

Glulam Rim in Fire Rated Design

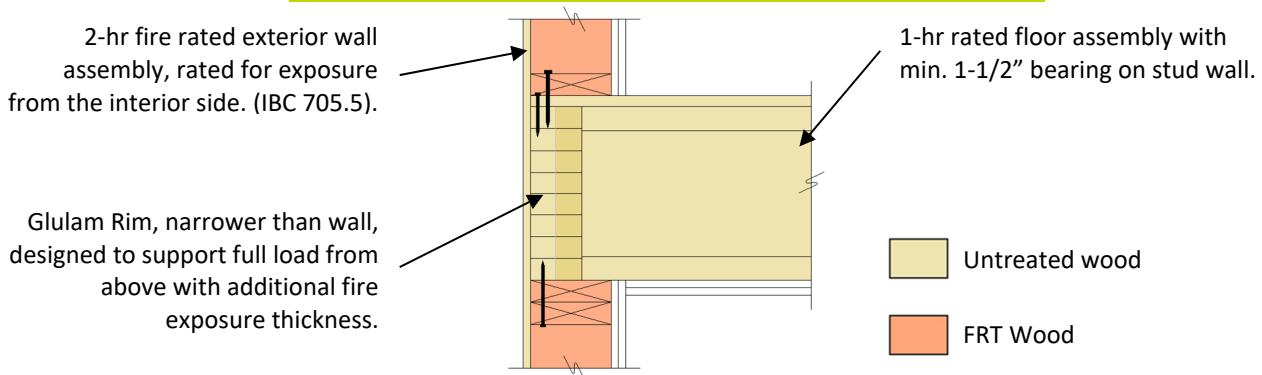
August 7, 2019

Type III construction requires two-hour fire rated exterior walls, which may interconnect with a one-hour fire rated or non-fire rated floor assembly. Designers are now specifying glulam rim because as a heavy timber product it performs well in fire and it is the most cost-effective engineered wood product on the market. Glulam rim is dimensionally stable and kiln dried to an average moisture content of 13%. Glulam rim is manufactured with depth tolerances to +/- 1/16" in standard dimensional lumber depths and I-Joist compatible (IJC) depths. Glulam IJC rim can match all I-joist and truss framing in depths of 9-1/2", 11-7/8", 14", 16" and 18" assuring compatibility with the floor system.

Heavy timber members have long been recognized for their ability to maintain structural integrity while exposed to fire due to the charring characteristics of the outer wood fiber. Glulam offers the same fire performance advantages as large solid sawn members with extensive research demonstrating that the adhesives used in the manufacture of glulam do not adversely affect fire performance⁽¹⁾.

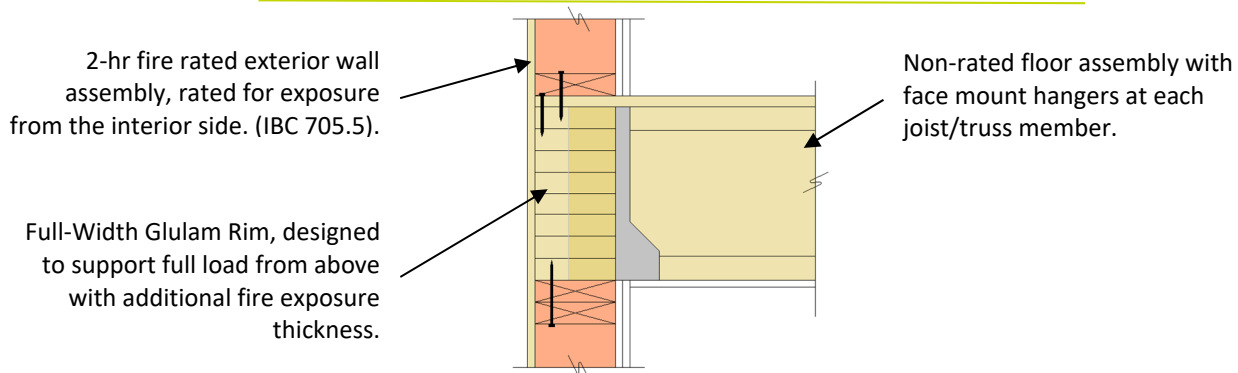
In Type III construction, there are typically two paths to conformance for achieving a 2-hour fire rated wall to floor intersection: a 2-hour rated wall assembly intersecting with a 1-hour rated floor assembly or a 2-hour rated wall assembly intersecting with a non-rated floor assembly. The following details have been developed as a way to utilize untreated solid rim board to achieve both paths of conformance:

Detail A: 2-hr Exterior Wall Intersecting 1-hr Floor Assembly



Detail A utilizes glulam rim as part of the 1-hour floor assembly allowing floor framing to bear directly on the FRT wood-framed wall below. This eliminates the need for additional blocking between framing members.

Detail B: 2-hr Exterior Wall Intersecting Non-Rated Floor Assembly



Detail B utilizes framing width glulam rim as part of the 2-hour wall assembly allowing for the use of standard face mount hangers which connect the floor framing direct to the glulam rim⁽²⁾.

In Details A and B above, glulam rim can be utilized in an untreated capacity given that the width of the glulam member is sufficiently sized to insulate the minimum designed rim board thickness required to support the full load from above. APA-The Engineered Wood Association has published a technical note: *Uniform Vertical Load Capacity of Glulam Rim Boards Subject to Fire Exposure (TT124)*, further documenting the load-transfer capabilities of glulam rim board that has been subject to fire exposure in accordance with the NDS Chapter 16 requirements.



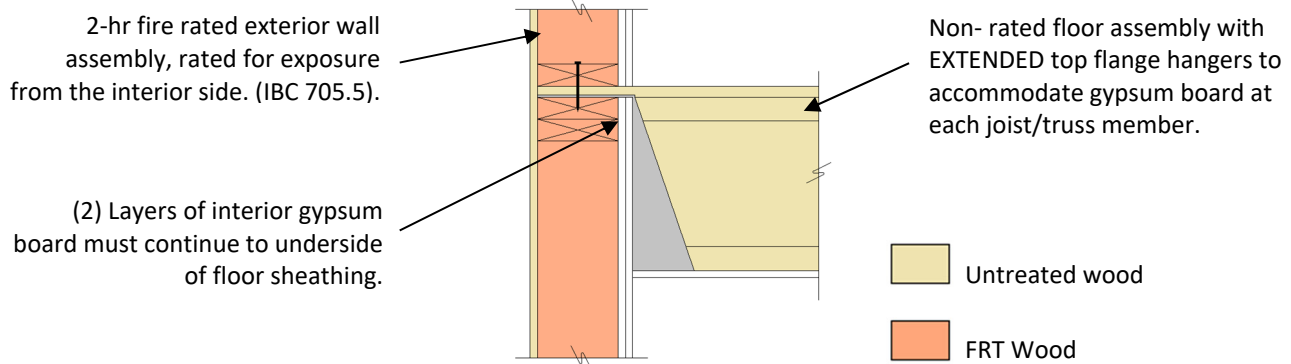
In a fire, the outer portion of a glulam member becomes charred. This layer of charred wood then functions as an insulator helping to protect the undamaged interior structural portion of the member from the heat. The nominal char rate for the development of the insulating layer on all surfaces of the glulam member exposed to fire is 1.5 in./hr.⁽³⁾ The rate of advancement of this insulating char layer into the remaining undamaged portion of the member has been well documented (approximately .025 inches or .06 mm per minute) and forms the theoretical basis of the equations used to predict fire endurance. Full scale fire tests on loaded beams and columns have confirmed the validity of these equations in

predicting their load-carrying capability under fire conditions and the method is recognized by the International Building Code (IBC)⁽⁴⁾.

IBC Section 722.1 permits the calculated fire resistance of exposed wood members in accordance with Chapter 16 of ANSI/AWC National Design Specification for Wood Construction (NDS). Contained within the NDS are formulas to determine the effective char depths and adjusted design strengths for exposed glulam members. The effective char depths and structural adjustments are based on the design exposure time and number of exposed surfaces.

Both details A and B provide a more economical solution than Detail C, shown below, which is most commonly used today. Detail C utilizes extended top flange hangers to allow for the interior gypsum finish to extend the full height of the wall as required to maintain the 2-hour rated wall assembly. These hangers are typically more expensive than hangers that attach directly to the rim as shown in Detail B⁽⁴⁾.

Detail C: Typical 2-hr Exterior Balloon Framed Wall Assembly



For additional detail on the design procedures for exposed wood members see:

American Wood Council *Technical Report No. 10: Calculating the Fire Resistance of Wood Members and Assemblies and Design for Code Acceptance 3: Fire-resistance-Rated Wood-Frame Wall and Floor/Ceiling Assemblies*

APA – The Engineered Wood Association EWS Y245B: *Calculating Fire Resistance of Glulam Beams and Columns*

APA – The Engineered Wood Association TT 124B: *Uniform Vertical Load Capacity of Glulam Rim Boards Subject to Fire Exposure*

References:

1. Malhotra, H and Rogowski, F: *Fire Resistance of Laminated Timber Columns*.
2. Lisa Podesto, P.E., MS, WoodWorks Senior Technical Director: *Fire Resistance Detailing for Light frame Mid-rise Structures*.
3. American Wood Council: *2018 National Design Specification for Wood Construction*, Chapter 16.
4. APA-The Engineered Wood Association: *Technical Note: Calculating Fire Resistance of Glulam Beams and Columns*.