

Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 21909	Project Address: 4901 SE Hawthorne Blvd
Hearing Date: 9/25/19	Appellant Name: David Mullens
Case No.: B-007	Appellant Phone: 3605186985
Appeal Type: Building	Plans Examiner/Inspector: Steve Mortenson
Project Type: commercial	Stories: 4 Occupancy: S-2, M, R-2 Construction Type: I-A V-A V-A
Building/Business Name: 49th and Hawthorne	Fire Sprinklers: Yes - NFPA 13 Thru out
Appeal Involves: Erection of a new structure	LUR or Permit Application No.:
Plan Submitted Option: pdf [File 1] [File 2] [File 3]	Proposed use: New Multi-Use Building

APPEAL INFORMATION SHEET

Appeal item 1

Code Section OSSC 703.2

Requires 703.2 Fire-Resistance Ratings

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 Refer to Drawing S3A-1, SE 49th & Hawthorne Apartments.

This drawing shows nine wide-flange shapes and one HSS shape to be protected with intumescent coating. All of these members are beams. In all cases the required fire resistance for the structural steel is one hour.

Intumescent coating applied to this beam is used to provide primary fire resistance.

Intumescent coating shall also cover the exposed edges of the wood nailer on top of the Wide Flange (WF) beam. This will prevent the wood nailer from charring and exposing the top of the WF beam.

Reason for alternative Available Manufacture recommendations are for columns not beams, but from a fire protection standpoint columns in the field of a building are a more demanding condition than a beam. Using the manufacturer's recommended intumescent coating thickness

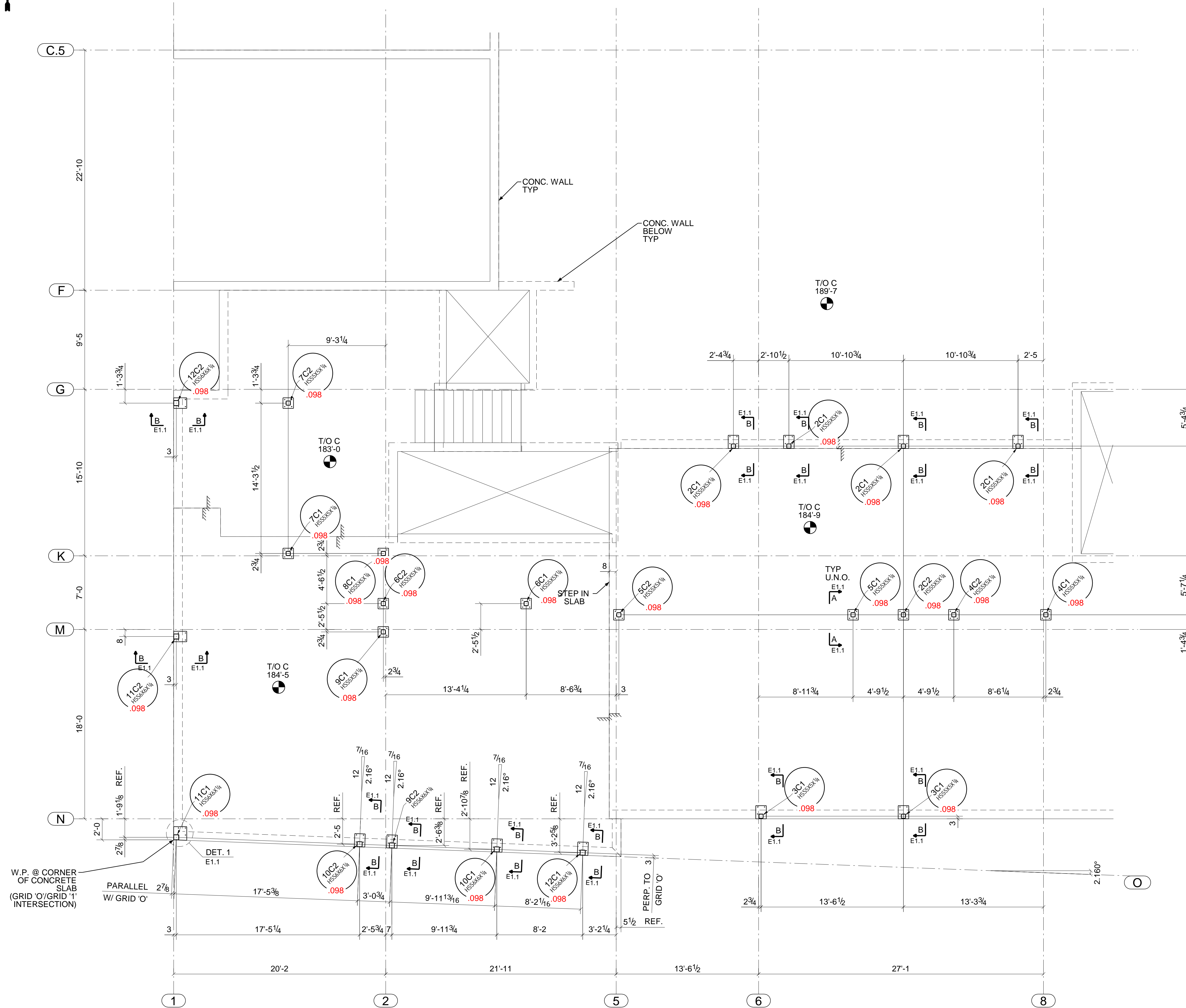
for a column on a beam with the similar W/D or A/P ratio provides at least as much fire resistance as published for the column

APPEAL DECISION

Alternate 1 hour fire rated assembly for wide flange and HSS beams 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.

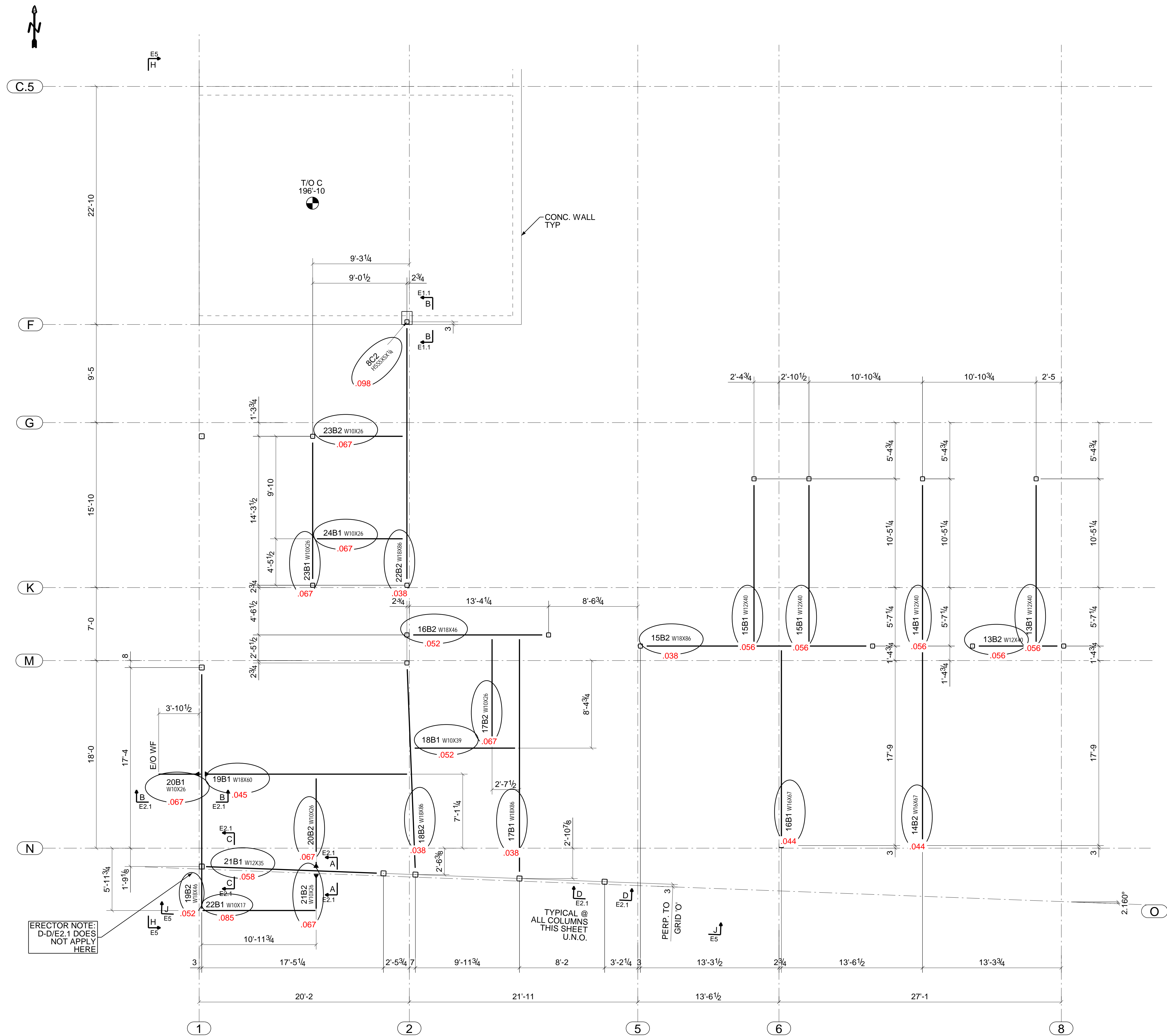
Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 90 calendar days of the date this decision is published. For information on the appeals process, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.



FOUNDATION PLAN - FIRST FLOOR
S2.11, A2.11S

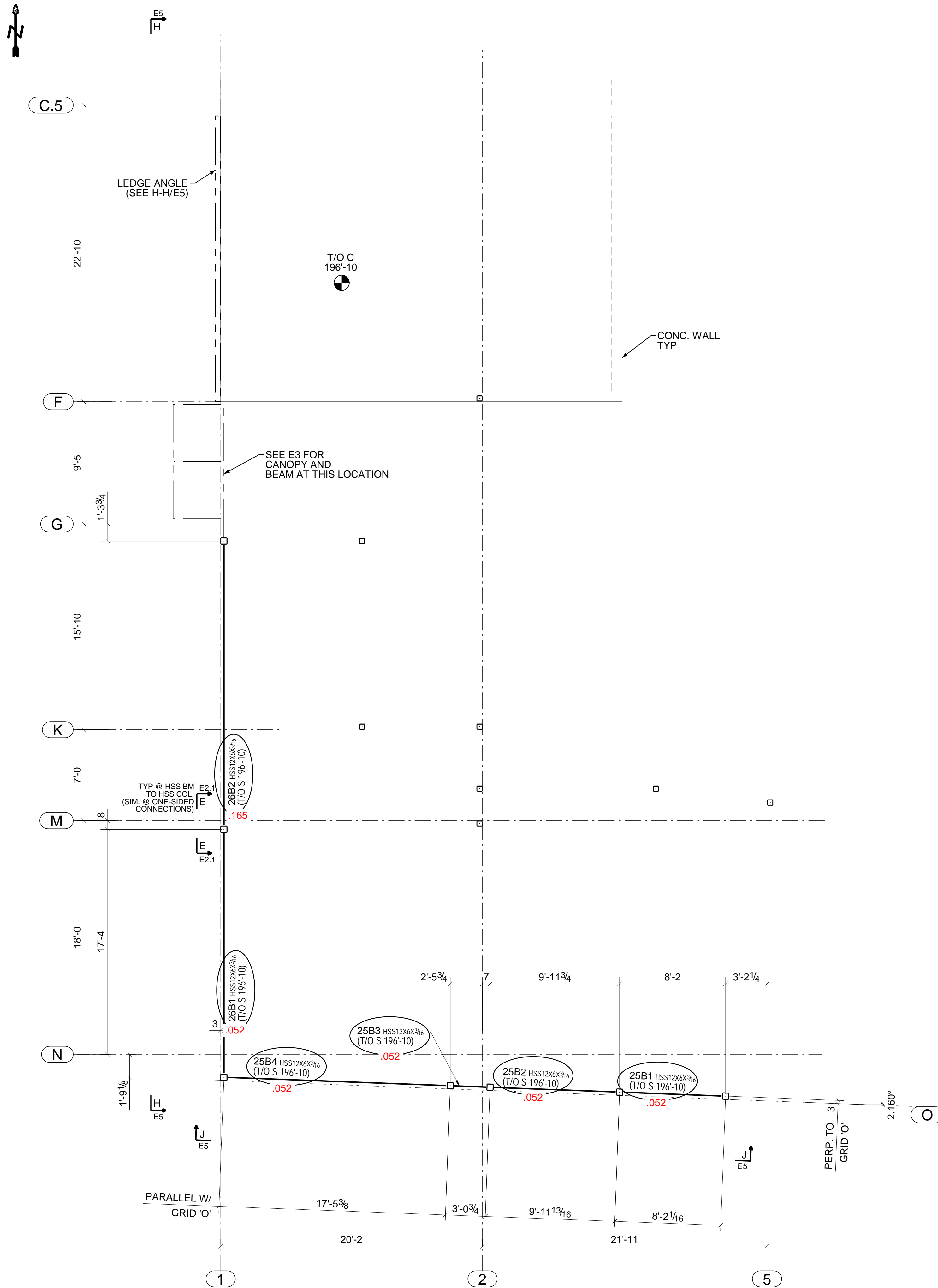
1478 SE 49th Ave
FOR STEEL LOCATION REFERENCE
WITH INTUMESCENT MILLAGE NOTED

NOTE:
1. DIMENSIONS ARE TO
C.L. OF COLUMNS U.N.O.



FRAMING PLAN - 2ND FLOOR
S2.12
T/O S ELEV. = 199'-0 1/2"

1478 SE 49th Ave
FOR STEEL LOCATION REFERENCE
WITH INTUMESCENT MILLAGE NOTED




PARTIAL PLAN - HIGH FRAMING @ CANOPY

1/56.01

1478 SE 49th Ave
FOR STEEL LOCATION REFERENCE
WITH INTUMESCENT MILLAGE NOTED

Letter

Date:	September 13, 2019
To:	Urban Development Group, Sent via Email
Attention:	David Mullens
From:	David Gessert, P. E. Fire Protection Engineer
Subject/Project:	49 th & Hawthorne 1478 SE 49 th Avenue Intumescent Coating Appeal
Job No.:	2019-36



Total Pages: 4

Introduction/Executive Summary

Life Safety Checksheet #2 from the City of Portland for the 49th & Hawthorne project requires a building code appeal to use a column assembly reference for the protection of beam. This letter is in support of that appeal.

A column is a more demanding fire protection than a beam as explained below. A beam is either protected on one or more sides from gaining heat or loses heat through conduction depending on the material that it is in contact with.

49th & Hawthorne – Intumescent Coating Analysis of Selected Steel Members

Refer to Drawing S3A-1, SE 49th & Hawthorne Apartments.

This drawing shows nine wide-flange shapes and one HSS shape to be protected with intumescent coating. All of these members are beams. In all cases the required fire resistance for the structural steel is one hour.

Intumescent coating applied to this beam is used to provide primary fire resistance. Intumescent coating shall also cover the exposed edges of the wood nailer on top of the Wide Flange (WF) beam. This will prevent the wood nailer from charring and exposing the top of the WF beam.

The test standard that is required to be met for this assembly is American Society for Testing and Materials (ASTM) E 119. See *Oregon Structural Specialty Code* (OSSC), 2014 Edition 703.2.

Per the ASTM E 119 time-temperature curve at one hour the test furnace has reached a temperature of approximately 1800°F. See Appendix for ASTM E 119 time-temperature curve.

Intumescent coatings swell or bubble up when exposed to heat and expands 15 to 30 times its original volume. These coatings, when heated, increase in volume and decrease in density, simulating the development of a char layer as is found on the surface of wood in fire conditions. As the intumescent char layer is formed when a blowing agent (a substance used to create bubbles in the material) is released which helps with the formation of a low-density, relatively thick carbonaceous layer. Intumescent coating's chemical process when heated is highly endothermic which contributes to extending the time before the structural steel members reaches its critical or yield temperature.

The intumescent mechanism involves the interaction of four types of compounds: a carbon source, an intumescent, a blowing agent, and a resin. When the coating becomes sufficiently heated, the carbon source reacts with a dehydrating agent to form a char, which is simultaneously expanded by gases released from the blowing agent. The resin binder prevents the gases from escaping. As a result, an insulating layer is produced that can be many times thicker than the original coating.

This char layer acts as insulation to the coated member thus delaying the temperature rise in the structural steel members during fire conditions.

The goal of intumescent coating is to keep the structural steel member from reaching a temperature of 1100°F. In determining the coating thickness the thermal mass of the member is taken into consideration. This thermal mass of a structural steel member is directly correlated to the weight per unit length of the member or the "W" in the W/D ratio. Similarly the "A" in the A/P ratio takes the thermal mass in consideration since the mass of the member is directly related to the cross sectional area. The greater the thermal mass the slower the member will rise in temperature when exposed to the ASTM E119 test chamber conditions.

Correspondingly the greater the heated perimeter of the structural steel member the faster the member will rise in temperature. This is the "D" in the W/D ratio and the "P" in the A/P ratio.

Columns are primarily exposed to axial loads and fail by buckling. With a column in the field of a floor (not in a wall or having other lateral bracing) a column can buckle in any direction. Moreover with a column in this position it is exposed to fire conditions on all sides and only loses heat or is insulated from gaining heat at its ends. From a fire protection standpoint a column is a more demanding position than a beam.

A beam typically fails by bending. Beams can fail by shear but this design constraint is rarely found in buildings. Moreover, beams typically have lateral restraint often provided by the floor or roof they support. Additionally beams typically are not exposed to fire conditions on all sides. They lose heat to or are insulated from gaining heat by the floor or roof they support. Due to

these heat transfer conditions and since beams fail in the plane of their bending this condition is equal to or less demanding than the column condition.

For intumescent coating thickness refer to Robert Casteel's August 9, 2019 letter.

Intumescent Coating Thickness

Steel Size	W/D or A/P	Thickness (mils)	Rating	UL Design Basis
W10x17	0.48	85	1 hour	Y615
W10x26	0.61	67	1 hour	Y615
W10x39	0.78	52	1 hour	Y615
W12x35	0.70	58	1 hour	Y615
W12x40	0.73	56	1 hour	Y615
W16x67	0.93	44	1 hour	Y615
W18x46	0.78 ¹	52	1 hour	Y615
W18x60	0.92	45	1 hour	Y615
W18x86	1.09	38	1 hour	Y615
HSS 12x6x3/16	0.18	165 ²	1 hour	Y614 ²

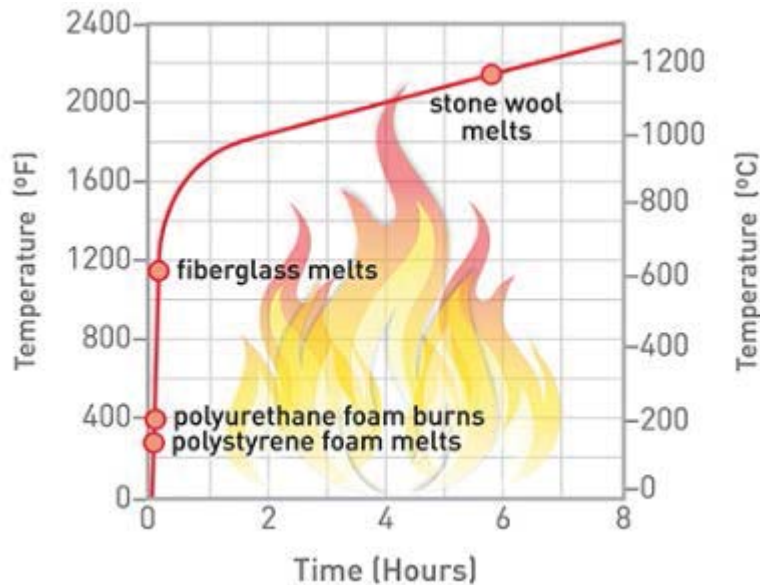
Table Notes

1. An error was made on the Casteel letter and is corrected here. This was verified with a phone conversation between Robert Castell and David Gessert.
2. UL Design Basis Y614 shows a structural steel shape with an A/P ratio of 0.18. The intumescent coating thickness for that A/P ratio is used here.

Conclusion

From a fire protection standpoint columns in the field of a building are a more demanding condition than a beam. Using the manufacturer's recommended intumescent coating thickness for a column on a beam with the similar W/D or A/P ratio provides at least as much fire resistance as published for the column.

Appendix – ASTM E119 Time Temperature Curve



References

Casteel, Robert, Applications & Intumescent Technical Specialist, CAFCO Fire Protection Products, August 9, 2019 letter to Michael Cobean, SK Hoff Construction, Re: City of Portland

Drawing S3A-1, Urban Development Group, SE 49th & Hawthorne Apartments, Portland, OR 97215, 09/04/2019, Studio 3 Architecture, Salem, Oregon

Fire Resistance Design Y614, September 22, 2016, Underwriters Laboratories, Northbrook, Illinois

Fire Resistance Design Y615, September 22, 2016, Underwriters Laboratories, Northbrook, Illinois

Fire Resistance Design Y616, September 22, 2016, Underwriters Laboratories, Northbrook, Illinois

Life Safety Chechsheets #2, City of Portland, Oregon – Bureau of Development Services, 1478 SE 49th Ave, August 26, 2019, Portland, Oregon

W/D, M/D, A/P Tables, Carboline Fireproofing Division, Issued: June 7, 2007, Carboline, St. Louis, Missouri

End of Report