

TCN

The concrete answer for
your timber connections



The **Timber-Concrete Node (TCN)** leverages a simple kit of parts to make easy and economical connections in post & beam timber structures.

Versatile Connection Capabilities:

- Use the TCN as a column splice and double-sided beam connection (3-in-1 functionality).
- Suitable for a wide range of conditions, from lightly loaded purlins to heavily loaded girders.
- Supports 3- and 4-way connections with beams and girders.

Simplified Installation:

- Requires minimal screws, saving time and money.
- Easy notching and cutting of timber elements for straightforward shop fabrication.

High-Quality Precast Component:

- Factory precasting ensures precise geometry and high-quality surface finish.

Fire Resistance:

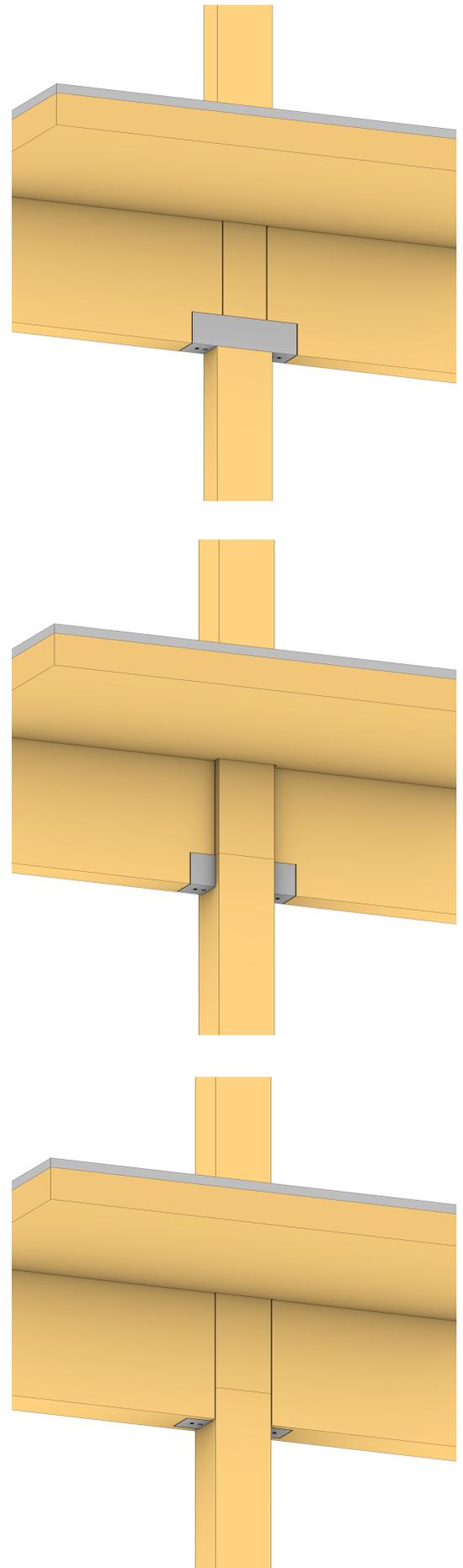
- Concrete's inherent fire resistance eliminates the need for fire tape, fire caulking, and sacrificial cover boards or plugs.

Architectural Flexibility:

- Vary the colors, shades, finishes, and textures for exposed concrete surfaces.
- TCNs can be left fully or partially visible, or can be concealed by the surrounding timber.

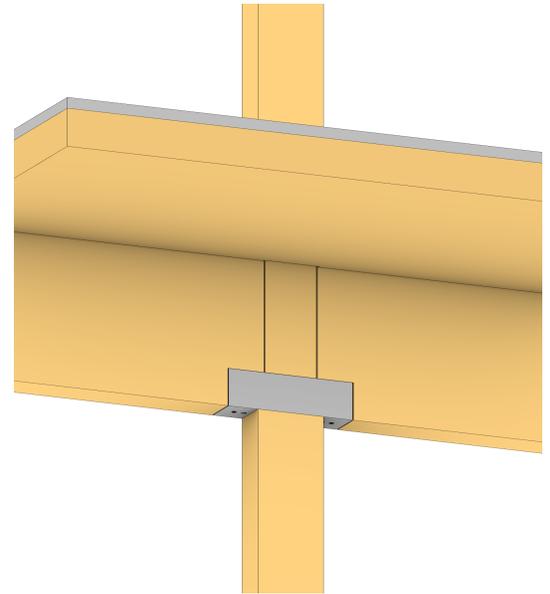
Simplified Construction:

- Use it as the column lifting device, simplifying the construction process with no parts to remove.
- High tolerance interfaces are achieved between the TCN and timber components.



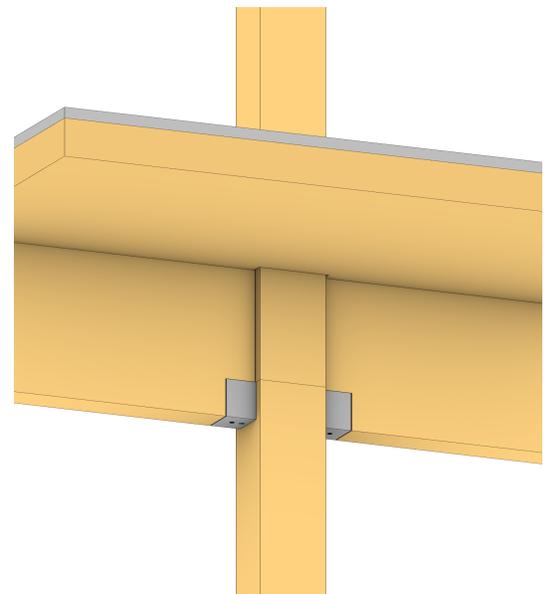
Visible

- TCN, Beam, and Column are selected as same width, so the full sides of the TCN are visible.
- Allows for maximum architectural expression of the node
- Beam bearing width is maximized.
- Column must be spliced.



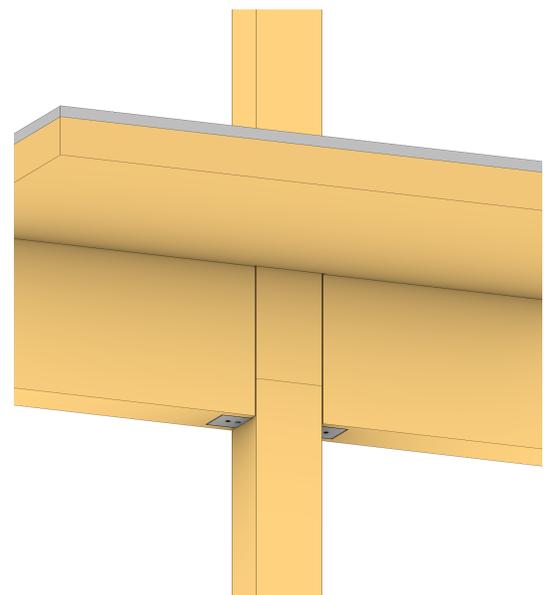
Partially Visible

- TCN and Beam are the same width, while the column is wider so the sides of the TCN are partially visible.
- Allows for partial architectural expression of the node.
- Beam bearing width is maximized.
- Column can be spliced at the TCN, or the TCN can be inserted through a hole in a continuous column.



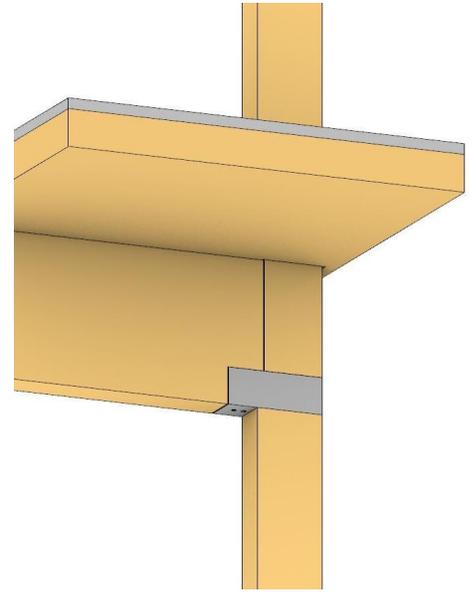
Hidden

- TCN is narrower than the Beams and Column, so only the bottom side of the TCN is visible.
- Allows for maximum expression of the timber.
- Beam bearing width is limited so TCN must be longer and deeper for a given load.
- Column can be spliced at the TCN, or the TCN can be inserted through a hole in a continuous column.



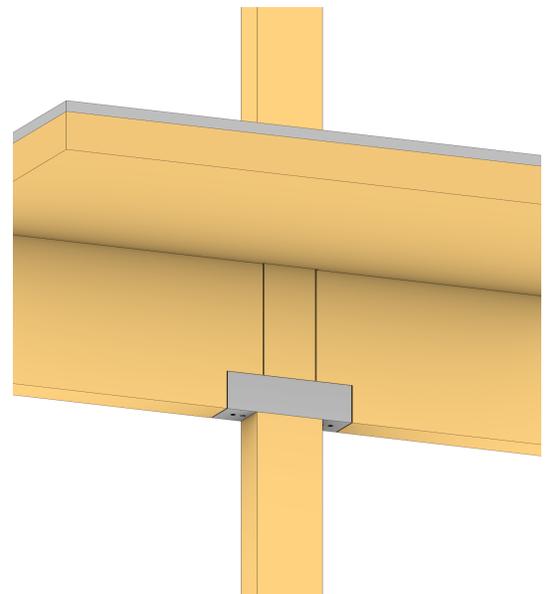
1-Sided

- Beam frames into the TCN from only 1 side of the column. This case occurs at the perimeter of the building, or at interior cores and other interruptions in the post-and-beam framing.
- TCN requires tie down screws to resist overturning for the full eccentric beam load.
- 1-Sided framing can be any of the Visible, Partially Visible, or Hidden configurations.



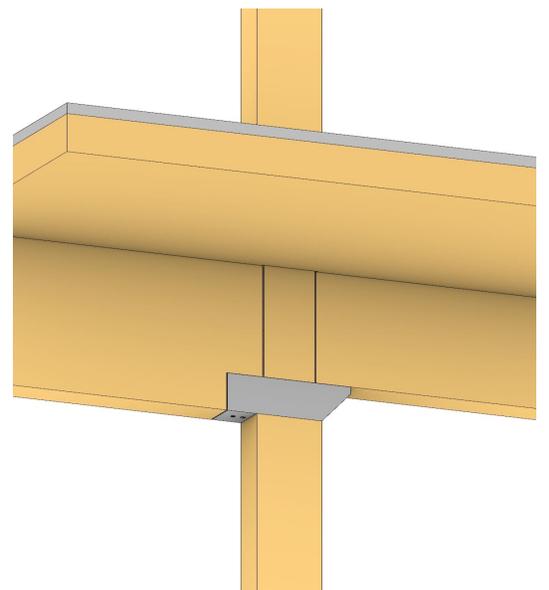
2-Sided

- Beams frame into the TCN from 2 sides of the column. This case occurs at the typical interior post-and-beam locations.
- 2-Sided framing can be any of the Visible, Partially Visible, or Hidden configurations.



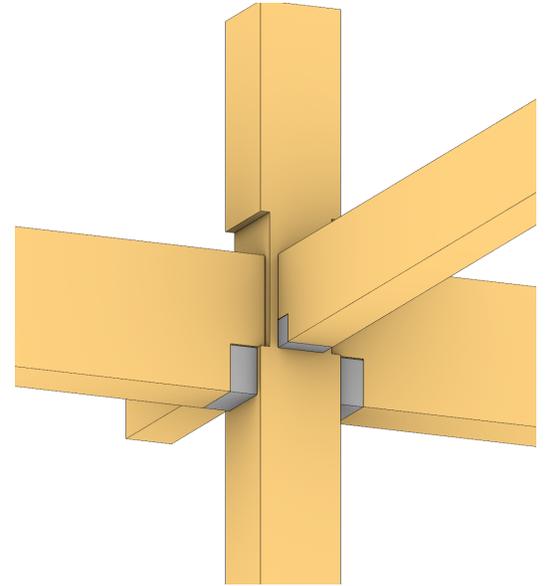
2-Sided Unequal

- Beams of unequal depths frame into the TCN from 2 sides of the column. This case may occur at interior post-and-beam locations with unequal spans.
- 2-Sided Unequal framing can be any of the Visible, Partially Visible, or Hidden configurations, but the TCN will always be at least partially visible on the side of the shallower beam.



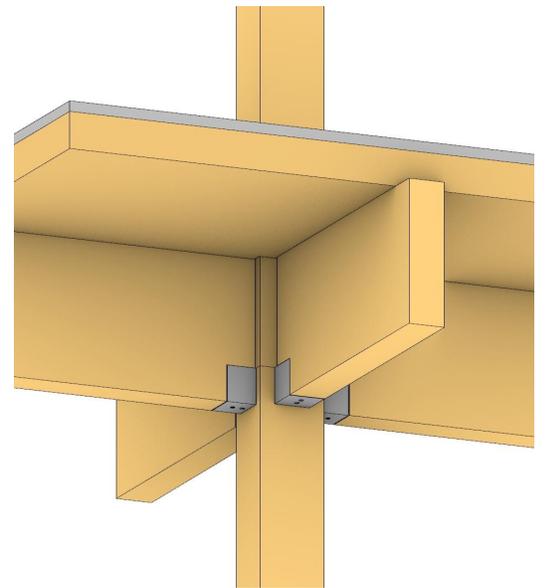
3- and 4-way Connections with Purlins

- When purlins and beams frame into the same column, 3- and 4-way connections can be created by stacking TCNs on top of one another.
- The purlin TCN can bear directly on top of the beam TCN, or be inserted through a higher hole in the side of the column in cases where the purlin is much shallower than the beam.



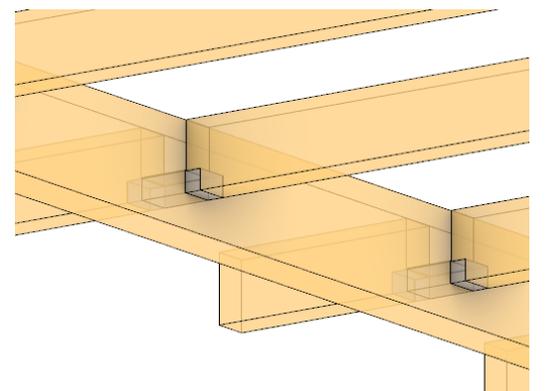
3- and 4-way Connections with Beams

- In cases where there are beams framing into the column from 3 or 4 sides and the beams are all the same depth, a single TCN can be made in a T-shape or Cruciform configuration.
- This option is atypical, and would always need to be a custom TCN casting.



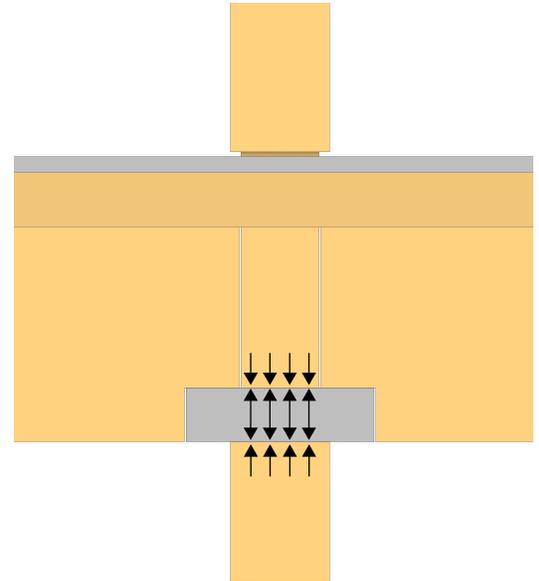
Purlin to Beam Connections

- Purlins can attach to supporting beams by inserting the TCN through a hole in the side of the beam (or similarly through a CLT wall).
- This detail is ideally used in a 2-sided configuration to limit prying the TCN and avoid splitting.



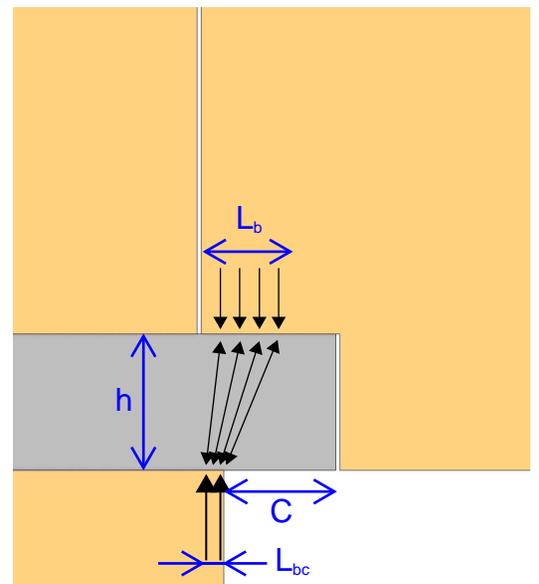
Column Load Path

- The upper column bears on the TCN, and the TCN bears on the lower column.
- When inserted through a hole in a continuous column, construction tolerance must be provided above the TCN, and the gap will be shimmed to ensure axial load is transferred through the concrete.



Beam Load Path

- Beams and purlins bear on the cantilevered portions of the TCN; the cantilever length (C) typically does not exceed the TCN depth (h).
- The face of the column is typically notched a small distance so a portion of the beam is located above the lower column section.
- The bearing width is assumed to be equal to the TCN width, while the bearing length (L_b) is chosen based on the perpendicular to grain bearing strength.



Eccentric Moment

- The eccentricity (e) between the centroid of the beam bearing length (L_b) and the column bearing length (L_{bc}) generates a bending moment on the TCN.
- The TCN is reinforced with rebar or threaded rods near the top surface so its bending capacity exceeds the maximum factored bending moment.

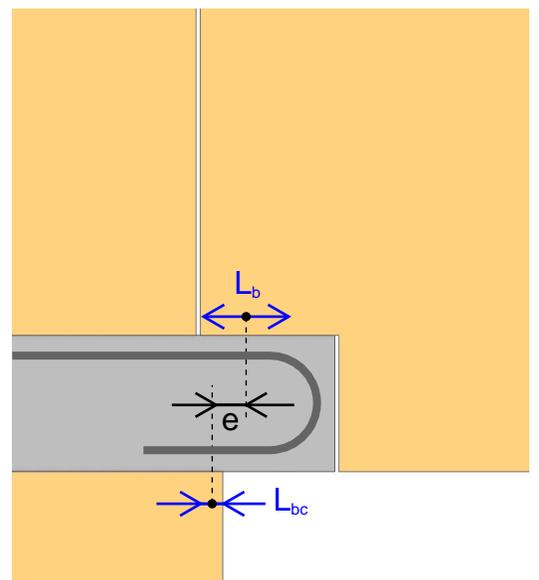


Table 1 - TCN Ultimate Load Capacity (N.Am. US Customary)

TCN Width [in] →	5	6 3/4	8 1/4	10 1/4	12 1/4
TCN Depth [in] ↓	Ultimate Load Capacity [k] per beam				
4 1/2	35	47	58	71	84
6	40	56	68	84	99
7 1/2	42	64	78	96	114

- Assumptions:
- 1) LWC (115pcf) with $f'_c = 6000$ psi minimum
 - 2) TCN reinforcing = 10M or #4 bars with $A_s = 1.2-3.5\%$
 - 3) $f_{cp} = 1020$ psi (DFir) with 10x200 bearing reinforcement screws
 - 4) Each glulam beam is notched into column face by 2in
 - 5) TCN overhang = TCN depth
 - 6) TCN sizing is based on North American glulam sizes

Table 2 - TCN Ultimate Load Capacity (N.Am. Metric)

TCN Width [mm] →	127	171	210	260	311
TCN Depth [mm] ↓	Ultimate Load Capacity [kN] per beam				
114	158	208	260	317	375
152	178	249	304	373	441
191	187	286	348	428	508

- Assumptions:
- 1) LWC (1840kg/m³) with $f'_c = 40$ MPa minimum
 - 2) TCN reinforcing = 10M or #4 bars with $A_s = 1.2-3.5\%$
 - 3) $f_{cp} = 7$ MPa (DFir) with 10x200 bearing reinforcement screws
 - 4) Each glulam beam is notched into column face by 50mm
 - 5) TCN overhang = TCN depth
 - 6) TCN sizing is based on North American glulam sizes

