, exposed concrete floors cannot be used.

3. Carpet and pad on the above construction will exceed the code minimums for impact insulation and likely be in the range of IIC 65-70, depending on the pad and carpet selected. We recommend a thick pad (minimum ½") under the carpet.

4. In areas where carpet and pad are not used the following acoustical underlayments are recommended. All of these options will meet or exceed the IIC goals for the project.

   a. Maxxon Acoustimatt II: Install under the upper concrete layer.

b. Kinetics RIM system: Install under the upper concrete layer

c. Kinetics SR Floorboard system: Install under the upper concrete layer

d. MP 'Quietwalk' (wood floor only): Install system between floor slab and finished floor.

e. MP 'Insulayment' (tile floor): Install system between floor slab and finished floor.

f. CeraZorb: Install system between floor slab and finished floor.
   i. Rating: IIC 50, IIC 57 with Wave hanger and hung ceiling.
   ii. Advantages:
      (a) Good performance.
      (b) Medium cost.
      (c) Simple installation.

g. Cera Silence: Install underlayment system between floor slab and finished floor.
   i. Rating: IIC 50, IIC 56 with Wave hanger
   ii. Advantages:
      (a) Excellent performance
      (b) Medium cost.
      (c) Simple installation.
   iii. Disadvantages:
      (a) Cannot level the floor as with Acousti-Mat II/Maxxon underlayment.
      (b) Adds up to 1" to overall floor depth.

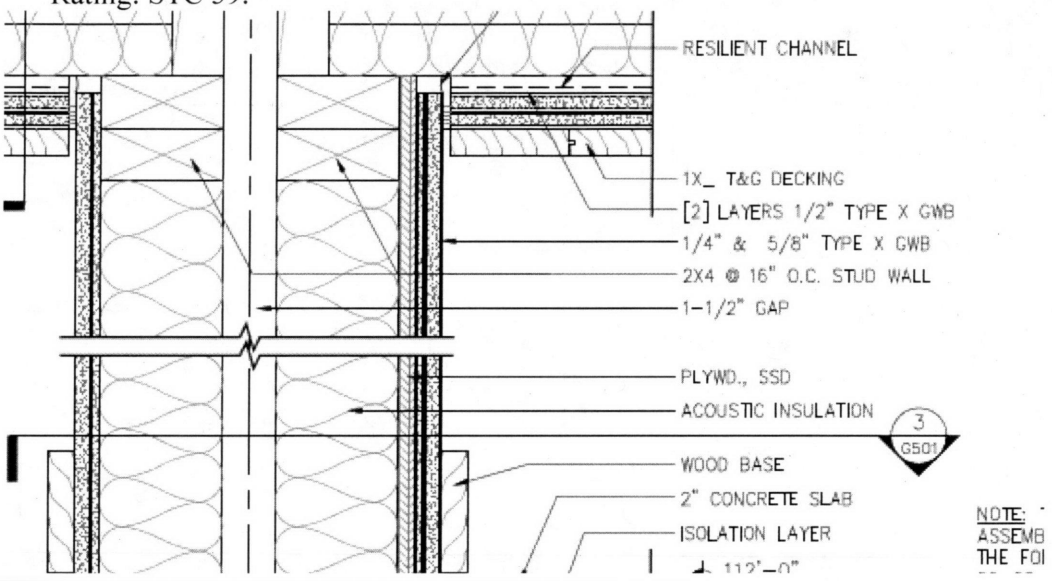
h. Jumpax (VCT, linoleum)
   i. Rating: IIC 50, IIC 56 with Wave hanger
   ii. Advantages:
      (a) Best underlayment for sheet goods
      (b) Free floating.
   iii. Disadvantages:
      (a) Rating is not as high as other options.

5. Additional recommendations:
   a. Fill all penetrated areas of the floor assembly. Seal with firestop stuffed into the gaps and non-hardening caulk covering the surfaces.
   b. Recessed ceiling mounted junction boxes should be completely covered in putty pads or two layer gwb boxes, caulked airtight.
   c. Recessed can light boxes should be boxed in with 2 layers of 5/8" gwb and sealed with acoustical caulk.

B. Partition Walls

The party walls should be at least STC 55. Options for wall types are:

1. As Designed: Double Stud: two 4" wood studs on separate tracks, 16" o.c. with 1 layer 5/8" and one layer ¼" Type X gypsum board on one side, 1 layer 5/8" and one layer ¼" Type X gypsum board on other side with 4" batts in both cavities. Rating: STC 59.



2. Alternate System 1: Staggered stud wall: 2 layer 5/8" Type X gypsum board both sides, RC channel one side, on 6" wood plates, 16" o.c., with 6" acoustical batts in the cavity. Rating: STC 56.

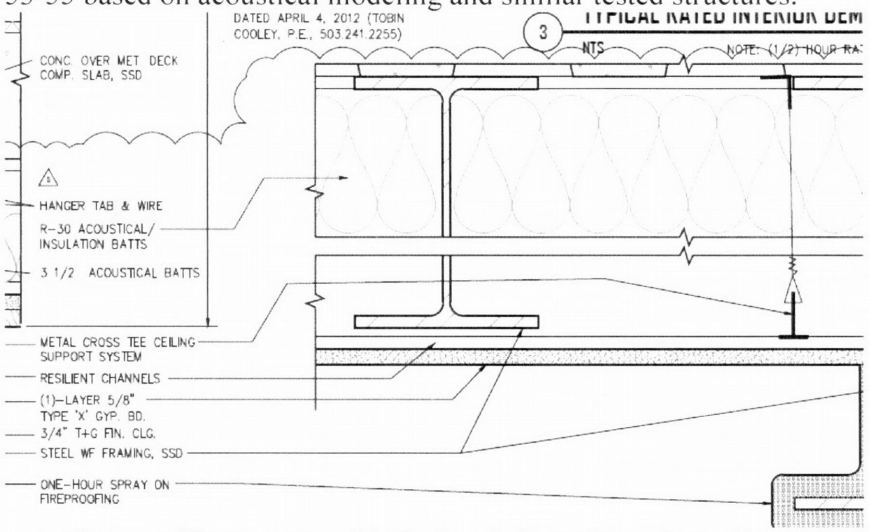
3. Alternate System 3: Single Stud: 6" wood studs 16" o.c. with 2 layers 5/8" Type X gypsum board on one side, RC channel, 2 layer 5/8" Type X gypsum board on other side with 6" batts in the cavity. Rating: STC 55.

4. Alternate System 4: Single Stud: 6" wood studs 16" o.c. with 1 layer 5/8" Type X gypsum board on one side, Kinetics Isomax clips and hat channel, 1 layer 5/8" Type X gypsum board on other side with 6" batts in the cavity. Rating: STC 57.

5. **CRITICAL:** Construction Details
   a. All outlets and junction boxes in party walls should be covered by putty pads. Hilti CP617 putty pad should be used to cover outlets in demising and corridor walls, plus any other important acoustical wall (stair to unit, etc).

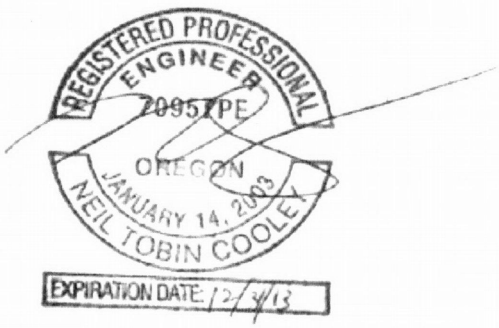
b. All layers of gwb in the demising wall and corridor wall need to be sealed with resilient caulk at the ceiling, floor, and corner junctions, including the junction with the exterior wall.
c. All penetrations through the demising walls and unit corridor walls need to be sealed with resilient caulk.

6. **Garage and TI spaces below units**: It is recommended a special noise study be carried out for any potentially loud sounds from commercial spaces below units. The acoustical separation between the garage and living unit must be STC 50 to meet code. The following detail (as shown on G501) is rated at an estimated STC 53-55 based on acoustical modeling and similar tested structures.



If there are any questions, or if we can provide further information, please do not hesitate to call.

Tobin Cooley, P.E.
Principal



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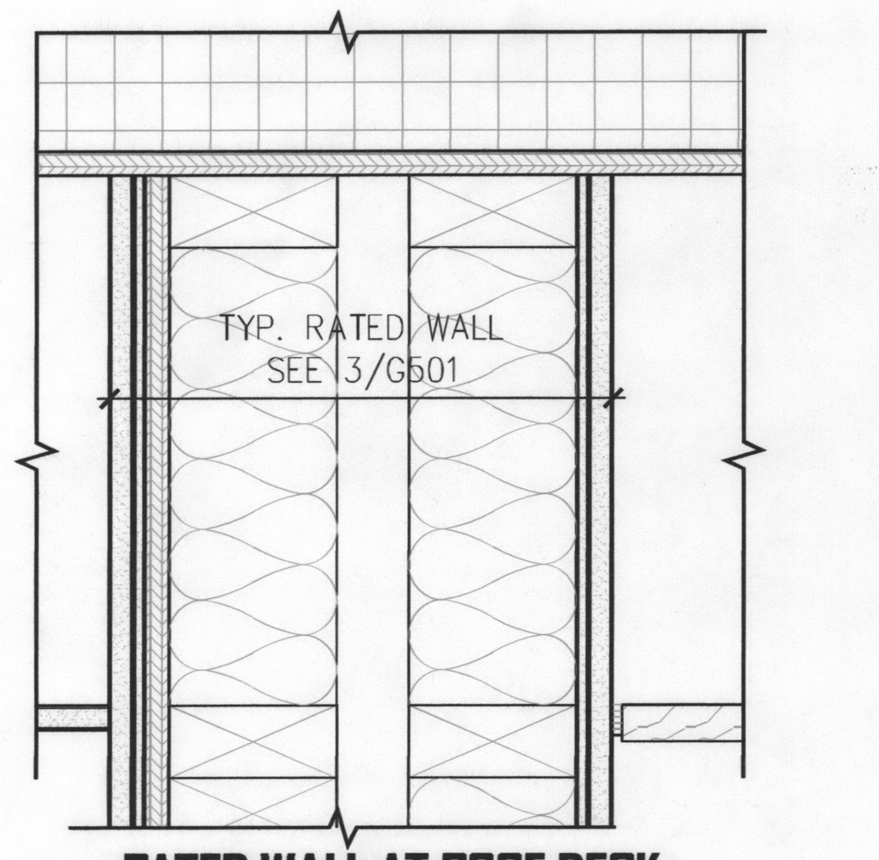
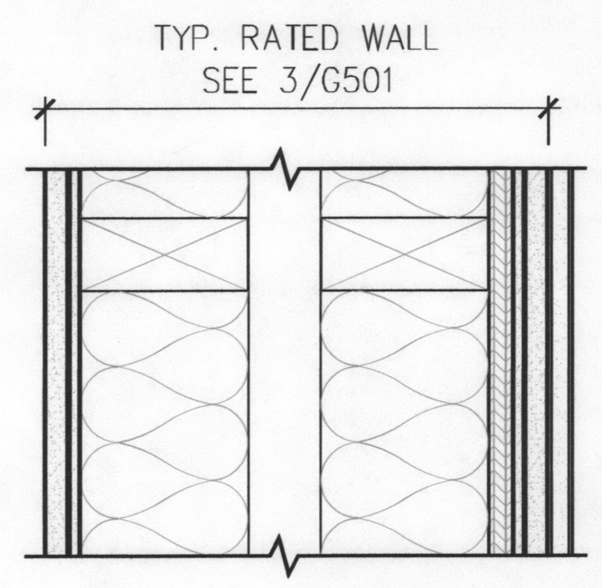
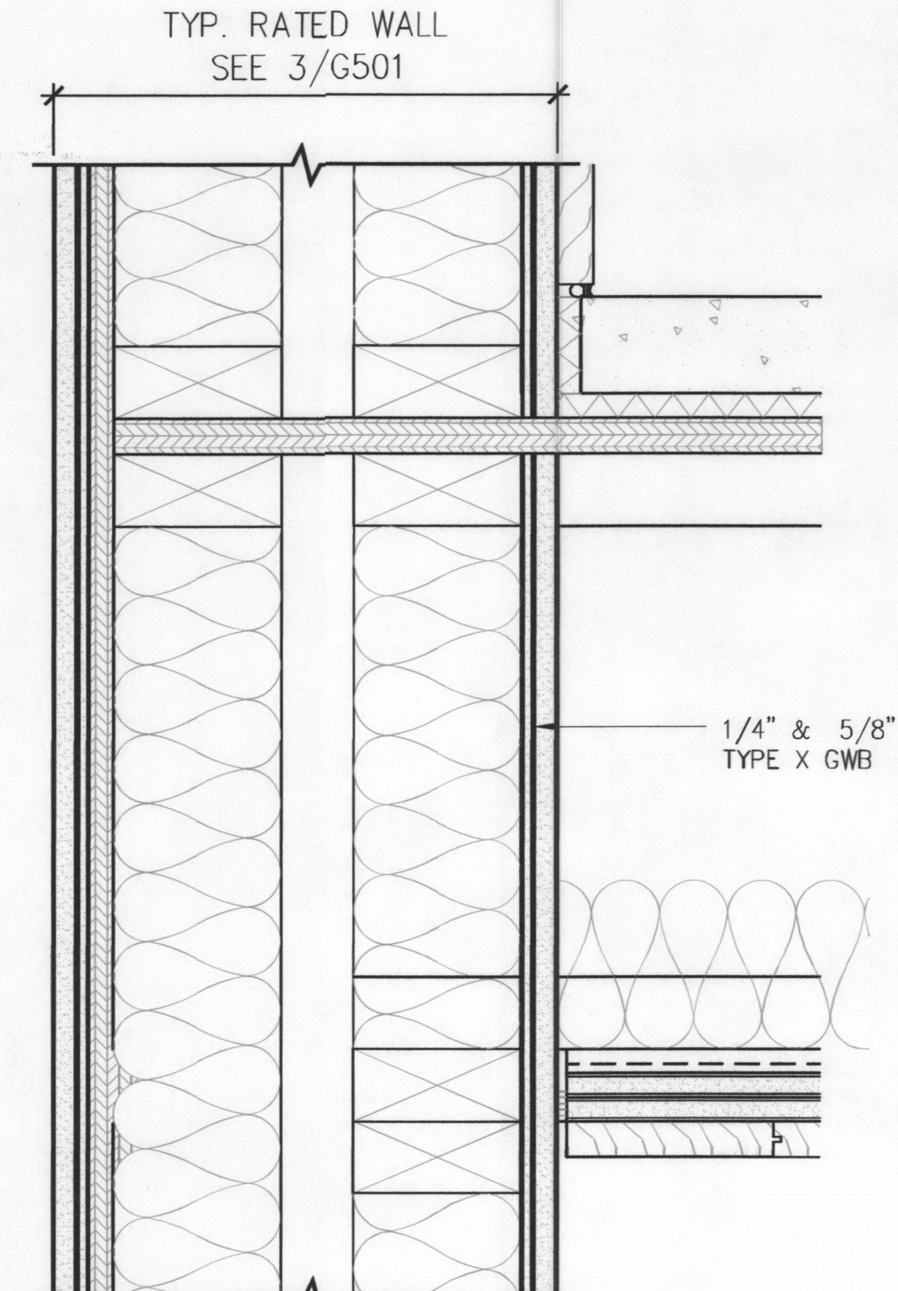


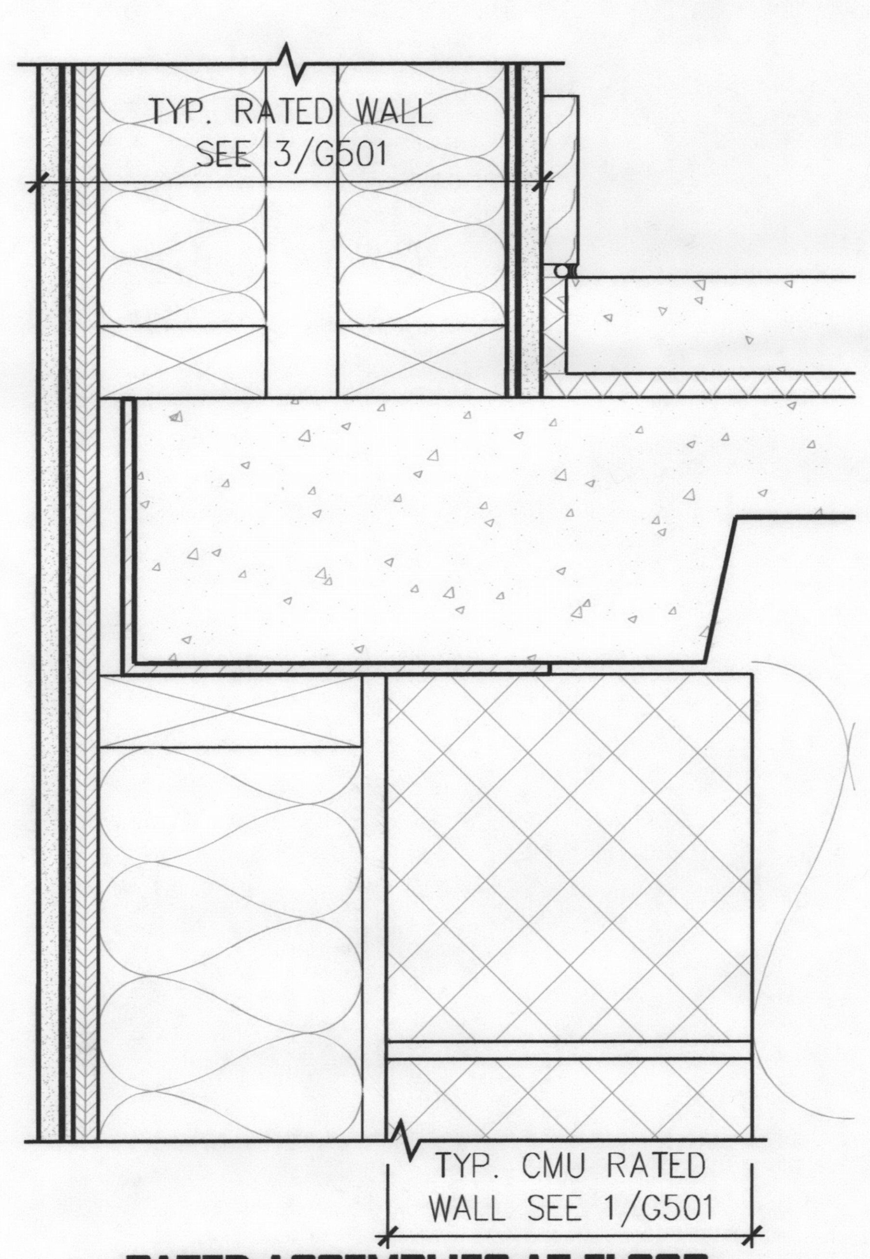
RATED WALL AT ROOF DECK
7
NTS



TYPICAL RATED DEMISING WALL AT TUB/SHOWER
6
NTS

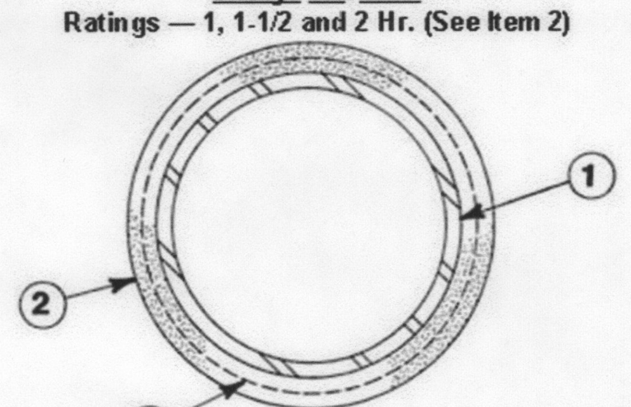


RATED ASSEMBLIES AT FLOOR
10
NTS



RATED ASSEMBLIES AT FLOOR
9
NTS

Design No. X615
Ratings — 1, 1-1/2 and 2 Hr. (See Item 2)



1. **Steel Columns** — Steel pipe columns with a minimum inside diameter of 4 in., a minimum wall thickness of 0.237 in. and a minimum weight of 10.79 lb. per foot. The column shall be free of dirt, loose scale and oil.
2. **Mastic Coating*** — Spray applied to desired thickness in multiple 1/8 in. thick (wet) coats. See table below for appropriate final dry thickness. After each coat, the surface shall be lightly rolled with a paint roller. Steel surfaces to be primed as required per application instructions.

Rating Hr	Min Thkns In.
1	0.38
1-1/2	0.61
2	0.85

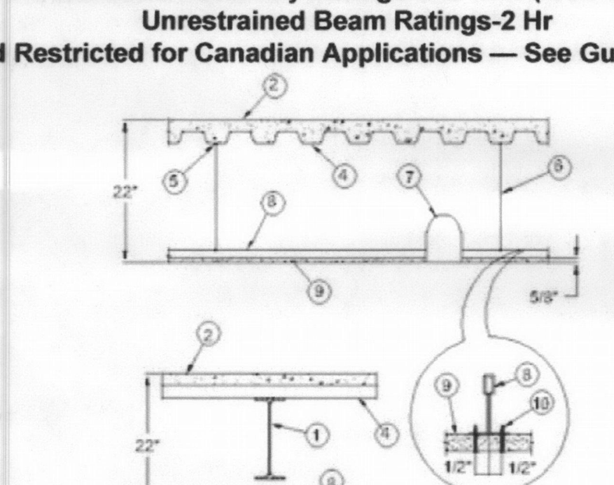
ALBI MFG, DIV OF STANCHEM INC — Type 89S intumescent mastic coating for Interior General PurposeUse; Type AC800 intumescent mastic coating for Interior General Purposeand Exterior Use.

3. **Reinforcing Mesh** — 1 in. hexagonal wire mesh (No. 20 SWG galvanized steel wire), tied together using the ends of the wire mesh. Mesh is embedded in the coating prior to application of final two (min.) coats in accordance with manufacturer's recommendations.

*Bearing the UL Classification Mark

RATED COLUMN
11
NTS

Design No. D503
Restrained Assembly Ratings-1 or 2 Hr (See Item 2)
Unrestrained Assembly Ratings-1 or 2 Hr (See Item 2)
Unrestrained Beam Ratings-2 Hr
Load Restricted for Canadian Applications — See Guide BXUV7



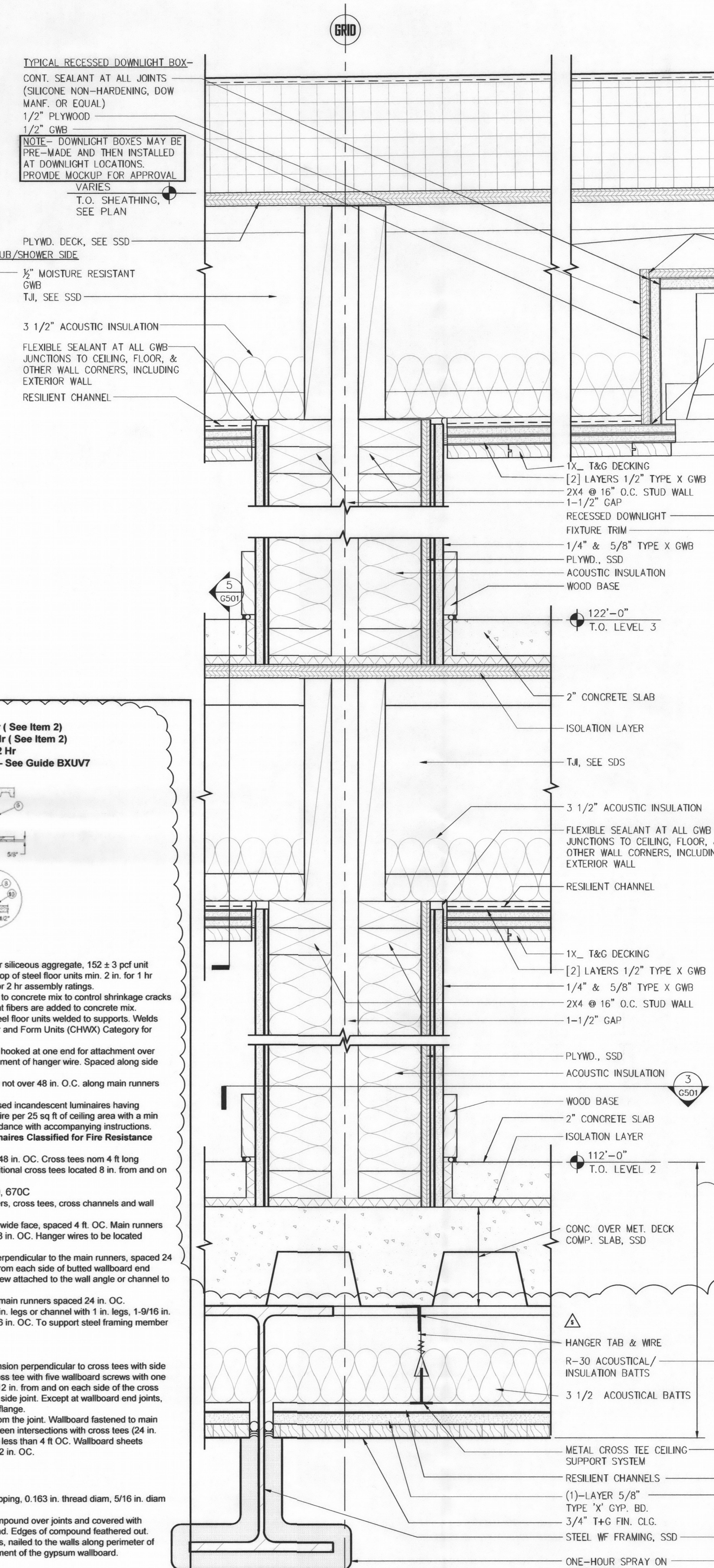
1. **Beam** — W12x19, min size.
2. **Normal Weight Concrete** — Normal weight concrete, carbonate or siliceous aggregate, 152 ± 3 pcf unit weight, 4000 psi compressive strength. Concrete thickness above top of steel floor units min. 2 in. for 1 hr assembly ratings and 2 hr unrestrained beam rating and 2-1/2 in. for 2 hr assembly ratings.
3. **Steel Fiber Reinforcement*** — (Not Shown) — Steel fibers added to concrete mix to control shrinkage cracks in concrete. See Fiber Reinforcement (CBXQ) Category for rate that fibers are added to concrete mix.
4. **Steel Floor Units*** — Min. 2 in. deep, min. 20-gauge galv fluted steel floor units welded to supports. Welds spaced 12 in. OC. Supports spaced max. 10 ft OC. See Steel Floor and Form Units (CHWX) Category for names of manufactures.
5. **Hanger Tab** — No. 18 GSG galv steel, 2 in. wide by 3-1/2 in. long, hooked at one end for attachment over male side joint of floor units; other end provided with hole for attachment of hanger wire. Spaced along side joints of floor units as required for hanger wire locations.
6. **Hanger Wire** — No. 12 SWG galv steel wire. Hanger wires spaced not over 48 in. O.C. along main runners and located at ends of main runners at walls.
7. **Recessed Luminaires Classified for Fire Resistance*** — Recessed incandescent luminaires having nominal 6 in diam. Spacing of luminaires not to exceed one luminiaire per 25 sq ft of ceiling area with a min separation of 3 ft between luminaires. Luminaires installed in accordance with accompanying instructions. Wired in conformance with the National Electrical Code. See **Luminaires Classified for Fire Resistance** (CDHW) Category for names of manufactures.
8. **Steel Framing Members*** — Main runners nom 12 ft long spaced 48 in. OC. Cross tees nom 4 ft long installed perpendicular to main runners and spaced 24 in. OC. Additional cross tees located 8 in. from and on both sides of each wallboard end joint.
   CHICAGO METALLIC CORP — Type 650, 650C, 670, 670C

8A. **Steel Framing Members*** — As an alternate to Item 8. Main runners, cross tees, cross channels and wall angle as listed below:
   a. **Main Runners** — Nom 10 or 12 ft. long, 15/16 in. or 1-1/2 in. wide face, spaced 4 ft. OC. Main runners suspended by min 12 SWG galv steel hanger wires spaced 48 in. OC. Hanger wires to be located adjacent to main runner/cross tee intersections.
   b. **Cross Tees** — Nom 4 ft. long, 1-1/2 in. wide face, installed perpendicular to the main runners, spaced 24 in. OC. Additional cross tees or cross channels used at 8 in. from each side of butted wallboard end joints. The cross tees or cross channels may be riveted or screw attached to the wall angle or channel to facilitate the ceiling installation.
   c. **Cross Channels** — Nom 4 ft. long installed perpendicular to main runners spaced 24 in. OC.
   d. **Wall Angle or Channel** — Painted or galv steel angle with 1 in. legs or channel with 1 in. legs, 1-9/16 in. deep attached to walls at perimeter of ceiling with fasteners 16 in. OC. To support steel framing member ends and for screw-attachment of the gypsum wallboard.
      CGC INC — Type DGL or RX.
      USG INTERIORS INC — Type DGL or RX.

9. **Gypsum Board*** — 5/8 in. thick, 4 ft wide, installed with long dimension perpendicular to cross tees with side joints centered along main runners. Wallboard fastened to each cross tee with five wallboard screws with one screw located at the mid-span of the cross tee, one screw located 12 in. from and on each side of the cross tee mid-span, and one screw located 1-1/2 in. from each wallboard side joint. Except at wallboard end joints, wallboard screws shall be located on alternating sides of cross tee flange.
   At wallboard end joints, wallboard screws shall be located 1/2 in. from the joint. Wallboard fastened to main runners with wallboard screws, 1/2 in. from side joints midway between intersections with cross tees (24 in. OC) End joints of adjacent wallboard sheets shall be staggered not less than 4 ft OC. Wallboard sheets screw-attached to leg of wall angle with wallboard screws spaced 12 in. OC.
   CANADIAN GYPSUM COMPANY — Type C
   UNITED STATES GYPSUM CO — Type C
   USG MEXICO S A DE C V — Type C
10. **Screw, Wallboard** — Type S-12, 1 in. long, self-drilling and self-tapping, 0.163 in. thread diam, 5/16 in. diam heads.
11. **Finishing System** — (Not Shown) — Paper tape embedded in compound over joints and covered with additional compound. Exposed screw heads covered with compound. Edges of compound feathered out.
12. **Wall Angle** — (Not Shown) — No. 26 MSG angle with 1-1/8 in. legs, nailed to the walls along perimeter of ceiling to support steel framing member ends and for screw-attachment of the gypsum wallboard.

*Bearing the UL Classification Mark

RATED CONCRETE/STEEL DECK FLOOR/CEILING
8
NTS — ONE-HOUR RATING



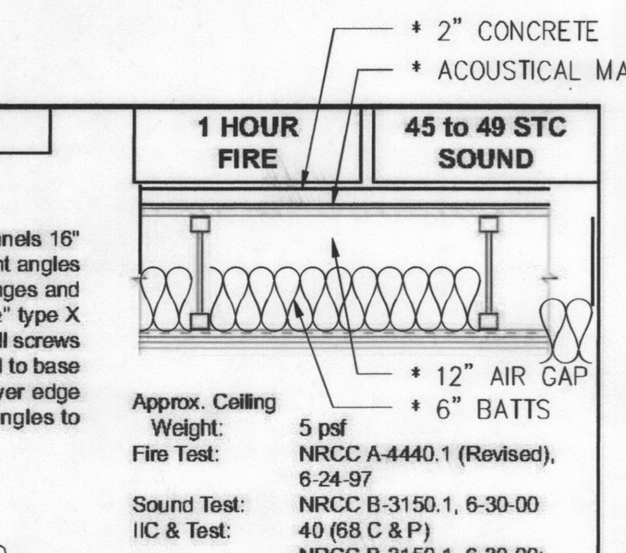
NOTE: THIS FLOOR/CEILING ASSEMBLY IS EXPECTED TO PROVIDE THE FOLLOWING RATINGS: STC = 55–58; IIC = 55–58. THIS IS BASED ON THE ACOUSTICAL REPORT PROVIDED BY LISTEN ACOUSTICS, DATED APRIL 4, 2012 (TOBIN COOLEY, P.E., 503.241.2255)

TYPICAL ONE HALF-HOUR RATED UNIT SEP. WALL
4
NTS (SEE DET. 8/G501 FOR ADDL. INFO.) — AT RETAIL WEST 002 + RETAIL EAST 003

GA FILE NO. FC 5241	GENERIC	1 HOUR FIRE	45 to 49 STC SOUND

WOOD I-JOISTS, GYPSUM WALLBOARD, RESILIENT CHANNELS

Base layer ½" type X gypsum wallboard applied at right angles to resilient channels 16" o.c. with 1¼" Type S drywall screws 12" o.c. Resilient channels applied at right angles to minimum 9½" deep wood I-joists, with minimum 1¼" deep x 1½" wide flanges and minimum ⅜" webs, 24" o.c. with 1¼" Type W drywall screws. **Face** layer ½" type X gypsum wallboard applied at right angles to channels with 1⅝" Type S drywall screws 12" o.c. Face layer end joints located midway between channels and attached to base layer with 1½" Type G screws 12" o.c. Edge joints offset 24" from base layer edge joints. Wood I-joists supporting ⅝" oriented strand board applied at right angles to I-joists with 8d common nails 12" o.c.



Approx. Ceiling Weight:	5 psf
Fire Test:	NRCC A-4440.1 (Revised), 6-24-97
Sound Test:	NRCC B-3150.1, 6-30-00
IIC & Test:	40 (68 C & P) NRCC B-3150.1, 6-30-00; NRCC B-3150.2, 6-30-00

NOTE: ADDITIONAL LAYERS MARKED W/ * ARE EXPECTED TO INCREASE THE ASSEMBLY'S PERFORMANCE AND PROVIDE THE FOLLOWING RATINGS: STC = 58–62; IIC = 54–58.
THIS IS BASED ON THE ACOUSTICAL REPORT PROVIDED BY LISTEN ACOUSTICS, DATED APRIL 4, 2012 (TOBIN COOLEY, P.E., 503.241.2255)

TYPICAL RATED FLOOR-CEILING ASSEMBLY
5
NTS — NOTE: (1/2) HOUR RATING REQUIRED – (1) HOUR RATING PROVIDED

DRAWING NOTES

1. RATED ASSEMBLIES ARE FROM THE 2006 GYPSUM ASSOCIATION FIRE RESISTANCE DESIGN MANUAL & UL FIRE RESISTANCE DIRECTORY – VOLUME 1 2008.
2. REFER TO STRUCTURAL DRAWINGS FOR LOCATIONS AND THICKNESSES OF WOOD STRUCTURAL PANELS. WHERE STRUCTURAL PANELS OCCUR, THEY SHALL BE ATTACHED AS BASE LAYERS DIRECTLY TO THE FRAMING (UNDER THE GYPSUM BOARD) AND THE GYPSUM BOARD FASTENERS SHALL BE INCREASED IN LENGTH BY NOT LESS THAN THE THICKNESS OF THE PANELS.
3. REFER TO PLAN DRAWINGS SERIES A100 AND SECTION DRAWINGS SERIES A400 FOR TYPICAL NON-RATED ASSEMBLIES (WALL, FLOORS AND CEILINGS).
4. REFER TO DWG. G101 FOR CODE ANALYSIS.
5. REFER TO STRUCTURAL DRAWINGS FOR SIZE AND SPACING OF ALL FRAMING MEMBERS.
6. REFER TO ARCHITECTURAL DRAWINGS FOR INTERIOR & EXTERIOR FINISHES.

Design No. U905
Bearing Wall Rating — 2 HR.
Nonbearing Wall Rating — 2 HR
Load Restricted for Canadian Applications — See Guide BXUV7

1. **Concrete Blocks*** — Various designs. Classification D-2 (2 hr). See **Concrete Blocks** category for list of eligible manufacturers.
2. **Mortar** — Blocks laid in full bed of mortar, nom. 3/8 in. thick, of not less than 2-1/4 and not more than 3-1/2 parts of clean sharp sand to 1 part Portland cement (proportioned by volume) and not more than 50 percent hydrated lime (by cement volume). Vertical joints staggered.
3. **Portland Cement Stucco or Gypsum Plaster** — Add 1/2 hr to classification if used. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a max. Classification of 1-1/2 hr. Attached to concrete blocks (Item 1).
4. **Loose Masonry Fill** — If all core spaces are filled with loose dry expanded slag, expanded clay or shale (Rotary Kiln Process), water repellant vermiculite masonry fill insulation, or silicone treated perlite loose fill insulation add 2 hr to classification.
5. **Foamed Plastic*** — (Optional-Not Shown) — 1-1/2 in. thick max, 4 ft wide sheathing attached to concrete blocks (Item 1).
   THE DOW CHEMICAL CO — Type Thermax

*Bearing the UL Classification Mark

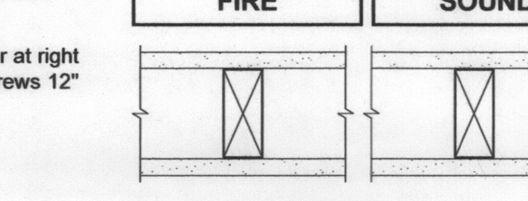
TYPICAL RATED CMU WALL
1
NTS — NOTE: (1) HOUR RATING REQUIRED – (2) HOUR RATING PROVIDED

GA FILE NO. WP 3514	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND

GYPSUM WALLBOARD, WOOD STUDS

One layer ⅝" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 2 x 4 wood studs 16" o.c. with 1¼" Type W drywall screws 12" o.c.

Joints staggered 16" on opposite sides. **(LOAD-BEARING)**



Thickness:	4¾"
Approx. Weight:	7 psf
Fire Test:	SWRI 01-4511-619, 8-19-92
Sound Test:	See WP 3520 (G&H NG-246FT, 7-2-65)

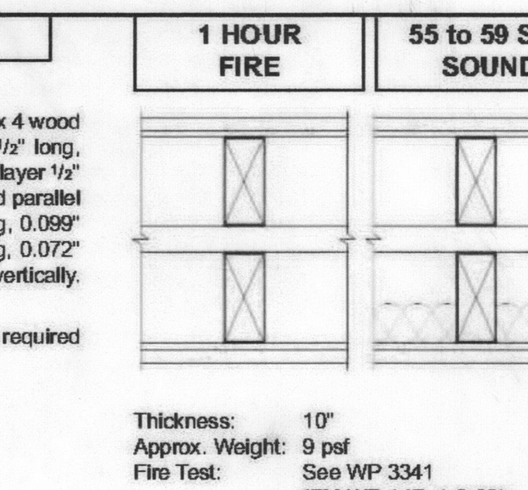
TYPICAL ONE-HOUR RATED INTERIOR WALL
2
NTS

GA FILE NO. WP 5510	GENERIC	1 HOUR FIRE	55 to 59 STC SOUND

GYPSUM WALLBOARD, WOOD STUDS

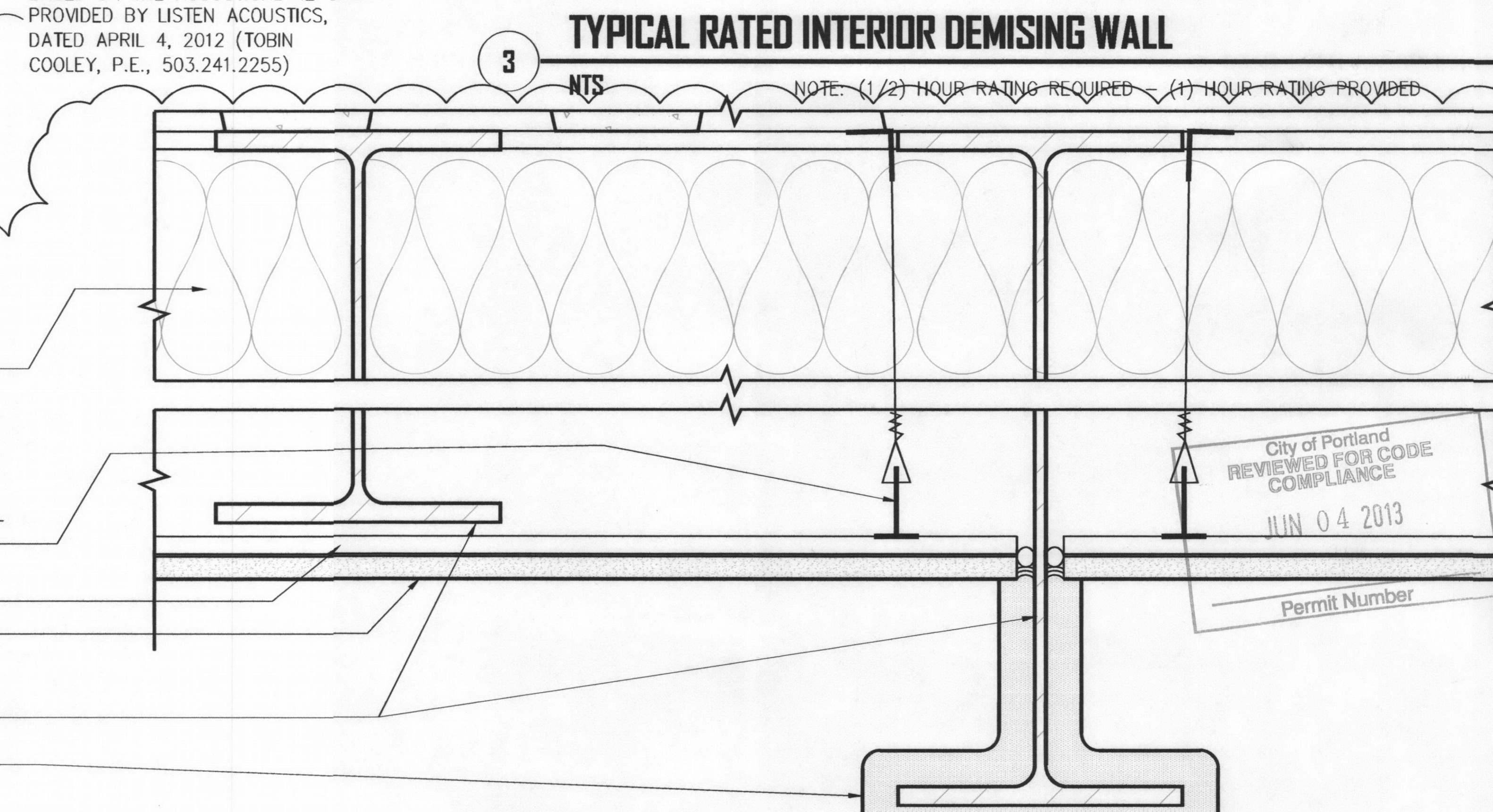
Base layer ¼" gypsum wallboard applied parallel to each side of double row of 2 x 4 wood studs 16" o.c. on separate plates spaced 1½" apart with 4d coated nails, 1½" long, 0.099" shank, ¼" heads, 12" o.c. Joints staggered 16" on opposite sides. **Face** layer ½" type X plain or predecorated gypsum wallboard or gypsum veneer base applied parallel to each side with ⅜" beads of adhesive 16" o.c. and 5d coated nails, 1¾" long, 0.099" shank, ¼" heads, 16" o.c. at top and bottom plates. 4d finish nails, 1½" long, 0.072" shank, 0.1055" heads, driven at a 45° angle 16" o.c. horizontally and 24" o.c. vertically. Joints offset 24" from base layer joints.

Sound tested with 1½" mineral fiber insulation in stud space. Horizontal bracing required at mid-height. **(LOAD-BEARING)**



Thickness:	10"
Approx. Weight:	9 psf
Fire Test:	See WP 3341 (FM WP-147, 1-2-69); UL R4024, 10-31-68
Sound Test:	G&H BW-32ST, 4-22-68

TYPICAL RATED INTERIOR DEMISING WALL
3
NTS — ~~NOTE: (1/2) HOUR RATING REQUIRED – (1) HOUR RATING PROVIDED~~



TYPICAL ONE HALF-HOUR RATED FLOOR-CEILING ASSEMBLY
4A
3"=1'-0" (SEE DET. 8/G501 FOR ADDL. INFO.) — AT PARKING 004

City of Portland
REVIEWED FOR CODE COMPLIANCE
JUN 04 2013
Permit Number

DRAWING REVISIONS

NO.	DATED
1	01.21.2013 REV 01– ASI 001
2	03.22.2013 REV 02R– ASI 002 REVISED
3	02.12.2013 REV 03– ASI 003
4	03.13.2013 RFI 31 RESPONSE
5	05.16.2013 RATED ASSEMBLY COOR.

REGISTERED ARCHITECT 4688 ERIK L. MATTHEWS PORTLAND, OR STATE OF OREGON

RATED ASSEMBLIES

SURROUND

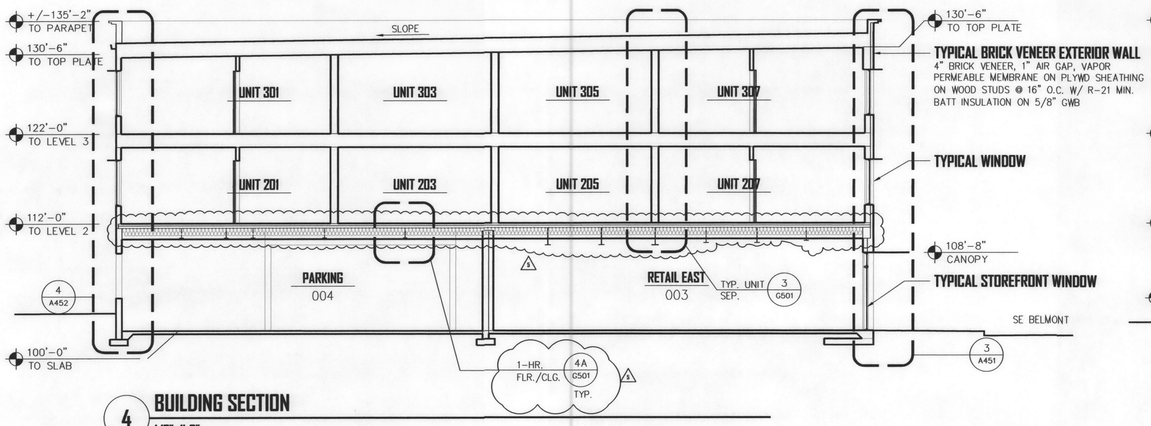
THE BELMONT at SE 38th
PORTLAND, OREGON

Surround Architecture, inc.

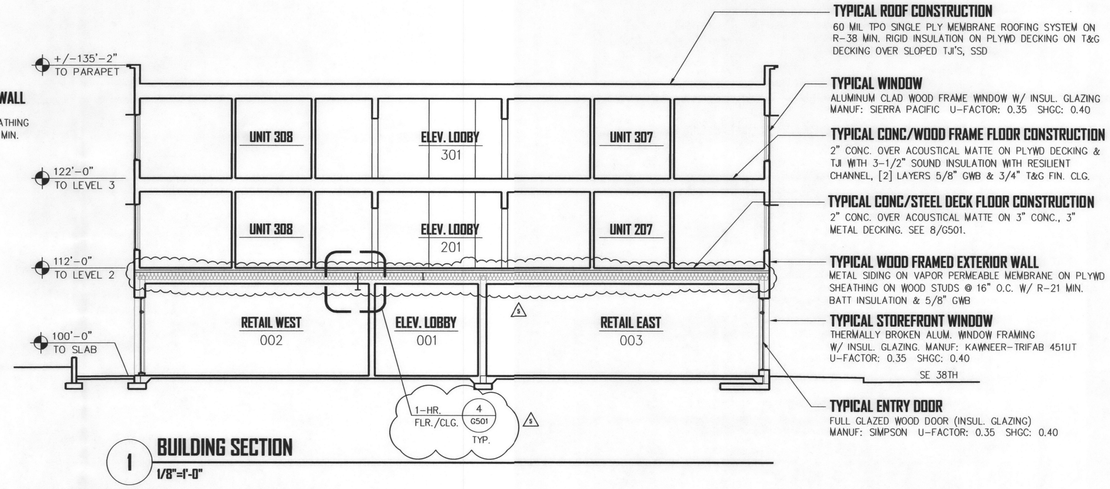
150 s.w. harrison, suite 100
portland, or 97201
t 503.224.6484
f 503.224.6485

date: 08.03.2012
phase: CONTRACT DOCUMENTS
drawn by: GF

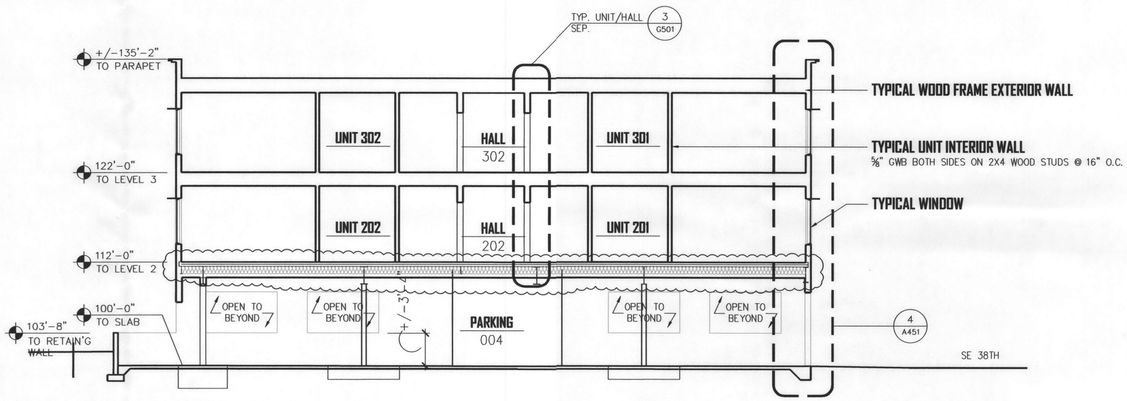
G501



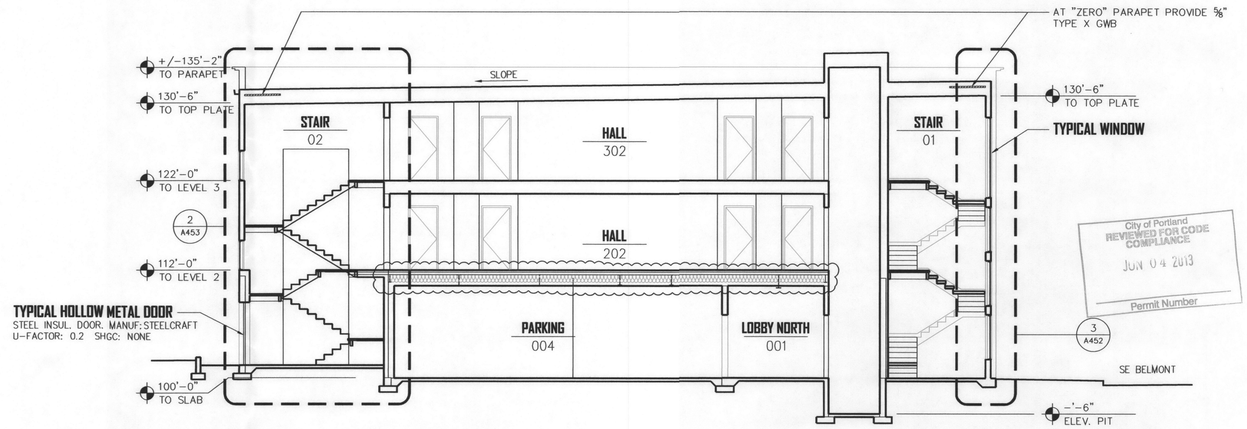
4 BUILDING SECTION
1/8"=1'-0"



1 BUILDING SECTION
1/8"=1'-0"



2 BUILDING SECTION
1/8"=1'-0"



3 BUILDING SECTION
1/8"=1'-0"

City of Portland
REVIEWED FOR CODE COMPLIANCE
JUN 04 2013
Permit Number

DRAWING REVISIONS

NO.	DATED
1	01.21.2013 REV 01– ASI 001
2	03.22.2013 REV 02R– ASI 002 REVISED
3	02.12.2013 REV 03– ASI 003
4	03.13.2013 RFI 31 RESPONSE
5	05.16.2013 RATED ASSEMBLY COOR.

REGISTERED ARCHITECT
4688
ERIK L. MATTHEWS
PORTLAND, OR
STATE OF OREGON

BUILDING SECTIONS

SURROUND

THE BELMONT at SE 38th

PORTLAND, OREGON

Surround Architecture, inc.
(c) 2012 SURROUND ARCHITECTURE, INC.
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date: 08.03.2012
phase: CONTRACT DOCUMENTS
drawn by: GF

A401