

Owner's Guide to Understanding Checks in Glued Laminated Timber



CHECKING IN GLUED LAMINATED TIMBER

Glued laminated timber (glulam) is an engineered wood product that is used in a variety of construction applications, including floor beams, ridge beams, window and door headers, columns and trusses. In commercial applications and home construction, glulam beams are often chosen for their beauty in exposed designs such as rafters in vaulted ceilings, long clear-span ridge beams or arches. Because glulam members are so visible in these open designs, seasoning characteristics, typically referred to as “checking” are more noticeable and can raise concern with the building owner.



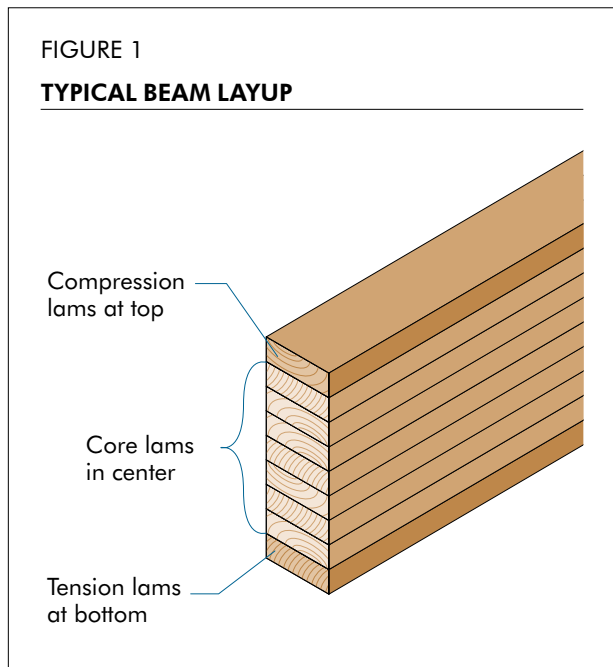
ANATOMY OF A GLULAM

Glulam members are composed of individual pieces of dimension lumber, or laminations, as shown in Figure 1. These pieces are end-jointed together to produce long lengths that are then bonded together with adhesives to create the desired dimensions. Individual laminations typically are 1-3/8 inches thick for southern pine and 1-1/2 inches thick for western species, although other thicknesses may be used. Beams are manufactured with the strongest laminations on the bottom and top of the beam, where maximum tensile and compressive stresses occur.

Because of their composition, large glulam members can be manufactured from smaller trees harvested from second- and third-growth forests and plantations of a variety of species.

With glulam, builders and owners can enjoy the strength and versatility of large wood members without relying on large old-growth dependent solid-sawn timbers.

FIGURE 1
TYPICAL BEAM LAYUP



What Is Checking?

Checking, the separation of continuous wood fibers, is a naturally occurring consequence of the seasoning process of wood, as shown in Figure 2. The outer fibers lose moisture to the surrounding atmosphere and attempt to shrink, but the inner portion of the timber member loses moisture at a much slower rate. The different rates of shrinkage can cause the wood to check or split. Rapid drying increases the differential moisture content between the inner and outer fibers and thus increases the propensity for checking in the timber. The checking (and shrinkage) process will stabilize as the moisture content of the member reaches equilibrium with the surrounding environmental conditions.

Glued laminated timber normally has fewer and smaller checks than solid-sawn timber since the individual laminations used to manufacture glulam have been dried before manufacturing. Glulam has an average moisture content of 12 percent at time of manufacture, which is relatively close to the equilibrium moisture content it will reach in most interior environments. This lower moisture content is one of glulam's inherent advantages over sawn timbers, which are typically supplied at a higher moisture content.

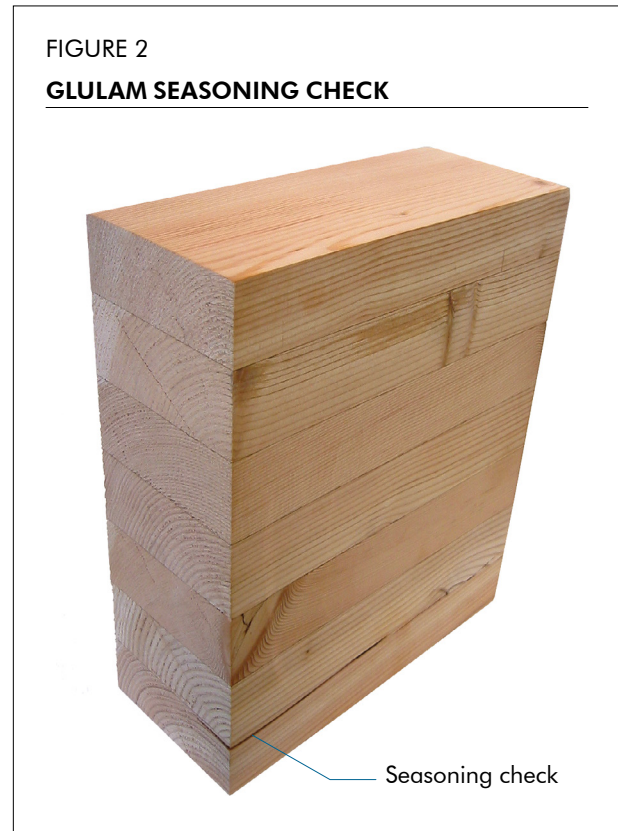
How Do You Identify Checks?

Checks are openings that occur parallel to the natural grain of the laminations. They show the separated wood fiber on each exposed surface at the check openings.

Seasoning checks, as shown in Figure 2, are commonly found near a glue line in a glulam member and often appear along the first glue line adjacent to the outermost lamination, where the amount of surface exposed by the outermost lamination is greatest and differential drying stresses are the highest.

Seasoning checks should not be confused with delamination. In delamination, openings are separations between the laminations at a glue line, not the wood fiber. Delamination occurs when the glue bond is not adequate to resist moisture cycling. With delamination, the surfaces of the laminations at the opening are smooth and often reveal the dark color of the phenol-resorcinol adhesive typically used for face bonding of glulam. When lighter-colored adhesives have been

FIGURE 2
GLULAM SEASONING CHECK



used, it may be more difficult to verify the presence or absence of wood fibers on the lamination surfaces. Delamination is highly unlikely in glulam members because they are manufactured with durable moisture-resistant adhesives under closely controlled manufacturing procedures.

Do Checks Significantly Affect the Strength of Glulam?

Building owners commonly ask, “Do checks significantly affect the strength of glulam?” First, the way the member is being used must be considered in evaluating the checks’ effect on strength.

For a glulam column or post, the only time a check becomes a structural concern is if it develops into a full-length (the entire height of the column or post, on both sides of the glulam) split. (Figure 3.) In this very unusual case, the length-to-depth (or L/d) ratio used in the design of columns will change, and the resulting structural capacity of the column should be confirmed by a qualified design professional. A partial check, as shown in Figure 3, is not a structural concern.

In bending members (beams, rafters, girders, etc.), checks are commonly observed on the face of the bottom lamination, on the side of the members and at the end of the members (Figure 4).

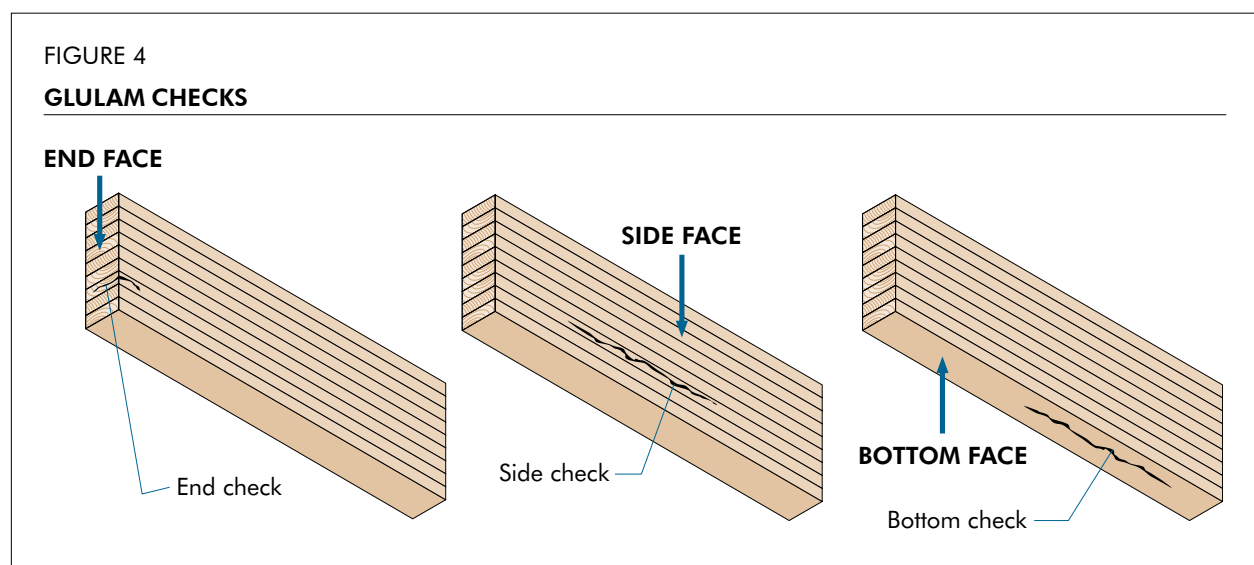
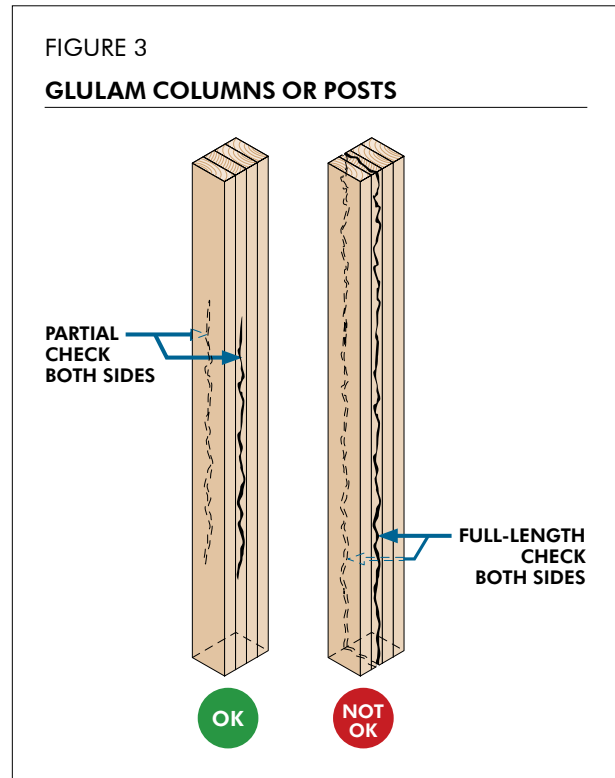


Figure 5 shows a face check on the bottom face of the member. As long as these checks are parallel to the natural grain of the lumber, they are not considered to be of structural significance, even if they are the full depth of the face lamination.

Figure 6 illustrates typical side checks. Testing at the APA Research Center reveals side checks that are no greater than one-third the width and one-third the length of the glulam have a negligible effect on the structural performance of the bending member. Side checks can appear at any depth of the member.

Testing also shows end checks or end splits, depicted in Figures 7A and 7B, with a length less than half the depth of the bending member also pose no structural concern.

FIGURE 5

BOTTOM VIEW

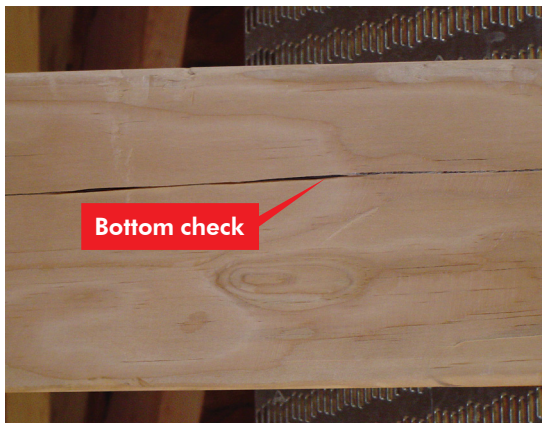


FIGURE 6

SIDE VIEW

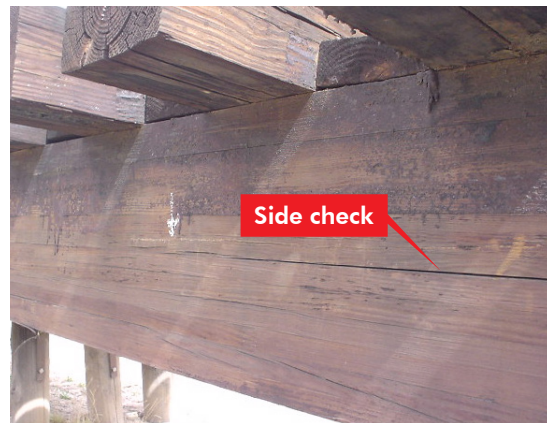


FIGURE 7A

END VIEW



FIGURE 7B

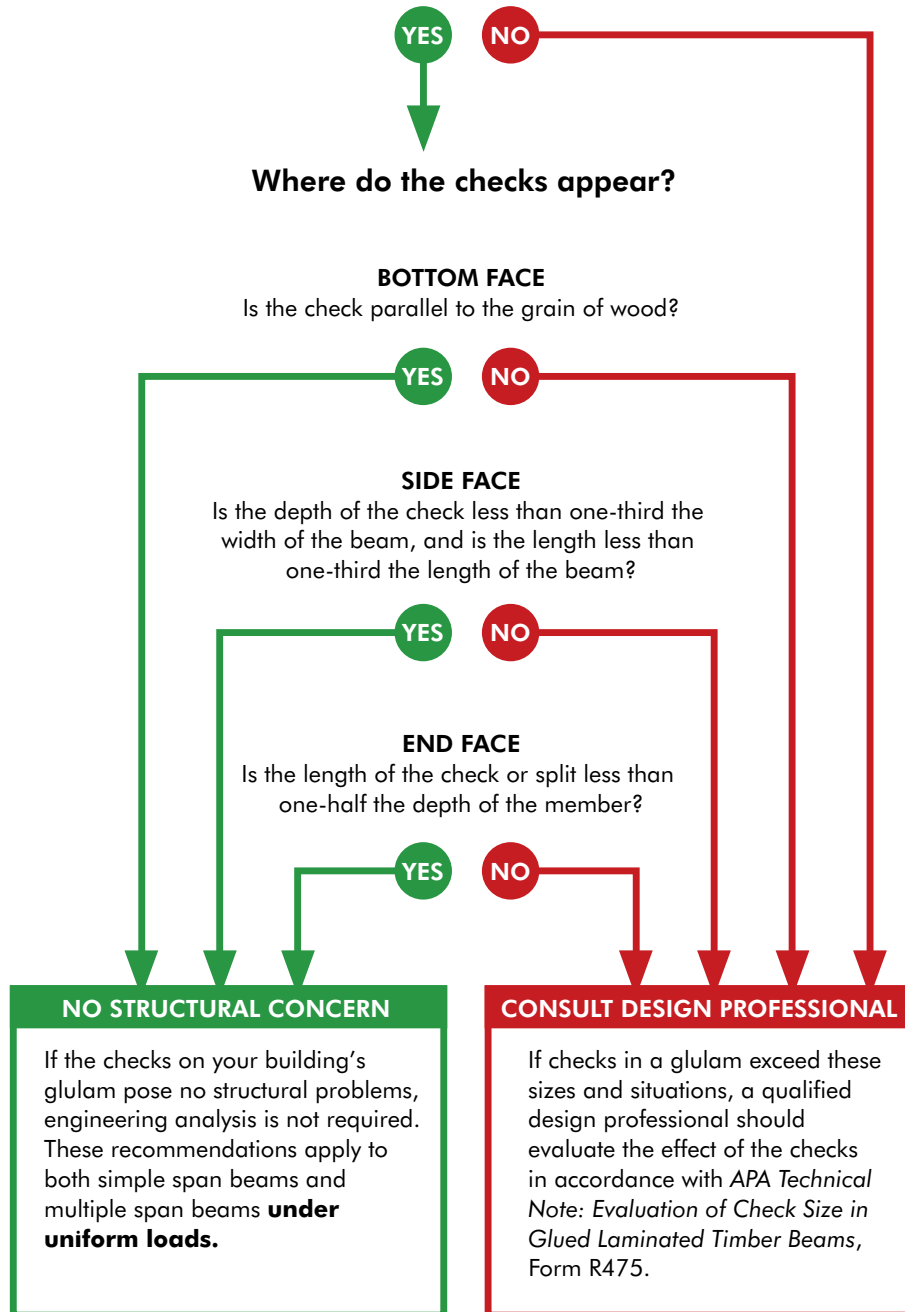
END VIEW



IS MY GLULAM STRUCTURALLY SOUND?

Is the span of the glulam beam greater than
10 times the depth?

Example: Depth is 12", span is greater than 10'



How Can Checks Be Prevented?

While checking is not a structural concern for most glulam applications, checks can be unsightly and detract from the visual appearance of the glued laminated member. Glulam members should be protected from extremes in temperature and humidity during transportation, storage and installation. Good storage and installation practices that minimize direct exposure to the elements will minimize the extent of checking. During and after installation, it is important that the glulam members not be exposed to rapid movement of air or to concentrated heating and cooling sources such as furnace or air conditioner, heater air outlets or job-site heating units.

When the building is enclosed, the beams should be allowed to adjust slowly to the ambient temperature and humidity of the building by avoiding rapid lowering of the humidity and/or exposure to high temperatures. Unless there are significant changes in ambient temperature and humidity, additional checking generally will not occur after the first full seasonal cycle of environmental conditioning of the building.

Site-applied finishes, such as oil-based semitransparent stains, oil-based solid color stains or latex-based paints, can also help mitigate checking by retarding moisture movement into and out of the wood.

Can Checks Be Repaired?

Since checking is a natural phenomenon associated with normal moisture cycling during transportation, job site storage, and installation—a sequence over which the manufacturer has no control—the manufacturer is not responsible for repairing checks. If checking does occur and is deemed by the designer, contractor, or owner to be visually unacceptable,



the checks can be filled with an elastomeric filler. When color-tinted to match the finish color of the glulam, these fillers will help to minimize the visual impact of the checks. Fillers should not be applied until the glulam members have cycled through at least one full heating and cooling season.

Rigid epoxy-type fillers should not be used to fill checks since these can cause the checks to worsen during normal moisture cycle changes.

For more information about glulam and the applications where it is used, contact APA – The Engineered Wood Association or visit www.apawood.org/glulam.

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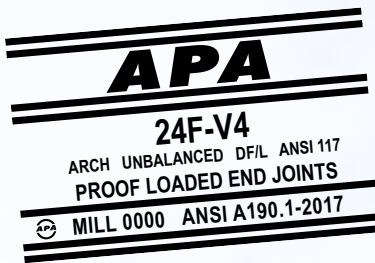
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Owner's Guide to Understanding Checks in Glued Laminated Timber

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