

# Development Services

## From Concept to Construction

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### APPEAL SUMMARY

**Status:** Hold for Additional Information

<b>Appeal ID:</b> 23284	<b>Project Address:</b> 5325 N Interstate Ave
<b>Hearing Date:</b> 1/8/20	<b>Appellant Name:</b> Ryan Miyahira
<b>Case No.:</b> B-007	<b>Appellant Phone:</b> 5032457100
<b>Appeal Type:</b> Building	<b>Plans Examiner/Inspector:</b> Chris Pagnotta, Corey Stanley
<b>Project Type:</b> commercial	<b>Stories:</b> 7 <b>Occupancy:</b> R-2, B, S-1, S-2 <b>Construction Type:</b> III-A over I-A
<b>Building/Business Name:</b> Interstate and Willamette Apartments	<b>Fire Sprinklers:</b> Yes - Full building
<b>Appeal Involves:</b> Erection of a new structure	<b>LUR or Permit Application No.:</b> 16-279600-CO
<b>Plan Submitted Option:</b> pdf [File 1] [File 2] [File 3] [File 4] [File 5]	<b>Proposed use:</b> Apartment - Multi Family residential

### APPEAL INFORMATION SHEET

#### Appeal item 1

<b>Code Section</b>	703.3, 722.1 2018 NDS Technical Report No. 10
<b>Requires</b>	<p>703.3 Alternative methods for determining fire resistance</p> <p>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.</p> <p>Alternative protection methods as allowed by section 104.11 Alternative materials, design methods of construction and equipment.</p> <p>722.1 Calculated Fire resistance General. The calculated fire resistance of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AF&amp;P National Design Specification for wood construction.</p>
<b>Code Modification or Alternate Requested</b>	
<b>Proposed Design</b>	<p>The building is a Type IIIA over IA. A non-fire treated glulam beam has been installed in the Type IIIA portion of the building at an intersection of the 3rd floor roof, 4th floor, and lower portion of 4th floor exterior wall. See the enclosed building section and beam detail.</p> <p>OSSC 703.3, 4 allows a comparison method for fire resistance ratings. See enclosed analysis from Fire Protection Consulting dated July 27, 2017.</p> <p>The alternate design is as follows:</p>

Wrapping the beam with two layers of 5/8-inch Type x gypsum wallboard to provide additional protection.

A char analysis of the beam prepared by the project structural engineer is enclosed showing the beams are adequate for 2-hour rating.

Fire sprinklers in the truss space open to the beam are provided.

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**Reason for alternative** A non-fire treated glulam beam has been installed in the type IIIA portion of the building.

The enclosed letter from the fire protection engineer provides three methods to determine fire resistance rating and concludes the combination of gypsum wallboard, glulam beam, and sprinklers is equivalent to the fire resistance required by code.

The enclosed analysis from the structural engineer demonstrates the adequacy of the installed glulam beam with two layers of 5/8-inch gypsum wallboard to meet a minimum of 2-hour required fire rating. Also the follow up letter indicated that the beam is a V4 beam with 4 laminations.

The proposed design complies with the intent of the provisions of the code and is equivalent to the prescribed code requirement for fire resistance.

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## APPEAL DECISION

**Alternate 2 hour fire rated beam assembly with engineering analysis: Hold for additional information. Appellant may contact Corey Stanley (971 291-8919) with questions.**

Additional information is submitted as a no fee reconsideration, following the same submittal process and using the same appeals form as the original appeal. Indicate at the beginning of the appeal form that you are filing a reconsideration and include the original assigned Appeal ID number. The reconsideration will receive a new appeal number.

Include the original attachments and appeal language. Provide new text with only that information that is specific to the reconsideration in a separate paragraph(s) clearly identified as "Reconsideration Text" with any new attachments also referenced. No additional fee is required.

An alternate design is proposed for this noncombustible construction requirement. The alternate design has two parts. These two parts are:

- Char analysis of the beam prepared by the project structural engineer. This analysis by the structural engineer is provided separately.

And

- Wrapping the beam with two layers of 5/8-inch Type X gypsum wallboard. This report analyzes the fire resistance provided by the GWB.

### **Method 1 for Determining Fire Resistance of the GWB**

For each layer of 5/8-inch Type X gypsum wallboard 40 minutes of fire resistance is assigned. See OSSC (2014) Table 722.6.2(1).

For two layers of 5/8-inch Type X gypsum wallboard the fire resistance assigned is the sum of the individual layers is 80 minutes (40 x 2) but is reduced to 60 minutes by code. See OSSC (2014) 722.6.2.1 and 722.6.1.1.

### **Method 2**

The Component Additive Method (CAM) for the determining the fire resistance of an assembly is described in Chapter 55, Analytical Methods for Determining Fire Resistance of Timber Members in the *SFPE Handbook of Fire Protection Engineering*. Both the CAM and the method of determining fire resistance described in OSSC (2014) 722.9.2.1 yield the same numeric results. However the CAM method described in the Handbook has been obtained in tests up to 90 minutes. Based on the CAM and the Handbook the two layers of 5/8-inch Type X gypsum wallboard protecting the glulam beam are assigned a fire resistance of 80 minutes.

### **Method 3 Alternative Method for Determining Fire Resistance**

This last method of determining the fire resistance of the two layers of gypsum wallboard covering the glulam beam most closely represents what would happen during a fire.

To determine fire resistance engineering analysis based on comparison of building element, component or assemblies designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E 119 or UL 263. See OSSC (2014) 703.3 4.

Harmathy's Rule 1 of fire endurance:

Rule 1: The "thermal" fire endurance of a construction consisting of a number of parallel layers is greater than the sum of the "thermal" fire endurances characteristic of the individual layers when exposed separately to fire.

See *International Existing Building Code*, 2018 Edition, Resource A, Guidelines on Fire Rating on Archaic Materials and Assemblies.

Refer to OSSC (2014) Table 721.1(2) Item Number 14-1.5. This assembly consists of two layers of 5/8 inch Type X gypsum wall board over conventional light wood frame construction. If this assembly is analyzed for fire resistance per OSSC (2014) 722.6.2.1 the result is:

**OSSC (2014) Table 721.1(2) Item Number 14-1.5  
Fire Resistance  
Method per 722.6.2.1**

Assembly Element	Fire Resistance (minutes)
Two layers 5/8 inch GWB (2 x 40)	80 <sup>1</sup>
Wood frame	20 <sup>2</sup>
Total fire Resistance	100

Table Notes:

1. See OSSC (2014) Table 722.6.2(1) for value
2. See OSSC (2014) Table 722.6.2(2) for value

However OSSC assigns 120 minutes (2 Hours) fire resistance to this assembly not the 100 minutes per 722.6.2.1 shown above. Where does the additional 20 minutes of fire resistance come from?

Code wise the wood frame of Item Number 14-1.5 is assigned 20 minutes per Table 722.6.2(2). So the two layers of 5/8 inch gypsum wallboard must have 100 minutes of fire resistance (120 – 20). Since these wallboard layers are in contact with each other they have a synergistic effect that increases their fire resistance from 80 to 100 minutes. This effect is described in Harmathy's Rule 1 of fire resistance as shown above. See the Appendix for more information.

### **Fire Sprinkler Protection – Combustible Concealed Space (Truss Space)**

Part of the subject glulam beam is exposed to a combustible concealed space that contains trusses. This concealed space will have fire sprinkler protection. For the beam to be exposed to fire from this concealed space the fire sprinkler system would have to fail to perform its design function. Complete fire sprinkler protection per NFPA 13 is designed for the Interstate and Willamette Apartments project.

## Conclusion

In ASTM E 119 fire test conditions, the two layers of 5/8-inch Type X gypsum wallboard will provide 100 minutes of fire resistance based on OSSC's alternate method of determining fire resistance. The actual fire resistance in test conditions may be greater than 100 minutes since the base layer of wallboard is in full contact with the glulam beam. This greater than 100 minute fire reissuance claim is supported by Harmathy's Rule 1 of fire endurance. Not only are the two layers of wallboard in contact with each other but the base layer is in contact with the glulam beam.

This analysis shows that relatively little of the glulam beam would be lost to char during a 2-hour fire exposure.

## Appendix

Refer to OSSC (2014) Table 721.1(2) Item number 14.1.3. This assembly has a single layer of 5/8-inch Type X gypsum wallboard over conventional light wood frame construction. When gypsum wallboard is exposed to fire the water that is chemically bound up in the gypsum is slowly driven off. This is an endothermic reaction which delays the heating of the wallboard. As water is driven off the wallboard material shrinks and cracks form. Type X GWB has glass fibers that make the panel stronger and helps control crack formation and growth.

Over time the GWB continues to be eroded away by the fire conditions. Eventually the single layer of GWB will become thin enough that it is no longer self-supporting and collapses. At this point the assembly has not failed since the light wood frame and the GWB on the far side are still in place. After a period of time (20 minutes per Table 722.6.2(2)) enough of the wood frame has burned away and is no longer self-supporting. At this point the remaining assembly is assumed to collapse and the assembly fails.

Refer to OSSC (2014) Table 721.1(2) Item number 14.1.5. This assembly has two layers of 5/8-inch Type X gypsum wallboard over conventional light wood frame construction. When the exposed layer of GWB panel would collapse on its own the underlying layer will delay the collapse. This is the basis of Harmathy's Rule 1 of fire endurance as applied to GWB and why this assembly has a 120 minute (2-hour) fire resistance rating rather than a 100 minute rating.

Another way for looking at this issue is to compare OSSC (2014) Table 721.1(2) Item number 14.1.3 and Item Number 14-1.5. These two assemblies are similar except 14-1.3 has a single layer of 5/8-inch GWB and a 60 minute rating while 14-1.5 has two layers of GWB and a 120 minute rating. If a single layer of GWB were added to 14-1.3 per 722.6.2.1 the assembly would have 40 more minutes of fire resistance or 100 minutes (60 + 40). However 14-1.5 is rated for 120 minutes.

## References

*International Existing Building Code*, 2018 Edition, International Code Council, Country Club Hills, Illinois

National Fire Protection Association 13, *Standard for the Installation of Sprinkler Systems*, 2016 Edition, National Fire Protection Association, Quincy, Massachusetts

*Oregon Structural Specialty Code*, 2014 Edition, International Code Council, Country Club Hills, Illinois

*SFPE Handbook of Fire Protection Engineering*, Fifth Edition, 2016, Springer Science+Business Media LLC, New York

End of Report



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CALCULATED BY PF DATE \_\_\_\_\_  
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SCALE \_\_\_\_\_

FIRE RESISTANCE RATING - LEVEL 4 WOOD BEAMS  
AT LOW ROOF SET BACK.

BB BEAMS - 5.5x24 GUB

PER ORIGINAL CALCULATIONS  $V = 21.4^k$   
 $M = 85.6^k$

PER AWS TR10  $B = 15$  DESIGN EVALUATION  
IS IN ACCORDANCE WITH SECTION 4.0

PER SECTION 4.4  $t = 40$  min. per layer of  $5/8"$  GUB  
IN ADDITION TO THE CHAR. RATING OF SECTION 4.1

PER 4.1 for  $t = 60$  min (1 hr) unprotected

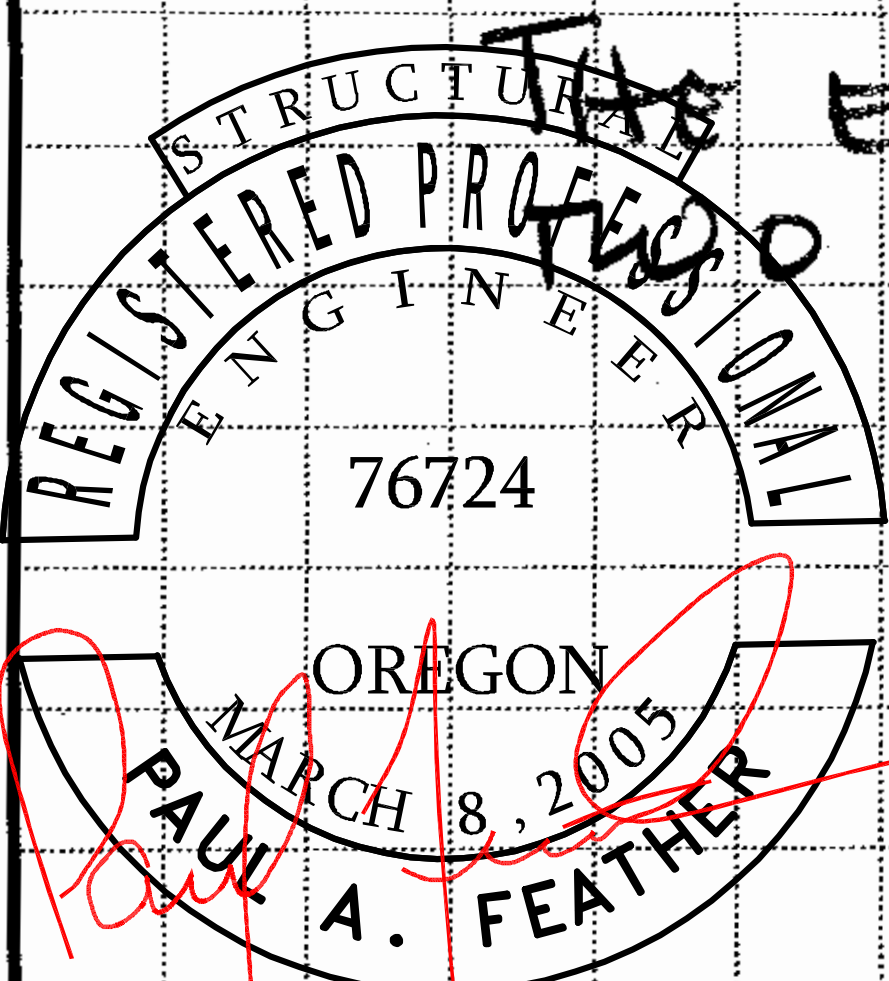
$$a_{char} = 1.5" \quad a_{eff} = 1.8" \quad b_{eff} = 5.5 - 2(1.8") = 1.9"$$
$$d_{eff} = 24 - (1.8") = 22.2"$$

$$S_{eff} = 156 \text{ in}^2 \quad K = 2.85 \quad M_{eff} = 2400(156)(2.85)/12$$
$$= 88957 \text{ lb-ft.}$$

$$88957 \text{ lb-ft} > 85600 \text{ lb-ft} \quad \therefore t_{char} \geq 60 \text{ min.}$$

$$60 \text{ min} + 2(40) = 140 \text{ min} > 120 \text{ min req'd.}$$

THE EXISTING BEAMS WITH 2 LAYERS EXCEED THE  
1 HOUR REQUIREMENT.







## STRUCTURAL ENGINEERING SOLUTIONS

October 24, 2019

Matthew Jorzak  
Fairfield Residential  
7000 SW Hampton St., #215  
Portland, OR 97223

Re: GLB Rated Beam  
16-279600-REV-04-CO #2

Per our previous Calculations, the beams are adequate as provided and are already in compliance with Figure 4-1 of the AWC-TR10.

AWC-TR10 covers many different conditions and options. The requirements outlined in the figure are for unprotected glue laminated beams per the testing outlined in section 3.6. With protection providing the balance of the rating, even though it is not specifically required, we already meet the middle picture (b.) requirements for the one hour condition.

The City Bulletin is in implicitly in recognition of this fact since there are three options (we are option 3), and the bulletin specifically states that we may both add protection combined with char time calculations following "the methods of AWC-TR10", but does not explicitly state that we are to conform to all the other non-calculation provisions of AWC-TR10.

Regardless, by calculation and specification, a V3 beam would suffice (this would be picture (a.) with 3 tension laminates). By default we (SES) always specify minimum V4 laminates on all of our beam lay-ups. Therefore we already have the additional laminate per the required diagram.

Everything is compliant and there is no justification to replace or otherwise modify the beams.

Sincerely,

Paul Feather, PE SE  
President  
SE-Solutions, Inc. dba  
Structural Engineering Solutions



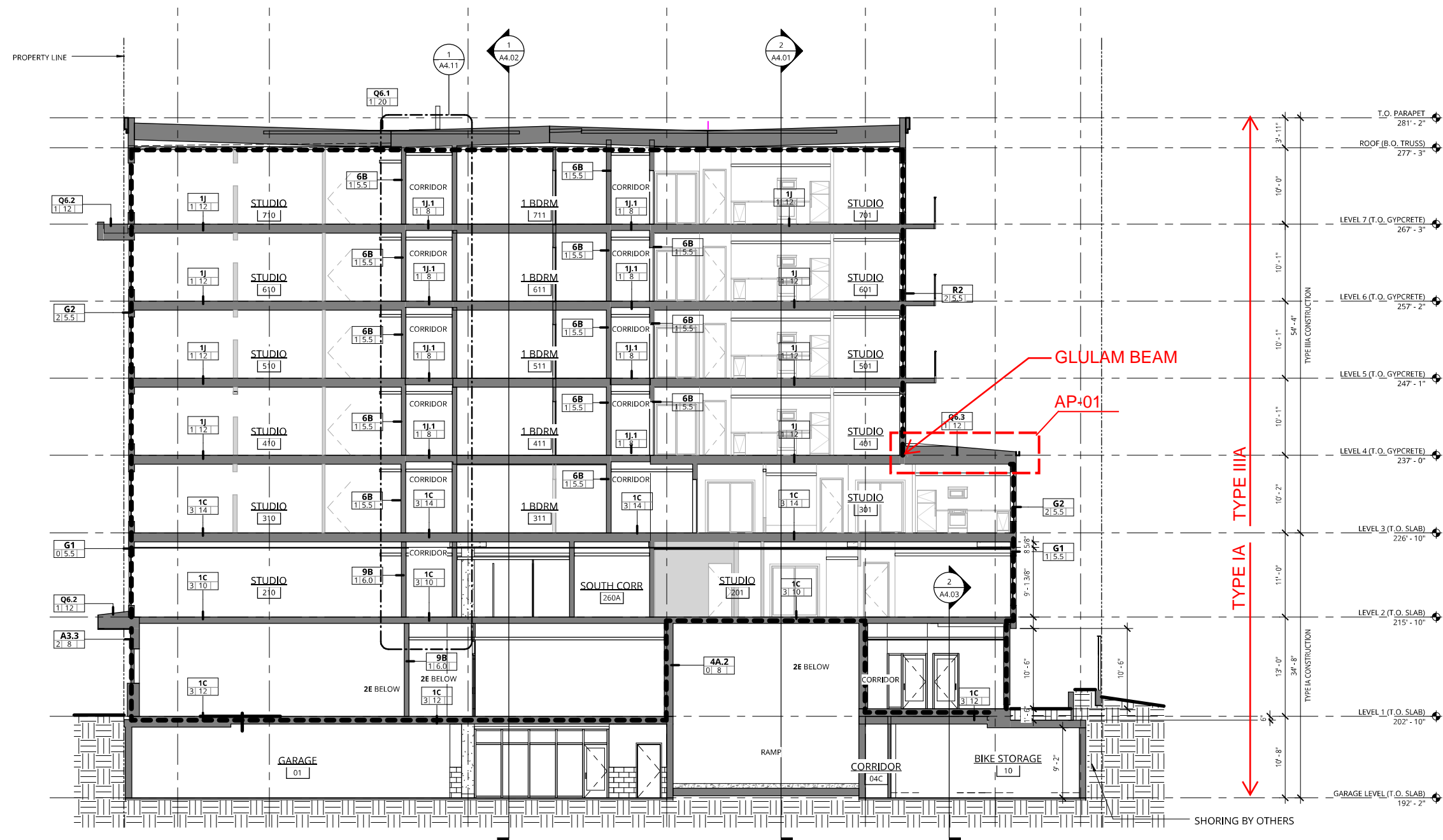
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## INTERSTATE AND WILLAMETTE APARTN

FAIRFIELD RESIDENTIAL

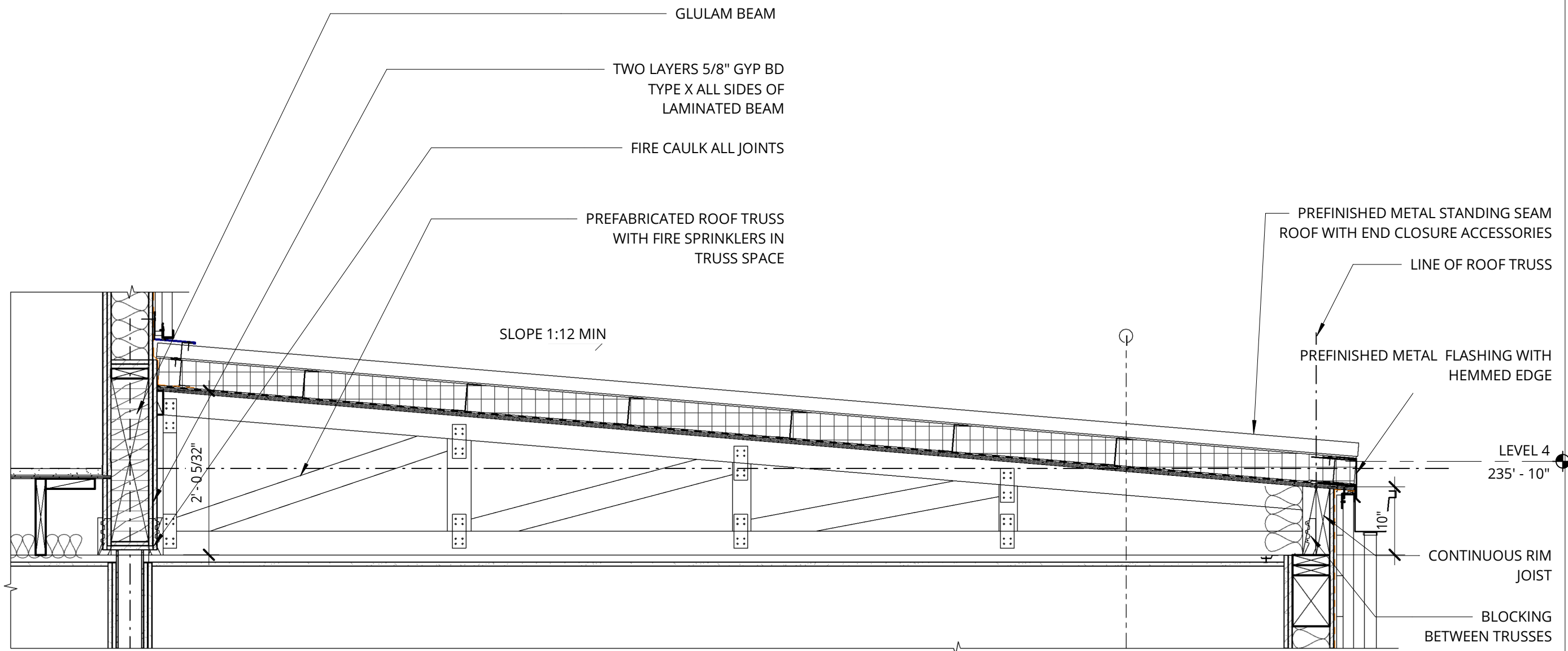
REVISION	DATE	REASON FOR ISSUE
1	08.25.17	DELTA 1
14	04.10.18	RFI 0052
20	04.11.18	RFI 0087
29	06.04.18	RFI 0105
56	01.31.19	RFI 224

CONSTRUCTION SET

DATE 8/25/2017	REVISION 56
PROJECT NUMBER 161900	SHEET NUMBER <b>A4.01</b>
SCALE As indicated	

12/29/2019 2:30:41 PM

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**1** **ROOF @ FOURTH FLOOR 2**  
3/4" = 1'-0"



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