Ceiling Joist Alterations
Interpretation

Issue Date:	April 2026
Code/Section:	2024 IRC R802.2, R802.3, R802.5.2, R802.5.2.1, R802.5.2.2, Table R802.5.2. AWC WFCM Table 2.3 via R301.1.1.
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Issue: This document addresses existing prescriptively framed roofs in buildings that are undergoing alterations. These alterations involve removing interior walls that supported ceiling joists. During this, the ceiling joists are proposed to be cut to make room for a beam. Many existing ceiling joists are under axial tension from resisting gravity loads and the roof-ceiling structure will not be stable without this continued tension resistance. See Figure 1.

Please be advised:
Cutting existing members under load without first providing proper members or shoring to replace that load path can result in sagging, damage, or structural collapse. This may cause serious injury or death. The Phoenix Building Construction Code does not regulate construction means, methods, or sequencing to achieve the final structural configuration.

Requirement:
When existing ceiling joists or rafter ties resisting tension are proposed to be cut, the designer of the alteration shall provide an alternate load path for that tension.

Cut ceiling joists or rafter ties shall be tied together with connectors that have approved, published thrust (axial tension) load resistance. This resistance must be equivalent to or greater than that obtained from the number of nails specified in Table R802.5.2.
This required tension load shall be derived from structural calculations or as below.

Where structural calculations are not provided, the following conservative minimum tension resistances are permitted to be used to size the tension connectors:

1. Roof spans of 36 feet:
    1.1. Rafters in 3:12 sloped roofs: 4,500lbs at 24 inch spacing. 2,250lbs at 12 inch spacing.
    1.2. Rafters in 4:12 sloped roofs: 3,380lbs at 24 inch spacing. 1,690lbs at 12 inch spacing.
    1.3. Rafters in 5:12 sloped roofs: 2,705lbs at 24 inch spacing. 1,355lbs at 12 inch spacing.
    1.4. Rafters in 6:12 sloped roofs: 2,255lbs at 24 inch spacing. 1,130lbs at 12 inch spacing.

These values are for a load duration factor listed for the tension connector of 1.6
Interpolation is not permitted for different roof slopes. Interpolation is permitted for 16” spacing.

Note that joist hangers are not rated for resisting axial tension.

Figures:
See the next page for figures showing common situations that do or do not have axial tension in the ceiling joists. Other situations exist and are not shown. Many details are not shown.

For more information about this publication, contact Planning & Development at (602) 262-7811.To request a reasonable accommodation, please contact Saneeya Mir, (602) 686-6461, Saneeya.Mir@phoenix.gov TTY: Use 7-1-1.

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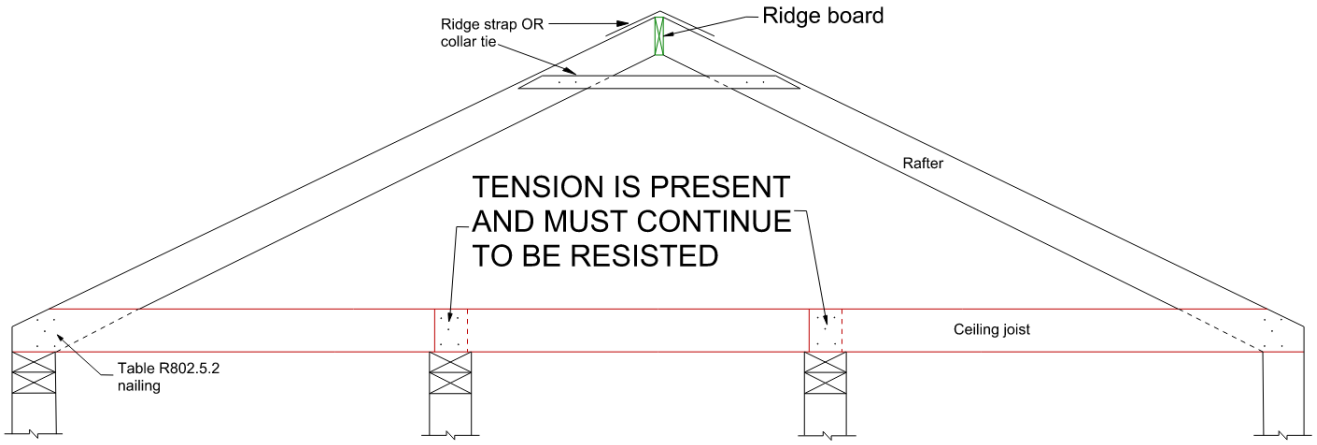

Figure 1 – Prior to alteration

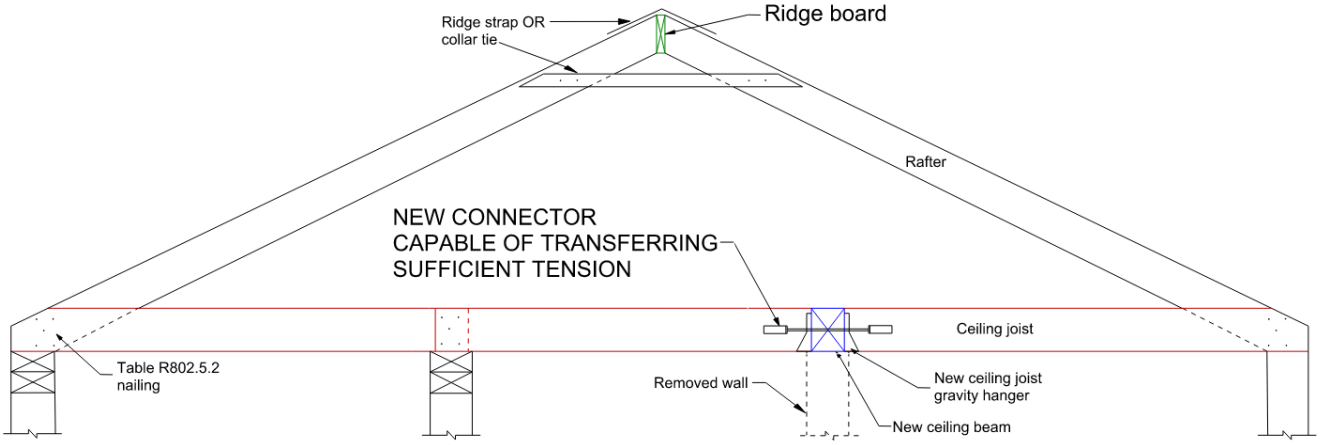

Figure 1A – One possible tension solution

Please be advised: Do not cut existing framing without tight strap or tension member in place

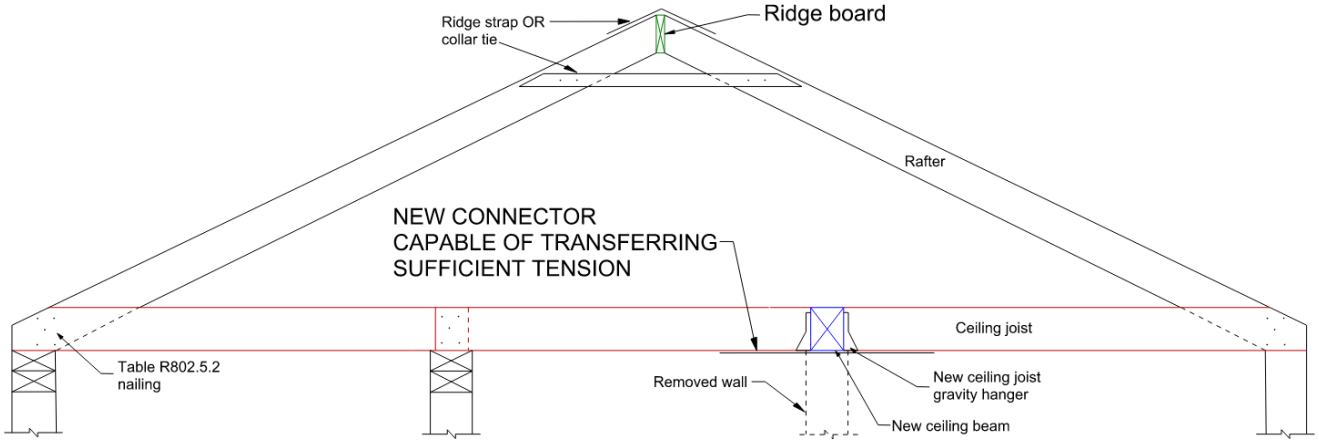

Figure 1B – One possible tension solution

Please be advised: Do not cut existing framing without tight strap or tension member in place

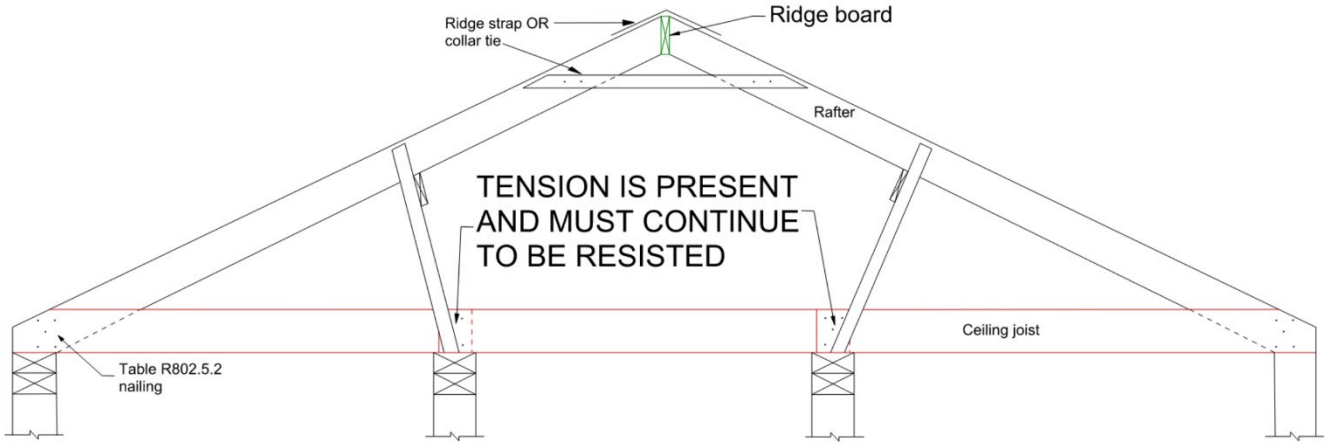

Figure 2 – Prior to alteration. Possible solution not shown.
Note: Do not remove purlins. Purlins must continue being supported.

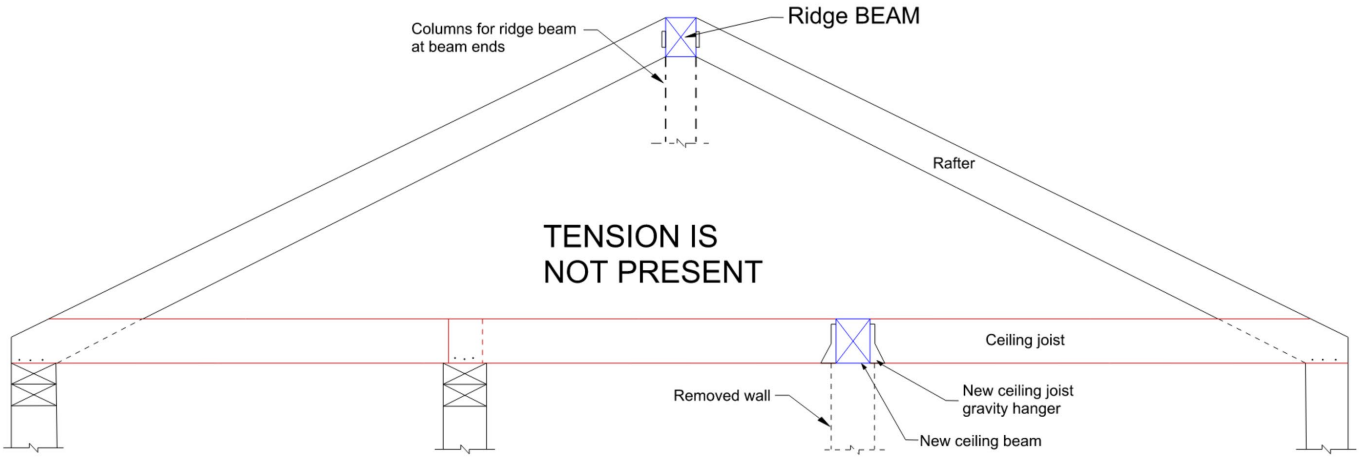

Figure 3 – No tension is present with a designed ridge BEAM

Rationale and Reference:
The gravity load paths differ greatly when a conventional construction ridge BOARD or equivalent is used versus a designed ridge BEAM.

Conventional construction requires that sloped opposing rafters push against each other at the ridge, carry axial compression along their length, and push apart at their supports. This pushing apart is called thrust. In conventional construction this thrust is resisted as axial tension in the ceiling joists or rafter ties and must be continuous from rafter to rafter.

Ridge straps and collar ties are NOT associated with this gravity load path.

Placing a strap along the bottom of the ceiling joists is eccentric with the axial load, however, the ceiling joist only needs to resist this eccentric moment with small vertical reactions at its two ends, usually quite far away from each other, which yield very small uplift at the ceiling joist to beam connection and very small down at the far end of the joist.