Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 25062	**Project Address:** 7000 NE Airport Way
Hearing Date: 8/11/21	**Appellant Name:** Tom Jaleski
Case No.: B-015	**Appellant Phone:** 971-238-5266
Appeal Type: Building	**Plans Examiner/Inspector:** David Bartley
Project Type: commercial	**Stories:** 1 **Occupancy:** A-3 **Construction Type:** I-A
Building/Business Name:	**Fire Sprinklers:** Yes - Throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:**
Plan Submitted Option: pdf [File 1]	**Proposed use:** Airport

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	104.11
Requires	104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. 104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources. 104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.
Code Modification or Alternate Requested	This appeal addresses the condition of the reinforcing structural steel for UL Design No.X854, attached for the purpose of showing equivalent protection of 3-hour fire-resistance protection as required by IBC Table 601.
Proposed Design	The proposed assemblies consist of large concrete members with reinforcing steel attached thereto. The steel in question is either C-channel or plate as shown in Figures 1 and 2 in the

	attached engineering judgment letter. Dimensions of the reinforcing steel are C12 x 30, MC18 x 42.7, MC18 x 58 and a plate with dimensions of 3/16-inch by 11-inch.
Reason for alternative	The OSSC requires a minimum 3-hour rating for the primary structure. Comparison between the proposed column designs and UL listed assembly Design No. X854 show that the code required 3-hour fire resistance has been met when reinforcing steel assemblies are protected as proposed above.

APPEAL DECISION

Alternate 3 hour fire rated C-channel and steel plate structural 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, call (503) 823-7300 or come in to the Development Services Center.

PDXNext TCORE

Engineering Judgment Report

3-Hour Fire Rating of Steel Beam

Client Name: ZGF Architects

Client Address: 1223 SW Washington St #200, Portland, OR 97205

Date: 8/5/2021

Table of Contents

1 PROJECT OVERVIEW

The Portland International Airport (PDX) is an existing airport terminal of Type IA construction protected throughout by automatic sprinklers. The terminal core expansion (TCORE) project at PDX includes a series of concrete assemblies to which additional support for the assemblies is provided via structural steel C-channels or plates attached beneath or to the sides of the assemblies, which involves Sprayed Fire-Resistive Material (SFRM). The proposed assemblies do not meet a tested/listed assembly for 3-hour protection per code.

This Engineering Judgement (EJ) addresses the conditions within Sectors 2 and 21 as identified on the structural fireproofing plans. This EJ was written for the purpose of showing equivalent protection of 3-hour fire-resistance protection as required by OSSC including the SFRM to meet prescriptive application to meet the required fire rating.

This Engineering Judgement (EJ) addresses the condition of the reinforcing structural steel for UL Design No.X854, listed below for the purpose of showing equivalent protection of 3-hour fire-resistance protection as required by IBC Table 601. This EJ is only applicable to the elements specified above. Other elements and locations were not reviewed for this document.

2 APPLICABLE CODES, STANDARDS, AND GUIDES

The report will be based on the following codes:

- 2014 Oregon Structural Specialty Code (OSSC), including the recently adopted Appendix N which references the International Fire Code.
- 2014 Oregon Fire Code (OFC)
- 2016 Portland Fire Code

3 DISCUSSION

3.1 Approach

- The proposed beam 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 proposed assemblies consist of large concrete members with reinforcing steel attached thereto. The steel in question is either C-channel or plate as shown in Figures 1 and 2 below. Dimensions of the reinforcing steel are C12 x 30, MC18 x 42.7, MC18 x 58 and a plate with dimensions of 3/16-inch by 11-inch.

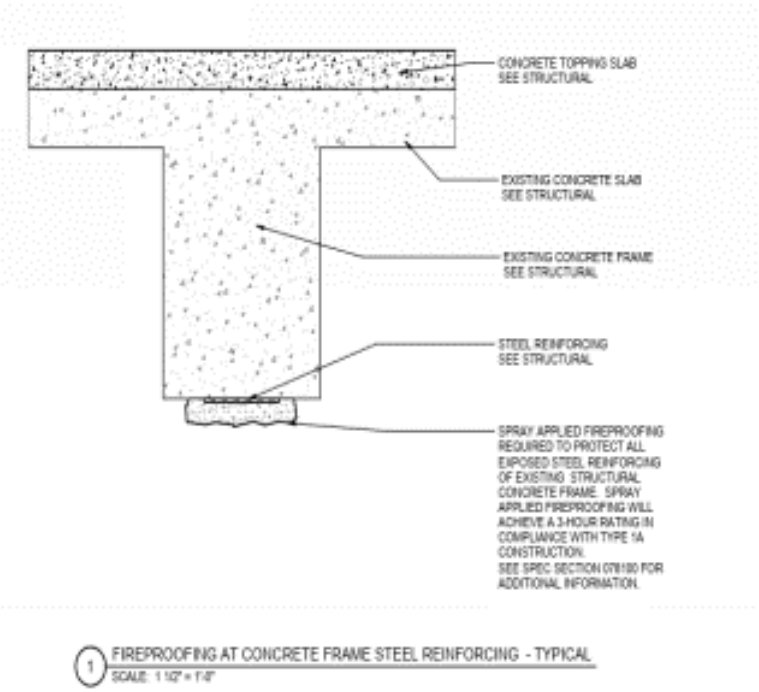


Figure 1: Fireproofing of Steel Plate

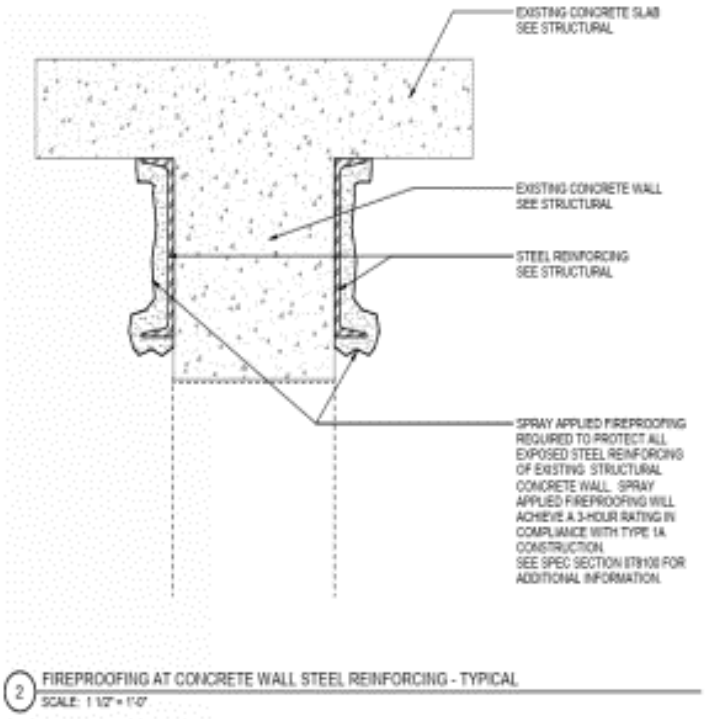


Figure 2: Fireproofing of Steel C-channel

These members are considered as primary structures for the building. Per 2014 OSSC Table 601, primary structural members are required to be minimum 3 hr. fire rated. It is assumed that the steel will be exposed to fire and the assembly will require continuous protection from three sides.

The reinforcing steel assemblies are proposed to be protected with spray-applied fireproofing (see **Figures 1 and 2**). The assemblies are proposed to be protected in 3-hour fire-resistance rated construction in a manner utilizing components outlined UL Listed Design X854. The result of these efforts is an Engineering Judgment (EJ).

5 ASSEMBLY ANALYSIS

The proposed assemblies are part of a primary structural member. While evaluating fire resistance requirement of members, different sized columns, beams and c-channels are compared against each other through a factor referred to as the W/D Ratio. 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. If the W/D ratio is greater than or equal to that of the tested design, the fire resistance rating and method of protection are applicable to that member. Each of the proposed members have been individually evaluated against **UL X854 (Figure 4)**. W/D ratios for the reinforcing steel C-channels and MC are shown in **Figure 3** below. The W/D ratio for the steel plate is calculated to be 0.61 based upon a weight of 7.65 lb/ft^2 and an exposure on three sides. The approach is to add the spray applied fire proofing in order to maintain the required fire-resistance rating of the assembly. Required thicknesses of Monokote spray-applied fireproofing are shown in **Figure 5** below.

SIZE (in. x lb./ft.)	Column W/D	Column Heated Perimeter (in.)	Beam W/D	Beam Heated Perimeter (in.)
C15 x 50	1.15	43.4	1.26	39.7
x 40	0.937	42.7	1.02	39.2
x 33.9	0.803	42.2	0.874	38.8
C12 x 30	0.845	35.5	0.929	32.3
x 25	0.714	35.0	0.781	32.0
x 20.7	0.598	34.6	0.653	31.7
C10 x 30	0.968	31.0	1.07	28.0
x 25	0.820	30.5	0.906	27.6
x 20	0.669	29.9	0.735	27.2
x 15.3	0.520	29.4	0.571	26.8
C9 x 20	0.725	27.6	0.803	24.9
x 15	0.556	27.0	0.612	24.5
x 13.4	0.502	26.7	0.551	24.3

SIZE (in. x lb./ft.)	Column W/D	Column Heated Perimeter (in.)	Beam W/D	Beam Heated Perimeter (in.)
MC18 x 58	1.13	51.2	1.23	47.0
x 51.9	1.02	50.8	1.11	46.7
x 45.8	0.907	50.5	0.985	46.5
x 42.7	0.849	50.3	0.922	46.3
MC13 x 50	1.19	42.0	1.33	37.6
x 40	0.973	41.1	1.08	37.0

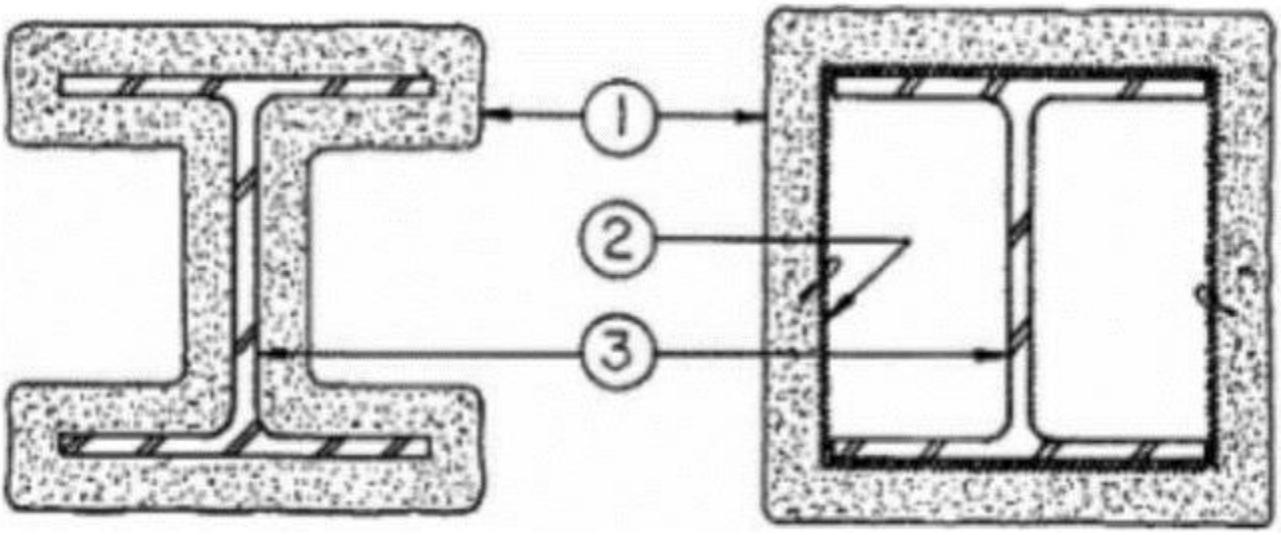
Figure 3: W/D Ratio Tables

Design No. X854

July 12, 2019

Ratings — 1, 1-1/2, 2, 3 and 4 h.

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



The thickness of Spray-Applied Fire Resistive Materials to be applied to all surfaces of the column (Item 1) required for rating periods of 1 h, 1-1/2 h, 2 h, 3 h, 4 h may be determined by the equation:

$$h = \frac{R}{1.05\ (W/D) + 0.61}$$

Where:

h = Spray-Applied Fire Resistive Materials thickness in the range 0.25-3.875 in.

R = Fire resistance rating in hours (1 - 4 h)

D = Heated perimeter of steel column in inches

W = Weight of steel column in lbs per foot

W/D = 0.338 to 6.76

Figure 4: UL Design X854

Section	W/D Ratio	Thickness (inches)
C12 x 30	0.929	1.89
MC18 x 42.7	0.922	1.90
MC18 x 58	1.23	1.58
Plate (3/16 x 11)	0.61	2.40

Figure 5: Required thickness of SFRM

6 CONCLUSION

The OSSC requires a minimum 3-hour rating for the primary structure. Comparison between the proposed column designs and UL listed assembly Design No. X854 show that the code required 3-hour fire resistance has been met when reinforcing steel assemblies are protected as proposed above.

Please contact me with any questions you may have regarding this Engineering Judgement.

exp 12/31/2022

Nicholas A Moriarty, PE

(702)408-8350

Fire Protection Engineer

Code Unlimited