Demystifying the Structural Provisions of the IRC

Topics of Discussion
- Ultimate vs. Nominal Wind Speeds
- Windborne Debris Regions
- Wind Exposure Categories
- Component and Cladding Wind Loads
- Attic Live Loads
- Basement Wall Nomenclature
- Basement Wall Reinforcing
- Non-Tabulated Loading Conditions for Joists & Rafters
- Hurricane Anchor Requirements
- Tied Rafters with Raised Ceilings
- I-Joists
- Prefabricated Wood Truss Bracing

Ultimate vs. Nominal Wind Speeds

2012 IRC Basic Wind Speeds
Nominal Wind Speeds ($V_{asd}$)

2015 IRC Ultimate Wind Speeds ($V_{ult}$)
Ultimate vs. Nominal Wind Speeds

Why the Change?
• Bring into alignment with IBC
• Inconsistencies with recurrence intervals
• Ultimate loads were used for seismic design

<table>
<thead>
<tr>
<th>2012 IRC</th>
<th>2015 IRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRFD: 1.2D + f_L + 1.6W</td>
<td>LRFD: 1.2D + f_L + 1.0W</td>
</tr>
<tr>
<td>0.9D + 1.6W</td>
<td>0.9D + 1.0W</td>
</tr>
<tr>
<td>ASD: D + 0.75(L + 1.0W)</td>
<td>ASD: D + 0.75(L + 0.6W)</td>
</tr>
<tr>
<td>0.6D + 1.0W</td>
<td>0.6D + 0.6W</td>
</tr>
</tbody>
</table>

What is the impact?

Windborne Debris Regions
• Per CT Supplement: Limited to areas south of I-95 from Madison to Stonington
• Protection of Openings – R301.2.1.2

Areas more than one mile from coastal mean high-water line as certified by a Registered Design Professional are exempt.
**Windborne Debris Regions**

- **Protection of Openings – R301.2.1.2**
  - Glazed Openings: Must meet requirements of Large Missile Test of ASTM E 1996 and ASTM E1886
  - Glazing in garage doors must meet approved impact-resisting standard or ANSI/DASMA 115.
  - In lieu of impact-rated glazing, wood structural panels may be used for opening protection.
    - Panels must be pre-cut
    - Panels must be pre-drilled
    - Anchors must be corrosion-resistant
    - Anchors must be permanently attached to building
    - For h ≤ 4.5', fastening per Table R301.2.1.2 is permissible

---

**Wind Exposure Categories**

- Why are they important?
  - Significant impact on wind pressure and suction loads

  **Example:**
  - Dwelling with 30' mean roof height
    - Exposure Category C loads are 40% higher than Exposure Category B
    - Exposure Category D loads are 66% higher than Exposure Category B and 19% higher than Exposure Category C

  - Impact wide array of elements including component and cladding loads, braced walls, rafter anchorage, etc.

- Change in IRC definitions for 2018 CSBC
  - Will now align with IBC

---

**Surface Roughness B**

Urban and suburban areas, wooded areas and other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
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**Wind Exposure Categories**

**Surface Roughness C**
Open terrain with scattered obstructions generally less than 30 feet. This category includes flat, open country, and grasslands.

**Surface Roughness D**
Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, slat flats and unbroken ice.

**Exposure B**
- For buildings with mean roof height up to 30’, Surface Roughness B prevails in the upwind direction for a distance of at least 1,500’ (2,600’ for mean roof height > 30’).

**Exposure C**
- Applies where Exposures B and D do not apply

**Exposure D**
- For buildings where Surface Roughness D prevails in the upwind direction for a distance of at least 5,000’. Also applies upwind of the site a distance of 600’ or 20 times the building height from the Exposure D condition.

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Wind Exposure Categories

Buildings < 30' high

Component & Cladding Wind Loads

• Load Performance Requirements for wall coverings, curtain walls, roof coverings, windows, skylights, doors, garage doors, etc. (§R301.2.1)
• Function of:
  • Wind speed
  • Exposure
  • Mean roof height
  • Effective wind area
  • Roof pitch
  • Location on dwelling

Component & Cladding Wind Loads

Pressure Zone Locations [Figure R301.2(7)]:

Walls

Gable Roofs (7º < Θ ≤ 45º)

• Also diagrams for hip roofs and lower pitch gable roofs
• a = 4’
Component & Cladding Wind Loads

Effective Wind Area:

- The smaller the area, the greater the potential for exposure to a higher, localized wind pressure/suction
- Effective wind area is often but not always the same as tributary area.
- Table R301.2(2) – Footnote a

The effective wind area shall be equal to the span length multiplied by an effective width. This width is permitted to be no less than one-third the span length.

- 3' x 5' window: $A_{\text{TRIB}} = 15$ s.f. = $A_{\text{EFF}}$
- 3' x 6'-8" door: $A_{\text{TRIB}} = 20$ s.f. = $A_{\text{EFF}}$
- 9' high wall stud spaced @ 16" o.c.: $A_{\text{TRIB}} = 12$ s.f.; $A_{\text{EFF}} = 9' \times 9'/3 = 27$ s.f.
- Fasteners: effective wind area not greater than area tributary to an individual fastener (footnote a)

### Component & Cladding Wind Loads

**Pressure and suction load tabulations [Table R301.2(2)]**

- 30' High – Exposure B

<table>
<thead>
<tr>
<th>Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>Area</td>
<td>10 s.f.</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
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<td>20 s.f.</td>
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<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
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<tr>
<td></td>
<td>50 s.f.</td>
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<td>50</td>
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<tr>
<td></td>
<td>100 s.f.</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

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<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td></td>
<td>20 s.f.</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
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<tr>
<td></td>
<td>50 s.f.</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>100 s.f.</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

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### Component & Cladding Wind Loads

- Pressure and suction load adjustment factors for height and exposure [Table R301.2(3)]

<table>
<thead>
<tr>
<th>MEAN ROOF HEIGHT</th>
<th>EXPOSURE</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>15</td>
<td>1.00</td>
</tr>
<tr>
<td>20</td>
<td>1.00</td>
</tr>
<tr>
<td>25</td>
<td>1.00</td>
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<tr>
<td>30</td>
<td>1.00</td>
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<tr>
<td>35</td>
<td>1.05</td>
</tr>
<tr>
<td>40</td>
<td>1.09</td>
</tr>
<tr>
<td>45</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Example: 8' wide x 7' high garage door in Haddam – 18” high door panels
- Wind speed = 130 mph
- Exposure: C (adjacent to open terrain)
- Mean roof height: 30'
- Pressure Zone Location: 4 (more than 4' from corner)
- Effective Wind Area – Panelized Door Spanning Horizontally: Tributary Area of Panel = 1.5' x 8' = 12 s.f. Per footnote ‘a’, the effective width shall be permitted to be not less than 1/3 the span length. Effective Wind Area = 8' x 8'/3 = 21 s.f.

Table R310.2(2):
- For 20 s.f. Effective Wind Area, C&C Pressure = 17.4 psf; C&C Suction = 19.0 psf

From Table R301.2(3):
- Height and Exposure Adjustment = 1.40

Design Pressure = 1.40 x 17.4 psf = 24.4 psf
Design Suction = 1.40 x 19.0 psf = 26.6 psf

### Attic Live Loads

- Table R301.5
  - Habitable Attics and Attics with Fixed Stairs: 30 psf
  - Uninhabitable Attics with Limited Storage: 20 psf
  - Uninhabitable Attics with No Storage: 10 psf
    (not concurrent with other live loads)

What differentiates Uninhabitable Attics with Limited Storage from those with No Storage? For Limited Storage:
- 20”x30” access opening at point of minimum 30” clear height required
- Slope of joists or truss bottom chords S:V=12:12
- Required insulation depth < joist or truss bottom chord depth
- Height opening limitations
**Attic Live Loads**

**Limited Storage: Joist Construction**
- Clear Height Between Joists and Rafters ≥ 42”

**Limited Storage - Truss Construction**
- Clear Height Between Truss Bottom and Top Chords ≥ 42”
- Web Configuration Can Accommodate 42”H x 24”W Rectangle Between 2 or More Trusses

**Basement Walls: Nomenclature**

- Wall Lateral Supported at Top & Bottom
- Step Wall Not Laterally Supported at Top
- Wall Not Laterally Supported at Top
**Basement Walls**

- When is reinforcing required?
  - Horizontal Reinforcing: Required in all basement walls
- Vertical Reinforcing: Function of:
  - Unsupported Wall Height
  - Unbalanced Backfill Height
  - Soil Type
  - Wall Thickness

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Basement Walls

- **Why horizontal reinforcing?**
  - Concrete shrinkage cracking

- **Horizontal Reinforcing [Table R404.1.2(1)]**
  - Unsupported wall height ≤ 8'
    - One #4 bar within 12” of top of wall
    - One #4 bar near mid-height of wall
  - Unsupported wall height > 8'
    - One #4 bar within 12” of top of wall
    - One #4 bar near third points of wall height
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**Basement Walls**

- **Horizontal Reinforcing** [Table R404.1.2(1)]
  - Bars interrupted

**Lap Splices** [Table R608.5.4(1)]

- **Lap Splice Lengths**
  - (#4): 30" 
  - (#5): 38" 
  - (#6): 45"

**Vertical Reinforcing**

- **Soil Types** – USCS – Table R405.1
Basement Walls

- Vertical Reinforcing
- Soil Types – USCS

**DESIGN LATERAL SOIL PRESSURES BASED ON SOIL CLASS**

<table>
<thead>
<tr>
<th>Soil Class</th>
<th>Lateral Soil Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW, GP, SW, SP</td>
<td>30 psi/ft of depth</td>
</tr>
<tr>
<td>GM, GC, SM</td>
<td>45 psi/ft of depth</td>
</tr>
<tr>
<td>SC, ML&lt;CL, Inorganic CL</td>
<td>60 psi/ft of depth</td>
</tr>
</tbody>
</table>

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- Reinforcing inhibits Cracking
- Footnote b: vertical bars located at center of the wall
Basement Walls

- Vertical Reinforcing
  - Flat Basement Walls 6” to 12” Thick
    - Tables R404.1.2(2) to R404.1.2(5) – Bars in center of wall (per
      footnote b): 6 @ 32” required per previous example
    - Table R404.1.2(8) – Bars located 1¼” clear from inside face of wall
      (per footnote h): 6 @ 38”o.c. required for same wall

Table R404.1.2(9)

Basement Walls

- Tables do not apply to walls not laterally supported at top!
  - §R404.1.1: Design in accordance with accepted engineering practice is required for
    walls supporting more than 48” of unbalanced backfill that do not have
    permanent lateral support at the top or bottom.
  - §R404.1.3.2.2: Stem walls not laterally supported at top with more than 48” of unbalanced fill – references to §R404.1.1*
    above and §R404.4 (retaining walls; design in accordance with accepted engineering
    practice)

Joist and Rafter Spans

- Floor Joist Span Tables R502.3.1(1) to R502.3.1(2)
- Ceiling Joist Span Tables R802.4(1) to R802.4(2)
- Rafter Span Tables R802.5.1(1) to R802.5.1(8)

Variety of:
  - Lumber Species
  - Lumber Grades
  - Joist/Rafter Spacings
  - Dead Loads
  - Live/Snow Loads
  - Deflection Criteria
Joist and Rafter Spans

- How to deal with non-tabulated loading conditions

  - For Rafters with Ground Snow Loads Between 30-50 psf:
    - Use linear interpolation in the span charts (permitted by R802.5 – 2018 CT Amendments)
    - Use AWC STJR, “Span Tables for Joists and Rafters,” as permitted by R802.5
    - Use rafter span handout from OSBI (limited to No. 2 DF, HF, SoP – 35 & 40 psf snow)
    - Use AWC Maximum Span Calculator for Wood Joists & Rafters
      (http://awc.org/codes-standards/calculators-software/spancalc)

- For Floor Joists with Higher Live Loads or Different Dead Loads:
  - Use AWC STJR as permitted by R502.3
  - Use AWC Maximum Span Calculator for Wood Joists & Rafters

Joist and Rafter Spans

- How to deal with non-tabulated loading conditions

  -AWC Maximum Span Calculator Example:
Roof Tie-Down Anchorage

When are tie-down anchors necessary?

- Table R802.11: Fastening per Table R802.3(1) (toe nails) is permitted when uplift force is less than 200 pounds.

### Table R802.11

<table>
<thead>
<tr>
<th>Roof Span</th>
<th>Rafter Span</th>
<th>Uplift Connex. Forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot; max.</td>
<td>8' max.</td>
<td>24&quot; max. overhang</td>
</tr>
</tbody>
</table>

#### Uplift Connex. Forces

- Note: Table is based on Roof Span, not Rafter Span!
- Tables are based on Exposures B & C. For Exposure D, use next highest tabulated value in Exposure C (e.g. for 130 mph Exposure D, use values from 140 mph Exposure C)
- Table not valid for roof overhangs greater than 24"
- Table not valid for mean roof height > 33'
- For connections more than 8' from building corners, uplift forces can be reduced by multiplying by 0.75
- For connections at hip roofs with pitch ≥ 5:12, uplift forces can be reduced by multiplying by 0.70

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Roof Tie-Down Anchorage

- Example
  - Given: Trusses/Rafters spaced @ 24" o.c.; overhang ≤ 24"
  - Find: The allowable roof span for which standard toe-nailed connections are permissible?
Tied Rafters with Raised Ceilings

- Heel connection requirements – Table R802.5.1(9)
  - 30 psf Ground Snow Load
  - 28' Roof Span
  - 24” Rafter Spacing

<table>
<thead>
<tr>
<th>Rafter Slope</th>
<th>16d Nails Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:12</td>
<td>16</td>
</tr>
<tr>
<td>4:12</td>
<td>12</td>
</tr>
<tr>
<td>5:12</td>
<td>10</td>
</tr>
<tr>
<td>7:12</td>
<td>7</td>
</tr>
<tr>
<td>9:12</td>
<td>6</td>
</tr>
<tr>
<td>12:12</td>
<td>4</td>
</tr>
</tbody>
</table>

Walls Bow Outward
- Ridge Dips

When are the options?
- Add a structural ridge beam
- Add rafter ties

<table>
<thead>
<tr>
<th>Rafter Span</th>
<th>Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRC 2012</td>
<td>IRC 2015</td>
</tr>
<tr>
<td>1/2 Hc/Hr</td>
<td>0.50</td>
</tr>
<tr>
<td>1/3 Hc/Hr</td>
<td>0.58</td>
</tr>
<tr>
<td>1/4 Hc/Hr</td>
<td>0.67</td>
</tr>
<tr>
<td>1/5 Hc/Hr</td>
<td>0.76</td>
</tr>
<tr>
<td>1/6 Hc/Hr</td>
<td>0.83</td>
</tr>
<tr>
<td>1/7,5 Hc/Hr</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Heel Connection [Table R802.5.1(9)]
- Modify per footnotes!
Demystifying the Structural Provisions of the IRC

Tied Rafters with Raised Ceilings

• Rafter/Ceiling Joist Heel Connections – Table R802.5.1(9)

Footnotes

f. Where rafter ties are substituted for ceiling joists, the heel joint connection requirements shall be taken as two-thirds of the tabulated heel joint connection requirements for two-thirds of the actual rafter slope.

h. Tabulated heel joint connections assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors.

<table>
<thead>
<tr>
<th>Hc/Hr</th>
<th>Heel Joint Connection Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/3</td>
<td>1.5</td>
</tr>
<tr>
<td>1/4</td>
<td>1.33</td>
</tr>
<tr>
<td>1/5</td>
<td>1.25</td>
</tr>
<tr>
<td>1/6</td>
<td>1.2</td>
</tr>
<tr>
<td>1/10 or less</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Footnotes:

f. Where rafter ties are substituted for ceiling joists, the heel joint connection requirements shall be taken as two-thirds of the tabulated heel joint connection requirements for two-thirds of the actual rafter slope.

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</tr>
<tr>
<td>1/10 or less</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Given:

• Gable Roof
• 28' roof span w/ 2' overhang
• 7:12 pitch
• No. 2 S-P-F
• 8' Plate Height
• 9'-9" Ceiling Height
• 2x6 Stud Walls
• 130 mph Wind Zone – Exp. B
• 30 psf Ground Snow Load (Ceiling Attached to Rafters)
• Uninhabitable Attic with No Storage
• 10 psf Roof Dead Load
• 2"x10 @ 16"o.c. Rafters
• 2"x6" @ 16" Ceiling Joists

Find:

1. Are rafters adequate?
2. Are ceiling joists adequate?
3. What is the required connection between the ceiling joists and rafters?
4. Are hurricane ties required between the rafter and stud wall?
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Tied Rafters with Raised Ceilings

Basic Geometry
- Roof Span = 28'
- Rafter Span = 28'/2 – 6" (wall) = 13'-6"
- \( H_C \approx 9'-9" \) (clg. ht.) – 8'-0" (plate ht.) + 6" (clg. joist depth) = 2'-3"
- \( H_R \approx 28'/2 \times \frac{7}{12} \) (pitch) + 8" (rafter ht. above plate at outside of wall) = 8'-10" 
- \( H_C/H_R = 2.25'/8.83' = 0.254 \approx \frac{1}{4} \)
- Ceiling Joist Span = \([13'-6" - (1'-9" \times \frac{12}{7})] \times 2 = 21'-0" \)

1. Are Rafters Adequate?
   - Table R802.5.1(5): Allowable span for 2"x10" @ 16"o.c. rafters (No. 2 S-P-F) with 30 psf snow load, 10 psf dead load and attached ceiling = 18'-5".
   - From footnote "a", Rafter Span Adjustment Factor for \( H_C/H_R \) of \( \frac{1}{4} \) = 0.76.
   - Modified Allowable Rafter Span = 0.76 x 18'-5" = 14'-0" > 13'-6" actual rafter span
     - Rafters are O.K.

2. Are Ceiling Joists Adequate?
   - Table R802.4(1): Allowable span for 2"x6" @ 16"o.c. ceiling joists (No. 2 S-P-F) with 10 psf live load (no storage) = 16'-11" < 21'-0" actual ceiling joist span.
     - 2"x6" ceiling joists are N.G.
     - Use 2"x8" ceiling joists instead – allowable span = 22'-4"

3. What is the Required Connection Between the Ceiling Joists and the Rafters?
   - Table R802.5.1(9): For a roof span of 28', ground snow load of 30 psf, rafter slope of 7:12 and rafter spacing of 16"o.c., five (5) 16d nails are required at the rafter/ceiling heel joint connection.
   - From footnote "h", a Heel Joint Connection Adjustment Factor is to be applied when the ceiling joists are located above the wall plate. For \( H_C/H_R = 1/4 \), this adjustment factor is 1.33.
   - Number of nails required = 1.33 x 5 = 6.7
     - Use seven (7) 16d nails at the rafter/ceiling heel joint connection
4. Are Hurricane Anchors Required Between the Rafter and Stud Wall?
- Table R802.11: For a 130 wind speed in Exposure B with rafters spaced @ 16” o.c., a roof span of 28’ with a 24” overhang and a 7:12 roof pitch, the rafter uplift connection force = 203#.
  - As the connection force exceeds 200#, the standard toe-nailed connections in the Fastening Schedule are not permissible and a hurricane anchor (or acceptable alternative connection) would be required.
  - Per footnote “d”, the tabulated connection forces at locations more than 8’-0” from the building corners may be multiplied by 0.70. The design connection force in these areas would be 0.70 x 203# = 142#; toe-nailed connections in accordance with Table R602.3(1) would be permissible in these locations.

**Special Considerations for I-Joists**

**Benefits**
- Dimensionally stable
- Longer spans
- Larger openings

**Challenges**
- More complicated installation
- Plethora of details to follow
- Footnotes galore
- Specific design criteria not contained within IRC

**Special Considerations for I-Joists**

**Concentrated Loads**
- Squash blocks at post loads and stacked bearing walls

At exterior bearing walls, rim joists can often eliminate need for squash blocks below bearing walls above; squash blocks are generally still required at posts.
Special Considerations for I-Joists

- Web stiffeners
  - Sometimes required at points of bearing and when supporting concentrated loads – required locations identified on drawings

Stiffener thickness and nailing requirements per manufacturer

- Joist Hangers
  - Hangers must provide lateral restraint of top flange; otherwise web stiffeners required

Hanger Does Not Restrain Top Flange
- Web Stiffener Required

Hanger Restrains Top Flange
Special Considerations for I-Joists

- **Joist Hangers**
  - When I-Joists are used as headers, backer blocks are required at hanger connections.

  **Backer Blocks on Both Sides at Face-Mount Hangers**
  (to bear flush with bottom flange)

  **Backer Blocks on Hanger Side at Top-Flange Hangers**
  (to bear flush with top flange)

- **Double I-Joists**
  - When double I-Joists are used as headers or to support concentrated loads, they must be interconnected with filler blocks to act as a unit.

Special Considerations for I-Joists

- **Joist Penetrations**
  - I-Joists can accommodate considerably larger penetrations than sawn lumber
  - Read the footnotes!!!
Special Considerations for I-Joists

- Joist Penetrations

  Example Based on LPI 42Plus Joists

<table>
<thead>
<tr>
<th>Joist Depth</th>
<th>Circular Hole Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot;</td>
<td>2.5&quot; 2.5&quot; 3.4&quot; 4.4&quot; 5.5&quot; 6.5&quot;</td>
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<tr>
<td>11.5&quot;</td>
<td>3.0&quot; 3.0&quot; 4.0&quot; 5.0&quot; 6.0&quot; 7.0&quot;</td>
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<tr>
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<td>16&quot;</td>
<td>4.0&quot; 4.0&quot; 5.0&quot; 7.0&quot; 8.0&quot; 9.0&quot;</td>
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<table>
<thead>
<tr>
<th>Joist Depth</th>
<th>Rectangular Hole Maximum Dimension</th>
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<tbody>
<tr>
<td>8&quot;</td>
<td>2.5&quot; 2.5&quot; 3.4&quot; 4.4&quot; 5.5&quot; 6.5&quot;</td>
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<td>4.0&quot; 4.0&quot; 5.0&quot; 7.0&quot; 8.0&quot; 9.0&quot;</td>
</tr>
</tbody>
</table>

- Joist Penetrations

  These web hole tables are valid for simple and continuous spans with uniform loads only, as sized from tables contained in LP’s current I-Joist product guides. Larger holes and non-uniform loading conditions and/or closer proximity to supports may be possible, but require further analysis using LP’s design software.

Multiple penetrations near support
Openings too close together
Penetration through flange
Special Considerations for I-Joists

- Load Path Issues

Concentrated Loads in Offset Bearing Wall

Joists Below Jambs Support Significantly Heavier Loads

Issues with Other Trades – Ductwork Conflicts

Joists cut – increases load on adjacent joists
Permanent Bracing Requirements

R802.10.3 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as, the SCBA "Building Component Safety Information (BCSI) Guide to Good Practice for Handling, Installing & Bracing of Metal-Plate-Connected Wood Trusses."

www.sbcindustry.com

Primary stresses in truss members:

- Top Chord: compression
- Bottom Chord: tension
- Webs: some compression, some tension

Permanent bracing inhibits buckling of compression members
Slenderness Ratio

How does the slenderness ratio affect the allowable compression strength?

- **2"x4" - No. 1/No. 2 Spruce-Pine-Fir - Snow Load Condition**

<table>
<thead>
<tr>
<th>$l/d$</th>
<th>$P_{allow}$</th>
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<tbody>
<tr>
<td>10</td>
<td>7,270#</td>
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<tr>
<td>25</td>
<td>2,324#</td>
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<tr>
<td>50</td>
<td>863#</td>
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</tbody>
</table>

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- **Triangulation**

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- **Permanent Bracing Requirements - Truss Basics**

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- **Truss Design Drawings**
  - Truss IDs
  - Geometry
  - Truss Bearing
  - Lumber
  - Plates
  - Permanent Restraint/Bracing
  - Forces
  - Deflections
  - Design Loads
  - Design Criteria
  - Multi-Ply Girder Fastening
Metal-Plate-Connected Wood Trusses

- Permanent Bracing Requirements
  - Truss Design Drawings
    - Top Chord
    - Bottom Chord
    - Webs

**BRACING**

- **TOP CHORD** Structural wood sheathing directly applied.
- **BOT CHORD** Felt or ceiling directly applied or 2-5/8" ac bracing.
- **WEBS** 1" R-10 at midspans.

Permanent Bracing Requirements

- **Web Member Lateral Restraint/Bracing**

Requires continuous lateral restraint and intermittent diagonal bracing.

Continuous lateral restraint alone will not prevent buckling of the compression web.
Use of Office of Education and Data Management (OEDM) training materials must be approved in writing by the State of Connecticut, Department of Administrative Services’ Office of Communications.

Permanent Bracing Requirements

Web Member Lateral Restraint/Bracing

Gable End Trusses

Prefabricated stud walls

Deliver loads to walls below

Must resist wind!

Need to establish load path by which to transfer lateral wind loads (pressure or suction) from the exterior wall surface into the structure so that they can ultimately be delivered down to the foundation.
Use of Office of Education and Data Management (OEDM) training materials must be approved in writing by the Chief of Construction Inspectorate and Maintenance for the Office of Communications.

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Demystifying the Structural Provisions of the IRC

**Metal-Plate-Connected Wood Trusses**
- Permanent Bracing Requirements
  - Gable End Trusses

**Potential Points of Failure**
- Excessive Bowing of Studs
- Ceiling Cracking/Connection Failure
- Failure at Stud Wall to Gable Truss Connection

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Still need to transfer loads at ceiling elevation
- Add L-Reinforcement to Strengthen Studs

---
Demystifying the Structural Provisions of the IRC

Metal-Plate-Connected Wood Trusses

• Permanent Bracing Requirements
• Gable End Trusses

➢ Add Bracing
Use of Office of Education and Data Management (OEDM) training materials must be approved in writing by the chief of compliance, Department of Administrative Services. Office of Communications.