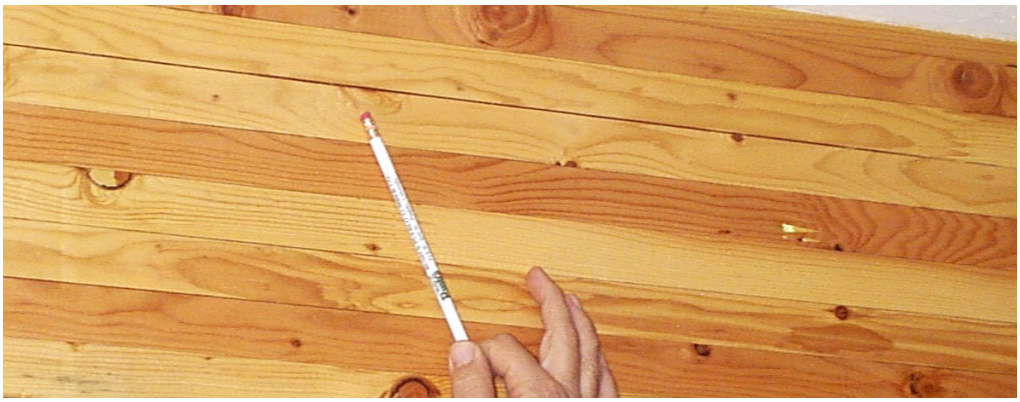
Checking in Glulam

INTRODUCTION

Checking is a natural occurrence in timber when wood fibers dry. As the outer fibers lose moisture and attempt to shrink, they are restrained by the fiber in the inner portion of the beam, which loses moisture at a much slower rate. Rapid drying increases the difference in moisture content between the inner and outer fibers and thus the chances for checking in the timber member.

In glulam beams and columns, checking most often occurs along gluelines. Each lamination can have slightly different moisture contents; once the beam dries, these differences cause stress concentrations at or near lamination boundaries (gluelines). Checking does not typically affect the beam strength capacity since the wood fibers are only being separated, not fractured. Checking along a glueline (see photo below) is sometimes mistaken as a delamination. Some glue maybe visible in the check openings but usually will have a “patchy” appearance, not a glossy look that is associated with insufficient glue adhesion.



Checking along gluelines is usually most evident along a beam’s first lamination from the bottom edge. In exposed applications, the bottom lamination dries quicker than the rest of the beam since it is exposed to heat on three sides. Thus, stress builds up along the glueline and checking occurs. Though visually the “separation” of the tension lamination may be alarming, checking at this first lamination has minimal effects on the beam’s strength.

HOW TO MEASURE CHECKS

There are two different types of checks, side and end as shown in the below figure. Side checks do not extend across the width of the glulam and are measured using an average depth. End checks do extend across the entire beam width and are sized by taking the average of the check lengths on each side of the beam.

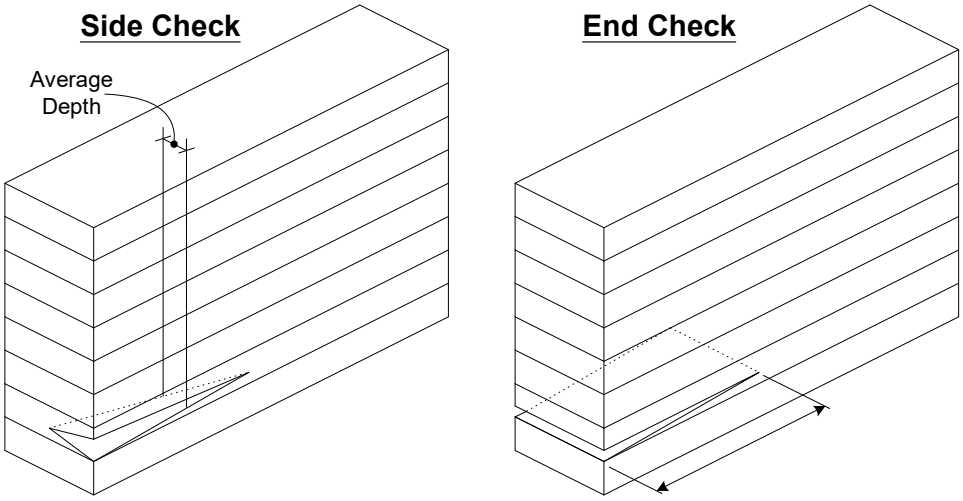


FIGURE 1: Measuring Checks in Glulam Beams

ANALYSIS

Most checking has insignificant effects on the glulam beam's design values since the checks are usually located in areas of relatively low stress. For beam applications, checking generally only affects the horizontal shear capacity when located in high shear zones. Shear stress is at a maximum only in beams that support a significantly large uniform load over shorter spans or concentrated loads. Checks that occur in high shear stress areas of such beams may reduce the beams' load carrying capacities.

The maximum allowable check depth depends upon its location within the depth and along the length of the beam. For uniform loaded beams, a high shear zone exists near supports in the middle ½ of beam's depth (see detail below). These high shear zones exist at all bearing locations.

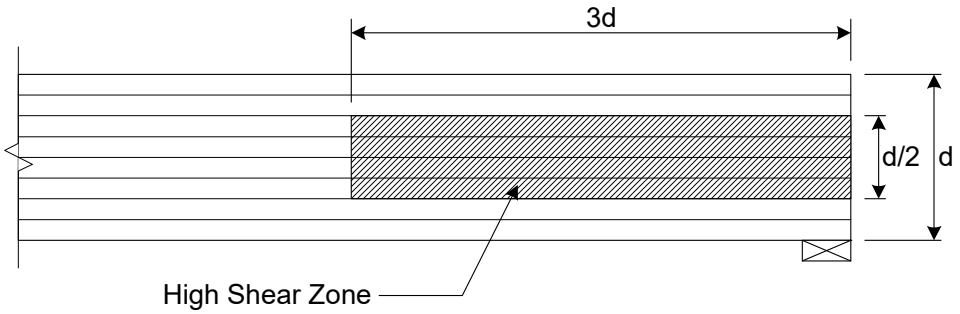


FIGURE 2: Beam High Shear Zone

APA – The Engineered Wood Association has published provisions for the analysis of checking on glulam horizontal shear. These provisions consist of a two-step analysis procedure. First, it is determined if the individual check is structurally significant. For a check outside the shear critical zone, the maximum check allowed is determined by the beam size and the location of check. This limit would apply to any checks located at the first glueline from the bottom.

OUTSIDE HIGH SHEAR ZONE CHECK SIZE LIMITS

The following table lists the maximum side check depth allowed outside the high shear zone. Please note that larger checks may be allowable, the maximum depth is dependent also on the beam depth and check location.

Glulam Width [in]	Allowable Side Check Depth [in]
3 1/8, 3 1/2	7/8
5 1/8, 5 1/2	1 3/8
6 3/4	1 7/8
8 3/4	2 1/2

HIGH SHEAR ZONE CHECK SIZE LIMITS

The allowable shear stress is reduced if a check located in a high shear zone exceeds the following limits:

Glulam Width [in]	Allowable Side Check Depth [in]	Allowable End Check Length [in]
3 1/8, 3 1/2	3/8	3
5 1/8, 5 1/2	1/2	4 1/2
6 3/4	5/8	6
8 3/4	7/8	7 7/8

If a check exceeds the previous limits, an engineering analysis is required using the design loads on the beam. A Boise Cascade EWP representative or design professional knowledgeable in wood design should consulted in these cases.

Most checks do not affect the load carrying capacities of a glulam beams. However, the presence of checks may indicate conditions of high humidity and temperature. The cause of excessive checking should be determined and corrected to prevent an increase in check numbers and/or size.