

# Development Services

## From Concept to Construction

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### APPEAL SUMMARY

**Status:** Decision Rendered

<b>Appeal ID:</b> 22222	<b>Project Address:</b> 3181 SW Sam Jackson Park Rd
<b>Hearing Date:</b> 12/18/19	<b>Appellant Name:</b> Tom Jaleski
<b>Case No.:</b> B-001	<b>Appellant Phone:</b> 9712385266
<b>Appeal Type:</b> Building	<b>Plans Examiner/Inspector:</b> Maureen McCafferty
<b>Project Type:</b> commercial	<b>Stories:</b> Occupancy: B, A-3, A-2 <b>Construction Type:</b> B, A-3, A-2
<b>Building/Business Name:</b> OHSU – Casey Eye Institute	<b>Fire Sprinklers:</b> Yes - Throughout
<b>Appeal Involves:</b> Erection of a new structure	<b>LUR or Permit Application No.:</b>
<b>Plan Submitted Option:</b> pdf [File 1]	<b>Proposed use:</b> Clinic / Office

### APPEAL INFORMATION SHEET

#### Appeal item 1

**Code Section** §703.3, §713.4

**Requires** 703.3 Methods for determining fire resistance. The application of any of the methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E119 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:

Engineering analysis based on a 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.

713.4 Fire-resistance rating. Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basement but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours. Shaft enclosures shall meet the requirements of Section 703.2.1.

**Proposed Design** The HSS Member is to be installed within a 2-hour rated shaft wall. The primary function of the member is providing stiffening of the wall at elevator doors. Membrane protection will be provided, as complete encapsulation protection per 704.3 will not be required as the members do not support a load bearing wall. The shaft wall is attached to the columns and is therefore self-supporting.

The proposed member assembly consists of 3 x 3 x 1/4" HSS section with a minimum of two layers of 5/8" Type X gypsum board installed on the exposed faces as shown in Figure 1b of the EJ.

For evaluation, it is assumed that the HSS members will be exposed to fire from the interior of the shaft only.

**Reason for alternative** The HSS member is not part of a UL listed as a fire rated assembly. Since it is part of a shaft enclosure connecting four or more stories, it is required to be 2-hour fire resistance rated per 2014 OSSC §713.4.

The proposed fire proofing application uses an analysis from an Oregon registered Fire Protection Engineer in the attached EJ, to provide equivalent life safety and fire protection for the requirements of the assembly.

When evaluated with exposure from one side, the proposed steel tube beam is thicker and provides greater heat resistance than the UL tested beam and therefore requires less added fire protection material than the UL tested assembly. The proposed member will be heated only from the interior, shaft facing side. Two layers of 5/8" type X GWB provide protection for the shaft exposed face, while compressed Mineral Wool ensures heat will not be transferred through the cavity.

The protection scheme for the member exceeds the minimum of 2 hours. The proposed protection will meet the minimum 2-hour fire resistance rating per the OSSC for this application.

Therefore, after review of the attached documentation, we urge you to approve this appeal.

APPEAL DECISION

**Alternate 2 hour fire rated HSS assembly 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.



# OHSU ECEC

## Engineering Judgment Report

### Fire Rating of 3" x 3" x 1/4" HSS Member

Client Name: Skanska

Client Address: 222 SW Columbia Street #300, Portland, OR 97201

Date: 12/11/2019

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## 1 PROJECT OVERVIEW

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The OHSU Elks Children’s Eye Clinic Expansion (ECEC) is a new project being developed in Portland, Oregon. It will be under the jurisdictional review of the City of Portland. The proposed 6-story medical office building is Type III-A construction and is protected by automatic fire sprinklers throughout. Code Unlimited has been asked to provide analysis for the fire rating for the installation of HSS members in the vertical shaft wall, to ensure it will maintain 2-hour fire rating as required.

## 2 APPLICABLE CODES, STANDARDS, AND GUIDES

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- 2014 Oregon Structural Specialty Code (OSSC), including Appendix N which references the International Fire Code.

## 3 APPROACH

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The proposed assembly has been analyzed in accordance with 2014 OSSC §703.3 **Alternative Methods for Determining Fire Resistance**.

Portions of the tested assembly are modified to suit the unique design condition. The modification is analyzed for equivalency using published fire test data and acceptable fire science principles.

## 4 PROPOSED DESIGN

The HSS Member is to be installed within a 2-hour rated shaft wall. The primary function of the members is to provide stiffening for the wall at the elevator doors. Membrane protection will be provided, as complete encapsulation protection per 704.3 will not be required as the members do not support a load bearing wall. The shaft wall is attached to the columns and is therefore self-supporting.

The proposed member assembly consists of 3 x 3 x 1/4" HSS section with a minimum of two layers of 5/8" Type X gypsum board installed on the exposed faces as shown in Figure 1b.

For evaluation, it is assumed that the HSS members will be exposed to fire from the interior of the shaft only.

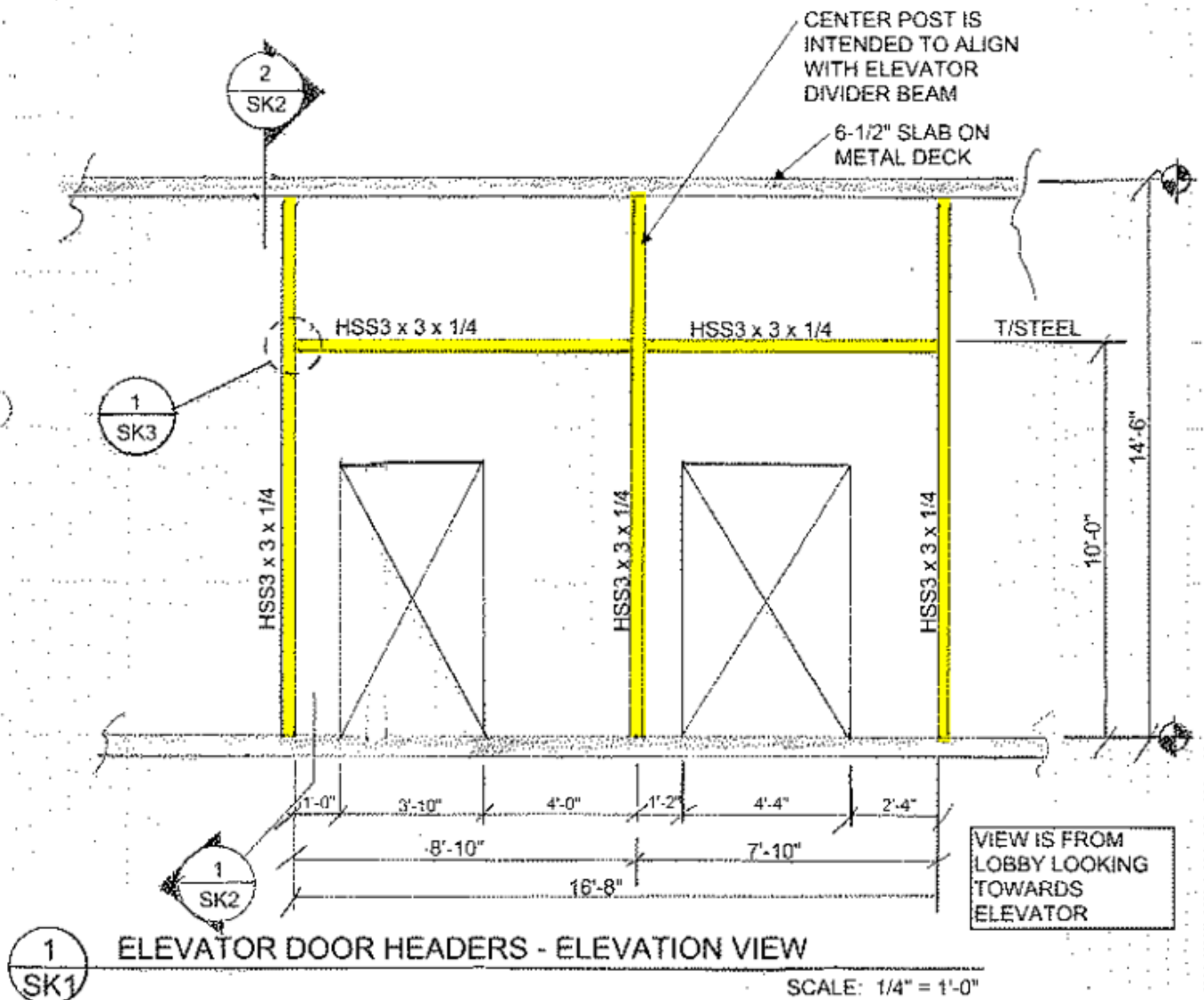


Fig 1a: Elevation of 3" x 3" x 1/4" HSS section



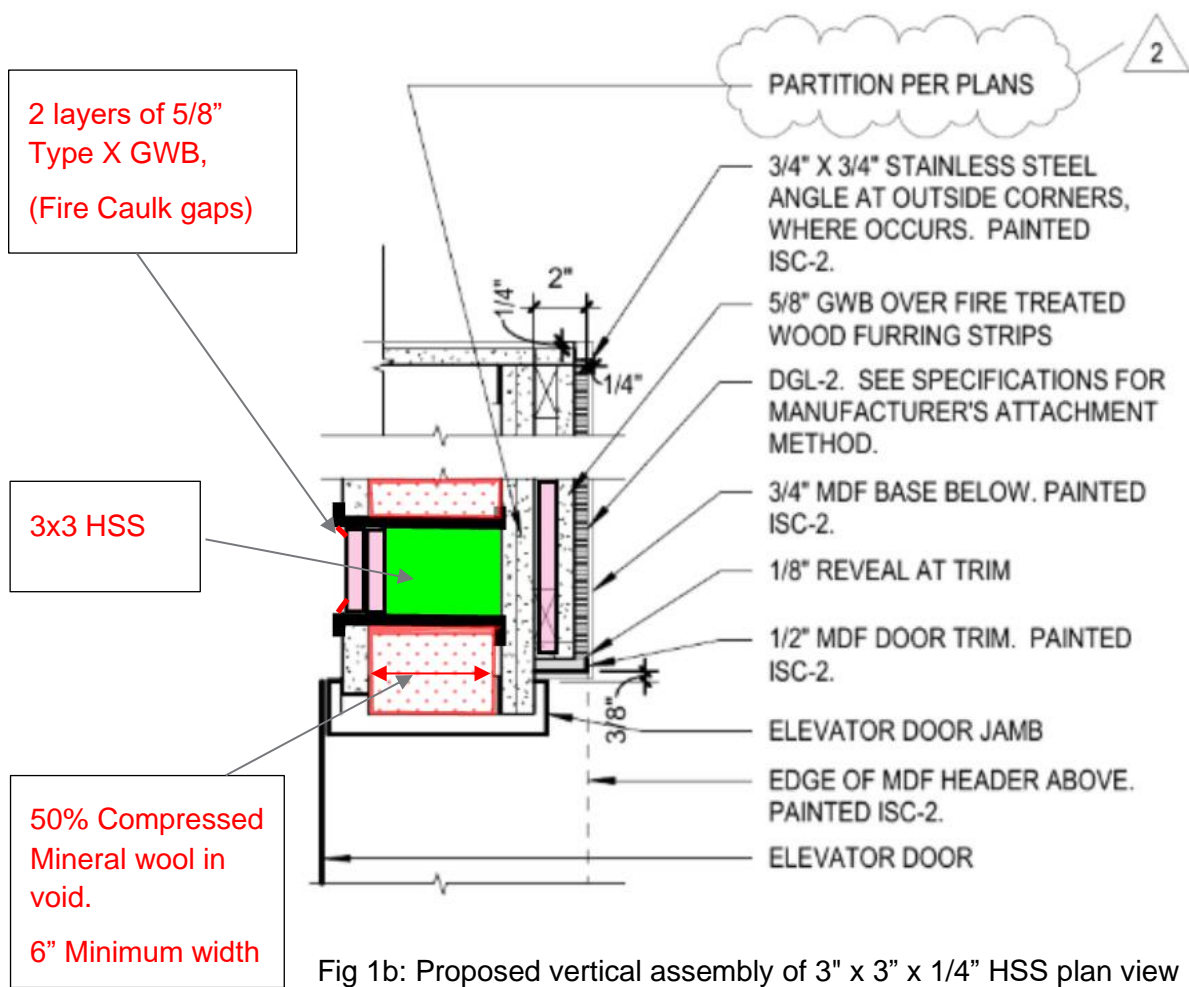


Fig 1b: Proposed vertical assembly of 3" x 3" x 1/4" HSS plan view

## 5 ASSEMBLY ANALYSIS

### 5.1 Proposed Assembly

The proposed assembly of HSS 3" x 3" x 1/4" as the primary structural member is an alternate to the W8 x 24 used in the test assembly N502 as shown in Figure 2.

Design No. N502

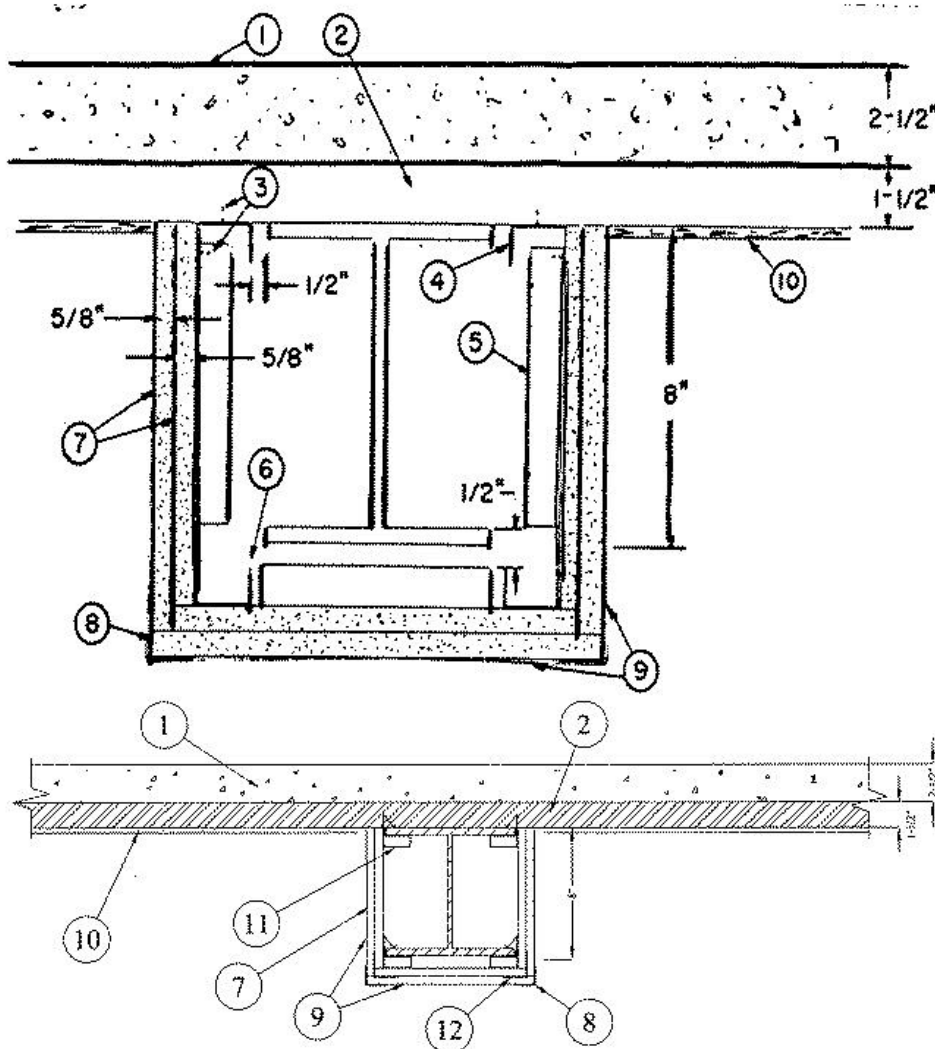
July 06, 2018

Restrained Beam Rating — 2 Hr.

Unrestrained Beam Rating — 2 Hr.

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide **BXUV** or **BXUV7**

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





**Steel Beam** — Min size, a W8 x 24 with outside dimensions of 7-7/8 x 6-1/2 in. with a flange thickness of 3/8 in., a web thickness of 1/4 in., and a cross-sectional area of 7.06 sq in.

1. **Normal Weight Concrete** — 148 pcf.
  2. **Steel Floor and Form Units\*** — 1-1/2 in. fluted type, welded to beam.
  3. **Drill Screw** — No. 8-18 by 1/2 in. long Phillips panhead drill screws, self-drilling and self-tapping, made of case-hardened steel.
  4. **Runner Channel** — Fabricated from 25 MSG galv steel, 1-11/16 in. deep with 1-in. legs. Fastened to steel deck with Item 3, 12 in. OC.
  5. **Channel Bracket** — Same material as Item 4 and fastened to runner channels with Item 3. Bracket spaced 24 in. OC.
  6. **Corner Channel** — Same material as Item 4. Placed in cutouts of channel brackets without attachment.
  7. **Gypsum Board\*** — 5/8 in. thick. First layer fastened with 1-1/4 in. long, 0.150-in. diam screws and spaced 16 in. OC. Second layer attached with 1-3/4 in. long, 0.150-in. diam screws spaced 8 in. OC. Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.
  8. **Corner Bead** — Fabricated from 20 MSG galv steel to form an angle with 1-1/4 in. legs. Legs perforated with 1/4 in. diam holes approx. 1 in. OC. Attached to wallboard with special crimping tool approx. 6 in. OC. As an alternate, the bead may be nailed to the wallboard.
  9. **Joint Compound** — 1/32 in. thick on bottom and sides of wallboard from corner beads and feathered out. Paper tape embedded in joint compound over joints with edges of compound feathered out. Nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard. Joints reinforced.
  10. **Protective Material — Spray-Applied Fire Resistive Materials\*** — Spray applied to the underside of the steel floor units, filling the flutes of the units and providing a smooth ceiling which was 1/4 in. thick as measured from the bottom plane of the floor units.  
See Spray-Applied Fire Resistive Materials (CHPX) category for names of manufacturers .
  11. **Alternate Construction — Steel Framing Members** — As an alternate to items 3, 4, 5 and 6, steel clips attached to both sides of beam flanges 2 ft OC and at ends of beam. First layer of gypsum board fastened to steel clips with 1-1/4 in. long Type S drywall screws. 2 in. by 2 in. 25 MSG angle fastened to clips on bottom portion of assembly with 2 in. long Type S drywall screws. Second layer of gypsum board fastened to angle and clips with 2 in. long Type S drywall screws spaced 2 ft OC. Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.
- JOHN WAGNER ASSOCIATES INC, DBA GRABBER** — Type CBClip.

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

Last Updated on 2018-07-06

Figure 2: UL N502 Assembly

**Table 1: Comparison between Tested and Proposed beam assembly**

Element	UL Assembly Design No. N502	Proposed Assembly
Steel Member	<ul style="list-style-type: none"> <li>• W8 x 24 (W/D=0.704)</li> </ul>	<ul style="list-style-type: none"> <li>• HSS 3x3x1/4 (W/D=0.91) Exceeds minimum requirement</li> </ul>
1. Normal Weight Concrete	<ul style="list-style-type: none"> <li>• 148 pcf</li> </ul>	<ul style="list-style-type: none"> <li>• N/A to review</li> </ul>
2. Steel Floor and Form Units	<ul style="list-style-type: none"> <li>• 1-1/2 in. fluted type, welded to beam.</li> </ul>	<ul style="list-style-type: none"> <li>• N/A to review</li> </ul>
3. Drill Screw	<ul style="list-style-type: none"> <li>• No. 8-18 by 1/2" long Phillips panhead drill screws, self-drilling and self-tapping, made of case-hardened steel.</li> </ul>	<ul style="list-style-type: none"> <li>• Attach GWB directly to HSS Member</li> </ul>
4. Runner Channel	<ul style="list-style-type: none"> <li>• Fabricated from 25 MSG galv steel, 1-11/16" deep with 1-in. legs.</li> <li>• Fastened to steel deck with drill screws (Item 3), 12" O.C</li> </ul>	<ul style="list-style-type: none"> <li>• Not Use, GWB attached directly to member.</li> </ul>
5. Channel Bracket	<ul style="list-style-type: none"> <li>• Same material as runner channel (Item 4) and fastened to runner channels with drill screws (Item 3).</li> <li>• Bracket spaced 24" O.C.</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
6. Corner Angle	<ul style="list-style-type: none"> <li>• Same material as runner channel (Item 4). Placed in cutouts of channel brackets without attachment.</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
7. Gypsum Board*	<ul style="list-style-type: none"> <li>• 5/8" thick. First layer fastened with 1-1/4" long, 0.150" diam screws and spaced 16" OC.</li> <li>• Second layer attached with 1-3/4" long, 0.150" diam screws spaced 8" OC.</li> <li>• Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.</li> </ul>	<ul style="list-style-type: none"> <li>• Base layer 5/8" type X wallboard to be attached directly to HSS Member. (Use power actuated pin X-U pin @ 16" o/c)</li> <li>• Second layer 5/8" type X wallboard applied directly to First layer, attached with 1" long, 0.150" diam screws spaced 12" OC.</li> </ul>

Element	UL Assembly Design No. N502	Proposed Assembly
8. Corner Bead	<ul style="list-style-type: none"> <li>• Fabricated from 20 MSG galv steel to form an angle with 1-1/4" legs.</li> <li>• Legs perforated with 1/4" diam holes approx. 1" OC.</li> <li>• Attached to wallboard with special crimping tool approx. 6" OC.</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
9. Joint Compound	<ul style="list-style-type: none"> <li>• 1/32" thick on bottom and sides of wallboard from corner beads and feathered out.</li> <li>• Paper tape embedded in joint compound over joints with edges of compound feathered out.</li> <li>• Nom 3/32" thick gypsum veneer plastic may be applied to the entire surface of Classified veneer baseboard.</li> <li>• Joints reinforced.</li> </ul>	<ul style="list-style-type: none"> <li>• Joints are not needed due to size of beam coverage. (If joints are necessary, reinforce joints)</li> <li>• Paper tape embedded in joint compound over joints with edges of compound feathered out.</li> <li>• Face Layer Screw holes shall be filled with Joint compound.</li> <li>• A 1/4" bead of fire caulking to be provided at the interface between the shaft GWB and the new 5/8" gypsum board.</li> </ul>
10. Protective Material – SFRM*	<ul style="list-style-type: none"> <li>• Spray applied to the underside of the steel floor units, filling the flutes of the units and providing a smooth ceiling 1/4" thick as measured from the bottom plane of the floor units.</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
11. Additional Protection	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Compressed Mineral Wool (6" wide Compression 50%) (Standard Weight MW-2 PCF)</li> <li>• Apply Fire Caulking at Edges (as Shown)</li> </ul>
<b>Fire-Resistance Rating</b>	<b>2-Hour</b>	<b>2-Hour (minimum)</b>

## 5.2 W/D Comparison of HSS and W-Beam

W/D ratios provide a means of evaluating different structural members for the purpose of fire protection rated resistance. Larger W/D Ratios intuitively provide a longer resistance to temperature rise and failure through excessive heating per SFPE Handbook. The larger the W/D ratio (or A/P with HSS member), the fewer fire protection layers need to be added to achieve the required fire resistance rating.

### 5.3 Evaluation

The listed wide flange structural steel beam with ASTM designation W8 x 24 used in the E119 test (Heated on 3 sides), has a W/D ratio of 0.704, with 2-hour fire rating as shown in Figure 3.

METRIC					IMPERIAL				
	Column		Beam			Column		Beam	
SIZE (mm x kg/m)	M/D	Heated Perimeter (m)	M/D	Heated Perimeter (m)	SIZE (in. x lb./ft.)	W/D	Heated Perimeter (in.)	W/D	Heated Perimeter (in.)
W 200 x 42	40.0	1.06	47.6	0.894	W 8 x 28	0.688	40.7	0.819	34.2
x 36	34.8	1.05	41.4	0.885	x 24	0.591	40.6	0.704	34.1

Figure 3: W/D ratio for W8 x 24

The proposed assembly of HSS 3" x 3" x 1/4" has W/D ratio of 0.91, as shown in figure 4:

IMPERIAL						
COLUMN				BEAM		
SIZE (in. x in. x in.)	A/P	W/D	Heated Perimeter (in.)	A/P	W/D	Heated Perimeter (in.)
3 x 3 x 0.375	0.314	1.07	10.8	0.368	1.25	9.20
x 0.313	0.267	0.91	11.0	0.320	1.09	9.16
x 0.250	0.218	0.74	11.2	0.267	0.91	9.13
x 0.188	0.166	0.56	11.4	0.208	0.71	9.10
x 0.125	0.112	0.38	11.6	0.144	0.49	9.07

Figure 4: W/D ratio for HSS 3" x 3" x 1/4"

The HSS member has an inherent fire resistance greater than the tested W beam. W/D comparison:  
0.91 > 0.704.

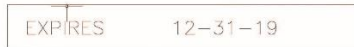
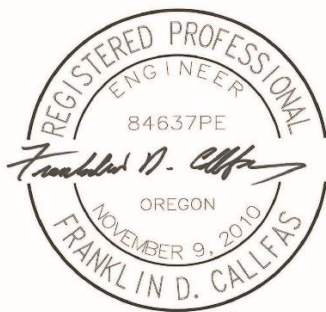
Note: Tested member is heated on 3 sides, while proposed design is only exposed to heat from 1 side (shaft).

## 6 CONCLUSION

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When evaluated with exposure from one side, the proposed steel tube beam is thicker and provides greater heat resistance than the UL tested beam and therefore requires less added fire protection material than the UL tested assembly. The proposed member will be heated only from the interior/ shaft facing side. Two layers of 5/8" type X GWB provide protection for the shaft exposed face, while compressed Mineral Wool ensures heat will not be transferred through the cavity.

Therefore, the proposed design for the HSS members near the elevator doors will maintain the required 2-hour rating as compared and detailed in this letter against the UL fire assembly, while maintaining the minimum 2-hour wall rating.



*Franklin Callfas*

Principal/Fire Protection Engineer

Code Unlimited