Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 20420	**Project Address:** 5060 N Greeley Ave
Hearing Date: 5/22/19	**Appellant Name:** George-Michael Rusch
Case No.: B-010	**Appellant Phone:** 503 946 5908
Appeal Type: Building	**Plans Examiner/Inspector:** Brian McCall
Project Type: commercial	**Stories:** 4 **Occupancy:** A-2 A-3 **Construction Type:** III-A
Building/Business Name: adidas	**Fire Sprinklers:** Yes - Throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 18-279416-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4]	**Proposed use:** Gymnasium

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	703.2
Requires	The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263 or in accordance with Section 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements, components or assemblies shall not reduce the required fire-resistance rating.
Proposed Design	The proposed design consists of two (2) glulam girders connected to a 1-hour fire rated HSS column through a 2.75” steel plate and two (2) 0.5” thick steel stiffeners. The 2.75”x8”x32” steel plate is adjacent to the HSS column. The two (2) 0.5”x6”x12” steel plate stiffeners are welded on the HSS column and the 2.75” thick steel plate. The exposed sides of the steel plates are protected with 0.047” of intumescent paint to provide 1-hour fire-resistance as compared with UL N635. The intumescent coating extends 1” into the penetration of the glulam girders to provide complete protection of the gap.
Reason for alternative	The steel plates are required to have a 1-hour fire rating to provide continuous protection of the fire-resistance of the HSS column. UL tested assemblies are not available to define this unique condition, hence the appeal. Code Unlimited has reviewed the proposed design against the tested beam, UL N635, as permitted by OSSC §703.3. The proposed W/D ratio is greater than the tested W/D ratio, which implies a greater inherent fire-resistance. The steel plates are protected with 0.047” intumescent

coating to provide 1-hour fire-resistance, equivalent intumescent application to the tested UL assembly.

Therefore, the proposed design for the steel plates coated with intumescent paint will exceed the minimum 1-hour fire-resistance as required per the OSSC. Hence, we urge you to approve this appeal.

Appeal item 2

Code Section	703.2
Requires	The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263 or in accordance with Section 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements, components or assemblies shall not reduce the required fire-resistance rating.
Proposed Design	The proposed design consists of 5 ½" X 5 ½" X 3/8" HSS beam supporting the roof, which includes 5 ply CLT, polyiso insulation, and cover board with PV waterproofing membrane. The beam will be encased with two layers of Type X gypsum board. The HSS beam will be fire caulked at the joints to the CLT member. These members are considered as primary structure. Per 2014 OSSC Table 601, primary structural members for Type IIIA construction are required to be encapsulated for a minimum 1-hour fire-resistance. The beams will be exposed to fire from below and the assembly will require protection from three exposed sides. Please refer to the attached Engineering Judgement Report, stamped by an Oregon licensed fire protection engineer, for more details.
Reason for alternative	The HSS beam is required to have a 1-hour fire rating per Table 601 of the OSSC. UL tested assemblies are not available to define this unique condition, hence the appeal. Code Unlimited has reviewed the proposed design using the component additive method and comparison against the 2-hour tested beam, UL N501, as permitted by OSSC §703.3. The proposed member W/D ratio is greater than the tested beam W/D ratio, which implies a greater inherent fire-resistance. The HSS beam is protected with 2 layers of 5/8" Type X gypsum board, equivalent application of gypsum boards in the 2-hour tested assembly, to provide a minimum 1-hour fire-resistance. Therefore, the proposed design for the HSS beam encased within the gypsum board assembly will exceed the required minimum 1-hour fire-resistance as compared and detailed in the attached report with the tested assembly UL N501. Hence, we urge you to approve this appeal.

APPEAL DECISION

1: Alternate 1 hour fire rated HSS beam assembly with engineering analysis: Granted as proposed.

2. Alternate 1 hour fire rated steel plate 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 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.

1-Hour HSS Beam

Engineering Judgement Report
Gypsum Board Protection of HSS Beam

Client Name: Lever Architecture

Client Address: 4713 N Albina Ave, 4th Floor, Portland, OR 97217

Date: 5/17/2019

Table of Contents

1. PROJECT OVERVIEW

Lever Architecture is designing the new South Building located on the Adidas campus in Portland, Oregon. The proposed building is four levels above grade of Type III-A construction and three levels below grade of Type I-A construction. The building is occupied by occupancy groups A-2, A-3, B, S-1, and S-2. The building is protected by an automatic fire sprinkler system and fire alarm throughout.

Code Unlimited has been asked to provide analysis for the fire protection of a 5 ½" X 5 ½" X 3/8" HSS beam encased with 2-layers of gypsum board to ensure 1-hour fire-resistance will be provided as required per OSSC.

2. APPLICABLE CODES, STANDARDS, AND GUIDES

- 2014 Oregon Structural Specialty Code (OSSC), including the recently adopted Appendix N.

3. DISCUSSION

3.1 Approach

- The proposed steel plates have been analyzed in accordance with 2014 OSSC §703.3 **Alternative Methods for Determining Fire Resistance**.
- The proposed design is compared to the 2-hour fire rated beam assembly, UL Design No. N501.
- 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 proposed design consists of 5 ½" X 5 ½" X 3/8" HSS beam supporting the roof, which includes 5 ply CLT, polyiso insulation, and cover board with PV waterproofing membrane. The beam will be encased with two layers of Type X gypsum board. The HSS beam will be fire caulked at the joints to the CLT member.

These members are considered as primary structure. Per 2014 OSSC Table 601, primary structural members for Type IIIA construction are required to be encapsulated for a minimum 1-hour fire-resistance. The beams will be exposed to fire from below and the assembly will require protection from three exposed sides.

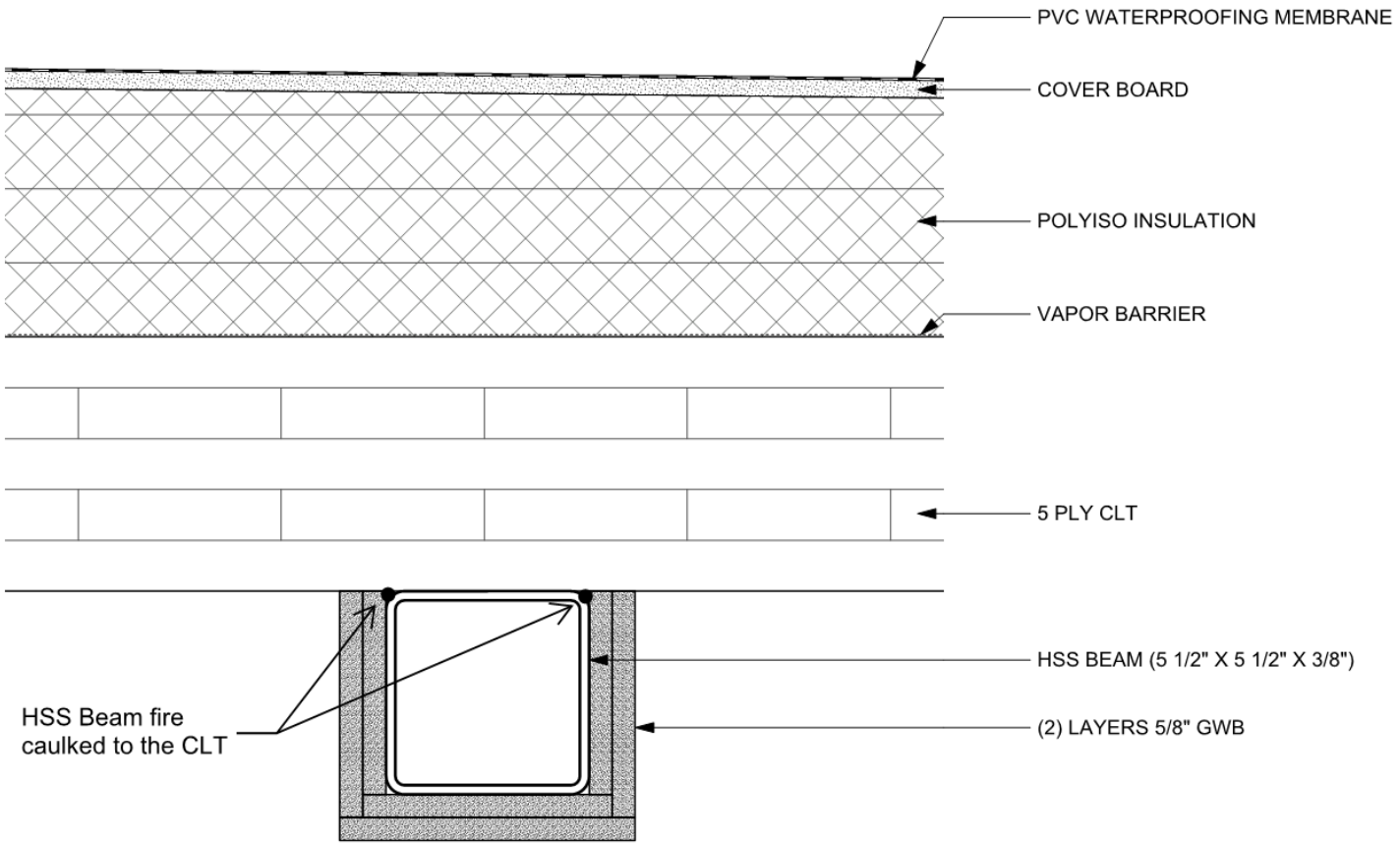


Figure 1: Proposed HSS beam supporting the roof.

5. ASSEMBLY ANALYSIS

5.1 Component Additive Method

2014 OSSC Table 722.2.1.4(2) allows for equivalent fire protection time of 40 minutes for each layer of 5/8" Type X gypsum board, which totals up to 80 minutes for the two layers on fire-exposed side of the beam.

5.2 UL Design No. N501 Comparison

Adequate testing is not available for a 1-hour assembly. Therefore, the proposed design is compared to the 2-hour W8x24 beam tested in UL N501,.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. N501

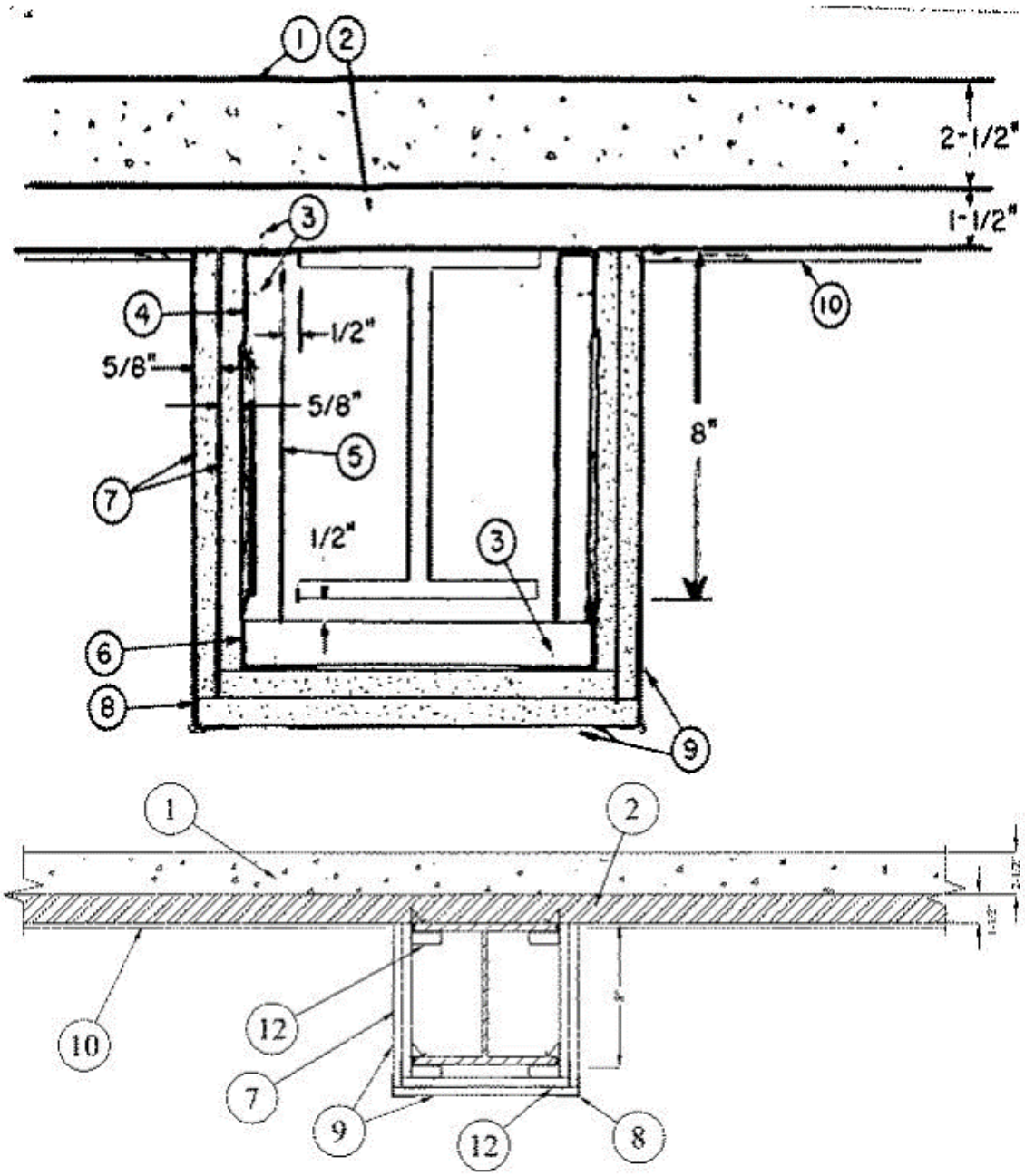
July 06, 2018

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 W8X24 with outside dimensions of 7-7/8x6-1/2 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 Angle —** 24 MSG galv steel with 1 and 2-in. legs. Fastened to steel deck 12 in. O.C. with Item 3.

5. **Channel Bracket —** Fabricated from 25 MSG galv steel, 1-11/16 in. deep with 1-in. legs and spaced 24 in. O.C. Fastened to the runner angles with Item 3.

6. **Corner Angle —** Same material as Item 4, fastened to channel brackets with Item 3.

7. **Gypsum Board* —** 5/8 in. thick. First layer fastened with 1-1/4 in. long, 0.150 in. diam screws spaced 16 in. O.C. Second layer attached with 1-3/4 in. long, 0.150 in. diam screws spaced 8 in. O.C. Screws are self-drilling and self-tapping Phillips head made of case-hardened steel.
ACADIA DRYWALL SUPPLIES LTD — Type X, 5/8 Type X, Type Blueglass Exterior Sheathing

AMERICAN GYPSUM CO — Types AGX-1, AG-C, LightRoc.

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1.

CERTAINTEED GYPSUM INC — Types FRPC, SF3, EGRG, GlasRoc, GlasRoc-2, Type C, Type X, Type X-1, Easi-Lite Type X-2.

CGC INC — Type C, IP-X1, IP-X2, IPC-AR, SCX, SHX or WRX.

CONTINENTAL BUILDING PRODUCTS OPERATING CO, L L C — Types LGFC6A, LGFC-C/A.

GEORGIA-PACIFIC GYPSUM L L C — Types 5, C, DAP, DD, DA, DAPC, DGG, DS, GPFS1, GPFS6, TG-C, Type X, Veneer Plaster Base-Type X, Water Rated-Type X, Sheathing Type-X, Soffit-Type X, GreenGlass Type X, Type LWX, Veneer Plaster Base-Type LWX, Water Rated-Type LWX, Sheathing Type-LWX, Soffit-Type LWX, Type LW2X, Veneer Plaster Base - Type LW2X, Water Rated - Type LW2X, Sheathing - Type LW2X, Soffit - Type LW2X.

NATIONAL GYPSUM CO — Types FSK, FSK-C, FSK-G, FSL, FSMR-C, FSW, FSW-C, FSW-G, FSW-3, FSW-6, FSW-8.

NATIONAL GYPSUM CO — Riyadh, Saudi Arabia — Type FR, or WR.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-3, PG-9, PG-11, PG-C, or PGS-WRS.

PANEL REY S A — Type PRC

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type C, Type X.

UNITED STATES GYPSUM CO — Types C, IP-X1, IP-X2, IPC-AR, SCX, SHX, WRX, ULIX.

USG BORAL DRYWALL SFZ LLC — Types C, SCX

USG MEXICO S A DE C V — Types C, IP-X1, IP-X2, IPC-AR, SCX, SHX, WRX.

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.

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 Joint System —** (Not Shown) — For lath only. A 1/16 in. thickness of gypsum plaster applied to entire exposed surface over either paper tape on joints embedded in cementitious compound or 2 1/2 in. wide glass fiber tape stapled 8 in. OC on joints.

12. **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 steel 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 CB Clip.

*** 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

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

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Figure 2: Detailed requirements of UL N501

IMPERIAL						
	COLUMN			BEAM		
SIZE (in. x in. x in.)	A/P	W/D	Heated Perimeter (in.)	A/P	W/D	Heated Perimeter (in.)
5.5 x 5.5 x 0.375	0.331	1.13	20.8	0.412	1.40	16.7
x 0.313	0.278	0.95	21.0	0.351	1.19	16.7
x 0.250	0.225	0.77	21.2	0.287	0.98	16.6
x 0.188	0.170	0.58	21.4	0.219	0.75	16.6
x 0.125	0.114	0.39	21.6	0.149	0.51	16.6

IMPERIAL				
	Column		Beam	
SIZE (in. x lb./ft.)	W/D	Heated Perimeter (in.)	W/D	Heated Perimeter (in.)
W 8 x 28	0.688	40.7	0.819	34.2
x 24	0.591	40.6	0.704	34.1

Figure 3: W/D ratio for the proposed and tested beams

Table 1: Comparison between UL tested and proposed HSS assembly

Element	UL Assembly Design No. N501	Proposed Assembly
1. Steel Beam	Steel Beam; min size W 8 x 24 (W/D ratio = 0.704)	5 ½" X 5 ½" X 3/8" HSS beam (W/D = 1.40) **Higher Inherent Fire-Resistance**
2. Normal Weight Concrete	148 pcf	5 Ply CLT **Exceeds 1-Hour rating. (Rating not required for 1-Hr evaluation)**
3. Steel Floor and Form Units	1-½" fluted type, welded to beam	Not required for evaluation
4. Drill Screw	No. 8-18 by ½" long Phillips panhead drill screw	Self-Tapping Tek Screws. (Predrill Member)

Element	UL Assembly Design No. N501	Proposed Assembly
5. Runner Angle	24 MSG galv steel with 1 and 2” legs	Air Gap not provided
6. Channel Bracket	Fabricated from 25 MSG galv steel	Air Gap not provided
7. Corner Angle	Same as Item #4	Air Gap not provided
8. Gypsum Board	2 layers of 5/8” Type X gypsum board	2 layers of 5/8” Type X gypsum board **Equivalent**
Fire-Resistance Rating	**2-hour fire-resistance rating**	**Exceeds 1-hour fire-resistance rating**

6. SUMMARY

The 1-hour fire protection of the beam will be achieved by the protection provided from the two layer of 5/8” Type X gypsum boards encasing the beam.

From the component additive method (2) layers (5/8”) of Type “X” gypsum wallboard provides 80 minutes of protection for the beam exposed sides. OSSC, allows up to 60 Minutes of assigned protection.

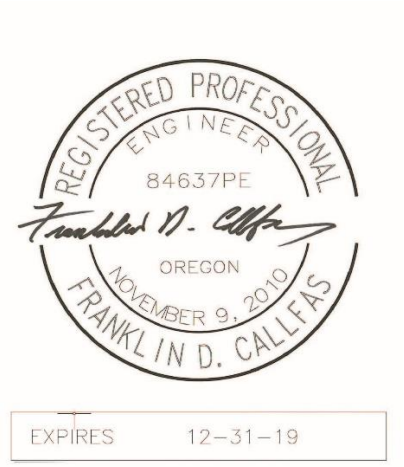
Additionally, UL test N501 was also considered to compare the protection provided by the gypsum board for the HSS beam. The proposed HSS beam fire protection is compared to the tested beam using the W/D ratio. The proposed W/D ratio (1.40) is higher than the tested W/D ratio (0.704) due to the limited heated perimeter and greater steel mass. Additionally, UL N501 is tested for 2-hour fire-resistance rating. Therefore, the proposed two layers of 5/8” Type X gypsum board encasing the HSS beam provides near equivalency to the UL assembly to ensure a minimum of 1-hour fire-resistance is provided.

Two items that are not equivalent to the UL assembly are the concrete deck above and the air gap for the 2-hour UL assembly. The wood decking does not act as a heat sink and an air gap is not provided, which would extend the proposed assembly rating for 120 minutes. Wood charring provides protection for the top surface of the beam. From the NDS, TR10, char rate perpendicular to heat source should be estimated at 50% of that for parallel charring, or 0.9” per hour horizontally which is less than the thickness of the GWB (1.25”). Fire caulking is provided as a secondary measure to ensure protection of the gap between the wood and GWB layer.

7. CONCLUSION

Code Unlimited has reviewed the proposed design using the component additive method and comparison against the 2-hour tested beam, UL N501, as permitted by OSSC §703.3. The proposed member W/D ratio is greater than the tested beam W/D ratio, which implies a greater inherent fire-resistance. The HSS beam is protected with 2 layers of 5/8” Type X gypsum board, equivalent application of gypsum boards in the 2-hour tested assembly, to provide a minimum 1-hour fire-resistance.

Therefore, the proposed design for the HSS beam encased within the gypsum board assembly will exceed the required minimum 1-hour fire-resistance as compared and detailed in this report with the tested assembly UL N501.



Franklin Callfas
Principal/Fire Protection Engineer
Code Unlimited

1-Hour Steel Plate

Engineering Judgement Report
Intumescent Paint Protection of Steel Plates

Client Name: Lever Architecture

Client Address: 4713 N Albina Ave, 4th Floor, Portland, OR 97217

Date: 5/17/2019

Table of Contents

1 PROJECT OVERVIEW

Lever Architecture is designing the new South Building located on the Adidas campus in Portland, Oregon. The proposed building is four levels above grade of Type III-A construction and three levels below grade of Type I-A construction. The building is occupied by occupancy groups A-2, A-3, B, S-1 and S-2. The building is protected by an automatic fire sprinkler and fire alarm systems throughout.

Code Unlimited has been asked to provide analysis for the fire protection of a 2.75”x8”x32” steel plate and two (2) 0.5”x6”x12” steel plates covered with intumescent paint to ensure 1-hour fire-resistance will be provided as required per OSSC.

2 APPLICABLE CODES, STANDARDS, AND GUIDES

- 2014 Oregon Structural Specialty Code (OSSC), including the recently adopted Appendix N.

3 DISCUSSION

3.1 Approach

- The proposed steel plates have been analyzed in accordance with 2014 OSSC §703.3 **Alternative Methods for Determining Fire Resistance**.
- The proposed design is compared to the 1-hour fire rated beam, UL Design No. N635.
- 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 proposed design consists of two (2) glulam girders connected to a 1-hour fire rated HSS column through a 2.75” steel plate and two (2) 0.5” thick steel stiffeners. The 2.75”x8”x32” steel plate is adjacent to the HSS column. The two (2) 0.5”x6”x12” steel plate stiffeners are welded on the HSS column and the 2.75” thick steel plate (Figures 1 and 2). The exposed sides of the steel plates are protected with 0.047” of intumescent paint to provide 1-hour fire-resistance as compared with UL N635. The intumescent coating extends 1” into the penetration of the glulam girders to provide complete protection of the gap.

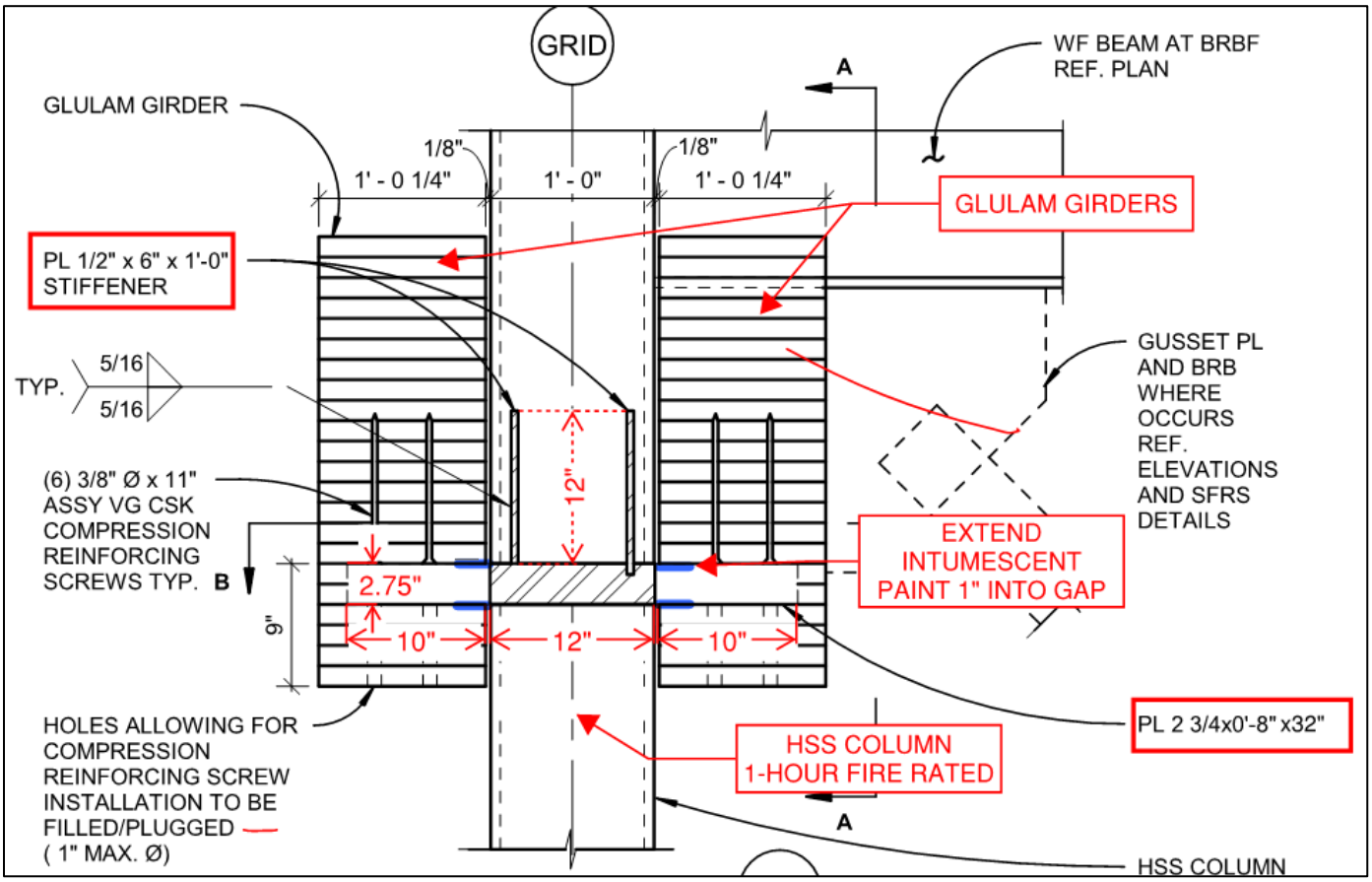


Figure 1: Proposed connection of glulam girders and HSS column using steel plates as shown.

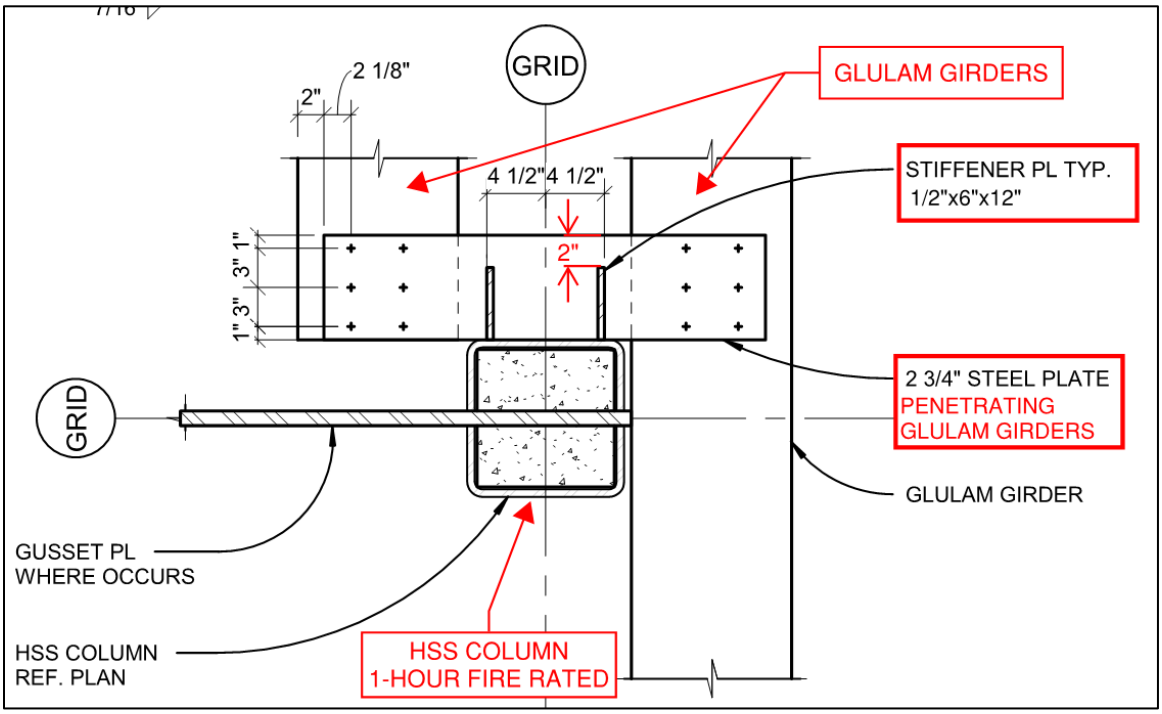


Figure 2: Plan view of proposed assembly.

5 ASSEMBLY ANALYSIS

5.1 W/D Ratio

The proposed fire protection of the exposed steel plates is to provide intumescent coating on all exposed surfaces. The calculated W/D ratio of the steel plates will be used for comparison with the tested UL beam, N635. W is the weight per unit length (lb/ft) and D is the heated perimeter (in.). The weight per unit length of a member is divided by the length of exposed heated perimeter area to determine the inherent fire resistance of a member. Lower W/D ratios correspond with thinner steel members that will be subject to earlier failure when heated.

The weight of the 2.75" thick steel plate is 112.20 lbs/ft^2 and the 0.5" thick steel plate is 20.40 lbs/ft^2 (*Steel Plates – Size & Weight*, Engineering Toolbox 2009). The weight of the single 2.75" thick plate per linear foot is 74.8 lbs/ft. The weight of a single 0.5" plate per linear foot is 10.2 lbs/ft.

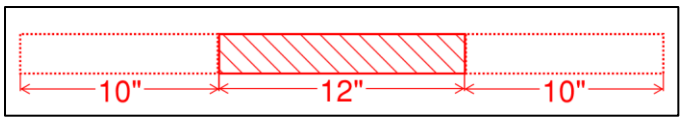


Figure 3: Section of 2.75" thick plate.

Steel Weight
Single plate = **74.8 lbs/ft.**

Heated Perimeter
Single plate—8" + 8" + 2.75" = **18.75"**
Calculated W/D (A) Ratio = **3.99**

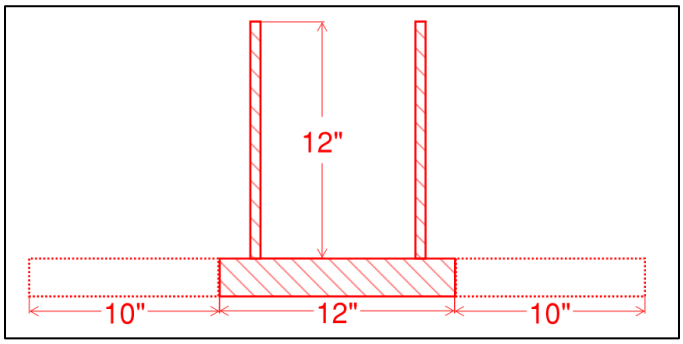


Figure 4: Section of all exposed steel plates.

Stiffener Evaluation
Single 0.5" thick plate.
Equivalent to the flange thickness dimension of a W8x35 beam.

Therefore, since the W/D ratio of the Steel plate of 3.99 far exceeds any UL tested member, we will focus on the thinnest member of the assembly the ½" stiffeners. These stiffeners are as thick as the flange of a W8x35

beam. Therefore, we will provide a comparison to a W8x35 beam and include the required protection thickness for the entire proposed assembly.

5.2 UL Design No. N635 Comparison

The proposed design is exposed steel plates connecting glulam girders to a 1-hour fire rated HSS column is compared to the W8x35 beam tested in UL N635.

Design No. N635

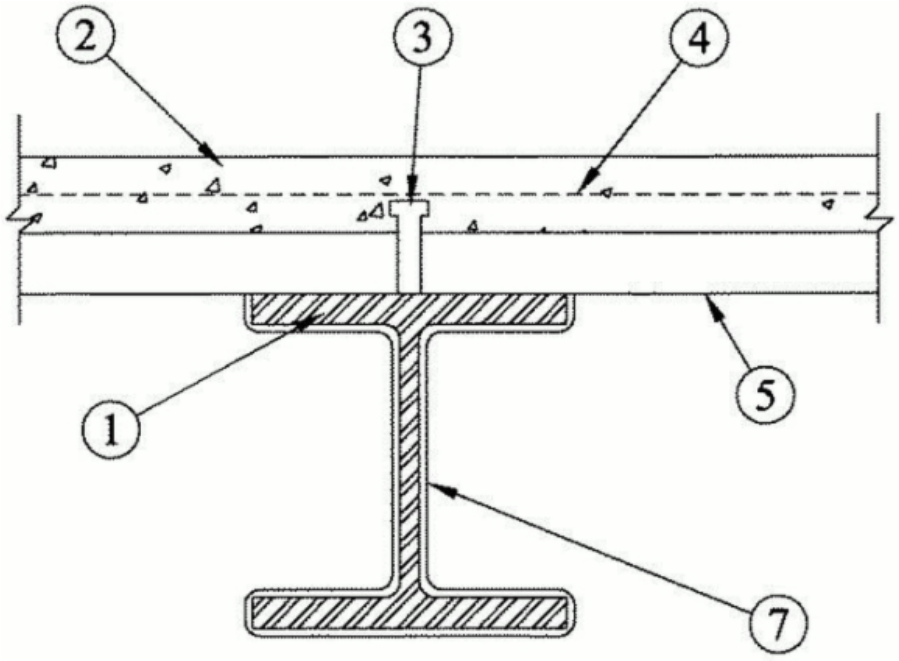
September 22, 2016

Restrained Beam Ratings - 1, 1-1/2, and 2 Hr. (See Item 7)

Unrestrained Beam Ratings - 1, 1-1/2 and 2 Hr. (See Item 7)

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.**



1. **Steel Beam —** W8x28 min size. Beams shall be free of dirt, loose scale and oil. Beams shall be primed with a phenolic modified alkyd resin primer, a metal alkyd primer, an acrylic primer or an epoxy primer at a nominal thickness of 1 mil.

2. **Normal Weight or Lightweight Concrete —** Compressive strength 3500 psi. For normal weight concrete either carbonate or siliceous aggregate may be used. Unit weight 146 lbs/cu ft. for normal weight concrete and 116 lbs/cu ft. for lightweight concrete. Min concrete thickness, as measured from top plane of steel floor and form units is 2-1/2 in.

3. **Shear Connector —** (Optional) — Studs, 3/4 in. diam headed type or equivalent per AISC specifications welded to the top flange of beam through the steel floor units.

4. **Welded Wire Fabric —** 6x6-10/10 SWG

5. **Steel Floor or Form Units —** 1-1/2, 2 or 3 in. deep cellular, fluted, or corrugated units, welded to beam.

6. **Mineral Wool Insulation —** (Not Shown) — Min 6 pcf mineral wool insulation cut into pieces and firmly packed into, and completely filling the spaces between the flutes of the steel floor and form units and the top flange of the beam. Mineral wool is not required when the top flange of the beam is protected with intumescent coating at the same thickness shown in the table in Item 7.

7. **Mastic and Intumescent Coatings*** **—** Coating spray or brush applied in accordance with the manufacturer's instructions at the min dry thickness as shown in the table below. The thickness shown below includes the primer thickness. When mineral wool (Item 6) is used, the top surface of the beam need not be protected with coating.

Beam Size	Unrestrained Beam Rating, Hr.	Minimum Dry Thickness	
		mils	mm
W8x28	1	47	1.19
W8x28	1-1/2	96	2.44
W8x28	2	154	4.11

Beam Size	Restrained Beam Rating, Hr.	Minimum Dry Thickness	
		mils	mm
W8x28	1	47	1.19
W8x28	1-1/2	70	1.77
W8x28	2	113	2.86

GREENTECH THERMAL INSULATION PRODUCTS MFG CO L L C — Type WB3, Investigated for Interior General Purpose. Type WB4, Investigated for Interior General Purpose. Type WB4, Investigated for Exterior Use with top coat as described in Item 8

ISOLATEK INTERNATIONAL — Type SprayFilm-WB 3 and Type WB3, Investigated for Interior General Purpose. Type SprayFilm-WB 4 and Type WB4, Investigated for Interior General Purpose. Type SprayFilm-WB 4 and Type WB4, Investigated for Exterior Use with top coat as described in Item 8

8. **Top Coat —** Type SprayFilm — TOPSEAL and Type TOPSEAL required for Exterior Use, applied at a minimum dry thickness of 14 mils (0.34 mm) over the intumescent material.

See Classification information in the **Mastic and Intumescent Coating** (CDWZ) category, Isolatek International, for mixing requirements.

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

Figure 5: UL N635.

N635 *Unrestrained Beam*

Floor Beams - Cellular & Corrugated Deck
Normal Weight and Lightweight Concrete
CAFCO® SprayFilm® WB 3 and WB 4 & ISOLATEK® Type WB 3 and WB 4

ASTM Desig.	W/D	Metric Desig.	M/D	Hp/A	1-Hour	1-1/2 Hour	2-Hour
W10 x 26	0.70	W250 x 39	41.3	191.4	NR	NR	NR
22	0.60	33	35.4	223.3	NR	NR	NR
19	0.60	28	35.4	223.3	NR	NR	NR
17	0.54	25	31.9	248.1	NR	NR	NR
15	0.48	22	28.3	279.1	NR	NR	NR
12	0.39	18	23.0	343.5	NR	NR	NR
W8 x 67	1.65	W200 x 100	97.4	81.2	0.047	0.096	0.154
58	1.44	86	85.0	93.0	0.047	0.096	0.154
48	1.21	71	71.4	110.7	0.047	0.096	0.154
40	1.03	59	60.8	130.1	0.047	0.096	0.154
35	0.90	52	53.1	148.9	0.047	0.096	0.154

Figure 6: Type WB 3 and WB 4 intumescent paint thickness to be applied to steel plates for 1-hour fire-resistance per ISOLATEK. Also shown is the W/D ratio of the tested beam.

Table 1: Comparison between UL N635 and the proposed steel plate assembly

Element	UL Assembly Design No. N635	Proposed Assembly
1. Steel	Steel Beam; W8 x 35 (W/D = 0.90 - Beam)	Steel Plates; (1) 2.75” thick plate + (2) 0.5” thick plates as stiffeners (W/D=3.99 -Plate) **Higher Inherent Fire-Resistance**
2. Intumescent Coating (IFRM)	Coating spray or brush applied in accordance with the manufacturer's instructions at the min dry thickness of 0.047” (Figure 6). The 0.047” thickness includes the primer thickness.	Coating spray or brush applied in accordance with the manufacturer's instructions at the min dry thickness of 0.047” (Figure 6). The 0.047” thickness includes the primer thickness. **See Summary**
Fire-Resistance Rating	**1-Hour**	**1-Hour (minimum)**

6 SUMMARY

During this evaluation, UL test N635 was considered to compare the required protection provided for the steel plates connecting the glulam girders to the 1-hour fire rated HSS column. The tested beam W8x35 requires 0.047” of intumescent painting to provide 1-hour of fire-resistance. The proposed steel plate fire protection is compared to the tested beam using the W/D ratio. The proposed assembly W/D ratio (3.99) is higher than the tested W/D ratio (0.90) due to the limited heated perimeter and greater steel mass. Additionally, the proposed member is substantially thicker than the tested beam member. The thinnest section of the proposed assembly is the ½” stiffeners which do not carry the loading of a beam but match the thin flange thickness of a W8x35 beam.

Therefore, the comparison as detailed in Table 1 provides the basis for the required coating. The proposed intumescent thickness is 0.047”, equivalent to the UL assembly will ensure a minimum of 1-hour fire-resistance.

It is important to ensure the gap between the wood and the steel plate is protected. Overlap the intumescent paint 1” onto the wood member or as an alternate extend the paint 1” into the wood/ steel gap (See note on Figure 1)

7 CONCLUSION

Code Unlimited has reviewed the proposed design against the tested beam, UL N635, as permitted by OSSC §703.3. The proposed W/D ratio is greater than the tested W/D ratio, which implies a greater inherent fire-resistance. The steel plates are protected with 0.047” intumescent coating to provide 1-hour fire-resistance, equivalent intumescent application to the tested UL assembly.

Therefore, the proposed design for the steel plates coated with intumescent paint will exceed the minimum 1-hour fire-resistance as required per the OSSC.

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