Development Services

From Concept to Construction

Phone: 503-823-7300 Email: bds@portlandoregon.gov 1900 SW 4th Ave, Portland, OR 97201
More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

APPEAL SUMMARY

Status: Decision Rendered. - Held over from ID 15267 (6/21/17) for additional information

Appeal ID: 15363	**Project Address:** 514 SE Belmont Ave
Hearing Date: 7/12/17	**Appellant Name:** Brad Bane
Case No.: B-019	**Appellant Phone:** 5039521529
Appeal Type: Building	**Plans Examiner/Inspector:** Brian McCall
Project Type: commercial	**Stories:** 7 **Occupancy:** A-2, A-3, B, R-2, S-2 **Construction Type:** Types III-A over Type I-A
Building/Business Name: Grand Belmont	**Fire Sprinklers:** Yes - Throughout project
Appeal Involves: Reconsideration of appeal	**LUR or Permit Application No.:** 16-211613-LU
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6] [File 7] [File 8] [File 9] [File 10] [File 11]	**Proposed use:** Mixed-use: Retail, Multi-Family Housing, Parking

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	2014 OSSC Table 601
Requires	Floors in buildings of Type III-A construction shall have a fire-resistance rating of 1-hour. Section 703.3 allows five different methods for determining the fire-resistance rating of an element or system. This request utilizes the Alternative protection methods as allowed by Section 104.11
Proposed Design	The project is a Type III-A mid-rise over a Type I-A podium per Section 510.2. Floors over the corridors are to be constructed as follows: 1” of self-leveling underlayment 7/8” APA rated wood sheathing (subfloor) Nominal 3 inch and 4 inch tongue and groove decking A non-rated suspended gypsum ceiling will also be provided below the assembly listed above Based on the American Wood Council Technical Report 10 (Exhibit ‘A’) the industry accepted rate of charring for Douglas Fir-Larch is 1.8” per hour of fire exposure. Based on this char rate, at the end of an ASTM E-119 test, the amount of structural wood remaining would be .7” for the 3x decking and 1.7” for the 4x decking. Per the attached calculations from our Structural Engineer (Exhibit ‘B’), 3x decking may be used for clear spans up to 6’ and the 4x decking for spans up to 10’-6”. A plan is included to show the corridor widths in the project. (Exhibits D thru D.3). All areas with a clear span greater than 6’ will utilize the 4x decking material
Reason for alternative	

This design has been approved in Portland numerous times. Refer to Appeal ID 12046 attached. (Exhibit 'C')

The thinner floor thickness provides adequate room for sprinklers, ducting and other necessary utilities above the non-rated ceiling without increasing the overall building height. In addition, this allows penetrations at the ceiling to be non fire-rated. See Exhibits D.4 and D.5 for proposed assemblies.

Reconsideration Text: We were asked to revise the char rate calculations to use 1.8" rather than 1.5" per hour and to provide plans so show the various spans for the decking. Based on the revised calculations, portions of the corridors will now be constructed using thicker decking to meet this higher char rate. This is indicated on the plans and additional construction detail.

Appeal item 2

Code Section	2014 OSSC Section 602.3
Requires	Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.
Proposed Design	The proposed design is to provide a 2-hour exterior wall assembly that consists of untreated 2"x6" wood stud framing with two layers of 5/8" thick type X gypsum board on the interior and either a stucco finish over cement backer board or brick veneer on the exterior side of the wall. Rock wool insulation will be friction fit between studs to completely fill the entire 6 inch nominal wall cavity. In addition to the rock wool insulation, the building will meet requirements 1 through 3, 5 thru 10 and 12 through 17 of the City of Portland Code Guide Topic: Type III Construction - OSSC/6/#4. (Exhibit F) Additional sacrificial studs around openings in the exterior wall are not included per requirement 4 in the Code Guide The building will be 83 feet from the top of the roof parapet to the lowest required fire apparatus setup point. This exceeds the 75 foot limit of requirement 11 in the Code Guide.
Reason for alternative	The attached white paper (Exhibit 'E') provides the fire analysis that supports the use of mineral wool (aka Rock Wool) insulation in the wall cavity of untreated wood stud framing as an alternate to FRT wood stud framing permitted by the OSSC section 602.3. The analysis is based on published temperature data from full scale testing of multiple configurations of fire rated stud walls. The assemblies tested included 1 hour and 2 hour rated assemblies, with and without insulation, insulations included fiberglass and Rock wool types. The analysis incorporates test data with the fire science fundamentals of gypsum calcification, pyrolysis of wood, and thermal conductivity of materials, accepted by the Society of Fire Protection Engineers, The National Bureau of Standards, and the American Wood Council. These are the accepted industry standards for this type of analysis. The appeal includes 15 additional conditions requested by the City of Portland. The equivalency analysis included in the white paper is a straight comparison between untreated wood and FRT wood framed wall assemblies, without any benefit from these additional conditions. The analysis documented in the attached white paper concludes that untreated wood framed walls with mineral wool insulation will outperform FRT wood framed walls without such insulation. Therefore, we are very confident that the performance of mineral wool filled wood stud framed walls with these 16

additional conditions will far exceed the code intent of FRT wood framing. Hence, we urge you to approve this appeal request.

Reconsideration Text: We were asked to make 2 revisions to the request. The original language was worded in a way that implied we were appealing the Code Guide allowing non-FRT wood. In fact we are only appealing the OSSC Code requirement to use it. We are proposing to use the rock wool in the stud cavities in lieu of the FRT wood. In addition to the rock wool, we are also meeting most of the requirements of the Code Guide. The second revision was the omission of the sacrificial studs around openings in the exterior walls. We were told that this is no longer a part of the Code Guide and therefore would not be required if we were using that Code path.

APPEAL DECISION

1. Alternate 1 hour fire assembly at corridor floors per engineered analysis: Denied. Proposal does not provide equivalent Life Safety protection.
Appellant may contact Eric Thomas (503-823-7653) for additional information.
2. Rock wool batt insulation with non-fire resistant treated wood in exterior walls of IIIA construction: Granted provided sacrificial studs are provided, or calculations by Oregon structural engineer showing structural members retain sufficient integrity after one hour of flame exposure to support the required load for the span proposed based on 1.8 inch effective char rate per hour.
Appellant may contact John Butler (503-823-7339) with questions.

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.

VALAR Consulting Engineering
12042 SE Sunnyside Road #357
Clackamas, Oregon 97015

July 5, 2017

Eric Bressman
Ankrom Moisan Architects Inc.
38 NW Davis Suite 300
Portland, OR 97209

RE: Corridor Fire Rating
Capacity of Framing Assembly
River Place Parcel 3 & Grand & Belmont

Dear Eric:

Please find attached calculation pages 1-2 dated 7/5/17 verifying the adequacy of a combined 7/8" sheathing over 3x and 4x tongue and groove corridor framing assembly. Based upon the given assembly the 3x and 4x tongue and groove can clear span between supports a maximum of 6'-0" and 10'-6", respectively, to resist code level loading for a 1 hour fire rating.

The proposed floor/ceiling assembly at corridors, includes the following; 1 inch self-leveling underlayment, over 7/8 inch APA rated sheathing, over 3x or 4x select dex tongue and groove solid lumber decking, with suspended drywall.

Per the American Wood Council Technical Report 10-2014, wood chars at a generally accepted rate of 1.8" per hour and this char rate is assumed to be constant, as such the 3x and 4x solid wood decking (2 ½ and 3 ½ inch actual depth, respectively) will be reduced to a 0.7 and 1.7-inch depth, respectively, after one hour of fire exposure.

The verification is based upon the requirements of the *National Design Specification for Wood Construction and Commentary, 2015 Edition*.

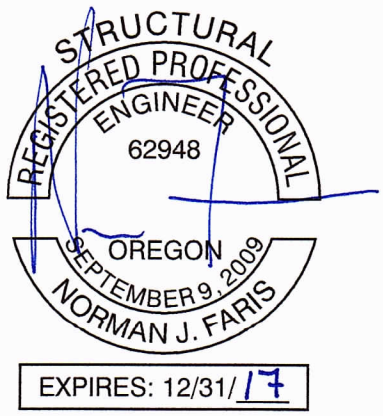
Please let us know if you have any questions or need any further information.

Sincerely,

Norman Faris, P.E., SE

Principal

Attachment



EXPIRES: 12/31/17

VALAR LLC
CONSULTING ENGINEERING
Portland, Oregon
www.valarengineering.com

Project CORRIDOR REVIEW.	By NJF	Sheet No. 1/2	
Location PDX	Date 7/5.		
Client AAMA	Revised	Project No.	
FIRE RATING OF CORRIDOR	Scale		

CHECK
7/8" SHEATHING OVER 3X OR 4X DECKING CAPACITY FOLLOWING 1.8" CHAR OR LOSS OF SECTION

- VERIFY MAX SPAN OF 3X AND 4X.

- 3X + 4X DECKING.
SELECT W/ F_b = 1750 PSI

PER NDS 16.

USE DL = 15 PSF
LL = 100 PSF

PER ASCE 7-10 2.5.
2.5.2.2.
USE 1.2D + 0.5L.

$q' = 1.2(15\ PSF) + 0.5(100\ PSF)$
$= 68\ PSF$

PER TABLE 16.2.2
$F_b' = 1750\ PSI \cdot 2.85 \cdot C_F = 1.04 \cdot C_{Fu} = 1.00$
$= 5187\ PSI$

ADD SHEATHING TO DECKING.

DECK SECTION AFTER LOSS

3X
$= 2\frac{1}{2}" - 1.8" = 0.7"$
$+ \frac{7}{8}"$ SHEATHING.

4X
$= 3\frac{1}{2} - 1.8" = 1.7"$
$+ \frac{7}{8}"$ SHEATHING.

MAX SPAN. (SIMPLE)

$q L^2/8 = M'_{ALL}/12.$

$L = \sqrt{\frac{M'_{ALL}}{12} \times 8 / q}$

$3X = \sqrt{\frac{0.7"^2 \cdot 12" \cdot 5187\ PSI \times 8}{\frac{6}{12} \cdot 68\ PSF}}$

$= 7.06'$

CHECK SHEAR.

$qL/2 = V'_{ALL}$

$L = 2V'_{ALL}/q.$

$= \frac{2(\frac{2}{3} \cdot 0.7" \cdot 12")(180\ PSI)}{68\ PSF}$

$= 29.6'$

VALAR LLC
CONSULTING ENGINEERING
Portland, Oregon
www.valarengineering.com

Project: CORRIDOR REVIEW.	By: NTF	Sheet No.: 2/2
Location: PDX	Date: 7/5	
Client: AAMA.	Revised:	Project No.:
FIRE RATING	Scale:	

DECKING CHECK COMM'D.

FOR 3X COMM'D.

CHECK Δ_{LL} @ 50 PSF

@ 7'-0 SPAN

$$= \frac{5\left(\frac{50}{12}\right)(84)^4}{384 \cdot 1.8^6 \cdot (0.875^3 + 0.7^3)\frac{12}{12}}$$

$$= 1.48''$$

$L/57$.

REDUCE TO $L/90$.

@ 72" = 0.80

$L/90$.

SO 72" CLR. OK

LIMIT 3X TO 6'-0" FOR SERVICEABILITY.

6'-0" MAX 3X

NOW CHECK 4X

$$L_{MAX} = \sqrt{\frac{1.7^2 \cdot 12}{\frac{6}{12 \cdot 60\ PSF}}\ .5187PSI \cdot 8.}$$

$$= 17.1'$$

CHECK SHEAR.

$$L = 2V'_{ALL}/q.$$

$$= \frac{2\left(\frac{2}{3} \cdot 1.7'' \cdot 12''\right)(180PSI)}{60\ PSF}$$

$$= 72'$$

17' CONTROLS

CHECK MAX Δ LIMIT TO $L/90$.

START W/ 10'.

$$\Delta = \frac{5\left(\frac{50}{12}\right)(120)^4}{384 \cdot 1.8^6 (0.875^3 + 1.7^3)\frac{12}{12}}$$

$$= 1.12''$$

OR $L/107$

@ 10'-6"

$\Delta = 1.36''$

$L/93$.

OK

10'-0" MAX 4X

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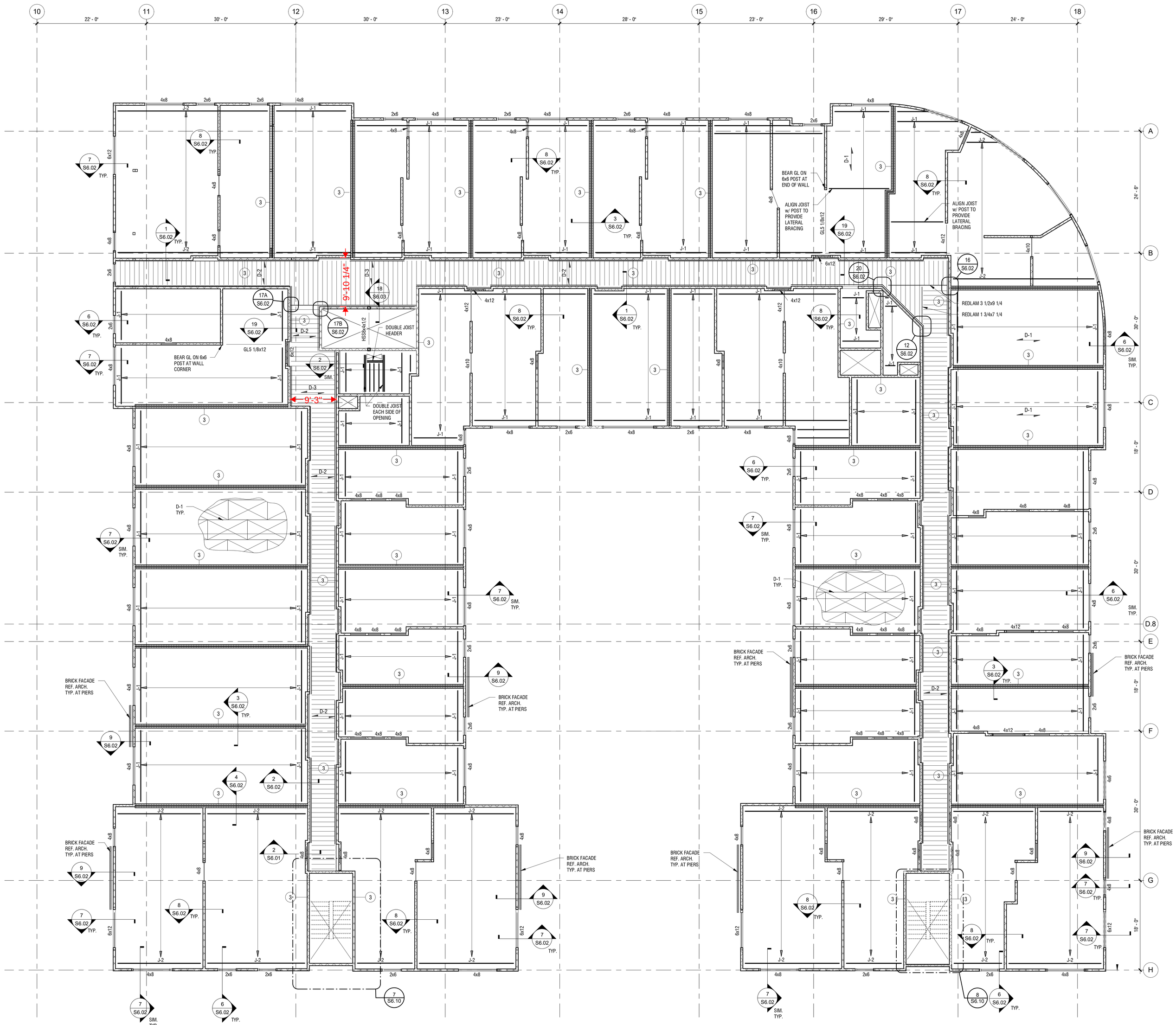

WOOD FRAME CONSTRUCTION LEGEND

1. INDICATES LOCATION OF CONTINUOUS TIE DOWN SYSTEM HOLDOWN AND POST. CONTINUOUS TIE DOWN SYSTEM TO BE DESIGNED BY MANUFACTURER. REF. HOLDOWN SCHEDULE 7/S6.05 FOR SCHEDULE OF LOADING.
2. INDICATES LOCATION OF HOLDOWN TO ALIGN WITH HOLDOWN ABOVE.
3. INDICATES BEARING WALL TYPE.
4. INDICATES SHEAR WALL TYPE.
6. INDICATES BEAM SPLICE.
7. INDICATES SNOW DRIFT IN ADDITION TO THE BASE SNOW LOAD SHOWN IN THE GENERAL NOTES. REF. 4/S1.32.
8. INDICATES A DOUBLE 2x DEMISING SHEAR WALL.
9. INDICATES SHEAR WALL REF. SCHEDULE.
10. INDICATES 2x6 BEARING WALL.
11. INDICATES SIMPSON STRAP.
12. GLXX — INDICATES A GLULAM BEAM.
13. LVL — INDICATES A MICROLAM VENEER LUMBER BEAM (MICROLAM).
14. PSL — INDICATES PARALLEL STRAND LUMBER BEAM (PARALLAM).
15. LSL — INDICATES LAMINATED STRAND LUMBER BEAM (TIMBERSTRAND).
16. <X"> — INDICATES CAMBER AT MID SPAN OF BEAM.
17. INDICATES BEARING WALL BELOW.

WOOD FRAMED CONSTRUCTION PLAN NOTES

1. INDICATES 2x SHEAR WALL WITH 15/32" SHEATHING TYPE. REF. 1/S6.05. PLYWOOD SHEATHING EXTENDS FROM HOLDOWN TO HOLDOWN.
2. INDICATES BEARING WALL TYPE. REF. 10/S6.01.
3. INDICATES CONTINUOUS TIE DOWN SYSTEM LOCATION. TYPE A, B, C, D, AND E INDICATE CONTINUOUS TIE DOWN SYSTEM LOCATION. CONTINUOUS TIE DOWN SYSTEM TO BE DESIGNED BY MANUFACTURER. REF 7/S6.05 FOR SCHEDULE OF TIE DOWN LOADS. REF. 16/S6.05 FOR DETAIL AT TYPE F AND G HOLDOWNS AT LEVEL 2. REF. 4/S.05 FOR HOLDOWN DETAIL AT TYPE F HOLDOWN AT LEVEL 3 AND 4 AND TYPE G HOLDOWN AT LEVEL 3.
4. J-X — INDICATES FLOOR JOIST TYPE AND SPACING w/ TOP FLANGE HANGERS
   J-1 11 7/8" I-JOIST @ 19.2" O.C. (REDBUILT I-65 OR EQUIVALENT)
   J-2 11 7/8" I-JOIST @ 19.2" O.C. (REDBUILT I-90 OR EQUIVALENT)
5. D-1 — INDICATES SPAN DIRECTION OF 23/32" T&G SHEATHING, BLOCKED, GLUE AND FASTEN @ 6" O.C. @ EDGES AND 12" O.C. INTERIOR. REF. 3/S6.05.
6. D-2 — INDICATES SPAN DIRECTION OF 3x6 DFL CAR DECKING w/ CONTINUOUS D-1 SHEATHING OVER, BEAR ON WALL/RIM JOIST. REF. 3/S6.05.
7. D-3 — INDICATES SPAN DIRECTION OF 4x6 DFL CAR DECKING w/ SHEATHING.
8. REFERENCE S6.01 THRU S6.06 FOR TYPICAL WOOD DETAILS.
9. ALL FLOORS TO BE TOPPED w/ 1" MAXIMUM GYP. CONCRETE TOPPING.
10. ALL OTHER WALLS NOT NOTED SHALL BE NON-LOAD BEARING PER ARCHITECTURAL REQUIREMENTS. ALLOCATE FOR CONNECTION TOP AND BOTTOM.
    NOTE: NOT ALL ARCHITECTURAL WALLS ARE SHOWN ON THE STRUCTURAL PLAN DRAWINGS.
11. REFERENCE ARCHITECTURAL AND MEP DRAWINGS FOR SLEEVES, BLOCKOUTS AND OTHER ITEMS TO BE COORDINATED WITH THE FOUNDATIONS.
12. REFERENCE ARCHITECTURAL DRAWINGS FOR DIMENSIONS.
13. PROVIDE DIAPHRAGM EDGE NAILING TO ALL JOISTS, PLATES OR BLOCKING IN LINE OR CONNECTED TO SHEAR WALLS.
14. COORDINATE LOCATIONS OF MECHANICAL PENETRATIONS, FLOOR DEPRESSIONS, OPENINGS, DRAINS OR STEPS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
15. REF. DETAIL 3 & 4/S6.01 FOR NOTCH AND HOLES ALLOWANCES AT STUDS, JOISTS, AND WALL PLATES.
16. REF. DETAIL 11 & 12/S6.01 FOR NON-BEARING PARTITION WALL DETAILS AT FLOOR AND ROOF.
17. REF. 6/S6.01 FOR THE TYPICAL HANGER SCHEDULE (U.N.O. ON PLANS).
18. PROVIDE DIAPHRAGM EDGE NAILING TO ALL JOISTS, PLATES OR BLOCKING IN LINE OR CONNECTED TO SHEAR WALLS.

1 LEVEL 3 FRAMING PLAN - EB
1/8" = 1'-0"

Ankrom Moisan TM
38 NW DAVIS STREET, SUITE 300
PORTLAND, OR 97209
T 503.245.7100

1505 5TH AVE, SUITE 300
SEATTLE, WA 98101
T 206.576.1600

1014 HOWARD STREET
SAN FRANSISCO, CA 94103
T 415.252.7063

VALAR LLC
VALAR CONSULTING ENGINEERING
12042 SE SUNNYSIDE RD #357
CLACKAMAS, OR 97015
503.758.8092

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 62948 OREGON SEPTEMBER 6, 2005 NORMAN J. FARIS
EXPIRES: 12/31/17

RIVERPLACE PARCEL 3
2095 SW RIVER PARKWAY
PORTLAND, OR 97201
BRIDGE HOUSING

REVISION	DATE	REASON FOR ISSUE

LEVEL 3 FRAMING PLAN - EB

BUILDING PERMIT

DATE	REVISION
06/12/2017	
PROJECT NUMBER	SHEET NUMBER
SCALE	S2.23

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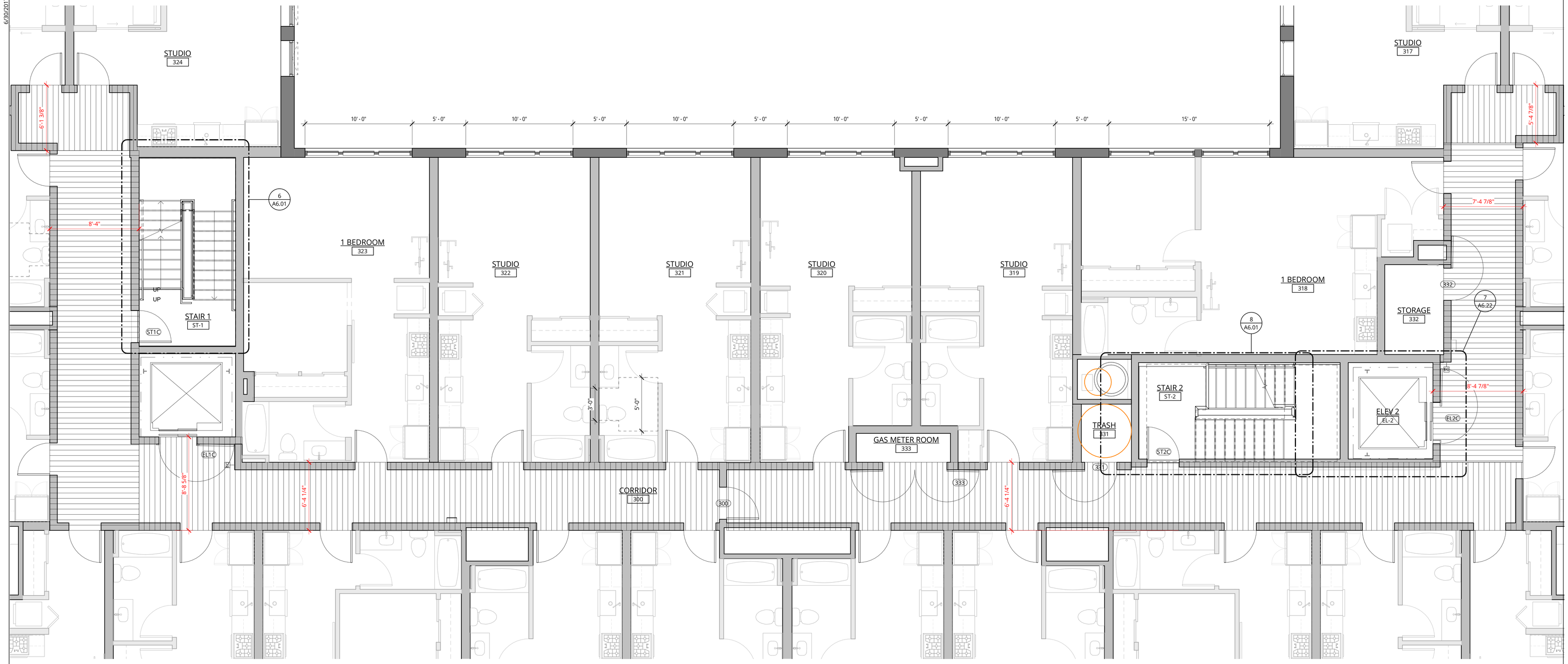
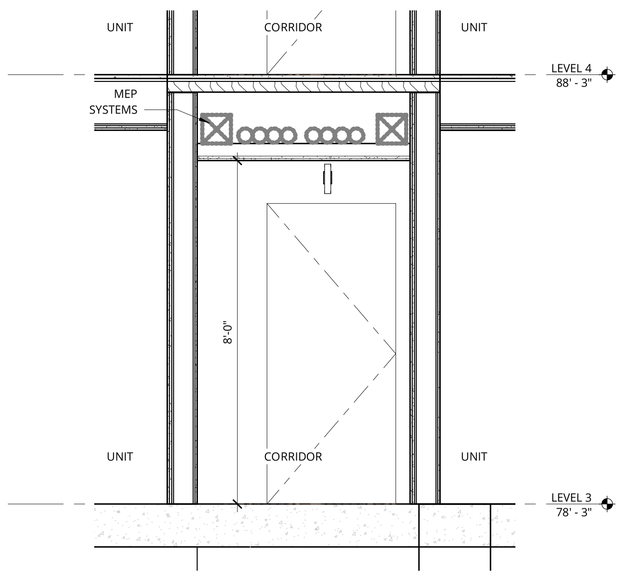


1 LEVEL 3

1/4" = 1'-0"



2 TYPICAL HALLWAY SECTION

1/2" = 1'-0"

GENERAL NOTES - FLOOR PLANS

1 REFER TO SHEET A0.01 FOR 'PROJECT NOTES' APPLICABLE ALL PORTIONS OF THE WORK
2 PRIOR TO FRAMING VERIFY THAT FINAL APPLIANCE AND PLUMBING FIXTURE SIZES/CLEARANCES MATCH THOSE USED AS BASIS OF DESIGN SHOWN ON DRAWING AX.XX
3 REFERENCE SLAB PLANS FOR CONCRETE WALL LOCATIONS, UNO. COORDINATE WITH STRUCTURAL DRAWINGS.
4 SEE SHEETS A0.11 AND A0.13 FOR WALL ASSEMBLIES.
5 SEE SHEET A0.12 FOR HORIZONTAL ASSEMBLIES.
6 SEE SHEET A0.14 AND A0.15 FOR TYPICAL FRAMING AND ACOUSTICAL DETAILS
7 SEE FIRE/LIFE SAFETY SHEETS G2.01 - G2.XX FOR LOCATIONS OF FIRE EXTINGUISHER CABINETS.
8 SEE ENLARGED PLANS FOR DETAILED DIMENSIONS, WALL TAGS AND DOOR TAGS.
9 REFER TO STRUCTURAL DRAWINGS FOR COLUMNS, SHEAR WALL AND BEAM SIZES.

NOT FOR CONSTRUCTION

Ankrom Moisan

38 NW DAVIS STREET, SUITE 300
PORTLAND, OR 97209
T 503.245.7100

1505 5TH AVE, SUITE 300
SEATTLE, WA 98101
T 206.576.1600

1014 HOWARD STREET
SAN FRANSISCO, CA 94103
T 415.252.7063

GRAND AND BELMONT
514 SE BELMONT

GRAND BELMONT LLC

REVISION	DATE	REASON FOR ISSUE

LEVEL 3 AND 6 FLOOR PLAN

PERMIT SET

DATE	REVISION
07.21.2017	
PROJECT NUMBER 161211	SHEET NUMBER A2.03
SCALE As indicated	

C:_Revit Projects\161211-17-GB2\161211_17_GB2_sophia.rvt

EXHIBIT 'C'

Development Services

From Concept to Construction

Phone: 503-823-7300 Email: bds@portlandoregon.gov 1900 SW 4th Ave, Portland, OR 97201
More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 12046	**Project Address:** 1800 NW Front Ave
Hearing Date: 5/27/15	**Appellant Name:** John Smith
Case No.: B-017	**Appellant Phone:** 503.445.7350
Appeal Type: Building	**Plans Examiner/Inspector:** Brian McCall
Project Type: commercial	**Stories:** 6 **Occupancy:** R-2 **Construction Type:** I-A, III-A
Building/Business Name: Riverscape Lot 8	**Fire Sprinklers:** Yes - FULL NFPA 13
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 14-216083-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6] [File 7]	**Proposed use:** Mixed use multi-family housing

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	2014 OSSC 703.3
Requires	703.3 Alternative methods for determining fire resistance. The application of any of the alternative methods listed in this section shall be based on fire exposure and acceptance criteria specified in ASTME 199 or UL 263. The required fire resistance of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures. Fire-resistance designs documented in sources. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in section 721. Calculations in accordance with section 722. Engineering analysis based on comparison of building element, component or assemblies designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E119 or UL 263. Alternative protection methods as allowed by section 104.11.
Proposed Design	The proposed project is a new multi-family residential development located in the Northwest neighborhood. Construction is fully sprinkled (NFPA 13) with 5 stories of Type III-A over 2 stories of Type I-A. The proposed floor/ceiling assembly at corridors (see exhibit A), includes the following layers from top to bottom: 1 inch self-leveling underlayment over 1/4 inch acoustic mat 7/8 inch APA rated wood sheathing (subfloor) 3x tongue and groove solid lumber decking A non-rated suspended gypsum ceiling will also be provided below the above mentioned rated floor assembly

	per the American Wood Council Technical Report 10-2014, Wood chars at a generally accepted rate of 1-1/2 inches per hour and this char rate is assumed to be a constant rate (see Exhibit B). As such the 3x solid wood decking (2-1/2 inch actual depth) will be reduced to a 1 inch depth after one hour of fire exposure per ASTM E-119. The reduced floor assembly would then consist of: 1 inch self-leveling underlayment over 1/4 inch acoustic mat 7/8 inch APA rated wood sheathing (subfloor) 3x tongue and groove solid lumber decking reduced to 1 inch actual depth The structural engineer has confirmed that the reduced floor assembly would still support the design load with a loss of 1-1/2 inch of section depth. (See Exhibit C).
Reason for alternative	The alternate design is required in order to provide: • The clearance needed for installation of mechanical, electrical, plumbing, and fire suppression systems. • The corridor ceiling height necessary for the owner's program. • A finished non-rated suspended ceiling assembly within the corridor. Similar appeals have been previously approved. See, for example, Appeal ID 9496, 11673 and others.

Appeal item 2

Code Section	2014 OSSC Referenced Standard ICC A117.1 – 2009, Section 308.3.2
Requires	308.3.2 Obstructed High Reach. Where a clear floor space allows a parallel approach to an element and the high side reach is over an obstruction the depth of the obstruction shall be 24 inches (610 mm) maximum.
Proposed Design	The proposed design provides an industry standard 24 inch deep cabinet with an additional extension of 1-1/2 inches for countertops for a maximum depth of 25-1/2 inches. This is required by the Fair Housing Act Design Manual (See Exhibit B) which is recognized as a federal safe harbor (See Exhibit A). Please see the attached reference documents: • Exhibit A: List of safe harbors for compliance with the Fair Housing Act • Exhibit B: Section 5.8 of Fair Housing Act Design Manual
Reason for alternative	The 2014 OSSC referenced standard is not consistent with the Fair Housing Act list of safe harbors as ICC A117.1-2009 has not been listed as a safe harbor. The proposed design provides industry standard depth countertops (25-1/2 inches) as accepted by the Fair Housing Act Design Manual which is recognized as a federal safe harbor. A117.1-2009 is not intended to be used as a stand-alone document. The previous ICC standard (A117.1-2003) was required to be utilized in conjunction with the Fair Housing Act Design Manual.

Appeal item 3

Code Section	2014 OSSC Table 1018.1 & Section 1018.6
Requires	Requires a fire-resistance rating of 0.5 hours for R occupancies equipped with automatic fire sprinkler systems. Fire-resistance rated corridors shall be continuous from the point of entry to an exit.
Proposed Design	The proposed project is a new multi-family residential development located in the Northwest neighborhood. Construction is fully sprinkled (NFPA 13) with 5 stories of Type III-A over 2 stories

	of Type I-A. Corridor walls adjoining the amenity and fitness rooms contain non-rated glass relites with additional fire sprinkler protection on each side of the openings with sprinkler heads mounted at 6'-0" on center. The glazing system has no horizontal framing members that would inhibit sprinkler performance.
Reason for alternative	To maintain visual openness and daylight access between common amenity/ fitness rooms and the circulation corridor/lobby without compromise to occupant life safety. All units at this level have direct on-grade exit to the exterior; corridor serves as second means of egress path.

Appeal item 4

Code Section	2014 OFC SECTION 307.4.3 and 308.1.4
Requires	307.4.3 Portable outdoor fireplaces. Portable outdoor fireplaces shall be used in accordance with the manufacture's instructions and shall not be operated within 15 feet of a structure or combustible material. 308.1.4 Open-flame cooking devices. Charcoal burners and other open-flame cooking devices shall not be operated on combustible balconies or within 10 feet of combustible construction.
Proposed Design	The proposed project is a new multi-family residential development. Construction type is fully sprinkled with 5 stories of Type III-A over 2 stories of Type I-A. A gas barbecue is proposed in the open courtyard of Building B at level 1 (3-HR, type I-A Concrete slab). While this is technically the roof for the parking garage below grade, it occurs on grade with an egress route direct to the public right of way. The proposed barbecue meets the following conditions: The barbecue is CSA Certified or UL listed The barbecue is fastened securely to the structure to prevent tipping. The barbecue is surrounded by non-combustible concrete pavers and landscape elements. The barbecue is located within 75 feet of a portable fire extinguisher A timer is connected to the barbecue to automatically shut off the flow of gas to the appliance. The fuel shutoff valve is connected to the fire alarm system such that it will interrupt the flow of gas when the fire alarm is activated anywhere in the building. A fire table with pre-manufactured linear fire trough is proposed on the roof terrace of building B meeting the following conditions: The fire table is CSA Certified or UL listed The fire table is fastened securely to the structure to prevent tipping. The fire table has glass guards to prevent combustibles from contacting or being ignited by the flames. The fire table is surrounded by concrete pavers over a Class A roof assembly with non-combustible sheathing. The terrace pavers are a non-combustible material The fire table is located within 75 feet of a portable fire extinguisher The roof terrace has 2 exits. A timer is connected to the fire table to automatically shut off the flow of gas to the appliance. The fuel shutoff valve is connected to the fire alarm system such that it will interrupt the flow of gas when the fire alarm is activated anywhere in the building.
Reason for alternative	There is no articulated code requirement for which to show equivalent means of fire & life safety protection. However, the proposed safety measures exceed those requested by the fire marshal and building official in the project's early assistance meeting.

APPEAL DECISION

1. Construction of One Hour Fire Resistive Floor/Ceiling Assembly at Corridor: Granted as proposed.

2. 25-1/2 Inch Depth Counter Tops: Granted for Type B dwelling units and denied for Type A dwelling units.

3. Sprinklers in Lieu of Protected Openings at Rated Corridor Construction: Granted as proposed.

4. Gas Burning Open Flame Appliance at Level 1 Courtyard of Building B and Roof Terrace of Building B: Granted as proposed and provided the following conditions are met:
1) The gas burning appliance is CSA certified or UL listed.
2) The gas burning appliance is secured to the roof or deck structure to prevent tipping.
3) The finished roof or deck is of non-combustible construction, with the exception of Ipe wood approved for decking only. Combustible finishes cannot be located less than 10 feet from the open flame appliance.
4) A portable fire extinguisher is installed on the same level and within 75 feet of the gas burning appliance.
5) A timer is connected to the valve of the gas burning appliance and allows gas to flow to the appliance for periods of up to 60 minutes.
6) A fuel shutoff valve is connected to the fire alarm system that will interrupt the flow of gas when the fire alarm is activated anywhere in the building.
7) A metal mesh screen or equivalent protection will be fixed in place over the fire pit to prevent combustibles from contacting or being ignited by the flames.

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.

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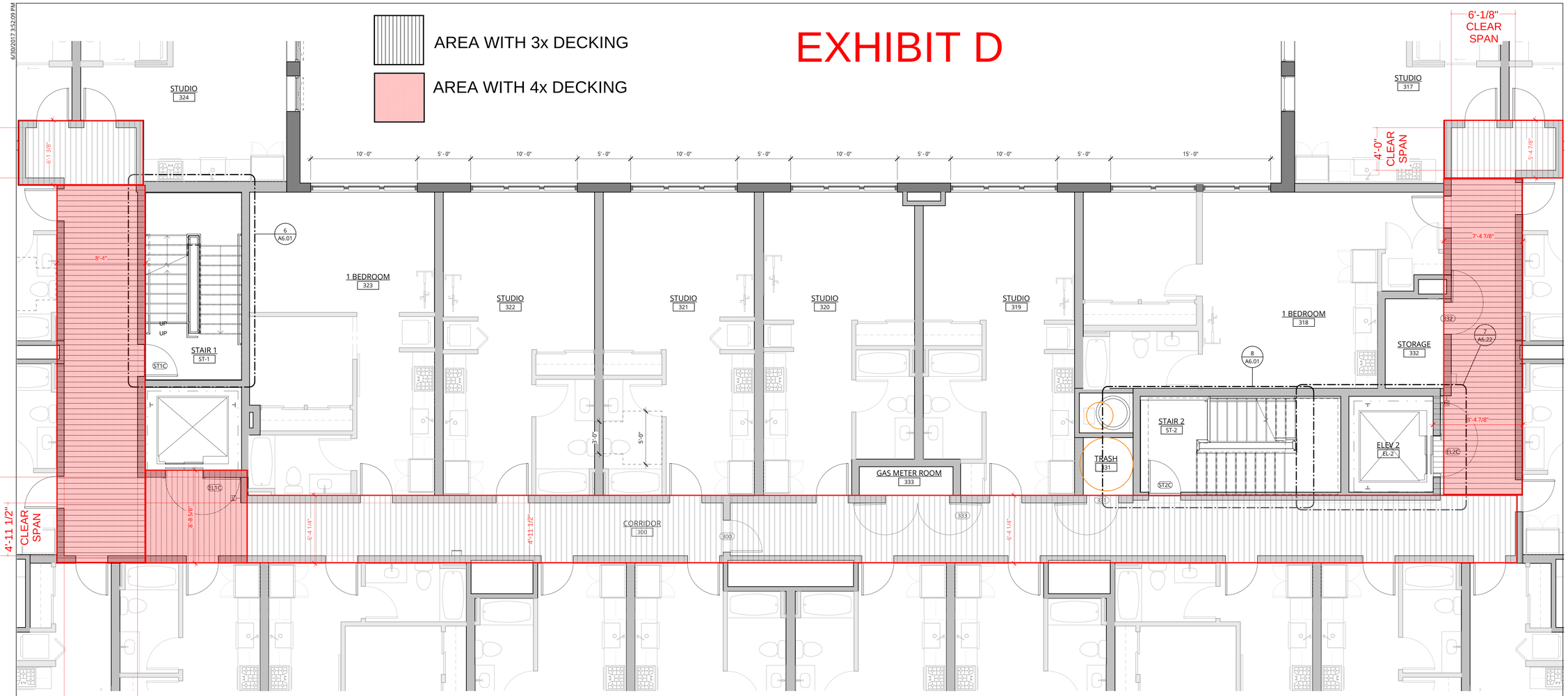
AREA WITH 3x DECKING

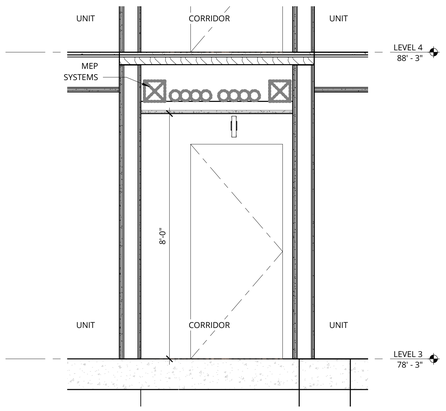
AREA WITH 4x DECKING

EXHIBIT D



1 LEVEL 3

1/4" = 1'-0"



2 TYPICAL HALLWAY SECTION

1/2" = 1'-0"

GENERAL NOTES - FLOOR PLANS

1 REFER TO SHEET A0.01 FOR 'PROJECT NOTES' APPLICABLE ALL PORTIONS OF THE WORK
2 PRIOR TO FRAMING VERIFY THAT FINAL APPLIANCE AND PLUMBING FIXTURE SIZES/CLEARANCES MATCH THOSE USED AS BASIS OF DESIGN SHOWN ON DRAWING AX.XX
3 REFERENCE SLAB PLANS FOR CONCRETE WALL LOCATIONS, UNO. COORDINATE WITH STRUCTURAL DRAWINGS.
4 SEE SHEETS A0.11 AND A0.13 FOR WALL ASSEMBLIES.
5 SEE SHEET A0.12 FOR HORIZONTAL ASSEMBLIES.
6 SEE SHEET A0.14 AND A0.15 FOR TYPICAL FRAMING AND ACOUSTICAL DETAILS
7 SEE FIRE/LIFE SAFETY SHEETS G2.01 - G2.XX FOR LOCATIONS OF FIRE EXTINGUISHER CABINETS.
8 SEE ENLARGED PLANS FOR DETAILED DIMENSIONS, WALL TAGS AND DOOR TAGS.
9 REFER TO STRUCTURAL DRAWINGS FOR COLUMNS, SHEAR WALL AND BEAM SIZES.

NORTH

NOT FOR CONSTRUCTION

Ankrom Moisan

38 NW DAVIS STREET, SUITE 300
PORTLAND, OR 97209
T 503.245.7100

1505 STH AVE, SUITE 300
SEATTLE, WA 98101
T 206.576.1600

1014 HOWARD STREET
SAN FRANSISCO, CA 94103
T 415.252.7063

GRAND AND BELMONT
514 SE BELMONT

GRAND BELMONT LLC

REVISION	DATE	REASON FOR ISSUE

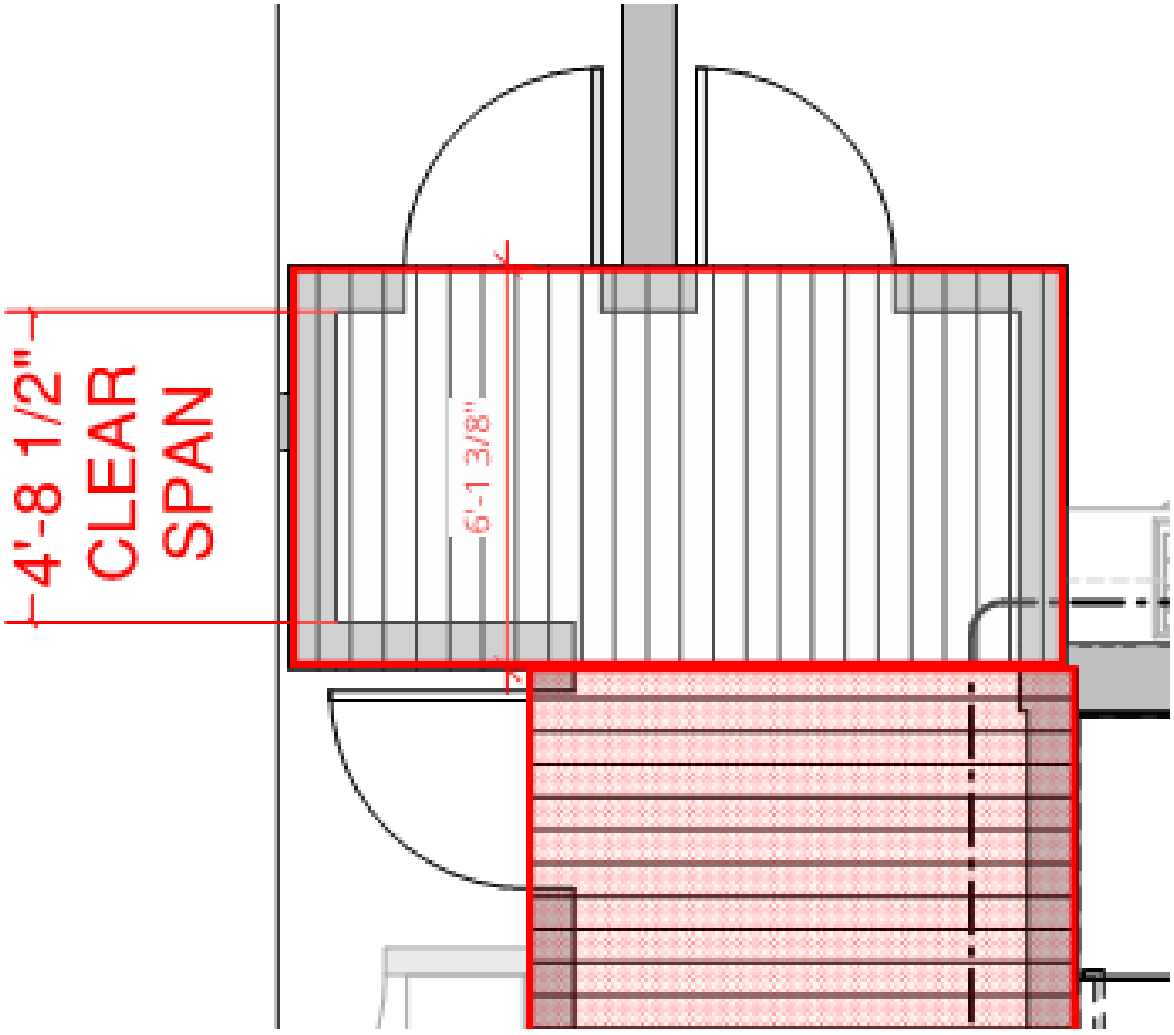
LEVEL 3 AND 6 FLOOR PLAN

PERMIT SET

DATE 07.21.2017	REVISION
PROJECT NUMBER 161211	SHEET NUMBER A2.03
SCALE As indicated	

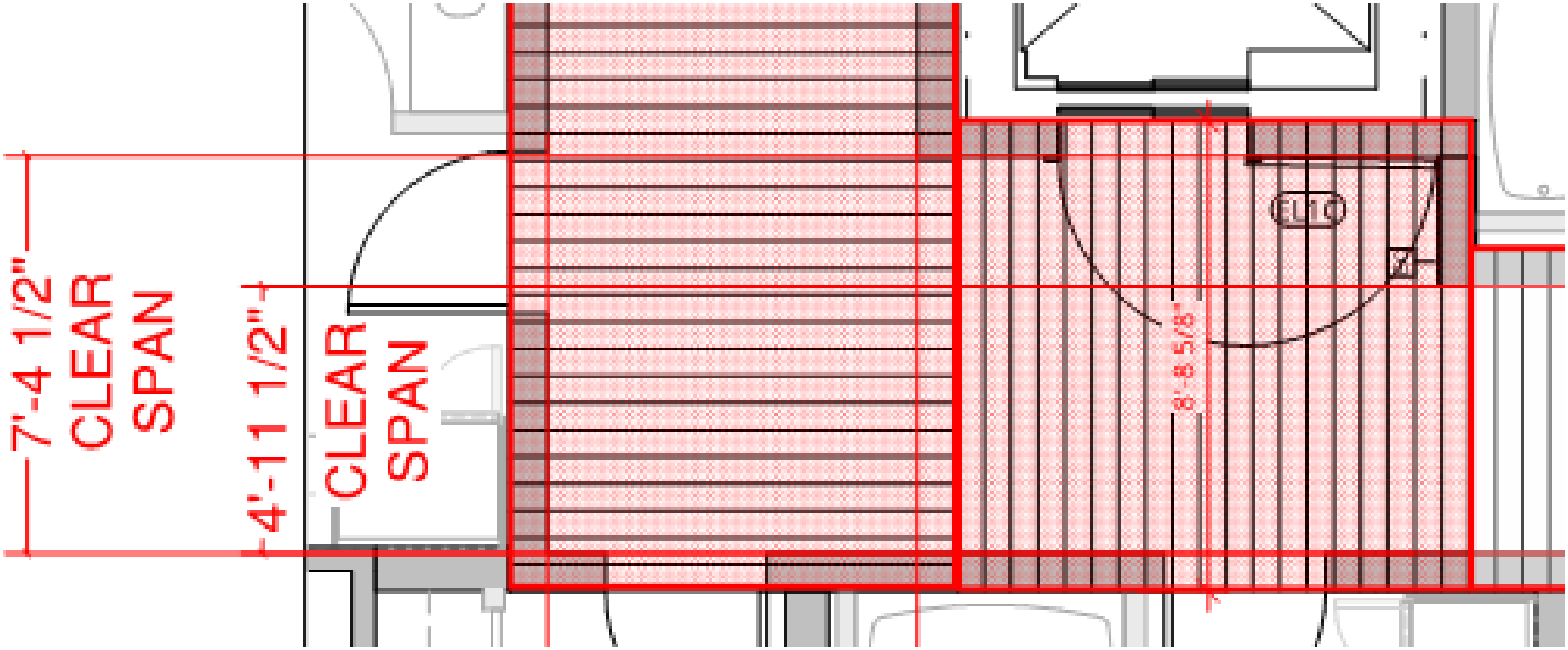
C:_Revit Projects\161211-17-GB2A161211_17_GB2_sophias.rvt

EXHIBIT D.1



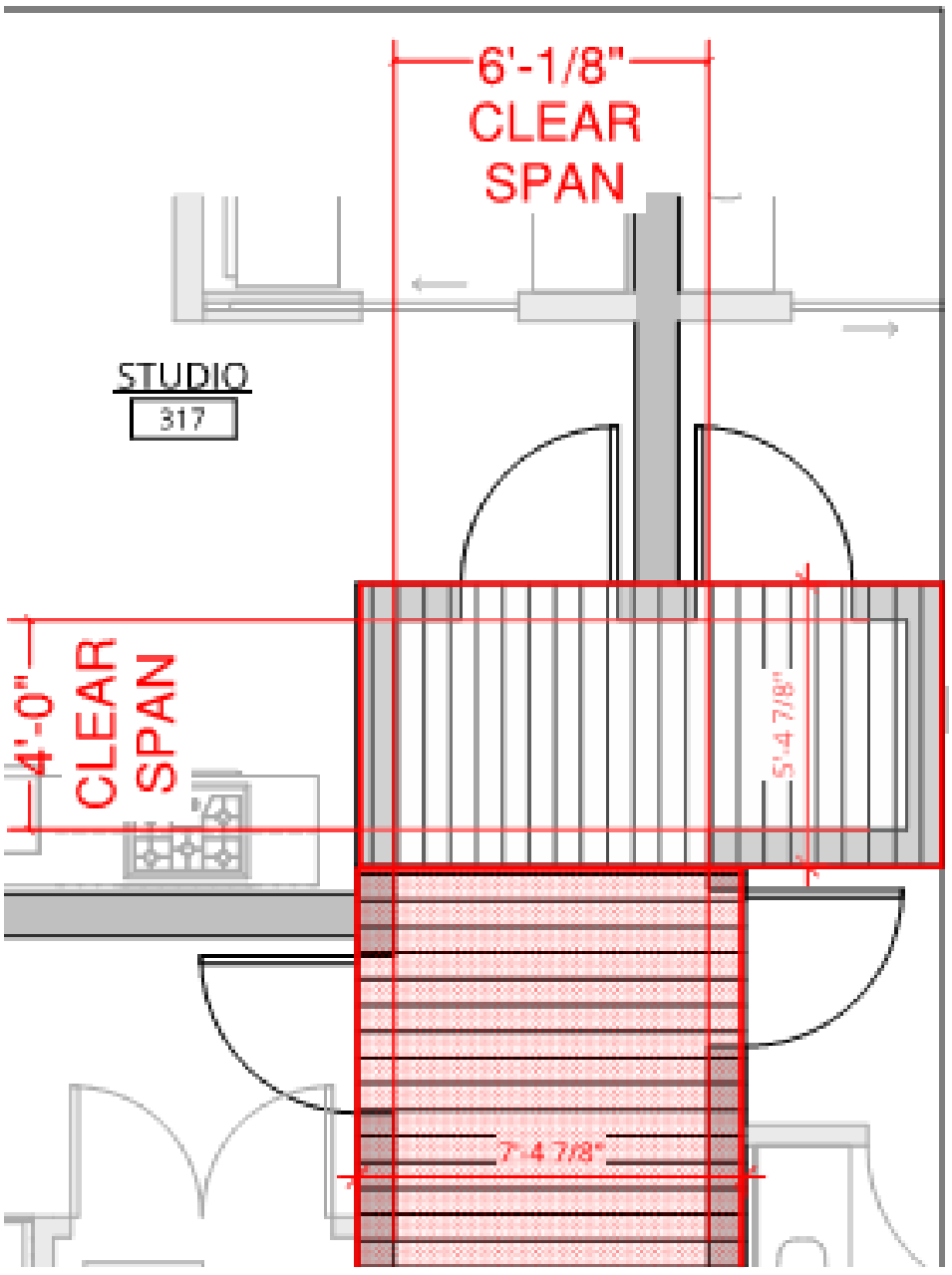
ENLARGED NE CORNER

EXHIBIT D.2



ENLARGED NW CORNER

EXHIBIT D.3



ENLARGED SE CORNER

EXHIBIT D.4

7/9/2017 9:43:30 AM

CONCRETE - 03 METAL - 05 WOOD - 06

FLOORS

1 INCH CAST UNDERLAYMENT
7/8 INCH PLYWOOD SHEATHING
NOMINAL 3 INCH T & G DECKING
SUSPENDED NON-RATED CEILING

CORRIDOR FLOORS

6H

FIRE RATING / SOURCE: 1 HOUR / CALCULATED
STC RATING / SOURCE:
IIC RATING / SOURCE:
INSULATION: N

1 INCH CAST UNDERLAYMENT
7/8 INCH PLYWOOD SHEATHING
NOMINAL 4 INCH T & G DECKING
SUSPENDED NON-RATED CEILING

CORRIDOR FLOORS

6H.1

FIRE RATING / SOURCE: 1 HOUR / CALCULATED
STC RATING / SOURCE:
IIC RATING / SOURCE:
INSULATION: N

GENERAL NOTES
HORIZONTAL ASSEMBLIES

ROOFS
GENERAL NOTES:
1. MAXIMUM RAFTER OR TRUSS SPACING IS 24 INCHES ON CENTER UNLESS NOTED OTHERWISE.
2. REFER TO STRUCTURAL DRAWINGS FOR LOCATIONS AND ADDITIONAL REQUIREMENTS.
3. RAFTER OR CORE THICKNESS ARE INDICATED ON THE ROOF TYPE TAGS ON THE PLANS. REFER TO THE TAG LEGEND ON SHEET A0.01.
4. TYPICAL GYPSUM WALLBOARD THICKNESS IS 5/8 INCH UNLESS NOTED OTHERWISE.
5. WHERE THE VAPOR RETARDER IS REQUIRED TO ALSO PERFORM AS THE AIR BARRIER, SEAL ALL EDGES, INTERSECTION AND LAPS TO CREATE AN AIR-TIGHT ENCLOSURE.

FIRE RATED ROOFS:
1. SEAL ALL PENETRATIONS, EDGES AND INTERSECTIONS WITH FIRE CAULKING.
2. COVER ALL RECESSED DEVICES WITH FIRE PROTECTIVE COVERINGS TO MEET THE LISTING SOURCE AND AHJ REQUIREMENTS.
3. INSTALL ALL MATERIALS IN STRICT ACCORDANCE WITH THE PUBLISHED REQUIREMENTS OF THE LISTING SOURCE, INCLUDING BUT NOT LIMITED TO: RAFTER OR TRUSS GAGE AND SPACING, FASTENER SIZE AND SPACING; ORIENTATION OF GYPSUM WALLBOARD; OFFSETS OF JOINTS BETWEEN ADJACENT LAYERS, BRIDGING AND CROSS BRACING.
4. REFER TO SHEET ***A0.xx*** FOR DETAILED INFORMATION FROM LISTING SOURCES.
5. RATING SOURCE REQUIREMENTS INDICATE MINIMUM TO ACHIEVE RATING; HOWEVER ADDITIONAL LAYERS, OR THICKER LAYERS, OF GYPSUM WALLBOARD OR SHEATHING MAY BE SHOWN TO MEET PROJECT REQUIREMENTS.

ACOUSTICALLY RATED ROOFS:
1. SEAL ALL PENETRATIONS, EDGES AND INTERSECTIONS WITH ACOUSTIC OR FIRE RATED ACOUSTIC SEALANT.
2. WRAP BACKS OF ALL RECESSED DEVICES WITH ACOUSTIC PADS.
3. REFER TO DRAWING ***A#.xx*** FOR ADDITIONAL DETAILS.

FLOORS
GENERAL NOTES:
1. MAXIMUM JOIST SPACING IS 24 INCHES ON CENTER UNLESS NOTED OTHERWISE.
2. REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS.
3. JOIST OR CORE THICKNESS ARE INDICATED ON THE FLOOR TYPE TAGS ON THE PLANS. REFER TO THE TAG LEGEND ON SHEET A0.01.
4. TYPICAL GYPSUM WALLBOARD THICKNESS IS 5/8 INCH UNLESS NOTED OTHERWISE.

FIRE RATED FLOORS:
1. SEAL ALL PENETRATIONS, EDGES AND INTERSECTIONS WITH FIRE CAULKING.
2. COVER ALL RECESSED DEVICES WITH FIRE PROTECTIVE COVERINGS TO MEET THE LISTING SOURCE AND AHJ REQUIREMENTS.
3. INSTALL ALL MATERIALS IN STRICT ACCORDANCE WITH THE PUBLISHED REQUIREMENTS OF THE LISTING SOURCE, INCLUDING BUT NOT LIMITED TO: JOIST DEPTH AND SPACING, FASTENER SIZE AND SPACING; ORIENTATION OF GYPSUM WALLBOARD, BRIDGING AND CROSS BRACING.
4. REFER TO SHEET ***A0.xx*** FOR DETAILED INFORMATION FROM LISTING SOURCES.
5. RATING SOURCE REQUIREMENTS INDICATE MINIMUM TO ACHIEVE RATING; HOWEVER ADDITIONAL LAYERS, OR THICKER LAYERS, OF GYPSUM WALLBOARD MAY BE SHOWN TO MEET PROJECT REQUIREMENTS.

ACOUSTICALLY RATED FLOORS:
1. SEAL ALL PENETRATIONS, EDGES AND INTERSECTIONS WITH ACOUSTIC OR FIRE RATED ACOUSTIC SEALANT.
2. WRAP BACKS OF ALL RECESSED DEVICES WITH ACOUSTIC PADS.
3. REFER TO DRAWING ***A.xxx*** FOR ADDITIONAL DETAILS.

NOT FOR CONSTRUCTION

Ankrom Moisan TM

38 NORTHWEST DAVIS, SUITE 300
PORTLAND, OR 97209
T 503.245.7100

1505 5TH AVE, SUITE 300
SEATTLE, WA 98101
T 206.576.1600

1014 HOWARD STREET
SAN FRANCISCO, CA 94103
T 415.252.7063

GRAND BELMONT
514 SE BELMONT

GRAND BELMONT LLC

REVISION	DATE	REASON FOR ISSUE

HORIZONTAL ASSEMBLIES

APPEAL 15267
RECONSIDERATION

DATE 7/10/2017
PROJECT NUMBER 161211

SHEET NUMBER
A0.31

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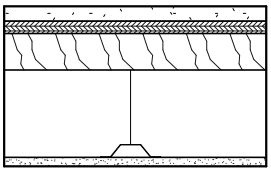
EXHIBIT D.5



1 INCH CAST UNDERLAYMENT
7/8 INCH PLYWOOD SHEATHING
NOMINAL 3 INCH T & G DECKING
SUSPENDED NON-RATED CEILING

CORRIDOR FLOORS

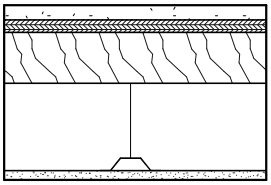
6H

FIRE RATING / SOURCE: 1 HOUR / CALCULATED

STC RATING / SOURCE:

IIC RATING / SOURCE:

INSULATION: N



1 INCH CAST UNDERLAYMENT
7/8 INCH PLYWOOD SHEATHING
NOMINAL 4 INCH T & G DECKING
SUSPENDED NON-RATED CEILING

CORRIDOR FLOORS

6H.1

FIRE RATING / SOURCE: 1 HOUR / CALCULATED

STC RATING / SOURCE:

IIC RATING / SOURCE:

INSULATION: N

EXHIBIT E

CODE UNLIMITED, LLC

White Paper - Fire Analysis of Fire Retardant Treated Wood Alternate

Project Name: Grand Belmont

Client: Ankrom Moisan Architects, Inc.

Prepared by: Code Unlimited

Address: 12655 SW Center Street, Suite 350, Beaverton, OR 97005

Date: 6/16/2017

Table of Contents

1. OVERVIEW

1.1 Project Overview

Ankrom Moisan Architects is designing the Grand and Belmont building in Portland, Oregon. It is a seven story building that consists of five stories of Type IIIA construction placed on top of two stories of Type IA construction for parking and residential (per previous appeal 14279). This construction is permitted by the Oregon Structural Specialty Codes when separated by a 3 hour horizontal separation and other restrictions. The building is fully protected by automatic sprinklers, fire and smoke detection and a fire alarm system.

Type IIIA construction requires that exterior walls be of noncombustible construction or of Fire Retardant Treated Wood (FRTW) construction. The project proposes to use conventional wood studs without the Fire Retardant Treatment (FRT). There are structural and environmental benefits for this approach.

1.2 Executive Summary

Fire-retardant treated (FRT) wood framing is permitted by code within exterior Type III wall assemblies with a fire-resistance rating of a 2 hours or less. This is based on the improved fire performance of such wood compared to regular wood of same species. FRT of wood delays ignition and resists “flame spread” once ignited. The proposed design uses tightly packed rock wool insulation between non-treated wood framing members in lieu of Fire Retardant Treated Wood (FRTW) to achieve equal or better fire performance.

Over the last several months Code Unlimited has analyzed this particular issue, namely the use of non-FRT wood in place of FRTW on multiple projects. This has been driven by many stakeholders within the Pacific Northwest region; local and state governments, universities and other research groups, manufacturers, real estate developers, and design and construction industry professionals. This white paper is the most current knowledge on this subject, based on rigorous analysis, review, and input from senior fire protection engineers and code experts within our company.

The white paper is structured to give the reader a detailed understanding of the code regulations that are driving this requirement along with excerpts from the International Building Code (IBC) commentary to clarify intent where necessary. We also provide other code citations where prescriptively the Oregon Structural Specialty Code (OSSC) and the IBC permits the use of rock wool (aka mineral wool) as a means to delay ignition or fire and flame migration. This is provided as documentation of established tradition. Many code provisions have evolved initially out of traditional construction practices and then undergo rigorous analysis and/or testing to substantiate performance in those applications. This white paper follows that time tested path by including a rigorous performance analysis based on currently available test data in support of non-FRT wood in an exterior wall of a type IIIA construction building.

Our analysis found that the fire performance of a non-FRTW framed wall with rock wool insulation is equal or superior to a FRTW framed wall. We also found support for the argument that this approach reduces the potential for chemical exposure to the environment and to the occupants of these buildings compared to the current practice of using FRTW.

1.3 Applicable Codes and Standards

Applicable Code or Standard
2014 Oregon Structural Specialty Code (OSSC)
2009 ASTM E-84 Test Methods for Surface Burning characteristics of Building Materials – American Society for Testing and Materials
2007 ASTM E-119 standard Test Methods for Fire Tests of Building Construction and Materials – American Society for Testing and Materials

1.4 Additional References

[1] 2007 Analysis of Inter-laboratory Testing of Non-loadbearing Gypsum/Steel-Stud Wall Assemblies, William Grosshandler, Samuel L. Manzello, Alexander Maranghides - Building and Fire Research Laboratory, Tensei Mizukami - Center for Better Living

[2] 1977 Effect of fire-retardant treatments on performance properties of wood. In: Goldstein, I.S., ed. Wood technology: Chemical aspects. Proceedings, ACS symposium Series 43. Washington, DC: American Chemical Society.

[3] 1992 Charring Rate of Wood for ASTM E119 Exposure, Fire Technology Volume 28, Number 1, Robert H. White and Eric V. Nordheim

[4] 1977 National Board of Standards Technical Note 945: An Investigation of the Fire Environment in the ASTM E 84 Tunnel Test

[5] 2007 Performance of a non-load-bearing steel stud gypsum board wall assembly: Experiments and modelling", Samuel L. Manzello, et al, Fire and Materials (Issue 31, pp 297-310)

[6] 2016 Calculating the Fire Resistance of Exposed Wood Members, Technical Report No 10, American Forest & Paper Association, Inc, American Wood Council, 1111 19th St., NW, Suite 800, Washington, DC 20036

[7] 2015 A Model for predicting heat transfer through insulated steel-stud wall assemblies exposed to fire, Sultan, M. A.; Alfawakhiri, F.; Bénichou, N., Fire and Materials - 2001 International Conference, San Francisco, January 22-24, 2001, pp. 495-506

[8] 2010 Wood Handbook, Wood as an Engineering Material, Chapter 17 Fire Safety, Robert H. White and Mark A. Dietenberger, Forest Product Laboratory, United States Department of Agriculture Forest Service, Madison Wisconsin

2. PROPOSED WALL ASSEMBLY

The proposed design is to provide a 2-hour exterior wall assembly that consists of untreated 2”x6” wood stud framing with two layers of 5/8” thick type X gypsum board on the interior and a stucco finish over cement backer board on the exterior side of the wall. Rock wool insulation will be friction fit between studs to completely fill the entire 6 inch nominal wall cavity. Details of the proposed wall sections are in the attached Appendix A. The conclusions of this report are limited to the proposed wall types C6, C6.1, W6, and W6.1 included in Appendix A of this white paper.

3. ROCK WOOL USE PRESCRIPTIVELY PERMITTED IN CURRENT CODES

The 2014 OSSC section 602.3 for Type III, exterior wall construction, permits the use of fire retardant treated wood (FRTW) in lieu of non-combustible materials.

Rock wool barriers have been allowed in the codes as a means to retard or prevent the ignition of wood in concealed spaces, for some time now:

1. OSSC 803.11.1.1 allows untreated wood to be used for furred walls or ceilings where Non-Combustible construction is required when the cavity is filled with rock wool insulation.
2. OSSC 718.2.1(7) allows rock wool batts to be used as fireblocking to cut off concealed draft openings.
3. OSSC 718.3.1 permits the use of rock wool batts as an approved draft stopping material.
4. ORSC 316.5.3 permits the use of 1.5 inch thick rock wool to satisfy the requirements for an ignition barrier.
5. NFPA 13 section 8.15.1.2.17 allows untreated wood joist to be treated as FRT wood when the cavity is filled with rock wool insulation.
6. OSSC 722.6 contains procedures by which the fire resistance ratings of wood assemblies are established by calculations.

   IBC Section 722.6 Commentary states:

   “Rock wool insulation provides additional protection to wood studs by shielding the studs from exposure to the furnace, thus delaying the time of collapse.”

   OSSC table 722.6.2(5) allows glass fiber, or rock wool, or cellulosic fill within stud cavity prescriptively to increase the fire resistance of a wall assembly by 15 minutes.

7. IBC Section 602.2 Commentary:

   “Fire Retardant-treated wood (FRTW), although combustible, is permitted in limited uses in building of Type I and Type II construction… it is not assumed to be fire-resistance rated, and generally does not afford any higher fire-resistance rating than untreated wood material.”

4. PERFORMANCE BASED ANALYSIS AND VERIFICATION

The list of prescriptive provisions in section 3 establishes the code history of use of rock wool insulation to improve the fire performance of wood wall and ceiling assemblies. These provisions are an outgrowth of tradition and historical construction practice. The values assigned to these are generic values, based on historical data. These are valuable in establishing precedence and intent of the code requirements. Our analysis is based on the full-scale test data documented in the research papers #5 and #7 listed in section 1.4 in this white paper. The remaining references #1, #2, #3, #4, #6 and #8, provide supporting evidence for the methodology used in this analysis as well as some other key metrics used in the analysis. The full-scale testing was performed with 4 inch metal stud wall assemblies, while the wall assemblies analyzed in this white paper are nominal 6 inch wood assemblies. Wood is a non-conductor of heat and superior performer than metal within the context of this analysis. Our test data includes wall assemblies with both fiber glass and rock wool insulation within the stud cavity. Rock wool out performs fiber glass insulation at higher temperatures. In these two cases as well as in all other cases our analysis takes the conservative value when there are multiple data points available.

Building structural component fire performance is predicated on the type of fire exposure. Most commonly fire from combustible building contents or furnishings expose the components such as walls of structural frame to heat from the fire, causing loss of structural integrity of the wall and its eventual collapse. The point at which the load-bearing components of a Type III wall (in this case, the wall studs) are exposed to heat from the fire, the building would have long since been evacuated and the space become untenable, as the temperature required to breach the gypsum board membrane would be beyond survivability. In this case, the sole concern is for the preservation of structural stability and to protect firefighters and adjacent structures. The studs of the walls provide the necessary structural, load bearing capability to support the exterior wall. Gypsum board or other sheathing is solely relied on to provide resistance to the fire exposure in order to protect the load bearing members, its contribution to the structural strength of the wall is negligible. The Commentaries to section 722.6 of the IBC state “It is assumed that once the structural members fail, the entire assembly fails.”

OSSC section 602.3 defines Type III construction as “that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.”

Fire retardant treatment of wood does not prevent the wood from decomposing and charring under fire exposure. The rate of fire penetration through treated wood approximates the rate through untreated wood. Fire-retardant-treated wood used in walls can slightly improve fire endurance of these walls, but, most of this improvement is associated with the reduction in surface flammability rather than any changes in charring rates

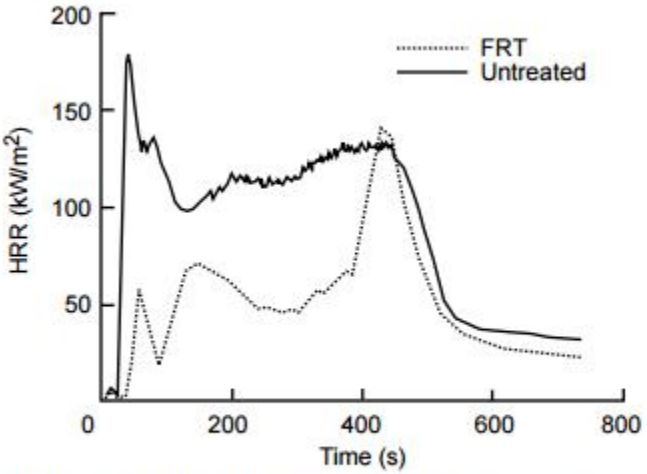


Figure 17–1. Heat release curves for untreated and FRT plywood exposed to 50-kW/m² radiance.

Fig.1. E84 Test Comparison (Wood Handbook Chapter 17)

The surface layer of FRTW is a fire retardant treatment that slows ignition by interfering with heat transfer to the material and chemically interferes with combustion. It does so by converting combustible gases and tars to carbon char at temperatures below 550°F[2,8] and releases carbon dioxide and water vapor which dilute the combustible gases. However, above temperatures of 550°F, outgassing and pyrolysis effects exceed the limits whereby ignition is interfered and FRT heat release rate and burning rates compare to untreated wood of the same variety. Charts of the ASTM E84 (Standard Test Method for Surface Burning Characteristics of Building Materials) heat release rates (Fig. 1) show that, at about 420 seconds (7 minutes), the heat releases rate (HRR) for FRTW and non-FRTW are virtually identical, indicating that, after the fire retardant treatment has been exhausted, the non-FRT and FRT wood studs will perform similarly.

Once the gypsum layers are compromised, the fire is free to attack the exposed studs. However, charring and consumption of the studs begins before failure of the gypsum membrane, as heat is conducted to the edge face of the studs and to the stud wall cavity by conduction through the gypsum board. In the stud wall cavity, the temperatures are already well over the autoignition temperature of wood and the point at which FRTW becomes ineffective (550°F) by the time the two gypsum board layers have been compromised. Although the standard stud begins charring sooner than the FRTW stud, total time to fail for the standard stud is much longer due to the insulative effects of the rock wool, slowing progressive char over the longer dimension (side) faces of the stud by preventing heat transfer to the stud cavity.

Above 550°F, FRTW studs behave similar to a standard wood studs and charring continues until it fails in load. Char rates for softwoods such as used in framing lumber are at an average rate of 1.5 in/hr [6]. By calculating the heated perimeter of the wood studs for an uninsulated, code-accepted FRTW stud and a rock-wool insulated standard stud, and using the average char rate, a time to failure of the two studs can be determined.

The effective heated perimeter of a 2” x 6” nominal FRTW stud is 12.5 inches at the point of its ignition. The effective heated perimeter of a rock wool insulated stud is only 1.5 inches at the same point, although the point of ignition is approximately 7 minutes earlier due to the effects of FRT and the delay of ignition of the FRTW stud. As the studs are consumed by charring, the 3-sided attack[6] on the FRTW stud results in much more

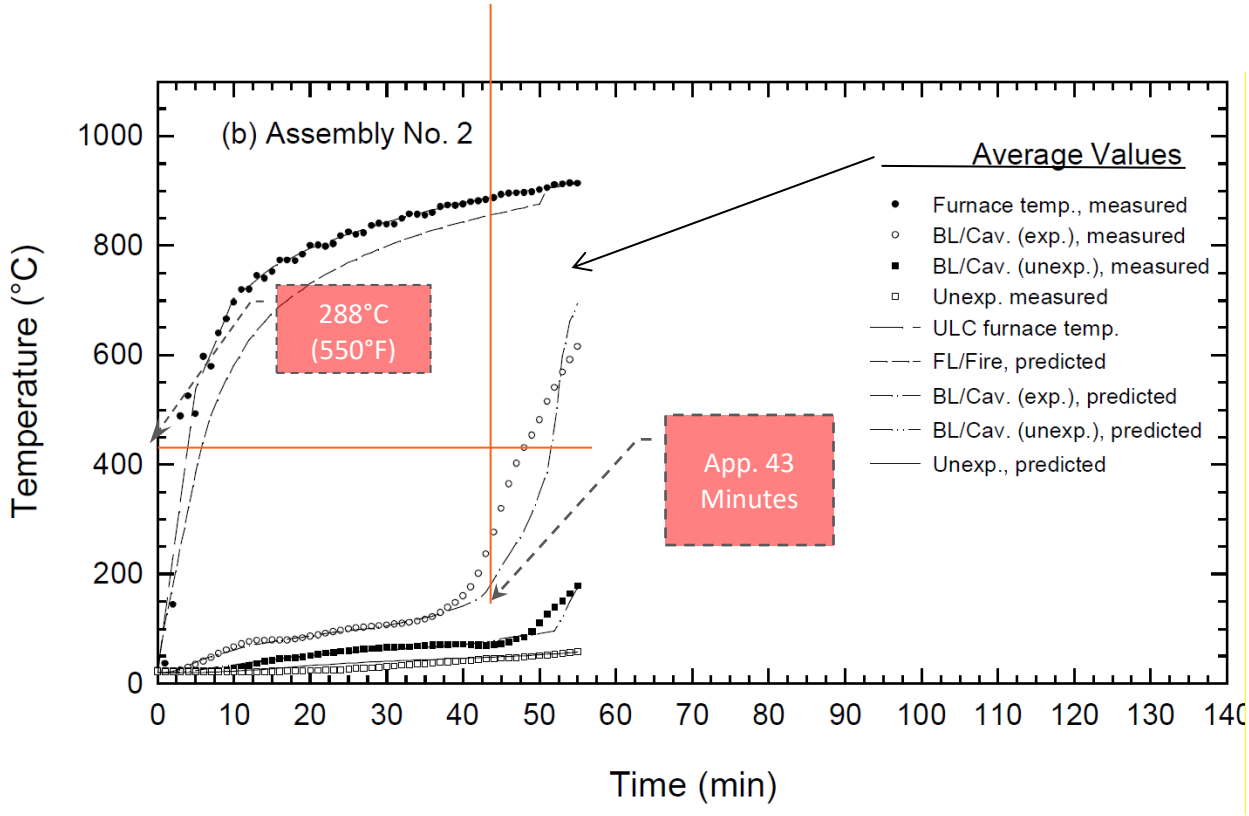
material loss due to charring and more rapid reduction in load-bearing capability. While there is some charring of the sides of the standard stud, especially nearest the exposed edge, the insulative properties of the rock wool significantly slow charring and loss of material.

OSSC Table 722.6.2(2) states that the time assigned for contribution of the wood frame to fire resistance is 20 minutes. Within that time, the fire is assumed to consume sufficient of the stud framing to compromise its structural strength such that it fails under load. Thus it was assumed that, once the FRTW studs reach the point where the fire retardant treatment no longer interferes with charring, the stud will have 20 minutes of load-bearing capability before failure. This occurs with approximately 25% of the original stud cross-section remaining after charring. A similar failure point was used for analysis.

OSSC Table 722.6.2(5) notes that “Additional Protection” can be provided to a wall for fire rating purposes by the addition of rock wool insulation at a specified minimum density. The Commentaries for IBC section 722.6 note that “Rock wool insulation provides additional protection to wood studs by shielding the studs from exposure to the furnace, thus delaying the time of collapse.” Rock wool does this by insulating the sides of the studs from direct heat and flame exposure and by interfering with flame spread by conduction, radiation and convection within the wall cavity. In this respect, the assembly is superior to FRTW with only fiberglass insulation, in that its ability to interfere with ignition is not compromised by high exposure temperatures. Rock wool has a melting point of 2150°F and can withstand a 4 hour test per ASTM E119 time-temperature curve, where the fire temperature reaches a maximum temperature of 2000°F, well above the temperatures expected in a flashover fire condition.

Unlike a simple, 2-hour rated FRTW stud wall, rock wool provides protection on the sides of the studs, ensuring the main route of burn-through to be in the longest dimension of the lumber (See Fig 4-6). In FRTW, fire attack, once the thermal membrane has been compromised, is on three sides of the stud and burn through of the stud is much more rapid. Use of rock wool insulation is specified as it has greater refractory qualities, higher installed density and remains in place long after fiberglass insulation has melted away.

Clearly, there is an advantage to the use of rock wool in the wall that an ordinary FRTW assembly does not match.



Legend

SL - Gypsum Board Single Layer BL - Gypsum Board Base Layer FL - Gypsum Board Face Layer
Std. - Stud Cav. - Cavity Exp. - Exposed Side Unexp. - Unexposed Side Fire - Directly exposed to furnace

Figure 2: Time vs temperature curve – Double Layer 5/8" Gypsum Board, Studs 16" O.C.[7]

Note: Line (open dots) for temperature at inner surface of base layer, exposed side. This is temperature of stud cavity/edge of stud.

Derivation Calculation

Utilizing test data from reference document #7, (equation #10) and Fig. 2 above. The calculated stud surface temperature can be derived and graphed.

Eq. 10[7]

$$T_m^{j+1} = T_m^j + \frac{\Delta t}{(\rho_i c_i)_m^j (\Delta y)^2}\left\{\left[\frac{(k_i)_{m-1}^j + (k_i)_m^j}{2}\right](T_{m-1}^j - T_m^j) - \left[\frac{(k_i)_m^j + (k_i)_{m+1}^j}{2}\right](T_m^j - T_{m+1}^j)\right\}$$

The calculated time to autoignition temperature for several depth increments into the mineral wool insulation (long direction of stud) are displayed below. (See Fig. 2A)

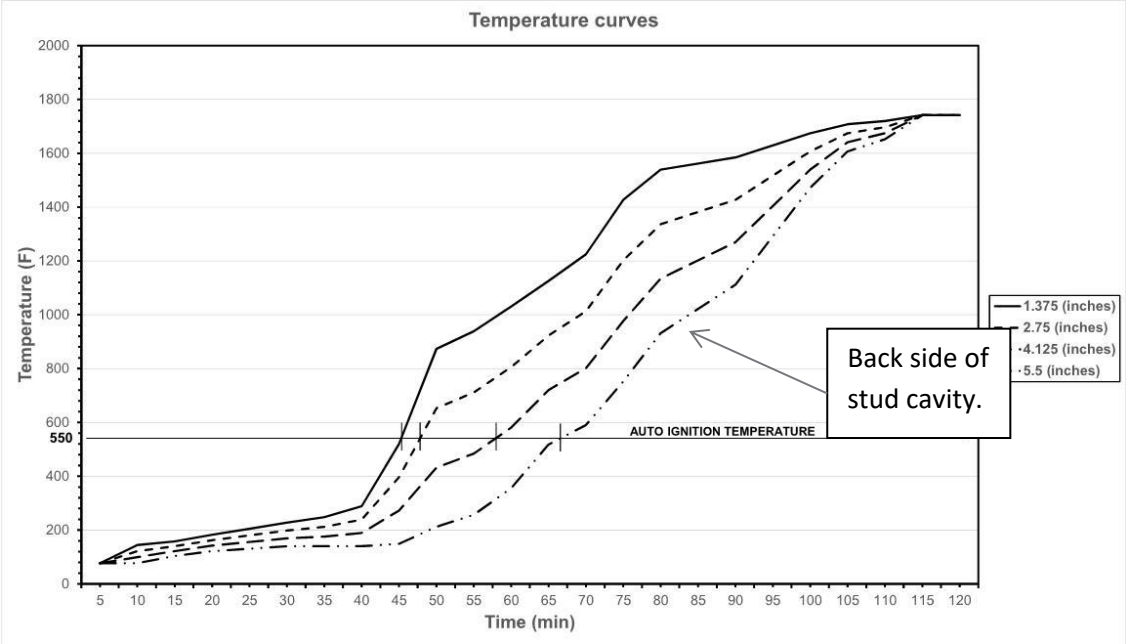


Figure 2A: Time vs Stud Surface Temperature curve – Calculated per Eq. 10.[7]

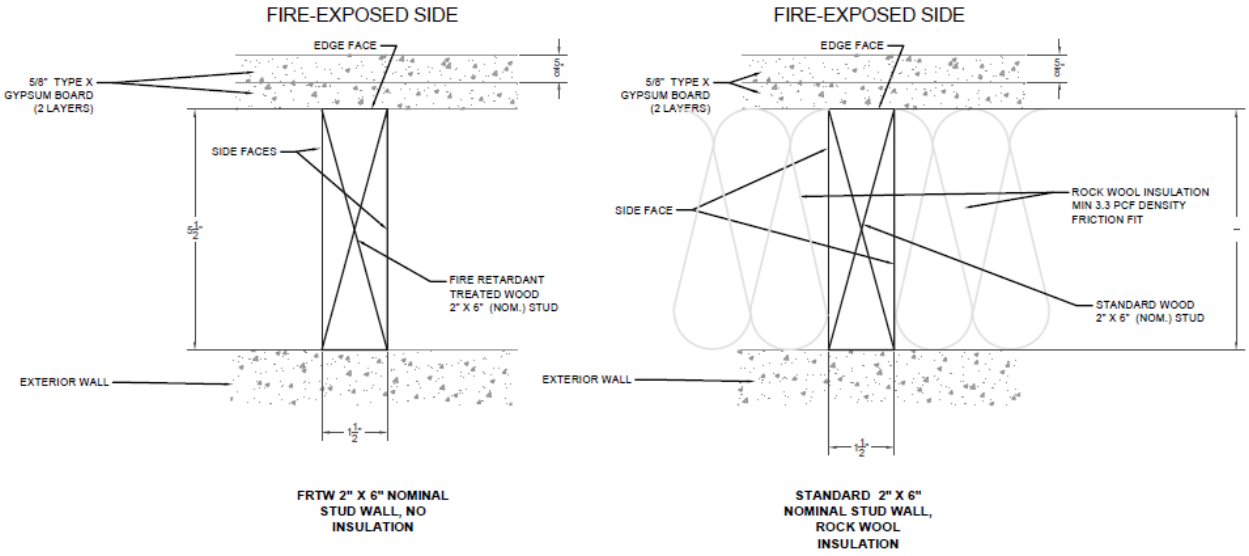


Figure 3: FRTW and Rock Wool Stud Walls

Note: Figures 3-6 do not show composition of the exterior (non-fire exposed) side, as other constructions, allowed by code for non-fire exposed assemblies, may be used. All wall types shall be 2-Hr rated as shown in Appendix A. In all cases addressed by this report, the Fire Separation Distance is greater than 10' and fire resistance rating may be calculated from the fire exposed side only in accordance with OSSC section 705.5.

5. FIRE RESISTANCE COMPARISON

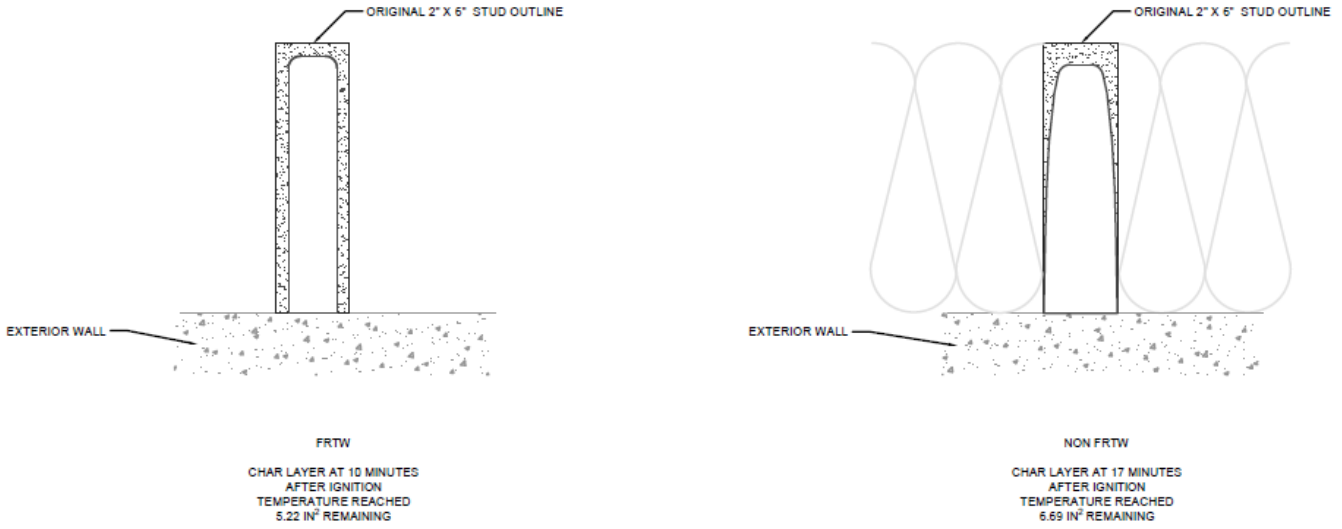


Fig 4: FRTW and non-FRTW Stud Wall at 60 Minutes After Fire Exposure of Gypsum Board Wall

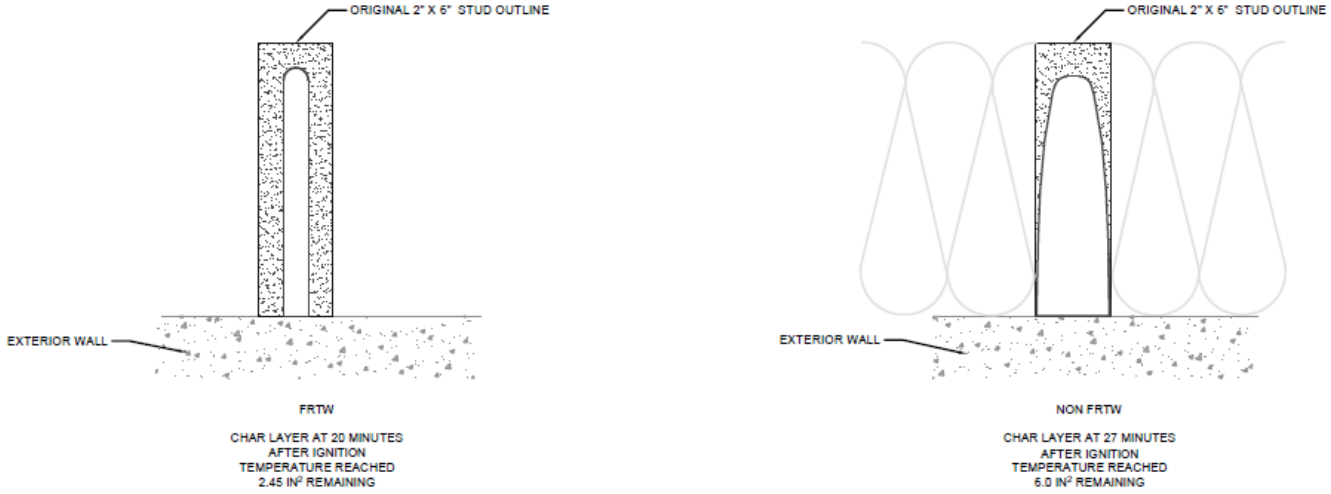


Figure 5: FRTW and Non-FRTW Stud Walls at 70 Minutes After Fire Exposure of Gypsum Board Wall Point of FRTW Wall Failure

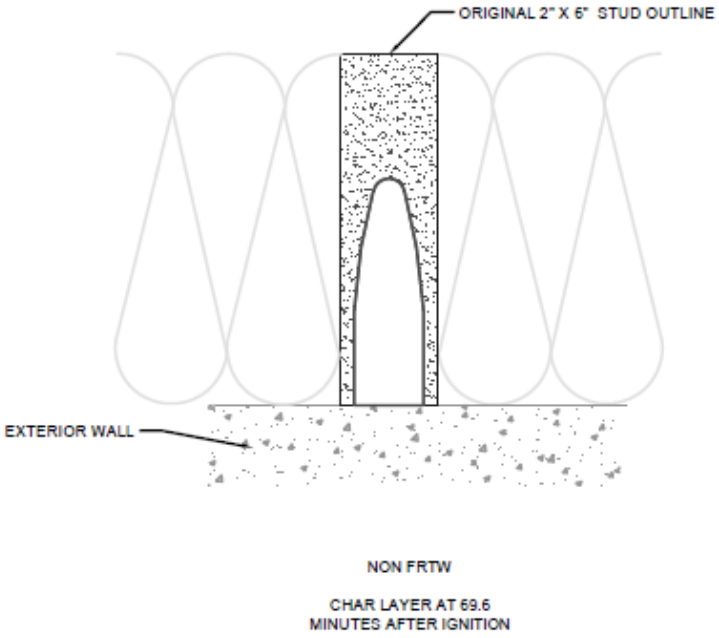


Figure 6: Non-FRTW Stud Wall at Failure at 112 Minutes – Reduced Cross Sectional Area Equivalent to FRTW at Failure

Charring and loss of load-supporting cross-section of the wood studs begins at approximately 43 minutes after exposure of the wall to fire, as heat conducts through the gypsum board and the temperature at the inside face of the gypsum board wall reaches the autoignition temperature of wood. Ignition of the FRTW is delayed by approximately 7 minutes by the action of the fire retardant treatment. By approximately 50 minutes after exposure, both studs are experiencing charring.

At 60 minutes after exposure, approximately 50% of the allowable cross-section of the FRTW stud has been consumed by charring. Somewhat less (27%) of the insulated non-FRTW stud has been consumed at the same point, due to the effects of rock wool of rock wool in limiting heat transfer to the wood.

At 70 minutes, the FRTW has lost sufficient cross section that it fails in load. At this point, approximately 25% of the original FRTW stud cross-section remains. However, only 39% of the insulated stud has been consumed.

At approximately 112 minutes, charring of the insulated non-FRTW stud reaches the point at which less than 25% of the original cross-section remains and the stud fails.

The table below provides a comparative analysis that clearly shows that standard wood framing with rock wool insulation performs better than FRT wood framing under fire conditions.

Time Interval (minutes)	Description	FRTW Stud Reaction	Standard Stud with Rock Wool Insulation Reaction
t = 0	Gypsum board face of wall is first exposed to flames/heat, interior of stud wall at ambient temperature	None	None
t = 43	Temperature at edge face of stud attached to gypsum board exceeds autoignition point of wood (500°F), stud cavity of FRTW exceeds autoignition point of wood (500°F) (See Fig. 2)	FRT of wood stud inhibits ignition of FRT studs	Charring begins on narrow edge of stud (1.5" wide)
t=50	Chemical and mechanical inhibition of ignition of FRT wood exhausted	Charring begins on narrow edge of stud (1.5" wide) and along both exposed long faces (5.5" wide each)	Charring along wide faces nearest to the gypsum board
t=60		Charring has consumed 50% of allowable	Charring has consumed approximately 27% of allowable
t =70		Char layer exceeds allowable, insufficient cross-section of stud available to support load, stud fails	Charring has consumed approximately 39% of allowable
t = 112.6			Char layer exceeds allowable, insufficient cross-section of stud available to support load, stud fails

6. ADDITIONAL BENEFITS

1. Depending on the species, type of product (stud, joist, plywood, beam), and its application (wall, floor, roof), the strength originally associated with wood is reduced when treated with a fire retardant. Therefore, the FRTW manufacturer is required to provide strength adjustments based on the intended use of the wood. This reduction in strength must be factored in to the structural design of the building. The effective spans and bearing capacity of the lumber is reduced, so beams are over-sized and more lumber is used in

the project than required with standard studs. Hence non-treated wood consumes less of the available resources and is structurally stronger than FRTW.

2. The process of pressure-impregnating chemicals into wood to achieve FRT lumber has a negative environmental impact, due to increased use of virgin chemicals and more waste chemicals that needs to be treated before it is discharged in to the sewer system. Additionally, there are health impact concerns regarding to the occupants of the building from a long term exposure to the chemicals used in pressure impregnation. Unlike the chemical FRT process, rock wool is made from an inorganic fiber that does not have adverse impacts on the environment or individual health of occupants.

3. Due to the potential corrosion of steel, hot-dipped galvanized fasteners are required over standard zinc-plated type, when using FRT wood. Rock wool is made from inorganic fiber, it does not reduce the strength of the wood, and does not require hot dipped galvanized fasteners. Hence, it is a better alternative for the environment and overall structural design.

7. CONCLUSION

Rock wool batt insulation friction fit between the 2x6 studs and filling the entire depth of the wall cavity will provide better protection than FRT wood framing as permitted by OSSC 2303.2 and 603.2. The architect is proposing to use comfort batt insulation by Roxul Company. The batt insulation will be 5.5 inches thick and will be friction fit within the stud cavity. This product is within the parameters of our analysis and the proposed wall assembly will exceed the performance of an FRT wood framed wall assembly. Code does not prohibit the use of better quality products than what is mandated; as this proposed assembly exceeds the base code criteria it will satisfy the code requirements.

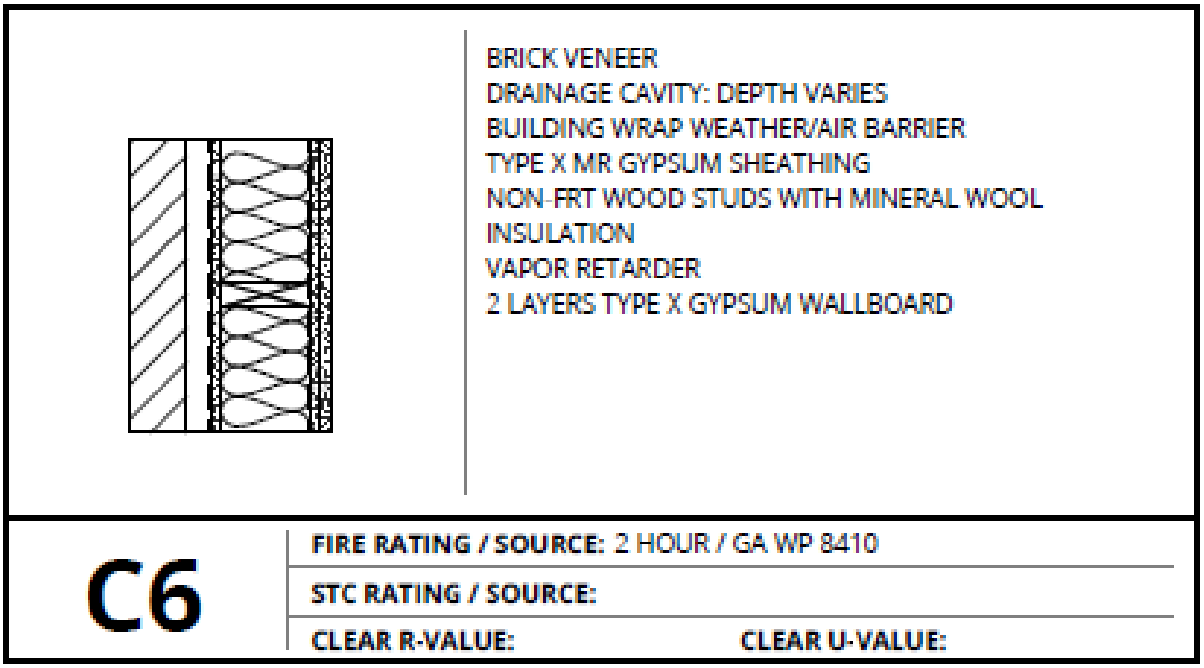
Samir Mokashi
Principal/Code Analyst
Code Unlimited

Franklin Callfas
Fire Protection Engineer
Principal/Code Unlimited

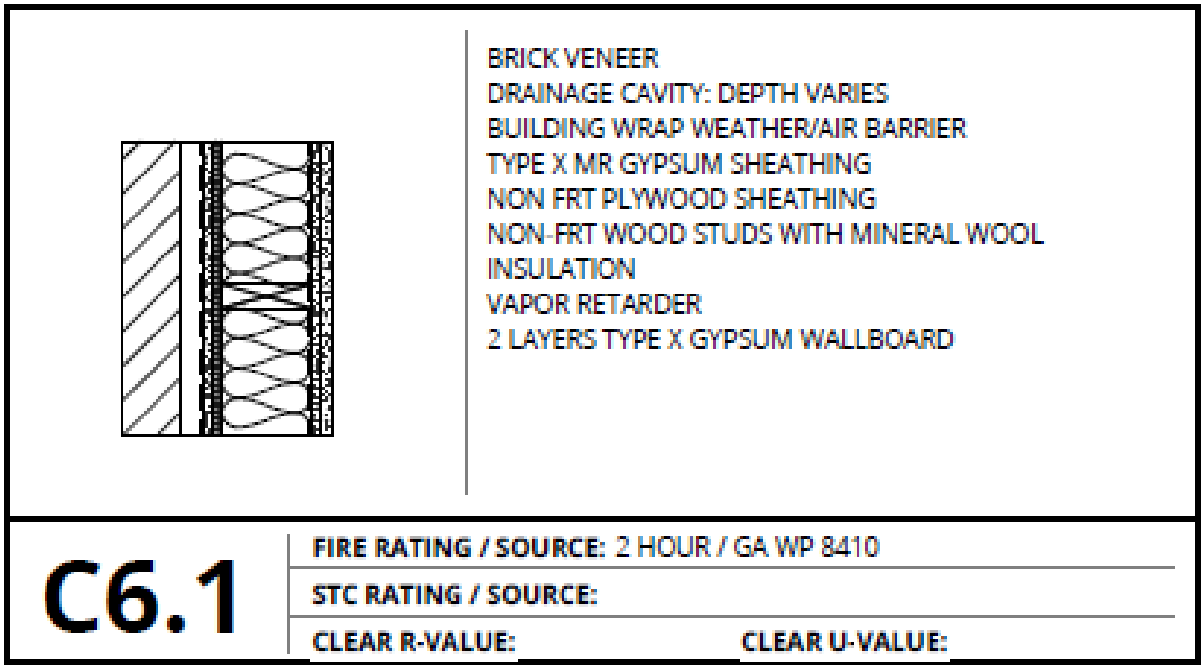
Appendix A

Proposed Wall Sections

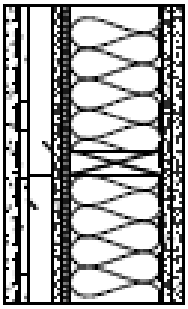
ALL WALLS 2” X 6” NOMINAL STUD SIZE, WITH MAXIMUM STUD SPACING IS 16 INCHES ON CENTER, GYPSUM SHEATHING THICKNESS IS 5/8 INCH TYPE X AND GYPSUM WALLBOARD THICKNESS IS 5/8 INCH TYPE X. ROCK WOOL IS 5.5 INCH THICK ROXUL ROCK WOOL.



Appendix A Figure C-6: C6 Wall Type



Appendix A Figure C-6.1: C6.1 Wall Type



MODIFIED CEMENT PLASTER (STUCCO)
PAPER-BACKED WIRE MESH
CEMENT BACKER BOARD
COLD-FORMED FURRING ASSEMBLY
BUILDING WRAP WEATHER/AIR BARRIER
TYPE X MR GYPSUM SHEATHING
NON FRT PLYWOOD SHEATHING
NON-FRT WOOD STUDS WITH MINERAL WOOL INSULATION
VAPOR RETARDER
2 LAYERS TYPE X GYPSUM WALLBOARD

RATED FROM INTERIOR SIDE ONLY

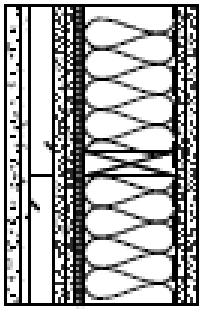
W6

FIRE RATING / SOURCE: 2 HOUR / GA WP 8416

STC RATING / SOURCE:

CLEAR R-VALUE: **CLEAR U-VALUE:**

Appendix A Figure W-6: W-6 Wall Type



MODIFIED CEMENT PLASTER (STUCCO)
PAPER-BACKED WIRE MESH
CEMENT BACKER BOARD
COLD-FORMED FURRING ASSEMBLY
BUILDING WRAP WEATHER/AIR BARRIER
2 LAYERS TYPE X MR GYPSUM SHEATHING
NON FRT PLYWOOD SHEATHING
NON-FRT WOOD STUDS WITH MINERAL WOOL INSULATION
VAPOR RETARDER
2 LAYERS TYPE X GYPSUM WALLBOARD

RATED FROM BOTH SIDES

W6.1

FIRE RATING / SOURCE: 2 HOUR / GA WP 8416

STC RATING / SOURCE:

CLEAR R-VALUE: **CLEAR U-VALUE:**

Appendix A Figure W-6.1: W6.1 Wall Type

EXHIBIT F

Bureau of Development Services FROM CONCEPT TO CONSTRUCTION — CODE GUIDE

TOPIC: **Type III Construction - OSSC/6/#4**

CODE: **Oregon Structural Specialty Code: 2014 Edition**

REVISED: **May 15, 2017 *[Rebecca Esau]*, Interim Director**

REFERENCE: **Chapters 6 and 7 – Structural Specialty Code**

SUBJECT: **Non-Fire-Retardant-Treated Wood Framing Within Exterior Walls of R-2 Occupancy Buildings of Type III Construction**

QUESTION: In buildings of either Type III-A or III-B construction, the Oregon Structural Specialty Code (OSSC) permits fire-retardant-treated wood framing within exterior walls where the wall is 2-hour fire-resistance rated or less.

May non-fire-retardant-treated wood be used as an alternative to fire-retardant-treated wood in these assemblies?

This question includes the condition in which the Special Provisions of OSSC Chapter 5 are utilized for a four or five-story, Type III building above a Type I-A podium building.

RESPONSE: Yes, in lieu of using fire-retardant-treated wood framing, the Bureau of Development Services (BDS) will allow non-fire-retardant-treated wood framing within exterior walls of R-2 occupancy buildings of Type III construction without a building code appeal provided all of the conditions listed below are met.

DEFINITIONS AND TERMINOLOGY:

Approved wall assembly: Wall assemblies designated “approved wall assembly” in the graphic details of this Guide must be constructed as described in the Conditions (below), unless it is a *tested assembly*.

Continuous and solid: The terms “continuous” and “solid” used in the details of this Guide means without air breaks or interruptions by a material of lesser fire rating for the full length and depth of the condition. A “continuous” or “solid” member may be built up of multiple wood members provided it complies with all structural requirements.

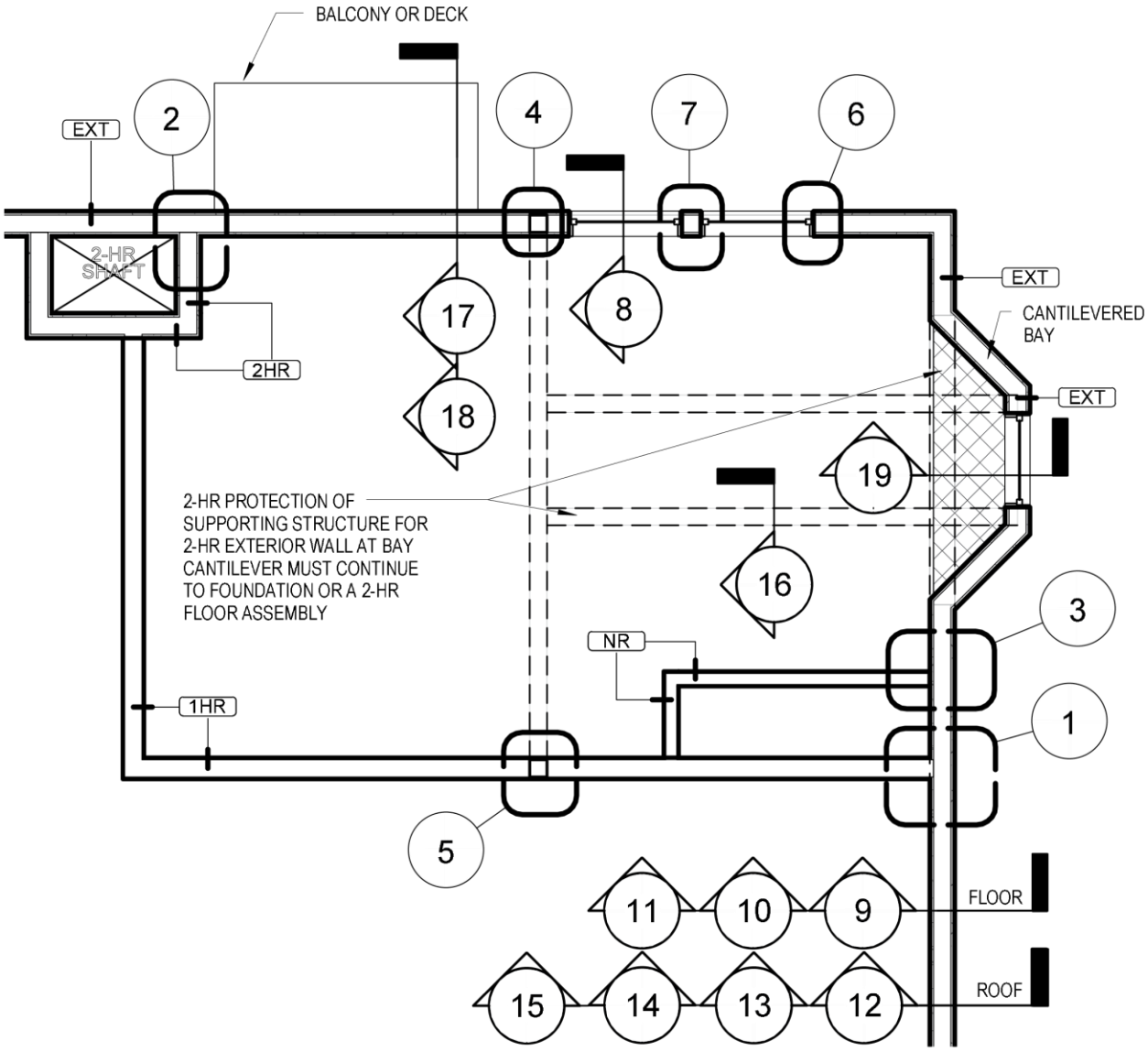
Sacrificial stud: The term “sacrificial stud” used in the graphic details of this Guide means an extra stud, 2-inch minimum nominal thickness and the same depth as the adjacent framing member, installed against a structural framing member to provide additional fire resistance at an opening in an exterior wall.

Tested assembly: A fire-resistant rated assembly that has been tested in accordance with the OSSC.

CONDITIONS:

1. Exterior bearing walls shall be protected based on their fire separation distance as defined in the OSSC as follows:
    a. Less than 10 feet: Protected on the inside with at least two layers of 5/8” minimum fire-rated gypsum board. Protected on the outside with at least two layers of fire-rated gypsum sheathing or one layer of fire-rated gypsum sheathing and one layer of 5/8” minimum fire-retardant-treated plywood. Alternatively, exterior bearing walls may be protected for fire exposure from both sides with a two-hour fire resistance *tested assembly*.
    b. Equal to or greater than 10 feet: Protected on the inside with at least two layers of 5/8” minimum fire-rated gypsum board. Protected on the outside with at least one layer of 5/8” minimum fire-rated gypsum sheathing.
2. Exterior non-bearing walls shall be protected on the inside and outside with at least one layer of 5/8” minimum fire-rated gypsum board or gypsum sheathing.
3. Non-fire-retardant-treated wood framing within exterior walls must be enclosed by gypsum board or gypsum sheathing, except where specifically noted in this Guide.
4. All openings in exterior walls for doors, windows or wall-mounted HVAC units and louvers must be protected with a *sacrificial stud* at the sides and top of the opening. The *sacrificial stud* may not be used to support a structural vertical load.
5. All exterior wall coverings shall be of non-combustible material.
6. Combustible roof sheathing and framing shall be protected from exposure to fire from above with gypsum-based products, fire-retardant-treated wood sheathing or similar UL tested products installed above or below the roofing membrane and/or rigid insulation.

7. Selective smoke detection coverage shall be installed in the Type III portion of the building per NFPA 72, National Fire Alarm Code, beginning at the access point to the path of egress and continuing until reaching all exits. If the exit passes through a lobby or other intervening space, selective smoke detection coverage requirements shall be extended to such spaces until reaching the exit discharge.
8. At least one operable exterior window shall be provided in each dwelling unit with a minimum opening width of 3-1/2 inches.
9. Walls and floor assemblies separating dwelling units shall have *tested* fire-resistance ratings of not less than 1-hour.
10. The base allowable building area specified in the OSSC for R occupancies in Types III-A and III-B construction shall not exceed 12,000 square feet. Area increases in accordance with the OSSC are allowed.
11. The distance from the top of the roof parapet to the lowest required fire apparatus setup point, as determined by the Fire Marshal's Office, shall not exceed 75 feet. A minimum of one dominant street-facing building façade shall meet Fire Code requirements for fire apparatus aerial access.
12. All required egress stairs shall include access to the roof. Such access may be via any method listed in OSSC Chapter 10 for roof access.
13. All penetrations through the exterior wall covering shall be fire-stopped at the exterior sheathing. "Penetrations" for purposes of this Guide includes elements such as conduits and piping and does not include "openings" such as doors, windows or wall-mounted HVAC units and louvers.
14. Ducts and vents penetrating exterior walls shall be 26 gage minimum.
15. No unprotected penetrations are permitted through the underside of fire-rated exterior wall projections that are required to be rated, including cornices, eaves, bays, exterior balconies, and similar projections extending beyond the exterior wall.
16. Elevator hoistways opening directly into corridors shall be pressurized or have smoke-tight protection as required for doors opening into fire-resistive corridors.
17. Framing at walls, floors, ceilings and roofs must be constructed as specified in the graphic detail drawings numbered 0 - 19 contained in this Guide, unless greater fire resistance is provided. Conditions not covered in this Guide must be constructed in accordance with the OSSC.

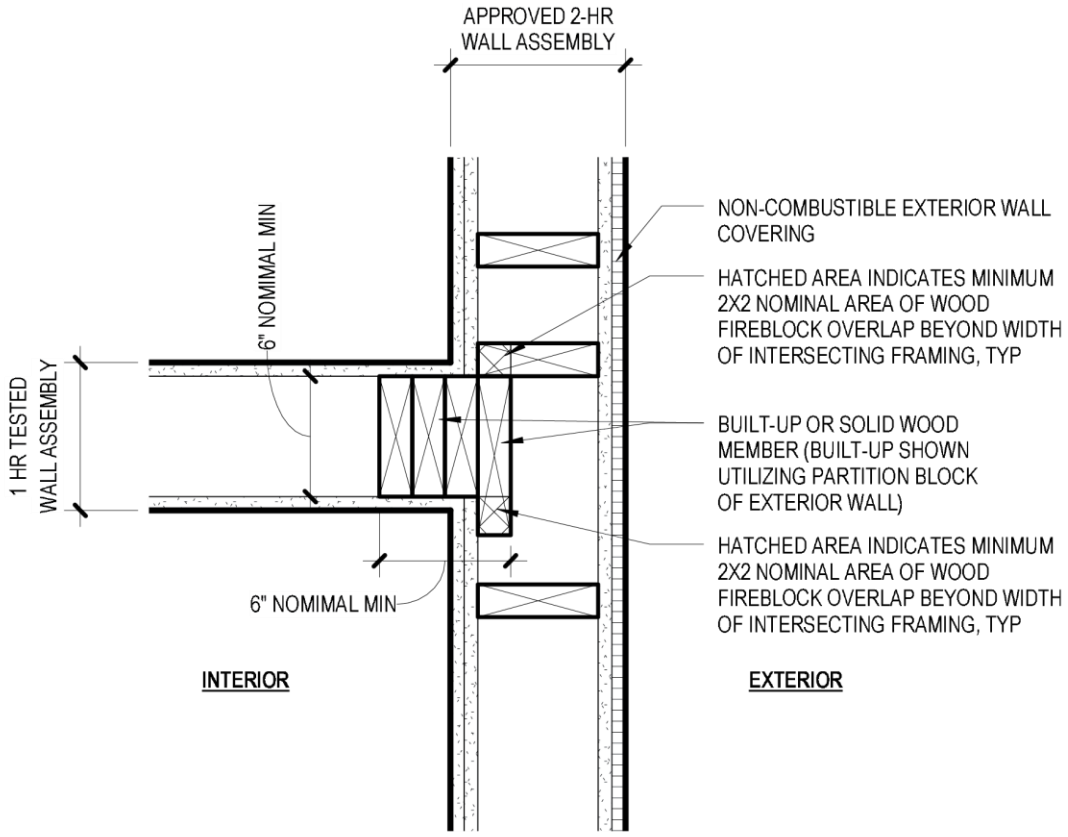


Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

B) These drawings illustrate the specific provisions of this Code Guide only and do not show all elements required by the OSSC, including but not limited to: structural requirements, thermal insulation, sound separation, weather resistance, ventilation, blocking and nailers.

C) These drawings illustrate details for minimum fire resistance allowed in this Code Guide and do not limit construction means and methods, or a designer's option to provide greater fire resistance.



1-HR INTERIOR WALL AT 2-HR EXTERIOR WALL 1

Notes:

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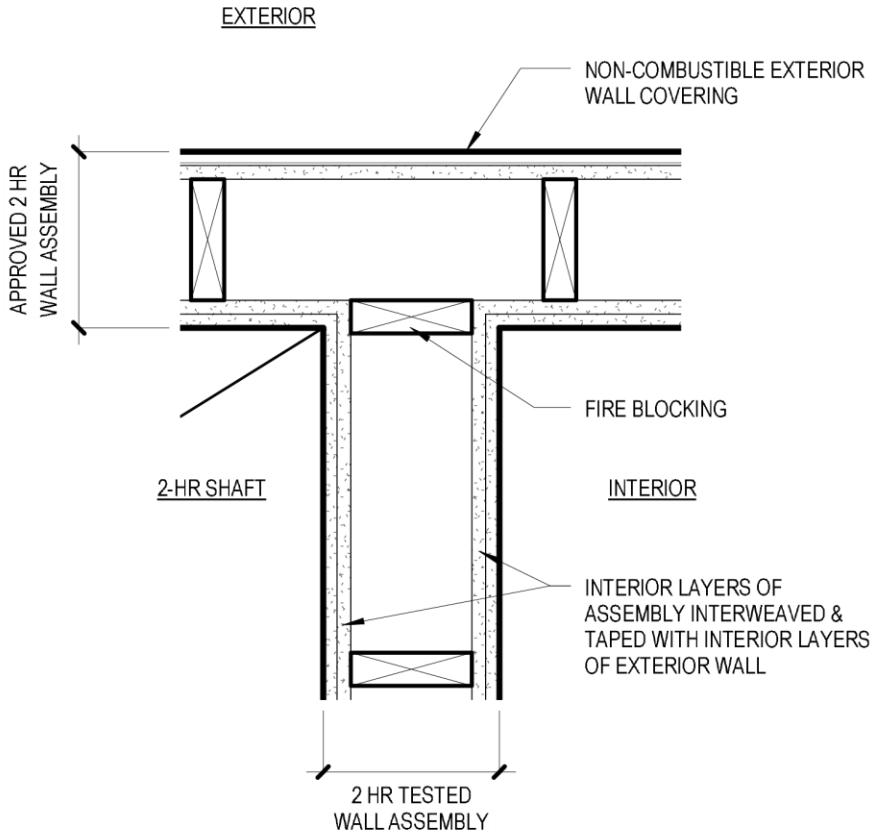

2-HR INTERIOR WALL AT 2-HR EXTERIOR WALL 2

Notes:

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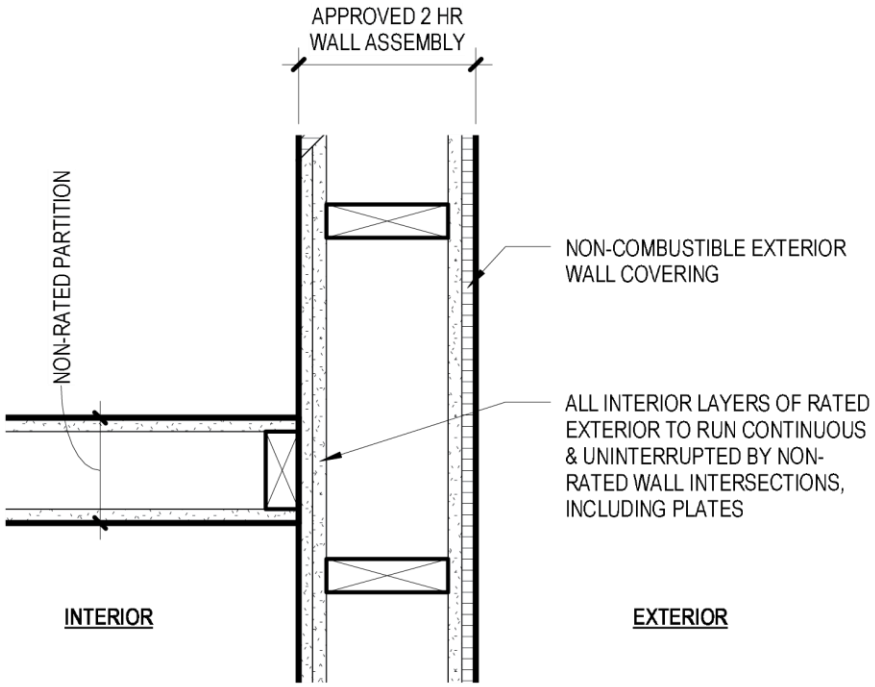

NON-RATED INTERIOR WALL AT EXTERIOR WALL 3

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

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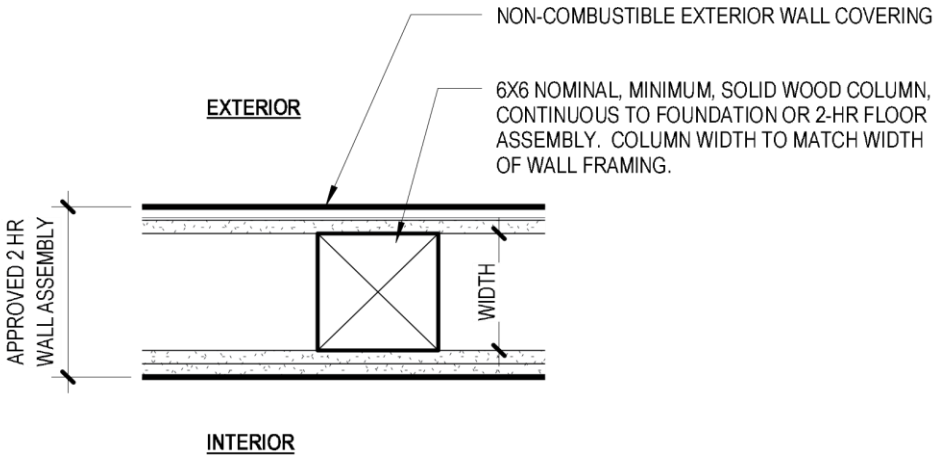

2-HR COLUMN WITHIN 2-HR EXTERIOR WALL 4

Notes:

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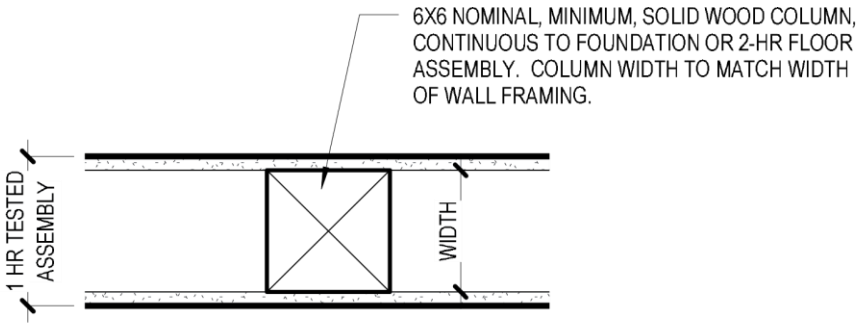

2-HR COLUMN WITHIN 1-HR INTERIOR WALL 5

Notes:

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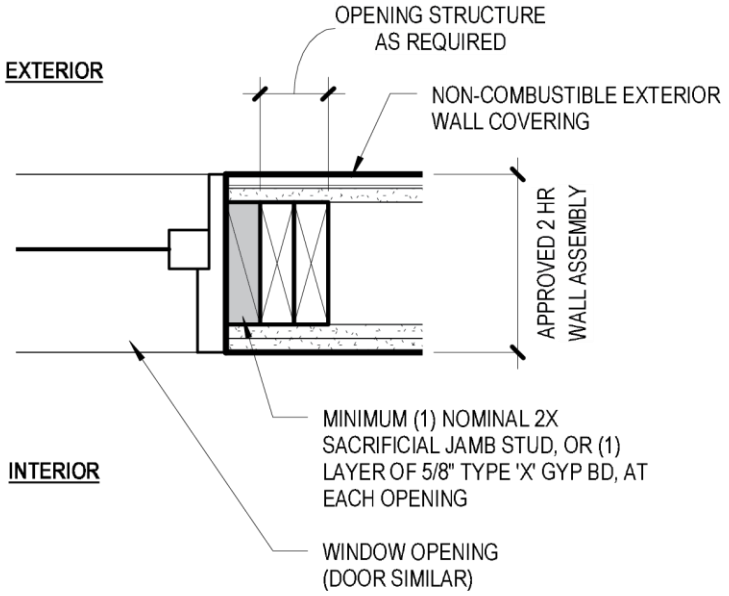

WINDOW JAMB 6

Notes:

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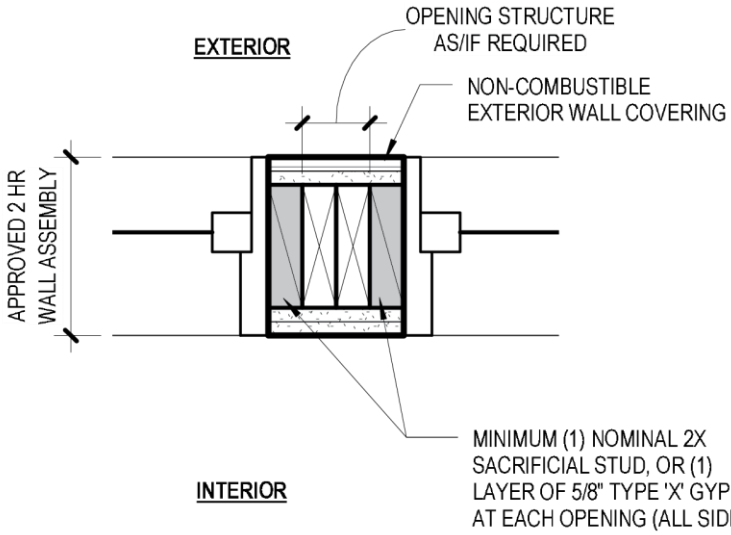

WINDOW MID JAMB (LOAD BEARING) 7

Notes:

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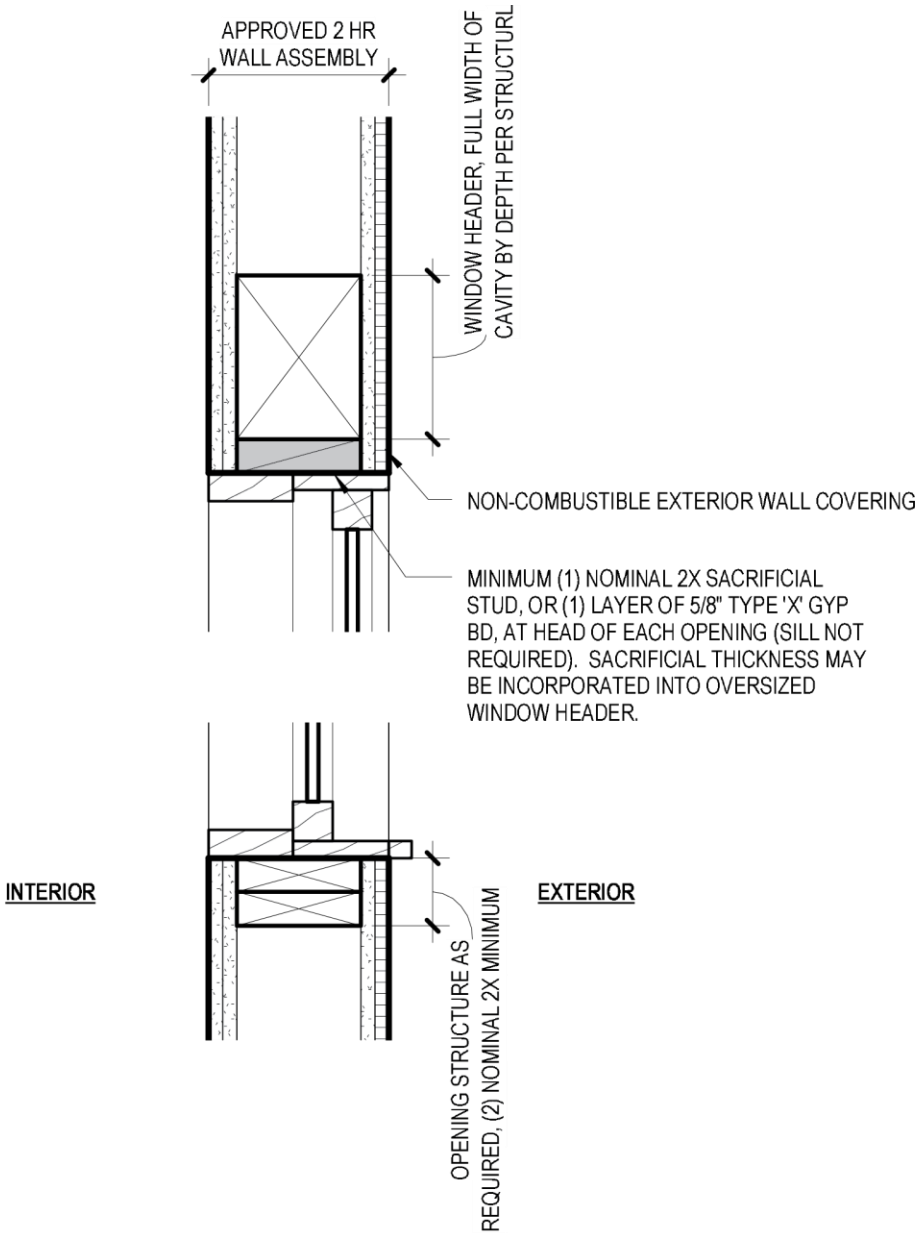

SECTION AT WINDOW 8

Notes:

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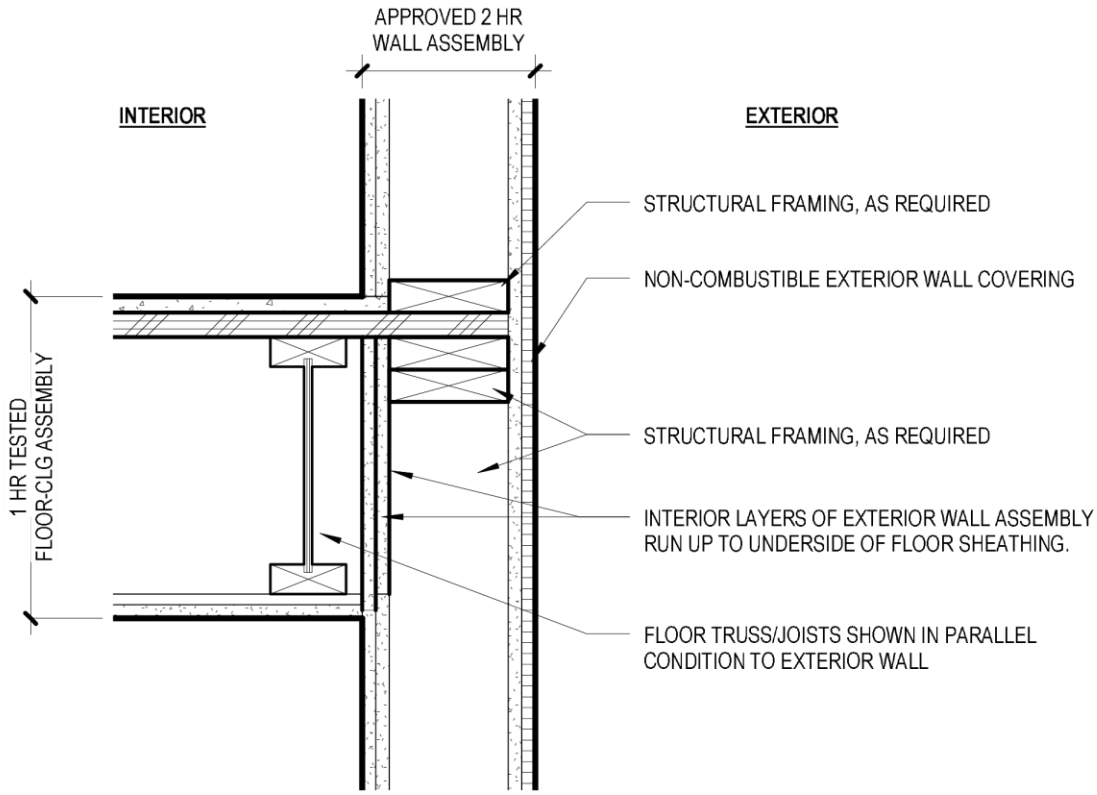

SECTION AT EXTERIOR WALL AND 1-HR FLOOR (PARALLEL) 9

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

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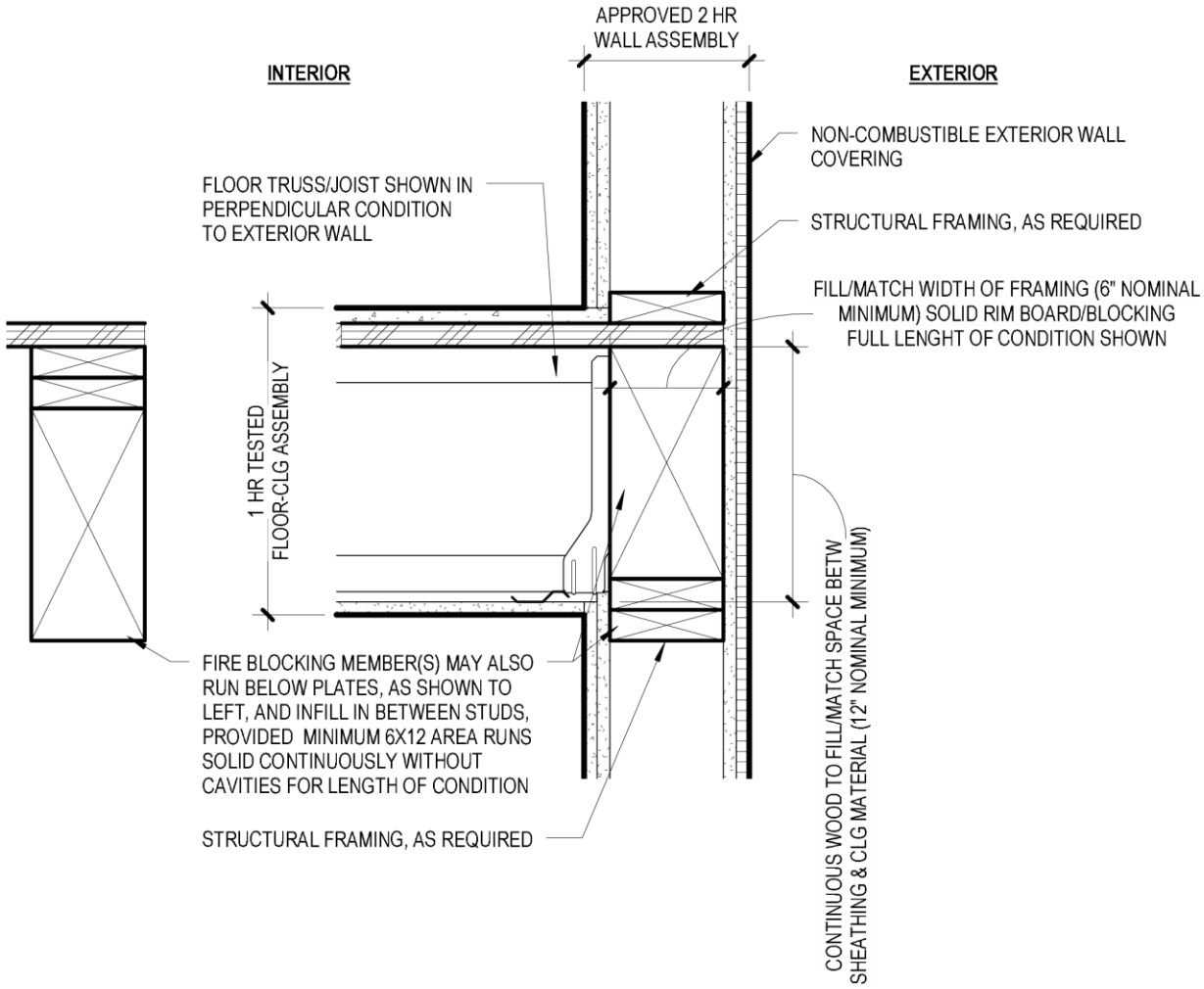

SECTION AT EXTERIOR WALL AND 1-HR FLOOR (PERPENDICULAR) 10

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

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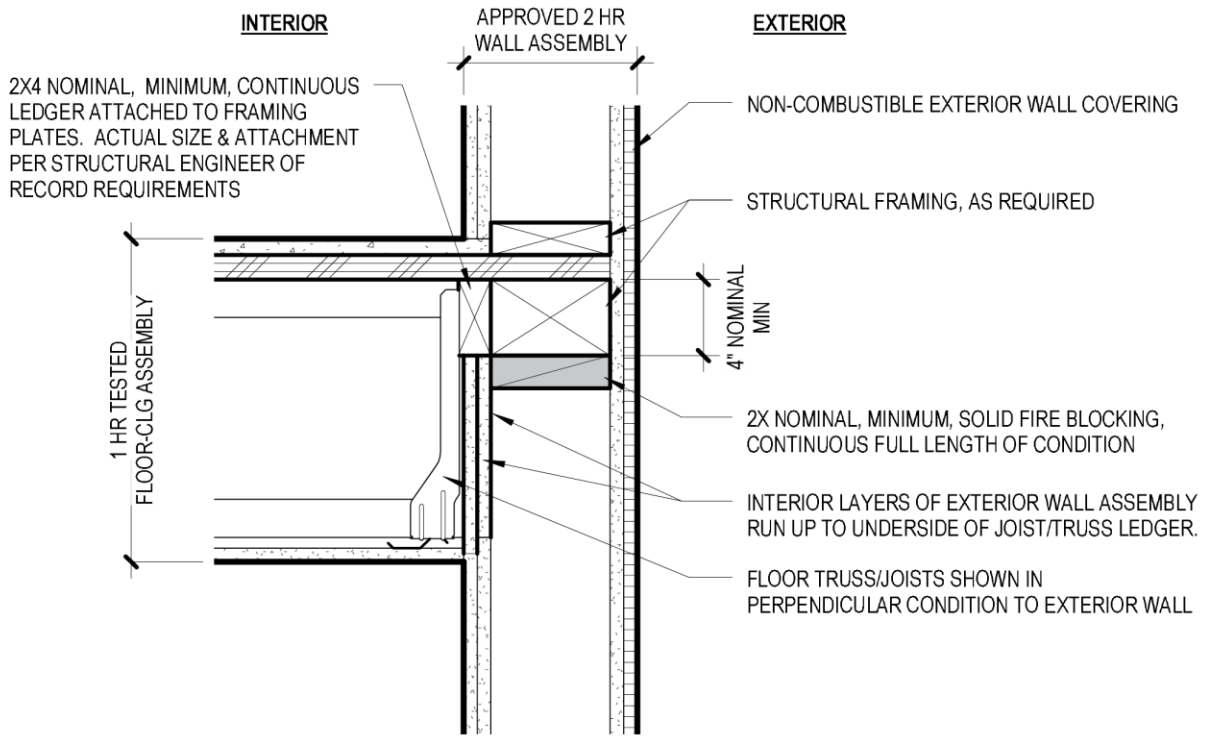

SECTION AT EXTERIOR WALL AND 1-HR FLOOR (PERPENDICULAR) 11

Notes:

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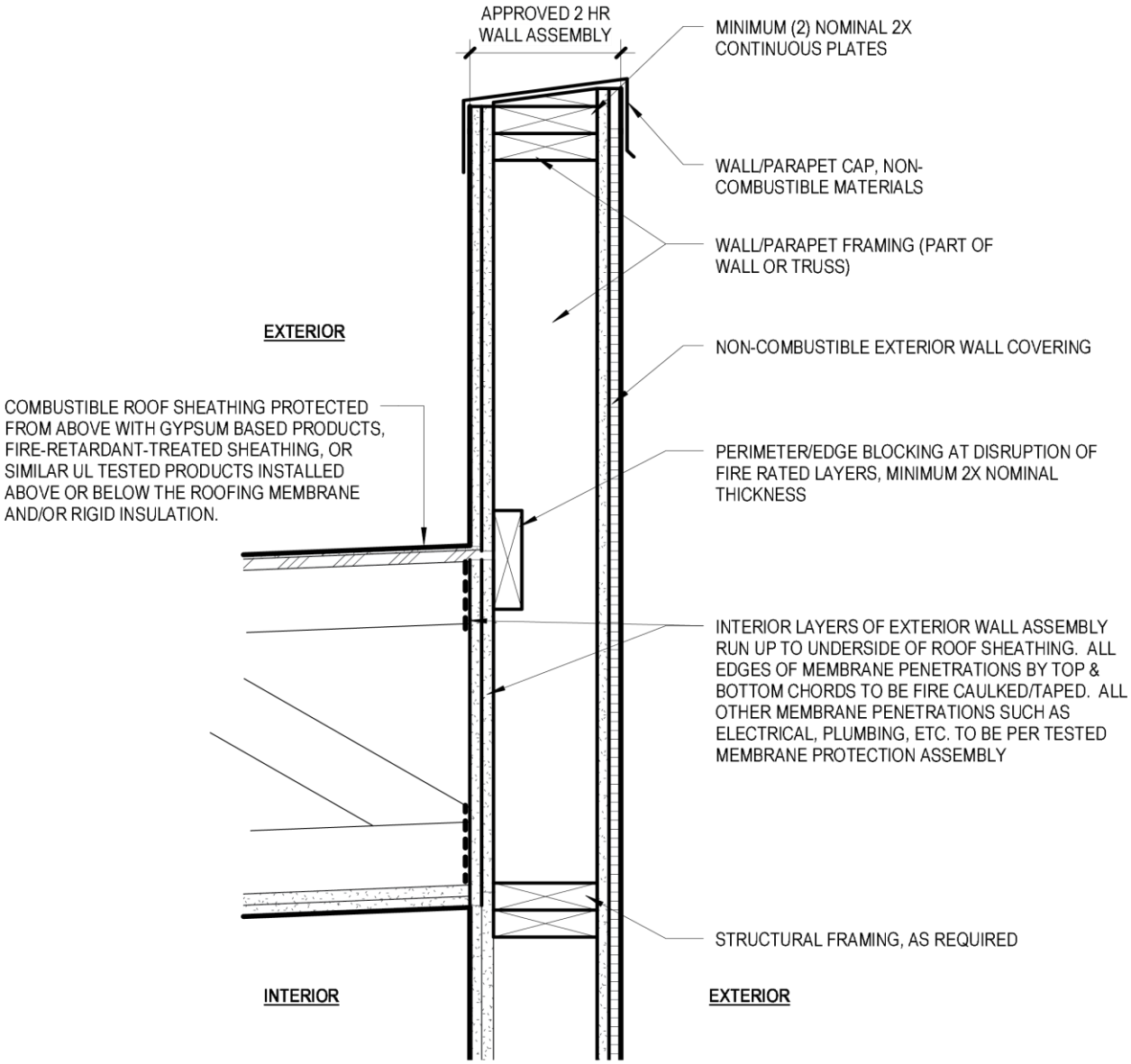


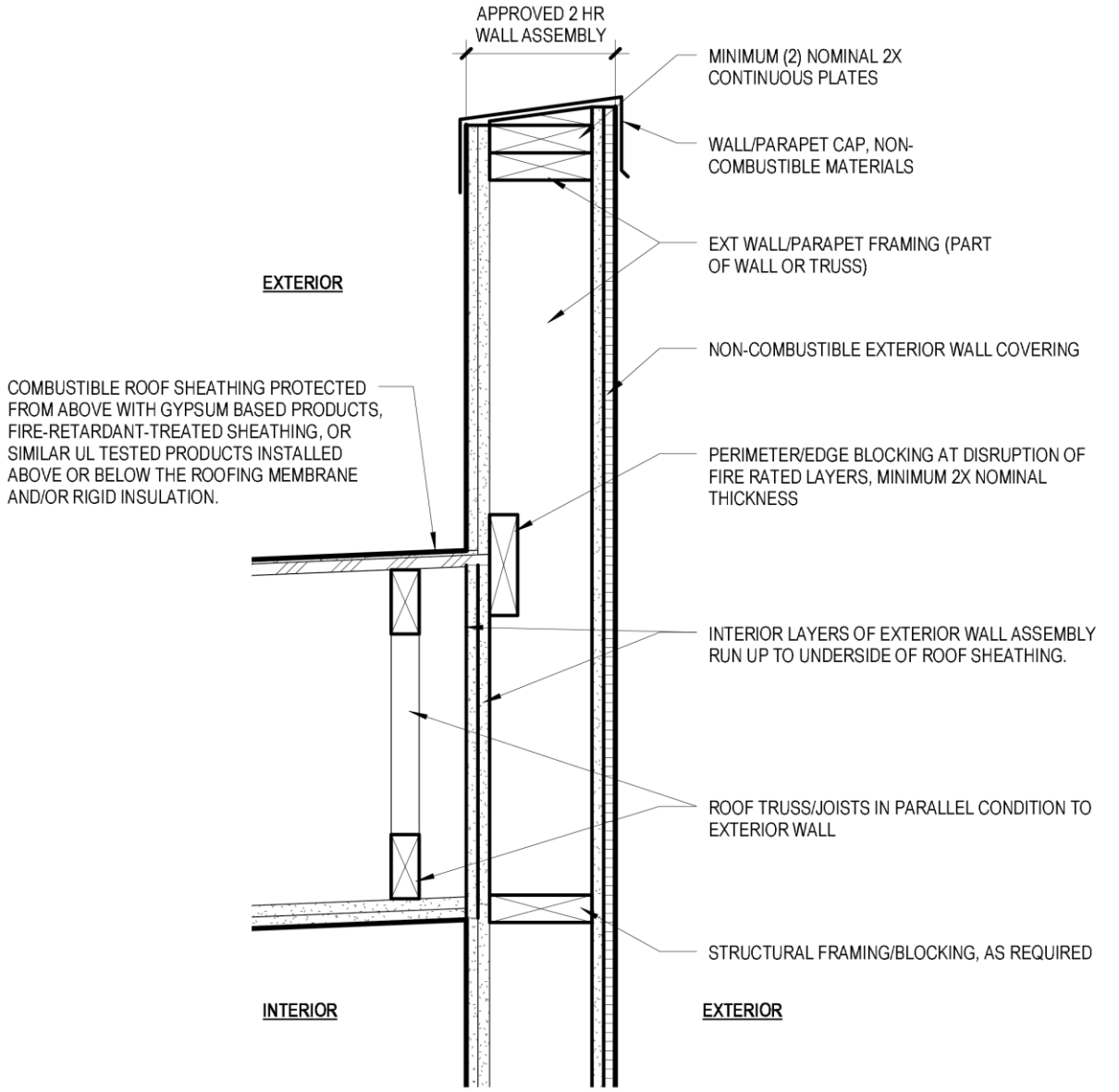
SECTION AT EXTERIOR WALL AND ROOF (ROOF AND PARAPET WALL FRAMING: SAME TRUSS) 12

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

B) These drawings illustrate the specific provisions of this Code Guide only and do not show all elements required by the OSSC, including but not limited to: structural requirements, thermal insulation, sound separation, weather resistance, ventilation, blocking and nailers.

C) These drawings illustrate details for minimum fire resistance allowed in this Code Guide and do not limit construction means and methods, or a designer's option to provide greater fire resistance.



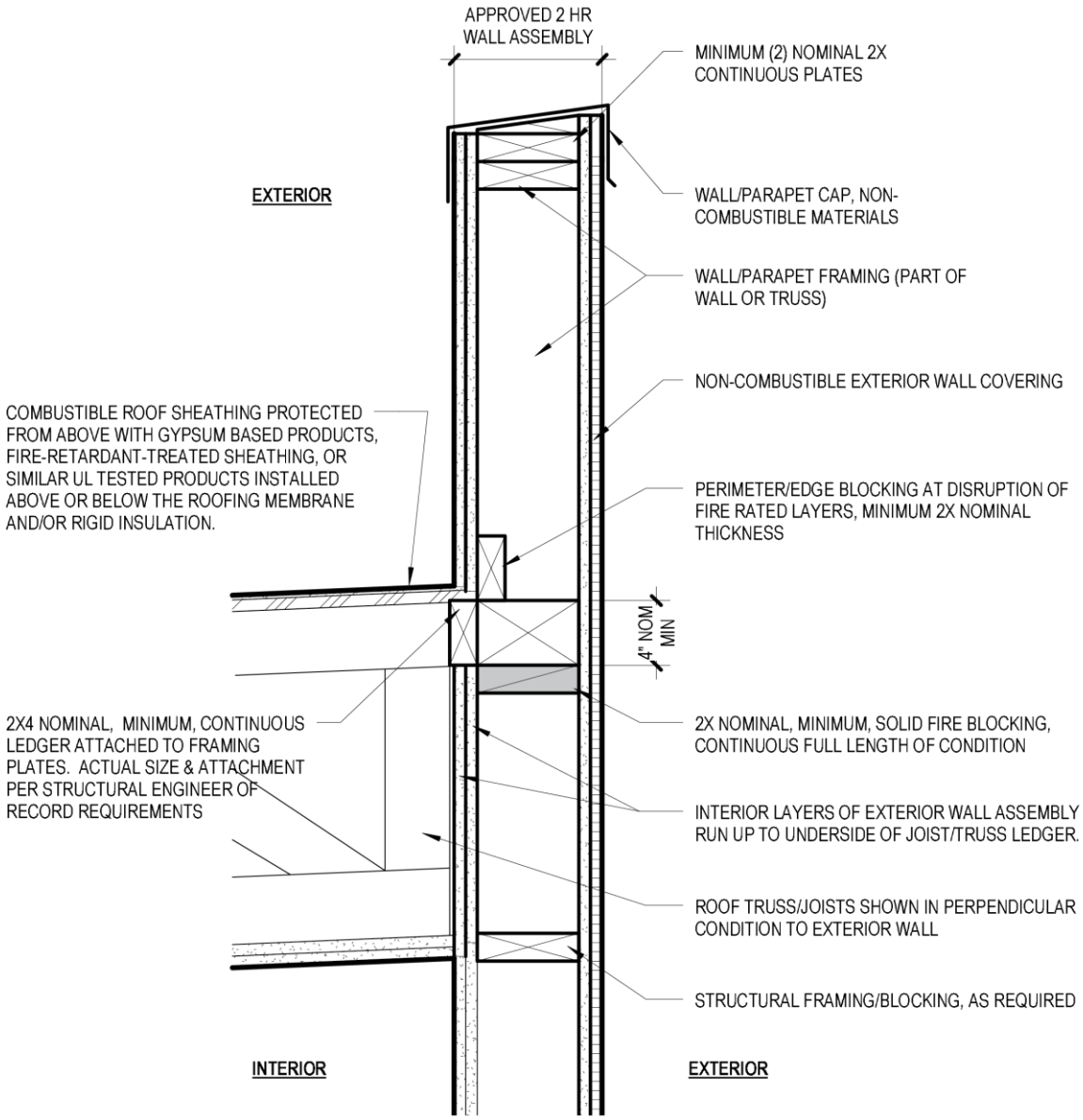
SECTION AT EXTERIOR WALL AND ROOF (PARALLEL) 13

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

B) These drawings illustrate the specific provisions of this Code Guide only and do not show all elements required by the OSSC, including but not limited to: structural requirements, thermal insulation, sound separation, weather resistance, ventilation, blocking and nailers.

C) These drawings illustrate details for minimum fire resistance allowed in this Code Guide and do not limit construction means and methods, or a designer's option to provide greater fire resistance.



SECTION AT EXTERIOR WALL AND ROOF (LEDGER) 14

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

B) These drawings illustrate the specific provisions of this Code Guide only and do not show all elements required by the OSSC, including but not limited to: structural requirements, thermal insulation, sound separation, weather resistance, ventilation, blocking and nailers.

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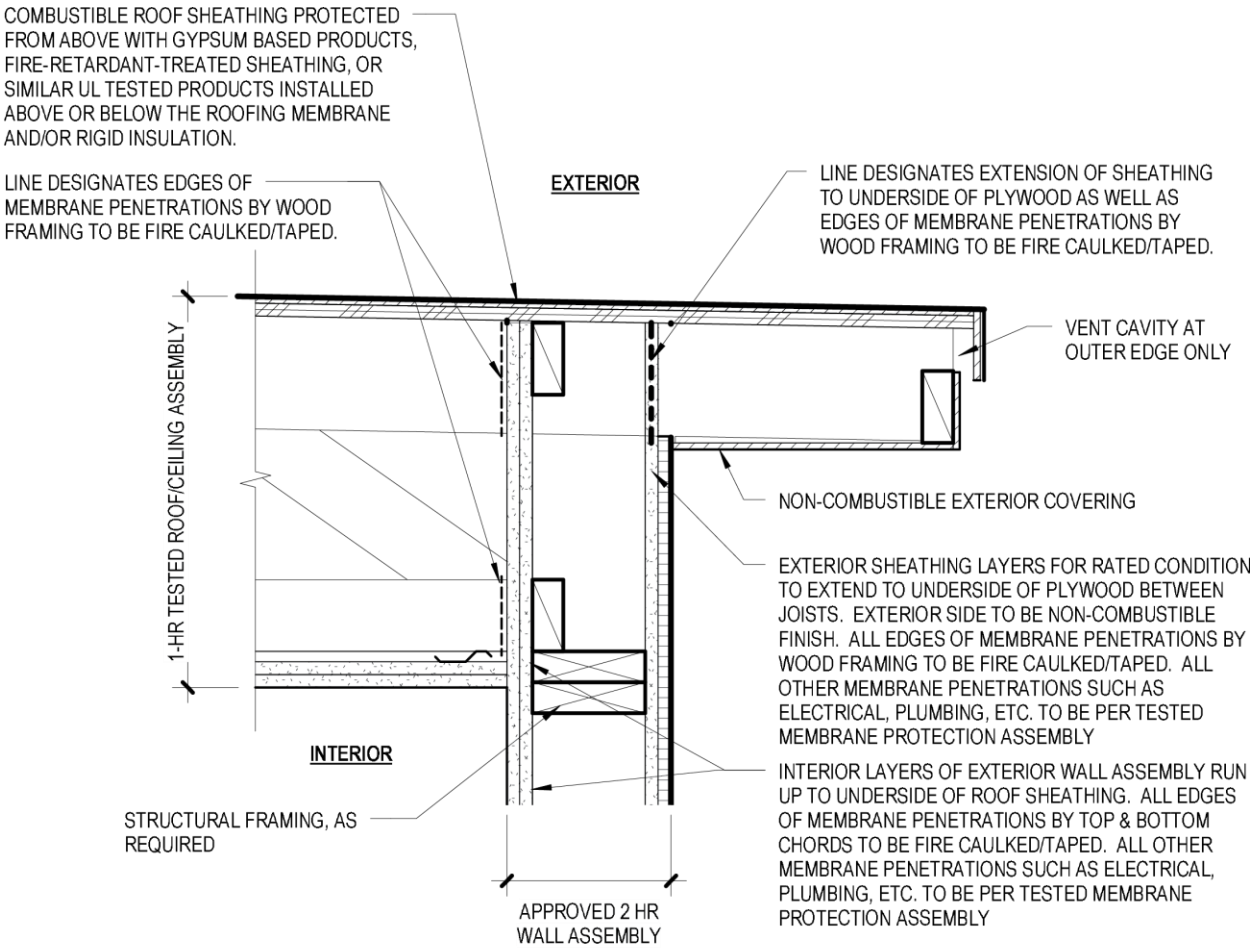

SECTION AT EXTERIOR WALL AND 1-HR ROOF OVERHANG 15

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

B) These drawings illustrate the specific provisions of this Code Guide only and do not show all elements required by the OSSC, including but not limited to: structural requirements, thermal insulation, sound separation, weather resistance, ventilation, blocking and nailers.

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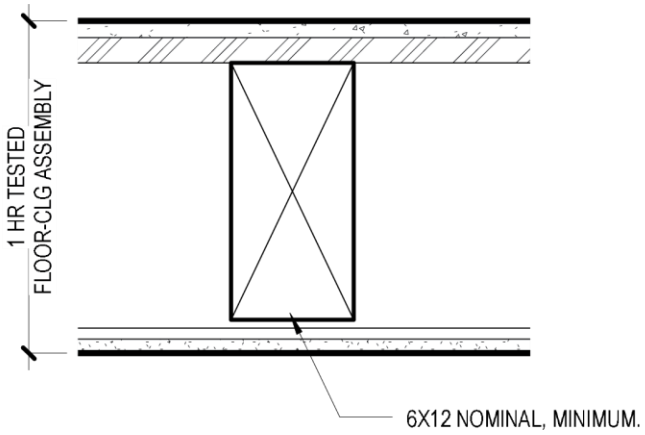

SECTION AT 1-HR BEAM WITHIN 1-HR FLR (FOR 2-HR STRUCTURAL SUPPORT CONDITIONS) 16

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.
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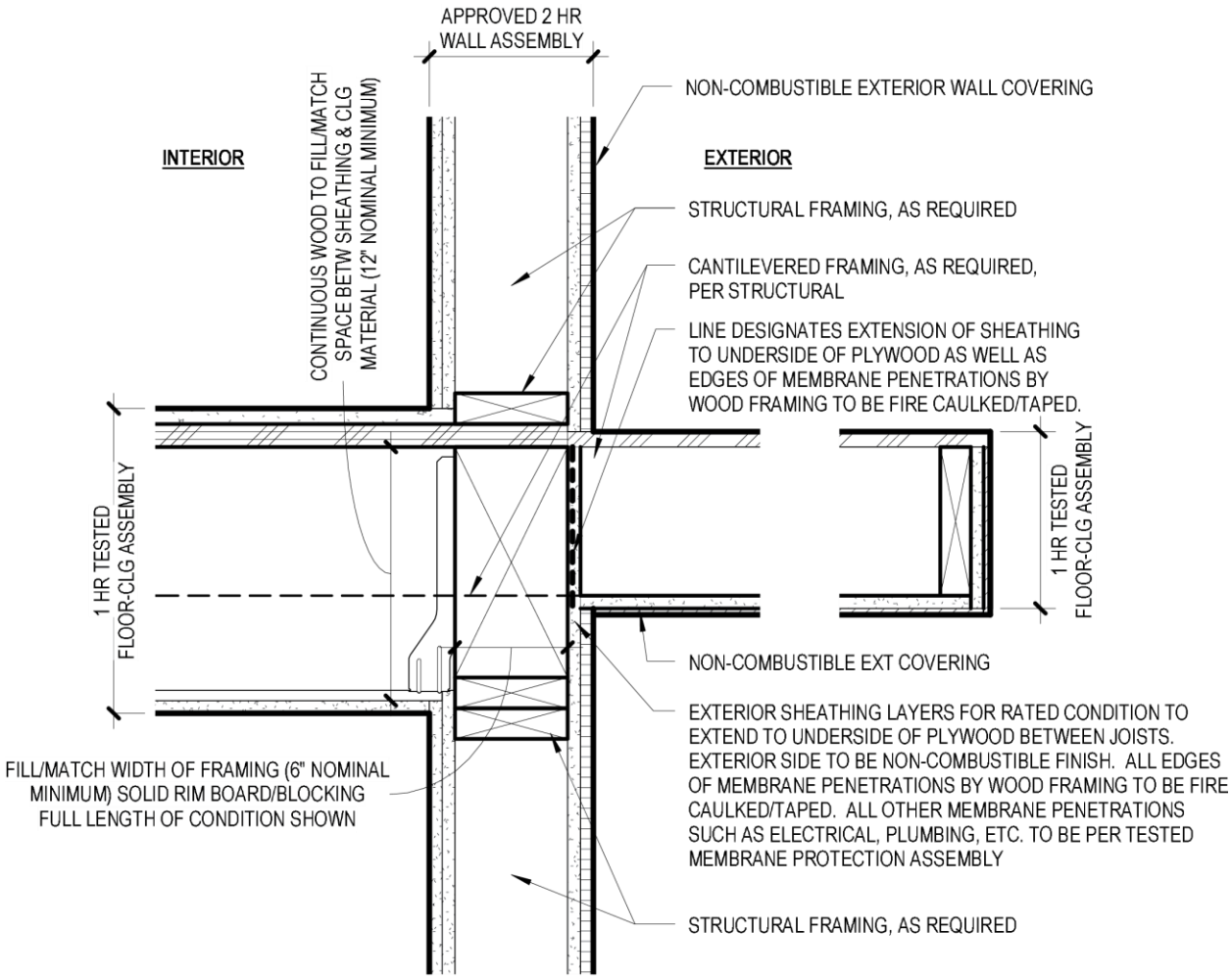

SECTION AT EXTERIOR WALL AND FLOOR/DECK 17

Notes:

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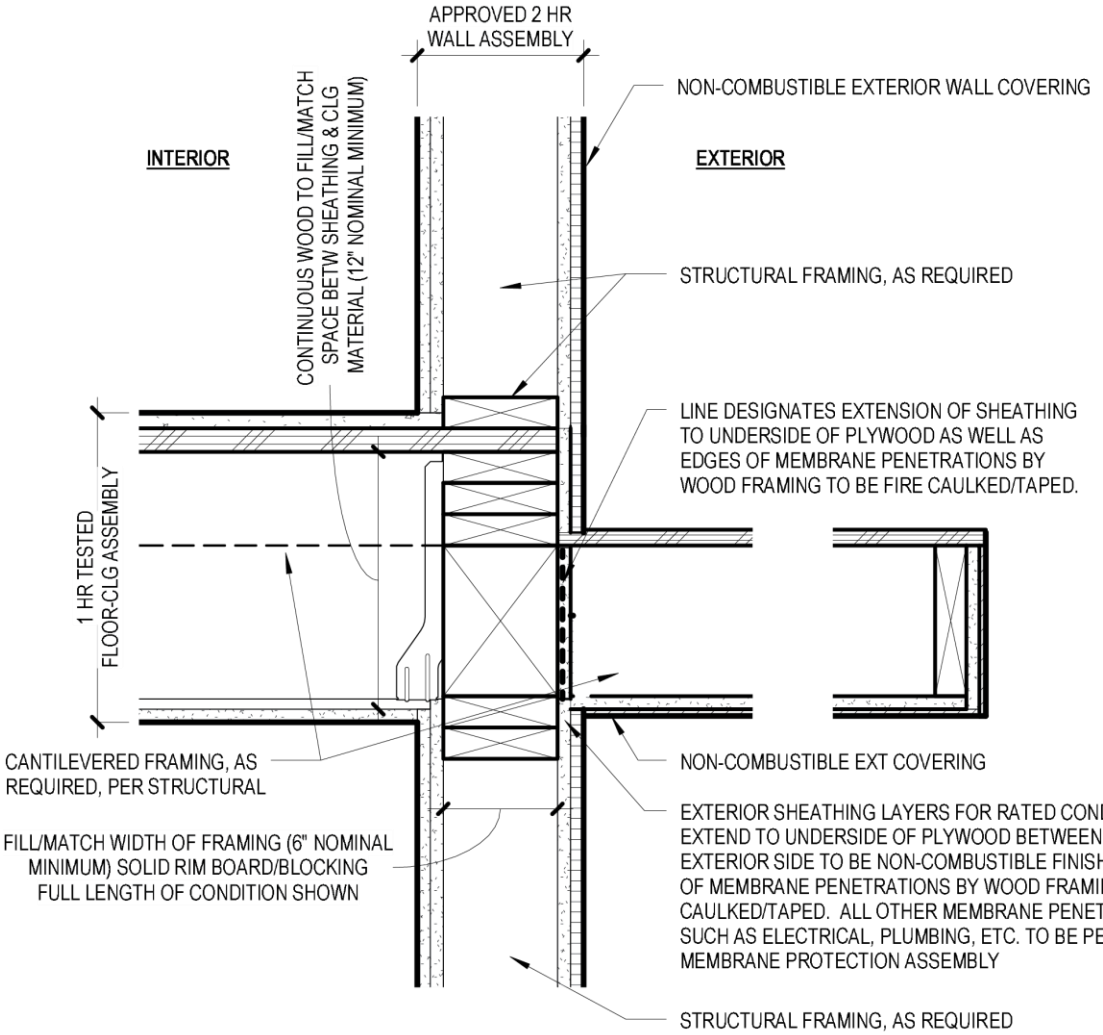

SECTION AT EXTERIOR WALL AND LOWERED FLOOR/DECK 18

Notes:

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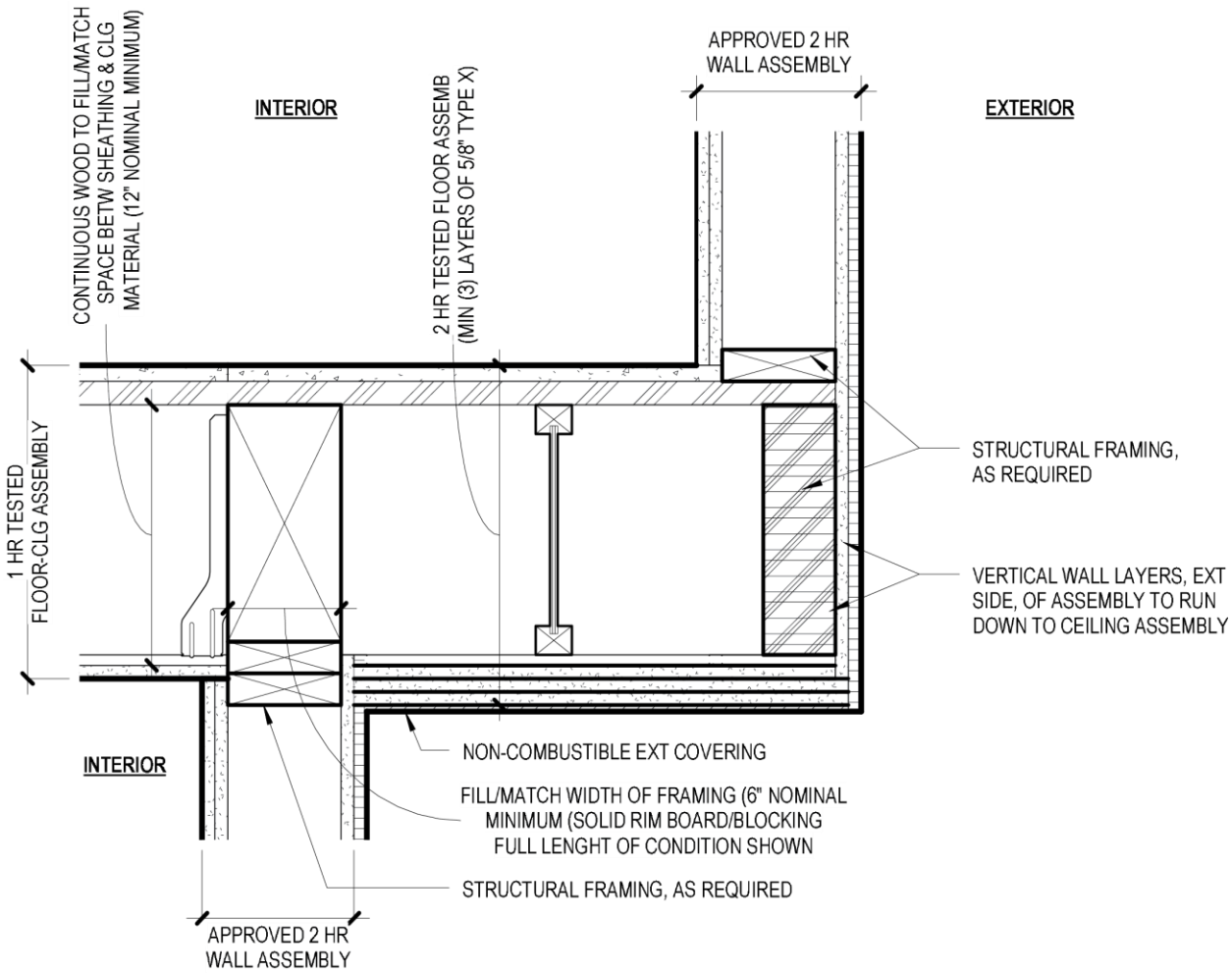

SECTION AT EXTERIOR WALL AND FLOOR AT CANTILEVERED BAY 19

Notes:

A) These drawings must be used in conjunction with all of the provision and conditions listed on Pages 1 through 3 of this Code Guide.

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