Multiple Member Connections - Beams

HORIZONTAL HOLES

Plotted holes in glued laminated timber are limited in size and location to maintain the structural integrity of the beam. The figure below shows the zones of a uniformly loaded, angle-supported beam where the field drilling of holes may be considered. These non-critical zones are located in portions of the beam stressed to less than 50% of design bending capacity and have less than 50% of design shear strength. For beams of non-complex loading or other than simple span, minor design changes may be necessary.

Field-drilled horizontal holes should be used for access only and should not be used as attachment points for fasteners or other load-bearing hardware unless specifically designed as such by the engineer or designer. These field-drilled horizontal holes should meet the following guidelines:

1. Hole size: The hole diameter should not exceed 1/16 inches or 1/10 the beam depth, whichever is lesser.

2. Hole location: The hole should have a minimum clear distance, measured from the edge of the hole to the nearest edge of the beam, of 4 holes diameters to the top or bottom face of the beam and 6 holes diameters from the end of the beam. Note that the horizontal holes should not be drilled in the non-critical, non-structural zones, as defined in the figure below, unless approved by an engineer or architect qualified in engineered timber design.

3. Hole spacing: The minimum clear spacing between adjacent holes, measured between the minimum clear distance of the edge of the hole to the nearest edge of the beam, should be 1-3/4 inches for 2-ply glued lamina end and edges. Standard cut washers shall be used between head and nut of the bolt and the glulam.

4. Number of holes: The maximum number of holes should not exceed 1 hole per 5 feet of beam length. In other words, the maximum number of holes should not exceed 4 for a 20-foot-long beam. The hole spacing limitations, as given above, should be adhered to separately.

For glulam members that have been cut to length, the guidelines above may be relaxed based on engineering analysis. Regardless of the hole location, holes drilled intentionally through the member should be positioned and sized with the understanding that the beam will deflect over a significant span. However, this area should be considered the critical zone.

VERTICAL HOLES

When possible avoid drilling vertical holes through glulam beams. As a rule of thumb, glulam beams are drilled through the depth of 1/5-glulam beam cross-section in the capacity at that location direction proportional to the ratio of 1/10 times the diameter of the hole to the width of the beam. For example, a 1-inch hole drilled in a 6-inch-wide beam would reduce the capacity of the beam at that section by approximately (1/10)(6) = 0.6.

For the reinforced section, where it is necessary to drill vertical holes through a glulam member, the hole should be placed in the uncracked zone of the beam, which provides the maximum capacity. When drilling in-situ holes, if the beam is expected to sustain a capacity of 50% or more in that section, the beam should be supported to prevent punching. In all cases, the end distance of the hole should be at least 2-1/2 times the hole diameter. To use a drill guide to minimize “wandering” of the bit or parts, both the end distance and diameter should be held to ± 1/32 inches. To ensure that the drilling is straight, use an engineer or architect qualified in engineered timber design.

LATERAL HOLES AND NOTCHES

Bored holes shall not be located in the same section as or near nails or bolts.

Diameter

Lateral Perpendicular

Lateral Parallel

Moment critical zone

Note

NOTES:

1. Fastened resistances have been increased 13% for multi-load results in accordance with CSA O86-09.

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3. All nails are common wire nails: $d_{1}d_{2}x1-1/2" = 0.144" diameter x 1-1/2" length.

4. For fast connectors, insert 0.150" diameter x 1-1/4" length.

5. Bolt holes shall conform to ASTM A307 and have a minimum yield strength of 45,000 psi. Bolt holes are recommended to be not more than 1/32 inch from the face of the bolt and the glulam.

6. Nails shall be driven alternately from one face when lap joints of the stud or column length exceed that of the beam.

TYPICAL TALL WALL FRAMING

Typical tall wall framing

ALLOWABLE HOLES AND NOTCHES

One hole may be cut anywhere along the length of the stud or column but must not be closer than 0.5 inch from the edge.

Maximum diameter:

- 3/8" for 3-1/4" thick walls

Maximum notch:

- 1-1/8" for 3-1/4" thick walls

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Chantiers Chibougamau warrants that our products, will meet or exceed our specifications for the lifetime of the structure.

Nordic LAM guarantees that, in accordance with local codes.

NOTES:

- Minimum of 2 rows 1/2-inch-diameter bolts or 1/4 x 6-inch wood screws at 24" o.c. staggered.

- Nailed connections require an additional row of nails when nail size is smaller than specified above.

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