

Uniform Vertical Load Capacity of Glulam Rim Boards[®] Subject to Fire Exposure

A Rim Board[®] is a structural element that fills the space between the sill plate and bottom plate of a wall or, in second floor construction, between the top plate of the wall below and the bottom plate of the wall above. APA Performance-Rated structural glued laminated timber (glulam) Rim Boards are manufactured in accordance with ANSI A190.1, *Standard for Wood Products – Structural Glued Laminated Timber*, and meet the requirements of ANSI/APA PRR 410, *Standard for Performance-Rated Engineered Wood Rim Boards*.

When wood is exposed to fire, the char layer protects the remaining unburned wood against heat. Under a fire exposure, up to 2 hours, the char depth of glulam can be calculated in accordance with Chapter 16 of the *National Design Specification for Wood Construction* (NDS) and Section 722, *Calculated Fire Resistance*, of the 2018 International Building Code (IBC). The residual cross section of glulam rim boards after a 1-hour and 2-hour fire exposure can usually still carry a significant uniform vertical load (UVL) because glulam rim boards are normally manufactured to a relatively larger width, as compared to other engineered wood rim boards.

In construction where the rim board is required to be 1-hour or 2-hour fire-rated, exposed (unprotected) glulam rim boards can achieve the intended fire rating, while safely carrying the design load. For example, if the exterior wall of a building is required to be 2-hour fire rated, an exposed glulam rim board in the width of 5-1/2 inches may be designed based on the calculated residual rim board cross section after the fire. This may be pertinent to Type III Construction where the exterior walls are required to be 2-hour fire-rated. It is understood that a fire-retardant treated (FRT) wood is required by the code for this application. However, it can be interpreted that if non-FRT treated components in the exterior wall, such as rim boards, are designed for a 2-hour fire rating, the exterior wall would meet the functionality intent for this construction. This interpretation is consistent with the Design for Code Compliance (DCA) 3, *Fire-Resistance-Rated Wood-Frame Wall and Floor/Ceiling Assemblies*, published by the American Wood Council (AWC) and is the prerogative of the authority having jurisdiction (AHJ) that is outside the scope of this document.

To verify the design UVL that can be safely carried by glulam rim boards after a fire exposure, APA conducted a series of mechanical property tests recently using a standard glulam layup with depths up to 24 inches and a reduced rim board width determined from the effective char rate published in Chapter 16 of the 2018 NDS. The reduced cross section assumed a one-sided fire exposure for fire duration of 1 and 2 hours.

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The tested rim board UVL capacities based on the reduced cross section exceeded the theoretical (calculated) rim board UVL capacities prescribed in ASTM D7672, *Standard Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies*. Therefore, the allowable glulam rim board’s uniform vertical load capacities for depths up to 24 inches can be justified as shown in Table 1.

Original glulam Rim Board thickness before fire exposure (in.)	3-1/2 in.	5-1/2 in.	5-1/2 in.
Fire exposure duration from one side (hr.)	1 hr.	1 hr.	2 hr.
Residual glulam Rim Board thickness after fire exposure (in.)	1.7 in.	3.7 in.	2.3 in.
Allowable uniform vertical load capacity after fire exposure (lbf/ft) ^a	2,300	5,600	3,400
Rim board depth, h	Allowable uniform vertical load capacity (lbf/ft)		
h ≤ 12 in.	2,450	5,700	3,500
12 in. < h ≤ 16 in.	2,300	5,600	3,400
16 in. < h ≤ 24 in.	1,700	4,200	2,100

It should be noted that the allowable uniform vertical load values listed in Table 1 assume the glulam rim board is in full bearing. If the glulam rim board also serves as a header or bending member, the glulam layup shall meet the requirements of a 1-hour or 2-hour fire-rated glulam in accordance with Section 13.3 of the 2017 ANSI A190.1. In addition, the header connections shall be designed in accordance with Section 16.3 of the 2018 NDS.

REFERENCES

American Wood Council. 2015. *National Design Specification for Wood Construction*. ANSI/AWC NDS-2018. Leesburg, VA.

APA – The Engineered Wood Association. 2017. *Standard for Wood Products—Structural Glued Laminated Timber*. ANSI A190.1-2017. Tacoma, WA.

APA – The Engineered Wood Association. 2016. *Standard for Performance-Rated Engineered Wood Rim Boards*. ANSI/APA PRR 410-2016. Tacoma, WA.

ASTM International. *Standard Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies*. ASTM D7672-14. West Conshohocken, PA.

International Code Council. 2018. *International Building Code*. Country Club Hills, IL.

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	Issued July 2018
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