

# Development Services

## From Concept to Construction

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### APPEAL SUMMARY

**Status:** Decision Rendered - Held over from ID 21894, Item #3 (9/18/19) for additional information

<b>Appeal ID:</b> 21954	<b>Project Address:</b> 151 SW 1st Ave
<b>Hearing Date:</b> 10/2/19	<b>Appellant Name:</b> Tom Jaleski
<b>Case No.:</b> B-015	<b>Appellant Phone:</b> 9712385266
<b>Appeal Type:</b> Building	<b>Plans Examiner/Inspector:</b> John Cooley
<b>Project Type:</b> commercial	<b>Stories:</b> 5 <b>Occupancy:</b> B, M, S-1 <b>Construction Type:</b> III-A
<b>Building/Business Name:</b> PAE Living Building	<b>Fire Sprinklers:</b> Yes - Throughout
<b>Appeal Involves:</b> Erection of a new structure, Reconsideration of appeal	<b>LUR or Permit Application No.:</b> 19-124284-LU
<b>Plan Submitted Option:</b> pdf [File 1] [File 2] [File 3] [File 4]	<b>Proposed use:</b> Office, Retail

### APPEAL INFORMATION SHEET

#### Appeal item 1

<b>Code Section</b>	704.10 ,Table 601, Table 602
<b>Requires</b>	<p>704.10 – Exterior structural members. Load-bearing structural members located within the exterior walls or on the outside of a building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:</p> <p>As required by Table 601 for the type of building element based on the type of construction of the building;</p> <p>As required by Table 601 for exterior bearing walls based on the type of construction; and</p> <p>As required by Table 602 for exterior walls based on the fire separation distance.</p> <p>Table 601 – Type IIIA</p> <p>Primary Structural Frame – 1 Hour</p> <p>Exterior Nonbearing walls – per Table 602</p> <p>Exterior Bearing Walls – 2 Hour</p> <p>Table 602 – Type IIIA</p> <p>0' to 30' Fire Separation Distance – 1 Hour Rating</p> <p>Greater than 30' Fire Separation Distance – No Rating</p>
<b>Proposed Design</b>	<p>The PAE Living Building is a 5-story type 3A building. The primary structural frame is 1 hour rated glulam post and beam, the floor and roof construction are 1 hour rated CLT5 deck as required by Table 601. The exterior walls are nonbearing standard brick veneer rain screen on metal stud partition. The exterior wall rating is defined by Table 602. The North and West exterior walls are either 1 hour or 2 hours as defined by fire separation distance requirements of the occupancy. The</p>

South and East elevation do not require a rating as they are street facing and have over 30' fire separation distance.

#### Chapter 2 Definitions:

**Exterior Wall** – A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees or greater with the horizontal plane.

**Exterior Wall Envelope** - A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

Refer to the attached Exhibit 3. Included are floor plans and details that indicate the relationship of the exterior wall to the primary structural frame. The nonbearing exterior wall assembly, consisting of interior finish membrane, wall structure, insulation and exterior finish, is provided as required between the conditioned interior space and the exterior space. In all cases, unless noted otherwise on the plans, we have designed the structure to be completely within the conditioned interior space of the exterior wall assembly. The exterior wall spans from the CLT floor decks. In cases where the structure is engaged in the exterior wall or on the exterior side of the wall, we are providing the required 2-hour rating at the primary structure, and all elements that support that structure will also be 2-hour rated. Those locations are indicated on the attached exhibit drawings.

On levels 1 and 5 on the South and East exterior walls, there are recesses between the column bays. In those locations the structure is still completely on the inside of the inner most exterior wall layer, and per Table 601 will require 1-hour rating. We are proposing an additional layer of 5/8" type X gypsum board on the interior side at the walls surrounding the structure in order to provide a 2-hour rated exterior wall assembly. These locations only occur on the street facing walls with a fire separation distance of greater than 30', and the locations on the 5th floor are over 56' above grade level.

#### Reconsideration Text:

The PAE Living Building is a 5-story type 3A building. The primary structural frame is 1 hour rated glulam post and beam, the floor and roof construction are 1 hour rated CLT5 deck as required by Table 601. The exterior walls are primarily nonbearing standard brick veneer rain screen on metal stud partition, with some locations of metal panel veneer on nonbearing metal stud partitions. The exterior wall rating is defined by Table 602. The North and West exterior walls are either 1 hour or 2 hours as defined by fire separation distance requirements of the occupancy. The South and East elevation do not require a rating as they are street facing and have over 30' fire separation distance.

#### Chapter 2 Definitions:

**Exterior Wall** – A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees or greater with the horizontal plane.

**Exterior Wall Envelope** - A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

Refer to the attached Exhibit 3. Included are floor plans and details that indicate the relationship of the exterior wall to the primary structural frame. The nonbearing exterior wall assembly, consisting of interior finish membrane, wall structure, insulation and exterior finish, is provided as required between the conditioned interior space and the exterior space. In all cases, unless noted

otherwise on the plans, we have designed the structure to be completely within the conditioned interior space of the exterior wall assembly. The exterior wall spans from the CLT floor decks. In cases where the structure is engaged in the exterior wall or on the exterior side of the wall, we are providing the required 2-hour rating at the primary structure by intumescent paint or char rating, and all elements that support that structure will also be 2-hour rated. Those locations are indicated on the attached exhibit drawings.

On levels 1 and 5 on the South and East exterior walls, there are recesses between the column bays. In those locations the structure is still completely on the inside of the inner most exterior wall layer, and per Table 601 will require 1-hour rating. The exterior wall assemblies on all sides of the columns and beams will be designed to provide a 2-hour protective rating from the exterior side, this will protect the primary structure from any fire risk on the exterior of the building. These locations only occur on the street facing walls with a fire separation distance of greater than 30', additionally the locations on the 5th floor are over 56' above grade level.

Engineering Judgements are provided for the proposed rated assemblies. Engineering Judgement 1 represents the brick wall assembly, Engineering Judgement 2 represents the metal panel wall assembly, and Engineering Judgement 3 represents the standing seam roof at the 5th floor balcony.

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**Reason for alternative** The conditions addressed above and in the attached exhibits were identified as within the exterior wall during permit review and not compliant with the Section 704.10 of the building code, and as a result it was requested to provide 2 hour rated structural components where the setbacks occur on levels 1 and 5, and to continue the rating to any structural elements that support those elements.

The exterior wall envelope as defined in Chapter 2, refers to the "assembly of components" that are used to provide protection of the building structural members. The non-load bearing exterior wall assembly, consisting of interior finish membrane, wall structure, insulation and exterior finish, is provided as required between the conditioned interior space and the exterior space. The structural elements all exist on the conditioned interior space of the exterior wall assembly and do not require additional rating beyond 1 Hour, per Table 601.

In order to provide protection of the structure at these areas on the 1st and 5th floor, the two layers of 5/8" gypsum board on the interior side along with the brick masonry unit on the exterior side will provide a 2-hour rated equivalent exterior wall assembly. We feel the proposed design meets the intent of the code and protects the structure from exposure to fire.

Reconsideration Text:

Non-Load Bearing exterior walls and roofs with a fire separation distance greater than 30 ft are requested by the Life Safety Plan Examiner to be 2 hours rated when primary structural frame, combustible members, are located adjacent to the exterior walls.

We have provided detailed analysis for the fire protection of these wall and roof assemblies to ensure, they will provide 2-hour fire protection as requested from a fire from the building exterior. The analysis is provided in the attached Engineering Judgment letters produced by and Oregon Licensed Fire Protection Engineer.

#### EJ#1-Brick Wall Assembly

The proposed design for the brick wall assembly will exceed the code request for 2-hour rated non-combustible non-loadbearing wall assembly. The additional components will enhance the structural strength and fire rating significantly. Therefore, as detailed in the attached EJ#1, the proposed exterior wall design will exceed the 2-hour fire-rated protection when installed as proposed.

#### EJ#2- Metal Panel Wall Assembly

The proposed design for the metal panel wall will exceed the code requirement of 2-hour rated non-loadbearing wall assembly. The proposed steel studs are heavier with closer spacing, supporting a greater fire resistance for the assembly. Therefore, as detailed in the attached EJ#2, the proposed exterior wall design will achieve a minimum 2-hour fire-rating when installed to exceed the minimum requirements of UL U411 for an exterior nonloadbearing wall.

#### EJ#3-Standing seam roof at the 5th floor balcony

The roof assembly for the standing seam roof is equivalent or superior to ICC Legacy Report NER-258, when the comparison includes the additional gypsum board on the upper portion of the assembly and heavier gauge of the steel studs. As documented in the attached EJ#3, the assembly meets the minimum requirements of the OSSC for a non-load bearing 2-hr assembly with an assumed fire location for this evaluation from the exterior.

Following a complete review of the attached documentation, we urge you to approve this appeal.

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## APPEAL DECISION

### **Alternate 2 hour wall assemblies with engineering analysis: Granted as proposed.**

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 90 calendar days of the date this decision is published. For information on the appeals process, go to [www.portlandoregon.gov/bds/appealsinfo](http://www.portlandoregon.gov/bds/appealsinfo), call (503) 823-7300 or come in to the Development Services Center.



# PAE Living Building

## Engineering Judgment Report #1

### Brick Wall Assembly

Client Name: ZGF Architects

Client Address: 1223 SW Washington Street Ste 200, Portland, OR 97205

Date: 9/29/2019

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## 1 PROJECT OVERVIEW

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The PAE Living Building is a new 5-story, Type III building of CLT construction in Portland, Oregon. The building is fully protected by automatic sprinklers and a fire alarm system. Non-Load Bearing exterior walls with a fire separation distance greater than 30 ft are requested by the Life Safety Plan Examiner to be 2 hours rated when primary structural frame, combustible members, are located adjacent to the exterior wall.

Code Unlimited has been asked to provide analysis for the fire protection of this wall assembly to ensure it will provide 2-hour fire protection as requested.

## 2 APPLICABLE CODES, STANDARDS, AND REFERENCES

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- 2014 Oregon Structural Specialty Code (OSSC)
- Chapter 16 of ANSI/AF&PA *National Design Specification for Wood Construction (NDS)*
- *Technical Report No. 10, Calculating the Fire Resistance of Exposed Wood Member*, American Wood Council, 2015

## 3 APPROACH

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- The proposed wall has been analyzed in accordance with OSSC section 703.3 procedure item 3 and 4, and compared to the requirements for OSSC §705 – Exterior Walls.
- We have evaluated the proposed wall assembly against a 1-hour fire rated WP 1350 wall tested by Gypsum Association (GA).
- Construction details of the proposed wall and an illustration of the tested assembly are provided for reference. Individual components of both are compared side by side in a table that follows.
- Analysis and commentary are provided in the conclusion.

## 4 PROPOSED DESIGN

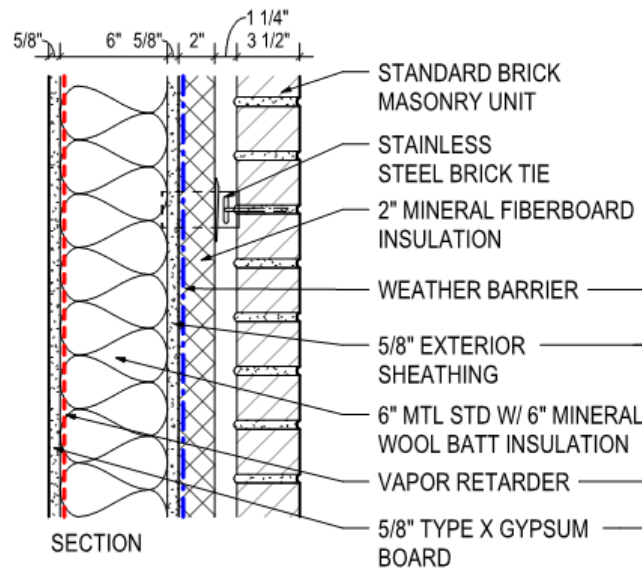
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The WP 1350 assembly is a symmetrical non-loadbearing 1-hour wall assembly.

The wall is rated to ensure the columns are afforded 2-hours of additional fire resistance from an assumed fire on the exterior of the wall.

The wall assembly is modified by adding 2-inch non-combustible mineral wool board on the exterior, an air gap and a brick exterior.





**BRICK WALL**

Figure 1a. Wall section.

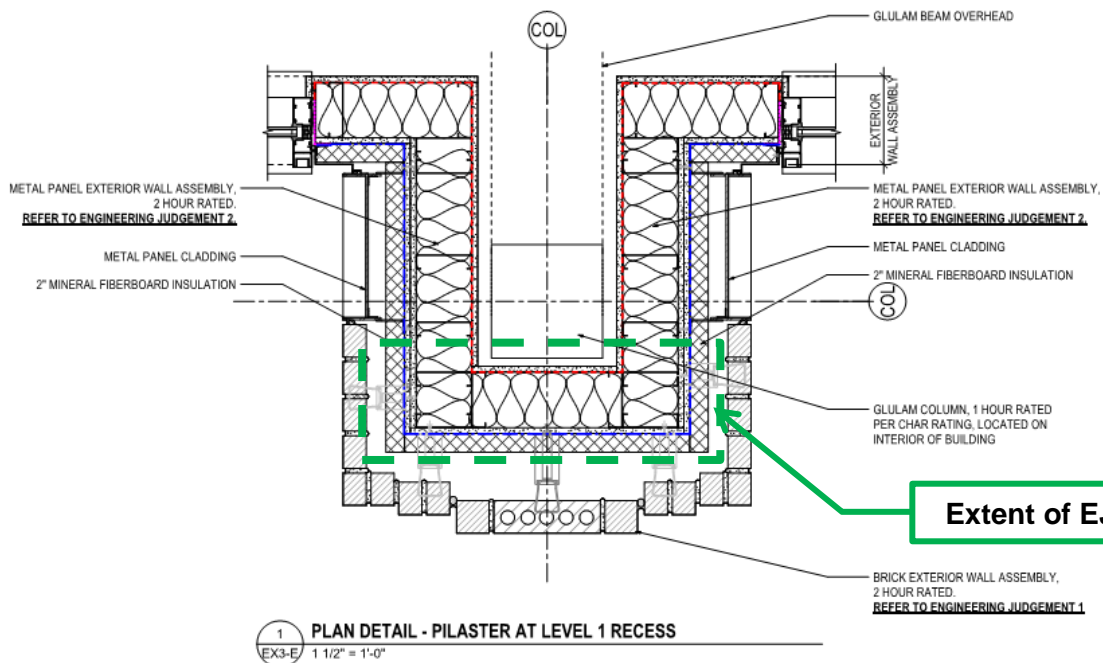


Figure 1b. Plan view.



## 5 ASSEMBLY ANALYSIS

The design intent is to meet all the provisions of WP 1350 design as a 1-hour basis. The additional components that are different from those listed in WP 1350 are mineral wool board, and a brick exterior. The wall is a non-loadbearing wall; therefore, the additional weight of the exterior components will not have any noticeable effect on the fire performance of the wall.

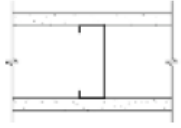
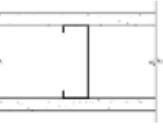
WALLS AND INTERIOR PARTITIONS, NONCOMBUSTIBLE			
GA FILE NO. WP 1350	GENERIC	1 HOUR FIRE	35 to 39 STC SOUND
<b>GYPSUM WALLBOARD, STEEL STUDS</b> One layer 5/8" type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to each side of 35/8" steel studs 24" o.c. with 1" Type S drywall screws 8" o.c. at vertical joints and 12" o.c. at floor and ceiling runners and intermediate studs. Joints staggered 24" on opposite sides. (NLB)			
		Thickness: 47/8" Approx. Weight: 6 psf Fire Test: FM WP-45, 6-19-68; OSU T-1770, 8-61; ULC 79T484, 79T500, 79T497, 8-12-81, ULC Design W415 Sound Test: NGC 2005004, 6-15-05 RAL TL06-114, 4-11-06	

Figure 2. WP 1350 – Nonbearing wall rating – 1-hour assembly.

TABLE 721.1(1)  
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS  
FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS<sup>m</sup>

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (Inches)			
			4 hours	3 hours	2 hours	1 hour
	1-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 6" × 6" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	2½	2	1½	1
	1-1.2	Carbonate, lightweight and sand-lightweight aggregate concrete, members 8" × 8" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	2	1½	1	1
	1-1.3	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" × 12" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	1½	1	1	1
	1-1.4	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 6" × 6" or greater. <sup>a</sup>	3	2	1½	1
	1-1.5	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 8" × 8" or greater. <sup>a</sup>	2½	2	1	1
	1-1.6	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 12" × 12" or greater. <sup>a</sup>	2	1	1	1
	1-2.1	Clay or shale brick with brick and mortar fill. <sup>a</sup>	3¾	—	—	2¼

Figure 3. OSSC Table 721.1(1) – Minimum protection of structural parts for various noncombustible insulating materials.

Table 1: Comparison between UL Design Number WP 1350 and Proposed Wall Assembly

Elements	GA Assembly WP 1350	Proposed Wall Assembly
1. Steel Studs	Min 3-5/8 in. deep, formed of min 25 MSG galv steel max stud spacing 24 in. OC.	Min 2-1/2 in. deep, formed of min <b>16 ga.</b> galvanized steel max stud spacing <b>16 in. OC.</b> Studs to be cut 3/4 in. less than assembly height. <b>(Exceeds minimum requirements)</b>
2. Batts and Blankets (Optional)	Mineral wool or glass fiber batts partially or completely filling stud cavity.	Mineral wool partially or completely filling stud cavity.
3. Gypsum Board	5/8 in. thick, outer layer paper, glass mat or vinyl surfaced. Gypsum board applied vertically attached to studs with 1 in. long Type S steel screws spaced 8 in. OC along vertical edges, and 12 in. OC in the field with joint compound, applied with a notched spreader producing continuous beads of compound about 3/8 in. in diameter, spaced not greater than 2 in. OC. Gypsum board attached to floor and ceiling runner track with 1-5/8 in. long Type S steel screws spaced 12 in. OC.	One (1) layer Type X exterior and one (1) layer Type X interior. 5/8 in. thick, outer layer paper, glass mat or vinyl surfaced. Gypsum board applied vertically attached to studs with 1 in. long Type S steel screws spaced 8 in. OC along vertical edges, and 12 in. OC in the field with joint compound, applied with a notched spreader producing continuous beads of compound about 3/8 in. in diameter, spaced not greater than 2 in. OC. Gypsum board attached to floor and ceiling runner track with 1-5/8 in. long Type S steel screws spaced 12 in. OC. <b>(1-Hour Wall)</b>
4. Mineral and Fiber Board*	Not Included	2" mineral board insulation. <b>(Additional fire resistance.)</b>
5. Standard Brick Layer	Not Included	4" Standard Brick <b>(4hr. min) (Additional fire resistance.)</b>
<b>Fire Resistance</b>	<b>1-Hour</b>	<b>4-Hour (minimum from exterior)</b>

## 6 SUMMARY

Brick is recognized for its ability to provide protection for other structural members in section 721 of the OSSC. Table 721.1(2) provides equivalent fire resistive rating for solid brick of clay or shale (Item 1-1.1).

The brick infill wall of one layer (4" thick) of brick has an equivalent fire resistive protection of greater than 2 hours. The exterior wall exceeds the 1-hour Tested wall with heavy steel studs positioned 16" on center.

## 7 CONCLUSION

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The proposed design will exceed the code request for 2-hour rated non-combustible non-loadbearing wall assembly. The additional components will enhance the structural strength and fire rating significantly.

Therefore, as detailed above, the proposed exterior wall design will exceed the 2-hour fire-rated protection when installed as proposed.



EXPIRES 12-31-19

*Franklin Callfas*

Principal/Fire Protection Engineer

Code Unlimited



Experienced.  
Innovative.  
Trusted.

# PAE Living Building

## Engineering Judgment Report #2

### Metal Panel Wall Assembly

Client Name: ZGF Architects

Client Address: 1223 SW Washington Street Ste 200, Portland, OR 97205

Date: 9/29/2019

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## 1 PROJECT OVERVIEW

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The PAE Living Building is a new 5-story, Type III building of CLT construction in Portland, Oregon. The building is fully protected by automatic sprinklers and a fire alarm system. Non-Load Bearing exterior walls with a fire separation distance greater than 30 ft are requested by the Life Safety Plan Examiner to be 2 hours rated when primary structural frame, combustible members, are located adjacent to the exterior wall.

Code Unlimited has been asked to provide analysis for the fire protection of this wall assembly to ensure it will provide 2-hour fire protection as requested.

## 2 APPLICABLE CODES, STANDARDS, AND REFERENCES

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- 2014 Oregon Structural Specialty Code (OSSC)

## 3 APPROACH

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- The proposed wall has been analyzed in accordance with OSSC section 703.3 procedure item 3 and 4, and compared to the requirements for OSSC §705 – Exterior Walls.
- We have evaluated the proposed wall assembly against a 2-hour fire rated U411 wall tested by Underwriters Laboratories (UL).
- Construction details of the proposed wall and an illustration of the tested assembly are provided for reference. Individual components of both are compared side by side in a table that follows.
- Analysis and commentary are provided in the conclusion.

## 4 PROPOSED DESIGN

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The U 411 exterior wall assembly is a symmetrical non-loadbearing 2-hour wall assembly.

The wall will be rated to ensure the interior columns are afforded 2-hour additional fire resistance. Therefore, an assumed fire is on the exterior of the building.

The wall assembly will be 2.5" Steel studs as detailed in Fig. 1a or 6" Steel studs with 2 inch mineral wool fiberboard on the exterior detailed in Fig. 1b.

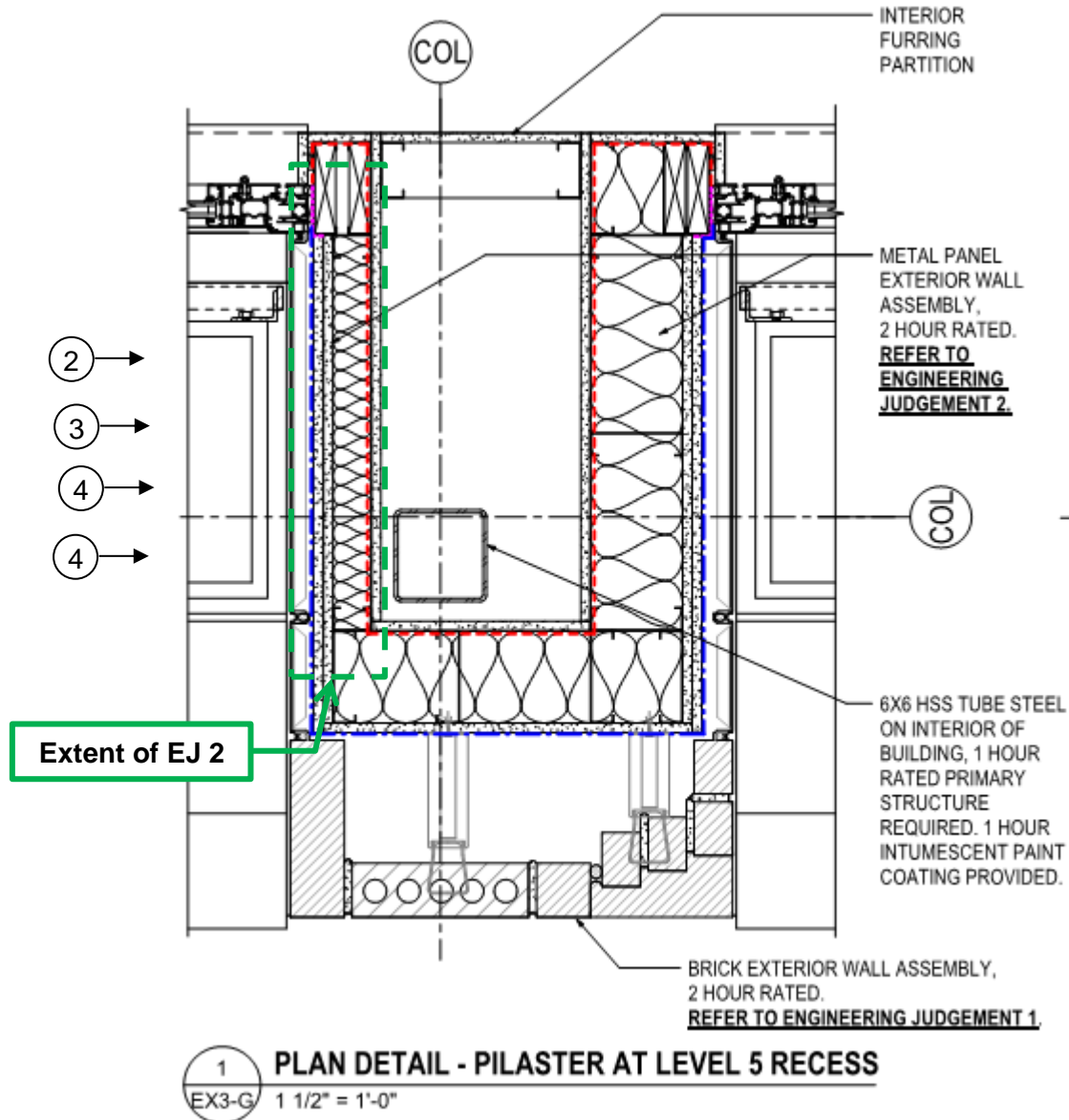


Figure 1a. Proposed wall assembly (2.5" studs).



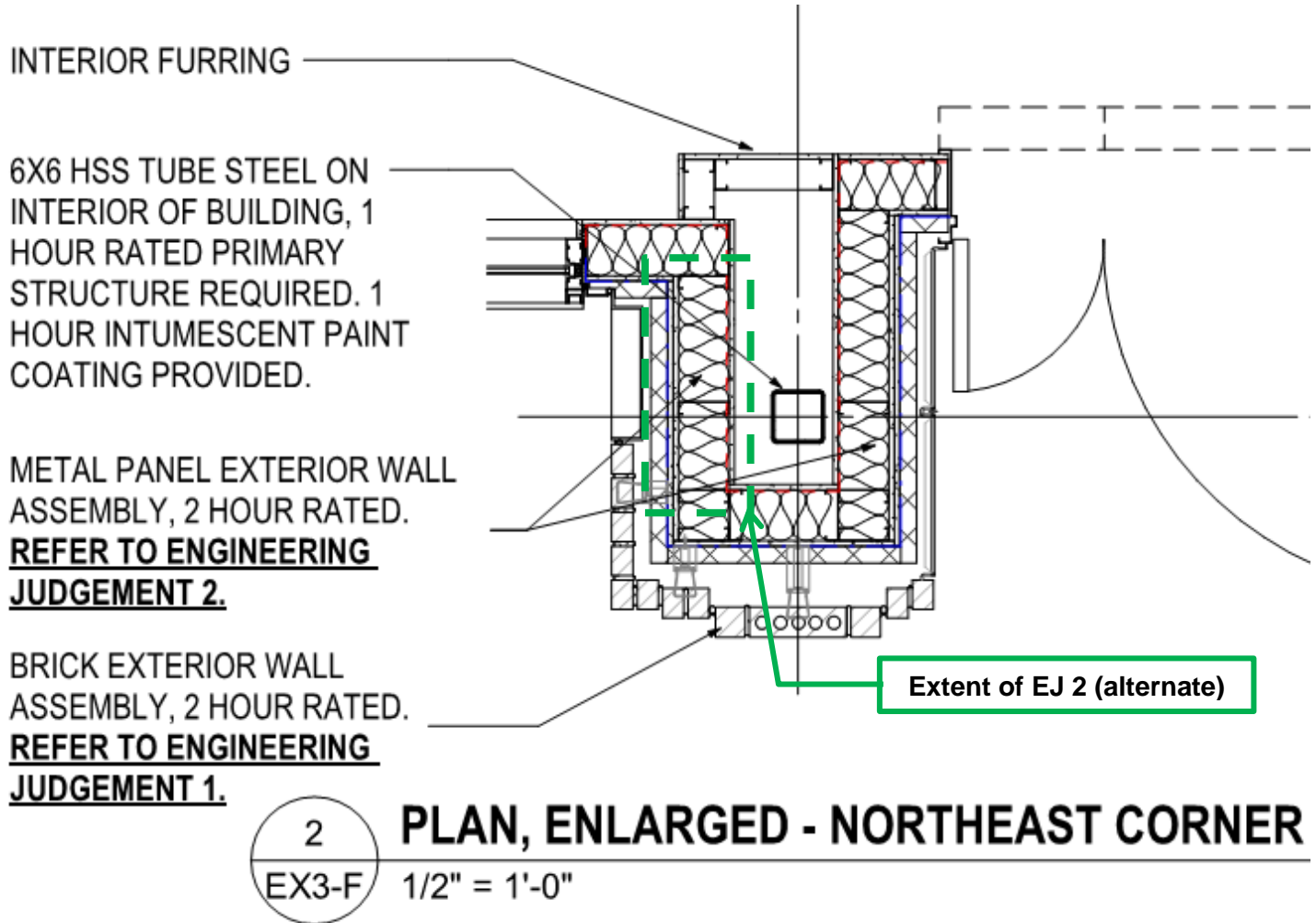


Figure 1b. Alternate proposed wall assembly (6" studs with fiberboard)

## 5 ASSEMBLY ANALYSIS

The design intent is to meet all the minimum provisions of U411 design. The addition components beyond those listed in U411 non-combustible materials. The wall is a non-loadbearing wall; therefore, the additional weight of the exterior components will not have any noticeable effect on the performance of the wall.

**Design No. U411**

September 18, 2019

**Nonbearing Wall Rating — 2 Hr.**

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

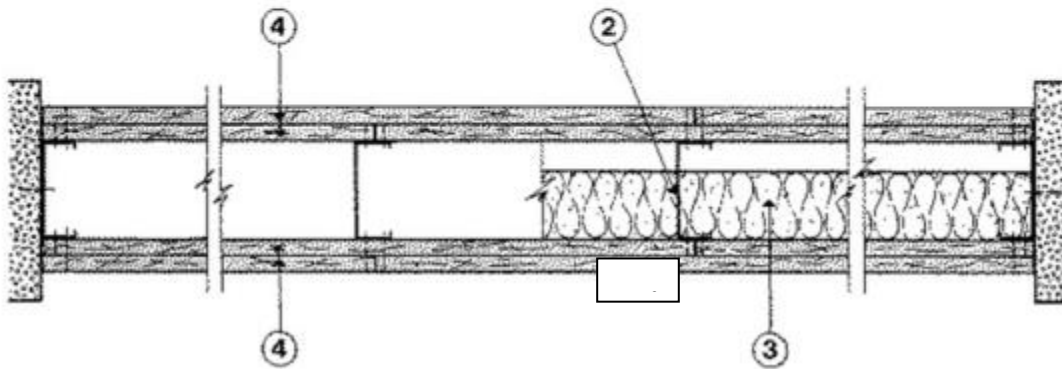


Figure 3. UL 411 – Nonbearing wall rating – 2-hour assembly.

Table 1: Comparison between UL Design Number U411 and Proposed Wall Assembly

Elements	UL Assembly U411	Proposed Wall Assembly
1. Floor and Ceiling Runners	Not applicable to review.	Not applicable to review.
2. Steel Studs	Min 2-1/2 in. deep, formed of min 25 MSG galv steel max stud spacing 24 in. OC. Studs to be cut 3/4 in. less than assembly height.	Min 2-1/2 in. deep, formed of min <b>16 ga.</b> galvanized steel max stud spacing <b>16 in. OC.</b> Studs to be cut 3/4 in. less than assembly height. <b>(Exceeds minimum requirements)</b>
3. Batts and Blankets (Optional)	Mineral wool or glass fiber batts partially or completely filling stud cavity.	Mineral wool partially or completely filling stud cavity.
4. Gypsum Board	5/8 in. thick, outer layer paper, glass mat or vinyl surfaced. (Laminated System) Gypsum board applied vertically in two layers. Inner layer attached to studs with 1 in. long Type S steel screws spaced 8 in. OC along vertical edges, and 12 in. OC in the field and outer layer laminated to inner layer with joint compound, applied with a notched spreader producing continuous beads of compound about 3/8 in. in	<b>Two (2) layers Type X exterior and one (1) layer Type X interior.</b> 5/8 in. thick, outer layer paper, DensGlass Sheathing (or equal). Gypsum board applied vertically in two layers. Inner layer attached to studs with 1 in. long Type S steel screws spaced 8 in. OC along vertical edges, and 12 in. OC in the field and outer layer laminated to inner layer with joint compound, applied with a

	<p>diameter, spaced not greater than 2 in. OC. Joints of laminated outer layer offset 12 in. from inner layer joints Outer layer gypsum board attached to floor and ceiling runner track with 1-5/8 in. long Type S steel screws spaced 12 in. OC.</p> <p>Optional, (Direct Attached System), Inner layer attached to studs with 1 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges. Outer layer attached to the studs over the inner layer with 1-5/8 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges and 12 in. OC to the floor and ceiling runners. Joints of screw-attached outer layer offset from inner layer joints. Joints of outer layer may be taped or untaped.</p>	<p>notched spreader producing continuous beads of compound about 3/8 in. in diameter, spaced not greater than 2 in. OC. Joints of laminated outer layer offset 12 in. from inner layer joints Outer layer gypsum board attached to floor and ceiling runner track with 1-5/8 in. long Type S steel screws spaced 12 in. OC.</p> <p>Optional, (Direct Attached System), Inner layer attached to studs with 1 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges. Outer layer attached to the studs over the inner layer with 1-5/8 in. long Type S steel screws spaced 16 in. OC in the field and along the vertical edges and 12 in. OC to the floor and ceiling runners. Joints of screw-attached outer layer offset from inner layer joints. Joints of outer layer may be taped or untaped.</p>
5. Lead Batten Strips	-	Not applicable to review.
6. Lead Discs or Tabs	-	Not applicable to review.
7. Mineral and Fiber Board* — (Optional, Not Shown)	<p>For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to studs and floor and ceiling runners with 1-5/8 in. long Type S steel screws, spaced 12 in. OC. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.</p>	<p>2" mineral board insulation.</p> <p><b>See Figure 1b (Alt wall).</b></p> <p><b>(Additional fire resistance.)</b></p>
<b>Fire Resistance</b>	<b>2-Hour</b>	<b>2-Hour Minimum</b> <b>(Fire Exposure from exterior)</b>

## 6 SUMMARY

While evaluating fire resistance of the wall, the proposed assemblies will provide additional protection beyond UL tested assembly U411 as proposed.

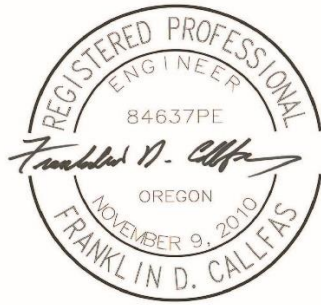
Note: The alternate wall shown in Fig. 1b, utilizes 6" steel studs, providing superior fire rating to the tested assembly with 2.5" Studs.

## 7 CONCLUSION

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The proposed design will exceed the code requirement of 2-hour rated non-loadbearing wall assembly. The proposed steel studs are heavier with closer spacing, supporting a greater fire resistance for the assembly.

Therefore, as detailed above, the proposed exterior wall design will achieve a minimum 2-hour fire-rating when installed to exceed the minimum requirements of UL U411 for an exterior nonloadbearing wall.



EXPIRES	12-31-19
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*Franklin Callfas*

Principal/Fire Protection Engineer

Code Unlimited



# PAE Living Building

## Engineering Judgment Report #3

### Roof Assembly

Client Name: ZGF Architects

Client Address: 1223 SW Washington Street Ste 200, Portland, OR 97205

Date: 9/29/2019

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## 1 PROJECT OVERVIEW

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The PAE Living Building is a new 5-story, Type III building of CLT construction in Portland, Oregon. The building is fully protected by automatic sprinklers and a fire alarm system. Non-Load Bearing exterior walls with a fire separation distance greater than 30 ft are requested by the Life Safety Plan Examiner to be 2 hours rated when primary structural frame combustible members are located adjacent to the exterior wall.

Code Unlimited has been asked to provide analysis for the fire protection of this roof assembly to ensure it will provide 2-hour fire protection as requested.

## 2 APPLICABLE CODES, STANDARDS, AND REFERENCES

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- 2014 Oregon Structural Specialty Code (OSSC)
- 2014 Oregon Structural Specialty Code Appendix N, which refers to International Fire Code

## 3 APPROACH

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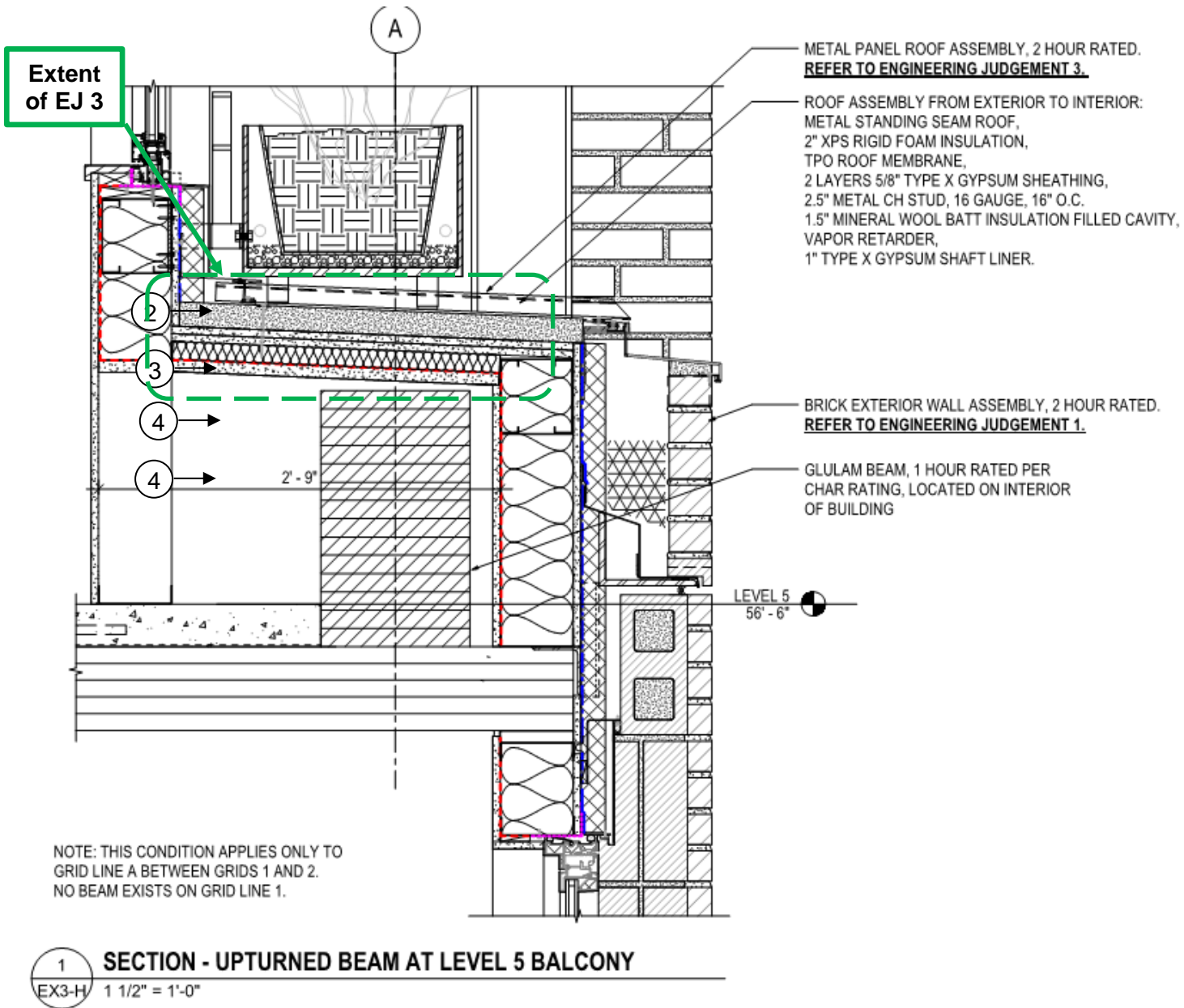
- The proposed ceiling assembly has been analyzed in accordance with 2014 OSSC Section 703.3 **Alternative Methods for Determining Fire Resistance.**
- The proposed design has been evaluated by an Oregon Licensed Fire Protection Engineer.

## 4 PROPOSED DESIGN

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In order to ensure primary structural frame member will be protected at the exterior wall and roof of the floor, the ceiling will be capped by a 2-hour rated ceiling assembly. This ceiling assembly will follow the requirements of NER-258 (Additional, clarifying evaluation, is provided in AER-09038 which details the test requirements of NER-258), and will utilize metal studs at 16" o. c. with two layers of 5/8" Type X on the top and one layer of 1" Type X gypsum shaftliner board on the bottom. Penetrations (if required) will be firestopped with an appropriate fire assembly per OSSC Section 715.



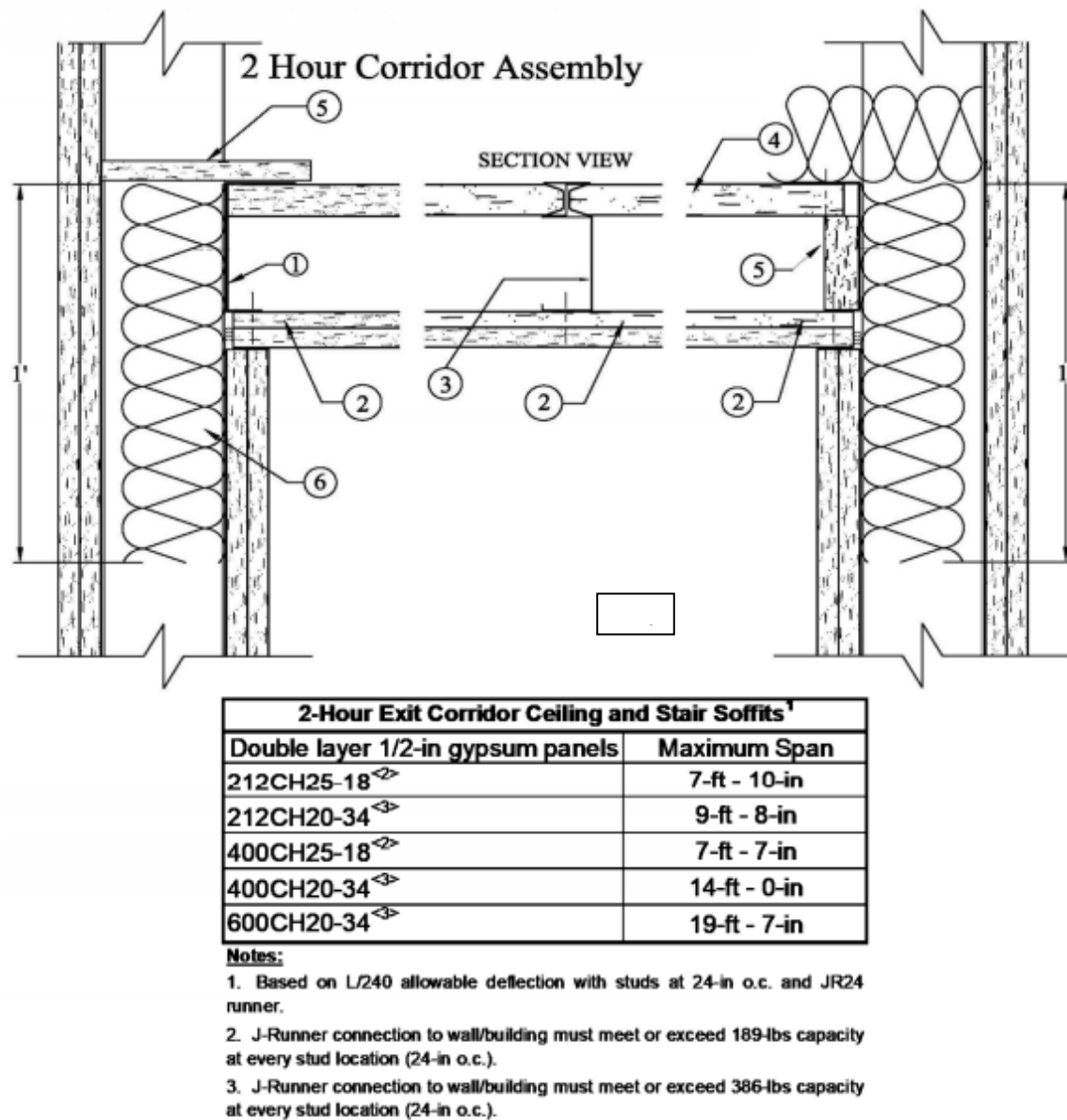


*Figure 1. Proposed Roof Assembly*

## 5 ASSEMBLY ANALYSIS

The assembly has been compared to a 2-hour corridor ceiling assembly listed in the NER-258, AER-09038 report, which requires minimum 2-1/2" C-H shaped metal studs at 24" o/c. The proposed assembly exceeds the requirements of figure 9, AER-09038 with 16 Ga members at 16" o/c.

Note: NER 258 refers to the ICC, ES-Legacy Report, while AER-09038 refers to PEI evaluation providing additional detailing.



**Figure 2. AER-09038 figure 9 – Two Hour Corridor Ceiling Assembly and Limiting Spans**

**Table 1: Comparison between Tested and Proposed Assemblies**

Element	NER 258/ AER-09038	Proposed Assembly
1. J-runner	A min 2-1/2" deep 24-gauge J-runner attached horizontally to perimeter or boundary walls with a power actuated fastener.	N/A to the proposed design

2. Gypsum Wall Board	Attached 2 layers of min ½" thick SHEETROCK® Brand FIRECODE® C Core Gypsum Panels (Type C) to the underside of the "Corridor Ceiling" of the C-H stud and the perimeter J-For the BASE layer, use a 1" long Type S screw that is spaced 24" o. c. along the perimeter and the edges. The FACE layer should be applied with a 1-5/8" long Type S screw that is spaced 12" o. c. in the field and perimeter. All joints must be staggered a minimum of 24" o. c. from the adjacent layer.	Attached 2 layers of min 5/8" thick type X Core Gypsum Panels to the top side of the C-shaped stud members. The BASE layer uses a 1" long Type S screw that is spaced 24" o. c. along the perimeter and the edges. The FACE layer should be applied with a 1-5/8" long Type S screw that is spaced 12" o. c. in the field and perimeter. All joints must be staggered a minimum of 24" o. c. from the adjacent layer. <b>(Equivalent, see summary below)</b>
3. Studs	Install C-H studs (max 20 gauge) perpendicular to J-runner spaced 24" o. c. with C-section of C-H stud facing downward towards the corridor side of the assembly with two (2) screws a min ½" long Type S-12 screws, one on each side.	(1000S162-54) 10" deep <b>16 gauge-</b> metal studs at <b>16" o/c.</b> <b>(Superior Components – provides additional protection with heavier members and spaced closer)</b>
4. Shaft liner	1" thick SHEETROCK® Brand Gypsum Liner Panel - Friction-fitted in "H" portion of C-H studs.	1" shaft liner to be installed on <u>bottom side</u> of assembly.
5. Ripper Board	<ul style="list-style-type: none"> <li>a. Where the liner panel (item 4) is cut short to be installed, gaps must be filled by using a strip of 1" thick SHEETROCK Brand Gypsum Liner Panel.</li> <li>b. As an alternative you can use mineral fiber insulation to prevent exposure to the top leg of the J-runner that forms the ceiling.</li> <li>c. Where the wall section extends above the corridor ceiling, above corridor height a rip of board must be used to cap the opening between studs and a strip of mineral fiber insulation as described in item 6 must be used.</li> </ul>	<ul style="list-style-type: none"> <li>a. N/A to conventional 5/8" GWB.</li> <li>b. Alternate not used.</li> <li>c. N/A to assembly.</li> </ul> <b>(Equivalent)</b>
6. Insulation	In order to prevent the passage of heat and gases, a 12" long strip of mineral fiber insulation must be used to fill in the stud cavity of the walls.	Cavity to be filled with 1.5" Mineral Wool Insulation. <b>(Equivalent)</b>
<b>Fire-resistance rating</b>	<b>2-hour</b>	<b>2-hour (Equivalent)</b>

## 6 SUMMARY

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The tested assembly is for nonbearing horizontal separation providing fire-resistance of 2 hour. Per the test criteria, this load is restricted to the dead weight of the ceiling assembly. The roof is a non-occupiable sill.

The assembly is located at the roof and will not have any live loading. Therefore, this is not required to be considered a load-bearing horizontal assembly.

The assembly has been compared to NER 258, which is an ICC legacy report that has been attached. The proposed horizontal ceiling system exceeds the tested system by using:

- 16 ga studs which are much heavier than the tested assembly
- The stud's cavity will be filled with Mineral wool, thereby extending the roof's fire resistance.
- The top of the assembly will utilize an additional 25% GWB, thus creating a more robust fire rating.

The bottom of the ceiling will be protected with 1 layer of 1" Type X GWB, which replaces the ½" Type C tested. An equivalent thickness of Type C is superior for fire endurance, due to its structural core stiffening under higher temperatures. The proposed assembly has compensated for the difference between Type X and Type C by utilizing a single ridged 1" thickness vs the (2) layers of ½" used in the test.

On the upper portion of the assembly, the proposed assembly will replace the 1" Shaft liner with two (2) layers of 5/8" Type X. Two (2) layers of 5/8" Type X can be utilized for two-hour assemblies as shown in Appendix A. The ASTM E119 Test FC 2116, which matches the upper half of our assembly contains 2 layers of 5/8" Type X GWB. The FC 2116 test provides an example for the steel protection within the cavity for the duration of the test. The important consideration for an E119 test is the requirement where the steel member average temperature does not exceed 1100°F.

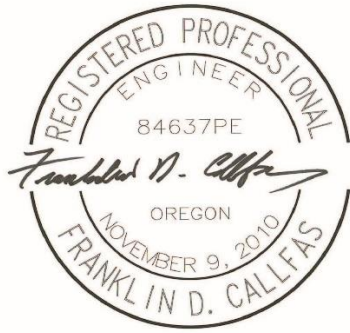
### Fire Scenario:

*We evaluated the potential fire event.*

*1-A fire on the exterior of the roof. The fire protection of the assembly to protect the Beam matches the minimum 2-hour requested.*

## 7 CONCLUSION

The roof assembly is equivalent or superior to ICC Legacy Report NER-258, when the comparison includes the additional gypsum board on the upper portion and heavier gauge of the steel studs. As documented above, the assembly meets the minimum requirements of the OSSC for a non-load bearing 2-hr assembly with an assumed fire location for this evaluation from the exterior.



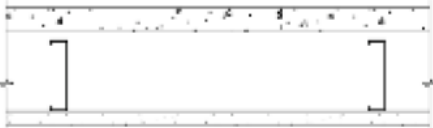
EXPIRES 12-31-19

*Franklin Callfas*

Principal/Fire Protection Engineer

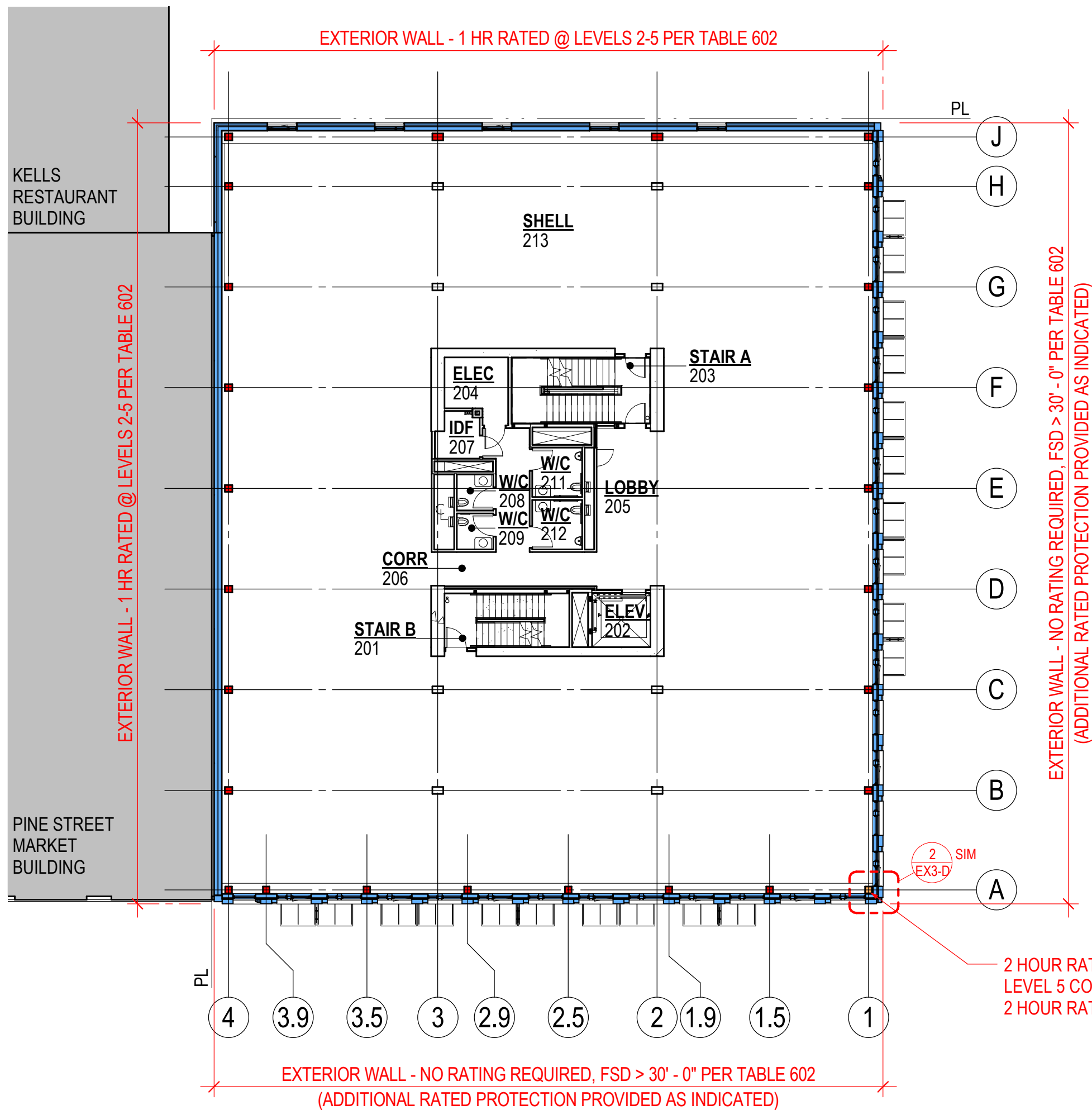
Code Unlimited

8 APPENDIX A

GA FILE NO. FC 2116	GENERIC	2 HOUR FIRE
<p>GYPSUM WALLBOARD, STEEL CHANNEL JOIST, CONCRETE SLAB</p> <p><b>Base</b> layer 5/8" type X gypsum wallboard or veneer base applied at right angles to channel shaped, minimum 7 1/4" deep, 18 gage galvanized steel joists 24" o.c. with 1" Type S-12 drywall screws 12" o.c. End joints located midway between joists and staggered between rows. <b>Face</b> layer 5/8" type X gypsum wallboard or veneer base applied at right angles to joists with 1 7/8" Type S-12 drywall screws 12" o.c. placed 2" from edges and 1 1/2" Type G drywall screws 12" o.c. placed 2" back on either side of end joints. End joints located midway between joists and all joints offset 24" from base layer joints.</p> <p>Joists supporting 28 gage corrugated metal deck and 2 1/2" concrete slab measured from the bottom of flutes. Joists braced at midspan with continuous 2" wide, 18 gage, galvanized steel straps attached to the bottom flange of each joist with one 3/8" Type S-12 panhead screw.</p>		 <p>Approx. Ceiling Weight: 5 psf Fire Test: FM FC 224-2, 9-19-75</p>

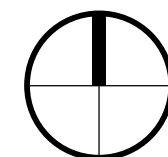


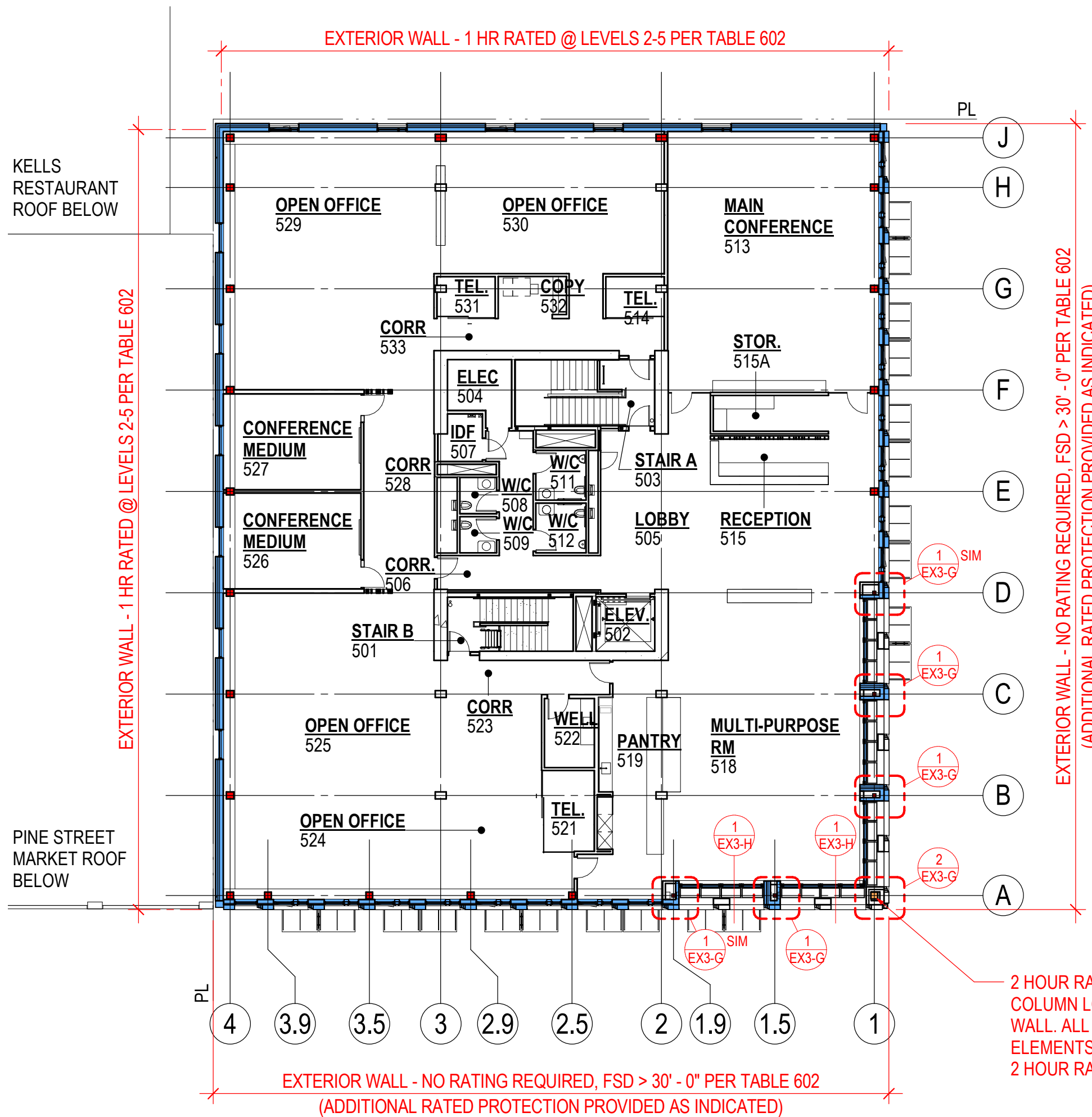




FLOOR PLAN - LEVELS 02-04

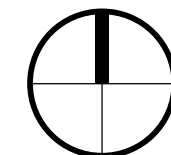
- EXTERIOR WALL
- 1 HOUR RATED PRIMARY STRUCTURE
- 2 HOUR RATED PRIMARY STRUCTURE

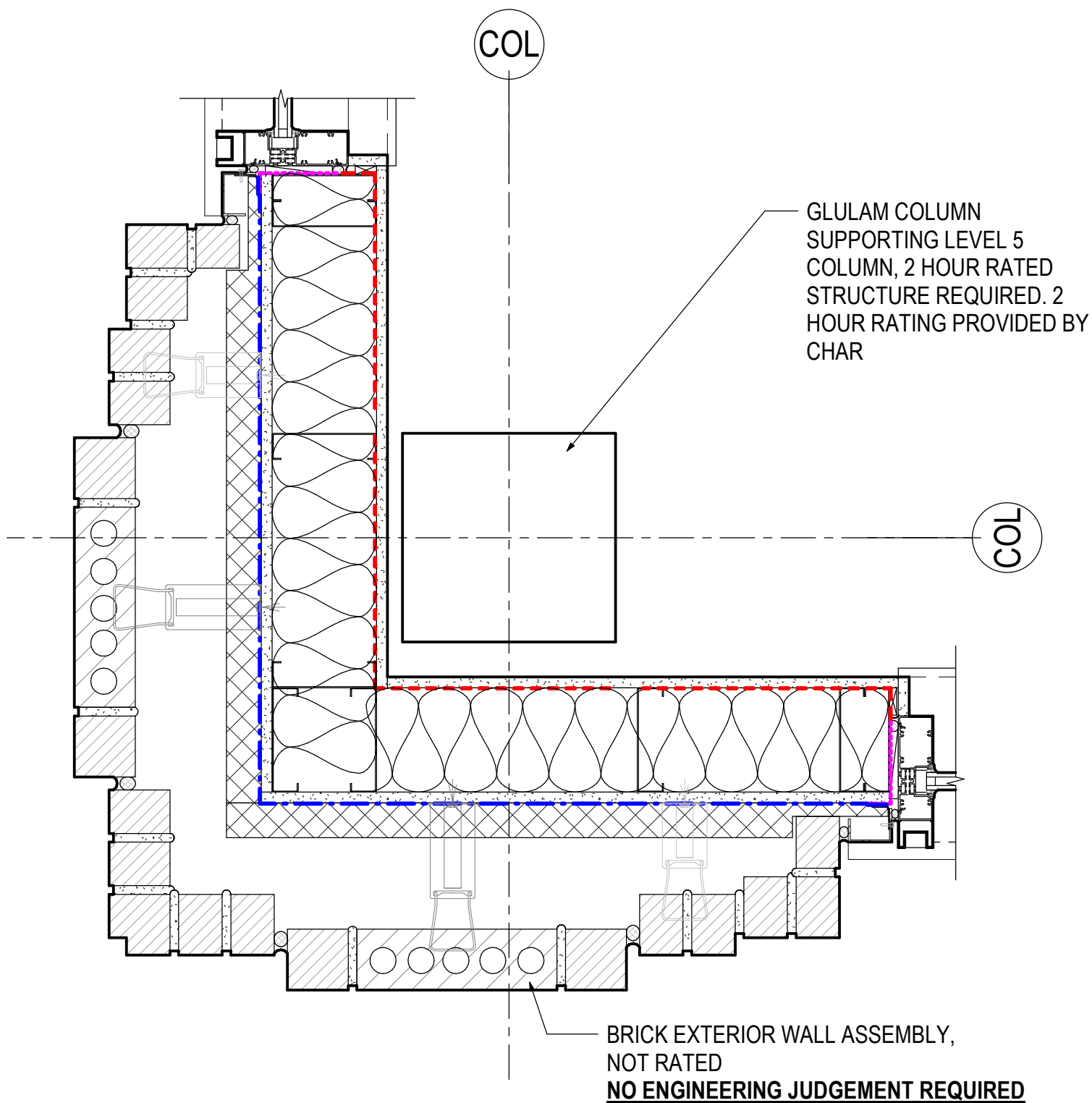
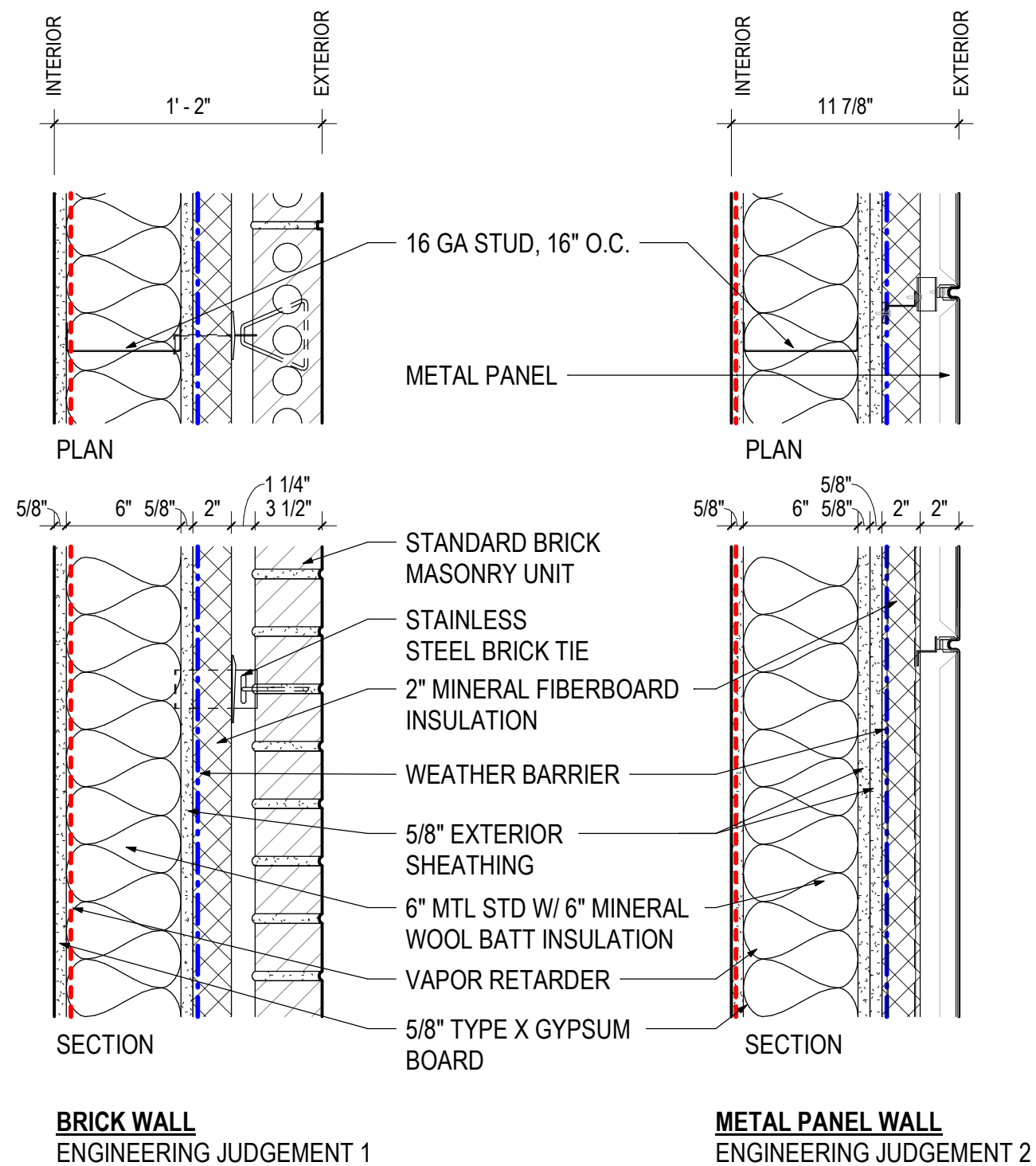




FLOOR PLAN - LEVEL 05

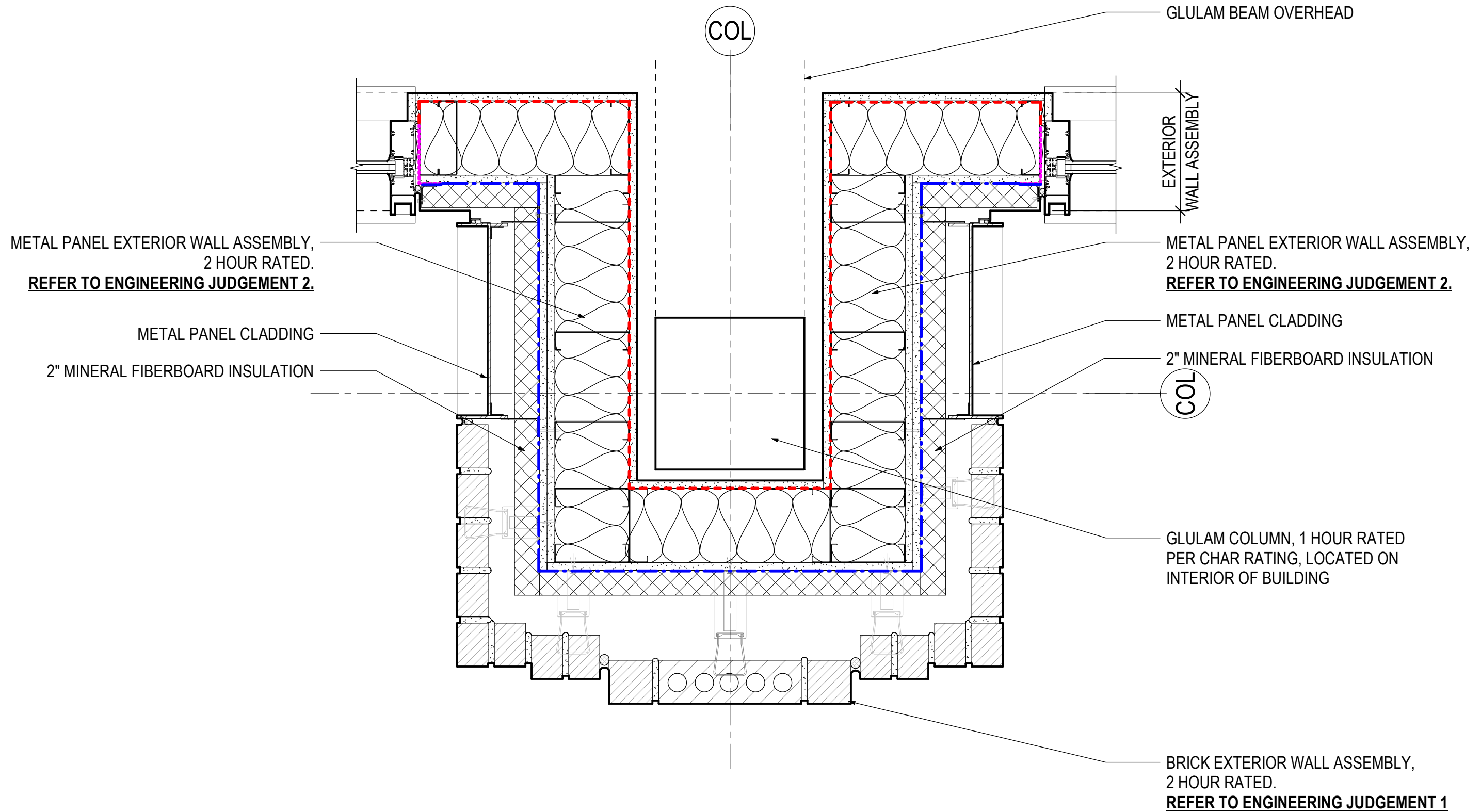
- EXTERIOR WALL
- 1 HOUR RATED PRIMARY STRUCTURE
- 2 HOUR RATED PRIMARY STRUCTURE





1 **EXTERIOR WALL ASSEMBLIES**  
EX3-D 1 1/2" = 1'-0"

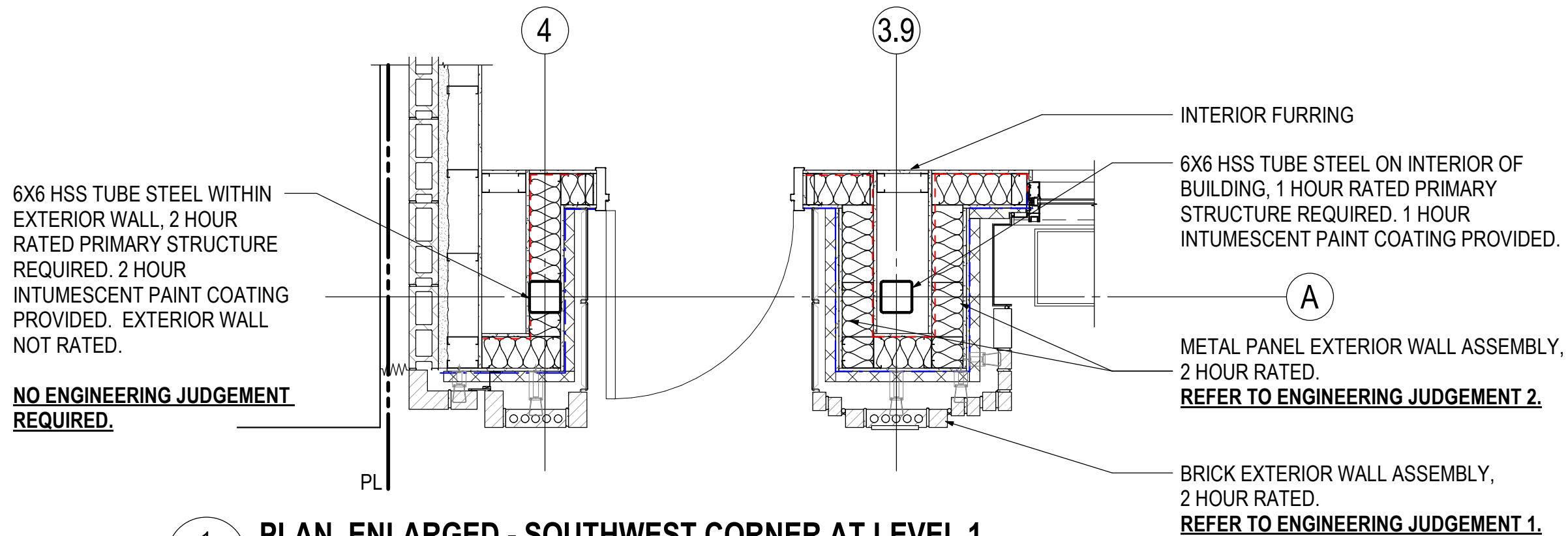
2 **PLAN DETAIL - SOUTHEAST CORNER AT LEVEL 1 (SIM @ LEVELS 2-4)**  
EX3-D 1 1/2" = 1'-0"



1  
EX3-E

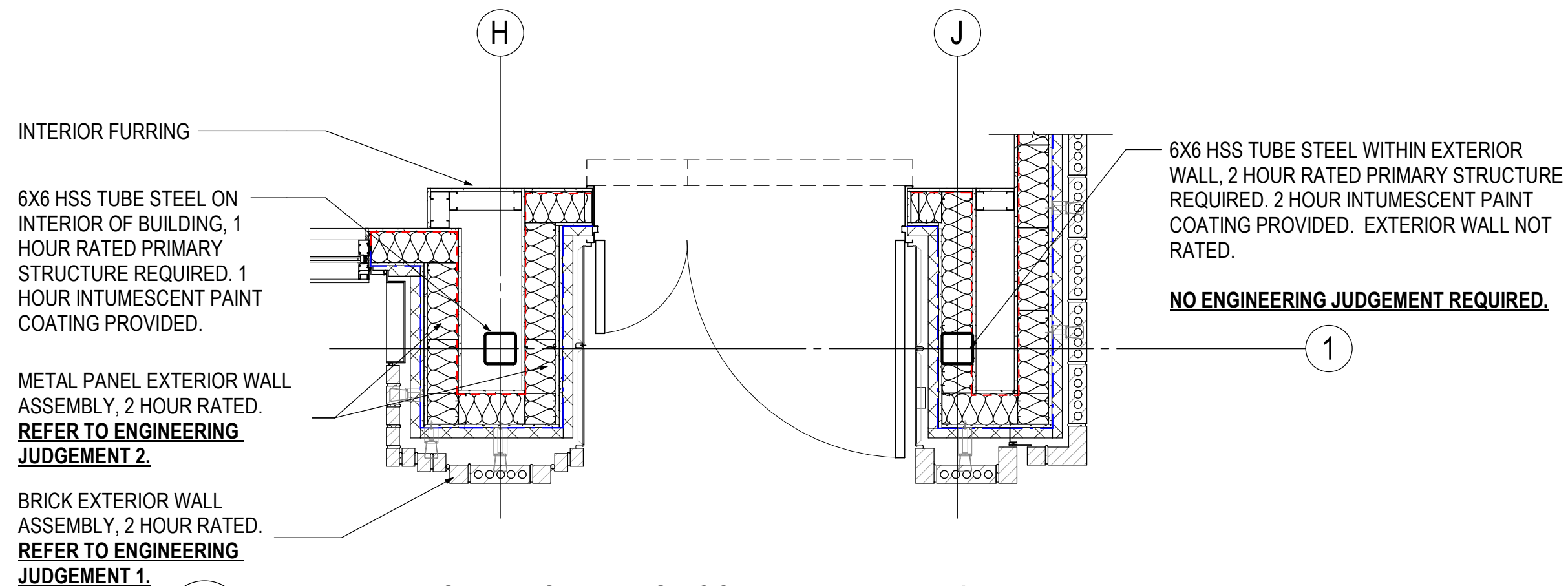
**PLAN DETAIL - PILASTER AT LEVEL 1 RECESS**

1 1/2" = 1'-0"



1  
EX3-F 1/2" = 1'-0"

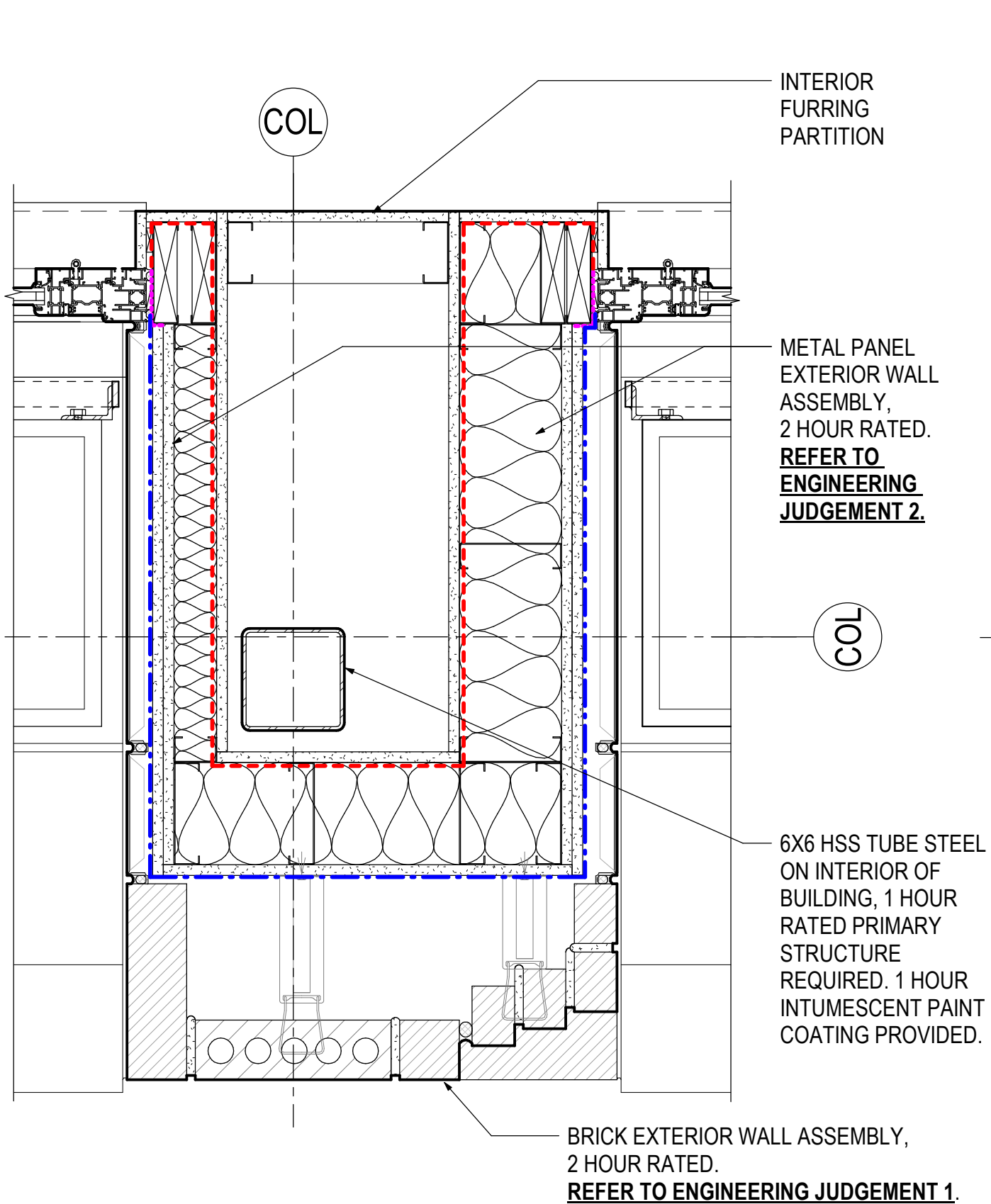
**PLAN, ENLARGED - SOUTHWEST CORNER AT LEVEL 1**



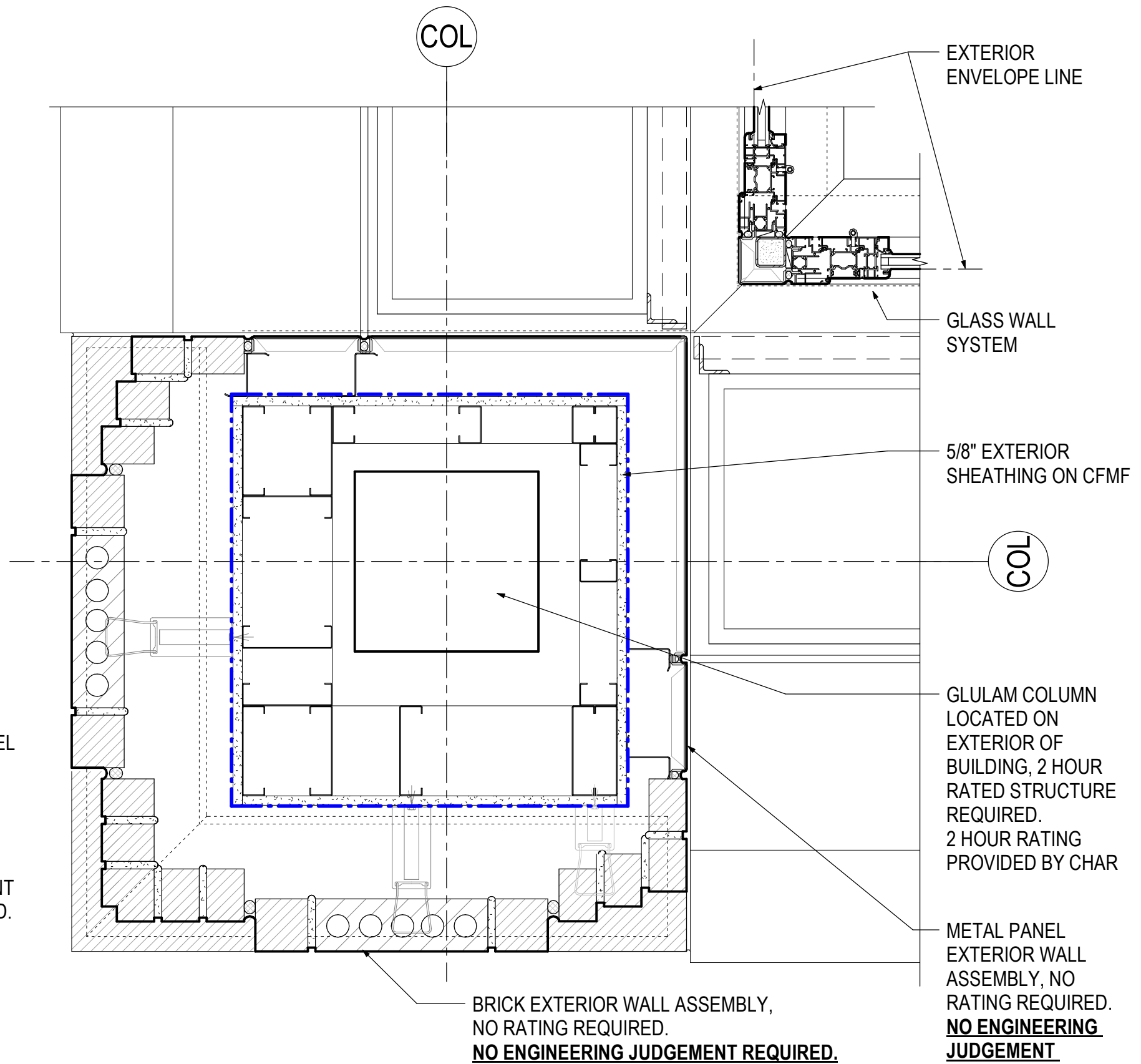
2  
EX3-F 1/2" = 1'-0"

**PLAN, ENLARGED - NORTHEAST CORNER AT LEVEL 1**





1 **PLAN DETAIL - PILASTER AT LEVEL 5 RECESS**  
EX3-G 1 1/2" = 1'-0"



2 **PLAN DETAIL - SOUTHEAST CORNER AT LEVEL 5**  
EX3-G 1 1/2" = 1'-0"

