IRC 2012 Code Compliant Wood Framed Residential details

Miss Installed Connectors with code references and remedies, discussion.
You can help avoid this, by being diligent with inspections.
Notes to Attendees

• This presentation is intended to point out details referenced in IRC 2012 that pertain to wood framed structures relative to use of metal connectors.

• Some States and jurisdictions have adopted amendments to the IRC 2012 to provide local or state provisions that are unique to the state or local practices that may deviate from wording in this presentation.

• USP Structural Connectors encourages designers, builders, engineers and architects to contact the permitting agency for the local building code in effect for the selected construction site.
USP Structural Connectors is a MiTek Builder Products Company

• With roots beginning as TECO in 1933, the original connector company.
• With recognized names as Silver-LumberLok-Kant Sag, Hughes, Semco.
• Acquired in 2011 by Berkshire Hathaway’s MiTek in 2011, world’s leading truss design software and hardware firm.
• Complete line of products for residential and commercial construction.
This 90 second video will explain

Notice of Violation
R113.2 in the IRC code

This refers to the authorization for the Building Official to serve notice on the PERSON RESPONSIBLE for the work performed, deviation from details on an approved plan or in violation of a permit or certificate that had been issued for that project.

This differs in that it is directed to the PERSON RESPONSIBLE for the work, not necessarily the OWNER.
Stop Work Order Provision
R114.1

This provision enables the building inspector or code enforcement official to notify the owner, owner’s agent or builder or tradesman to STOP work immediately (in writing) and to identify the conditions that must be met in order for work to resume.
Lawful continuance  
R114.2

• This point of the code refers to the ability of the person who has been notified to STOP WORK to perform the work necessary to remove the violation or unsafe condition.

• Any work other than that is subject to penalties provided by law.
Just to recall, this is not a tornado, just high winds south of Syracuse NY in July of 2014.
Fastener’s change how connectors perform

- Catalogue nail vs what is used.

<table>
<thead>
<tr>
<th>Catalog Nail</th>
<th>Replacement Fastener¹</th>
<th>Allowable Load Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DF-L</td>
</tr>
<tr>
<td>10d x 1-1/2 (0.148” x 1-1/2”)</td>
<td>8d x 1-1/2 (0.131” x 1-1/2”)</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>No. 8 (0.164”) x 1-1/2 Wood Screw</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>8d Box (0.113” x 2-1/2”)</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>10d Sinker (0.120” x 2-7/8”)</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>8d common (0.131” x 2-1/2”)</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>10d Box (0.128” x 3”)</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>8d x 1-1/2 (0.131” x 1-1/2”)</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>10d x 1-1/2 (0.148” x 1-1/2”)</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>16d Sinker (0.148” x 3-1/4”)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>No. 8 (0.164”) x 1-1/2 Wood Screw</td>
<td>0.72</td>
</tr>
</tbody>
</table>
Chapter 4- Wood Foundations

• R402.1.1 references Fasteners for use BELOW grade in wood foundations for plywood on exterior side of wood studs must be 304 or 316 Stainless Steel.

• Wood foundations must not use electro-plated nails nor galvanized staples even in the above grade portions of a wood foundation. These are most common type in air powered nailers.
R403.1.6 Foundation Anchorage

- Foundation anchorage is clearly defined for exterior walls and for interior walls on monolithic slabs for walls part of a BRACED WALL PANEL on page 79.

- The anchor bolts must be min. ½” diameter and extend min. 7” into concrete of grouted cells of CMU. The next slide will help determine the appropriate length of the anchor bolt.
Hummm, Oops
What length anchor bolt??

• OK if the bolt has to be 7” into the concrete, the concrete has to be how thick at the outside edge? (8”??)

• And if it has to go thru 1 ½” sill plate and have threads enough for a washer and nut, 7” + 1 ½ + ½” for washer and nut= total minimum 9”

• Sort of makes you wonder why so many 6” anchor bolts are sold at the supply centers.
Additional details on Pg. 79

• Please familiarize yourselves with the provisions for spacing – min. 6’, 2 bolts per plate section and must have one bolt not more than 12” from the end of each plate section.

• Please be aware that it is difficult to find load values assigned to the power of the anchor bolts.
Is this good or bad?, What is needed?
Typical “J” bolt installation

• This is not the only way to do it!
Does this hold down look to be OK?
How about this one?
Is this acceptable?
Will this pass?
Exceptions are allowed that provide equivalent anchorage to ½” J bolts

- Typical FA3 Foundation Anchor
- Anchored to form boards,
Other style alternates

- Wrap around plate
- Thru a hole drilled in plate.
Is it equivalent??

- Manufacturers test products to assign values that engineers and designers rely upon.
Pier and Curtain wall straps

- R404.5.1.3 on page 106 refers to the embedment, gauge of the strap and number and size of nails needed to install
Typical floor joist layout
## Floor joist span table from mycarpentry.com

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Spacing (o.c.)</th>
<th>Species and Grade of Lumber (based on 40 lb / sq. ft. Live Load)</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Southern Yellow Pine</td>
<td>Southern Yellow Pine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#1 grade (kiln dried)</td>
<td>#2 grade</td>
</tr>
<tr>
<td></td>
<td>2&quot; x 6&quot;</td>
<td>2&quot; x 6&quot;</td>
<td>2&quot; x 6&quot;</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>11-4</td>
<td>10-3</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>10-4</td>
<td>9-4</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>9-0</td>
<td>7-9</td>
</tr>
<tr>
<td></td>
<td>2&quot; x 8&quot;</td>
<td>2&quot; x 8&quot;</td>
<td>2&quot; x 8&quot;</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>15-0</td>
<td>13-6</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>13-7</td>
<td>12-3</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>11-11</td>
<td>10-3</td>
</tr>
<tr>
<td></td>
<td>2&quot; x 10&quot;</td>
<td>2&quot; x 10&quot;</td>
<td>2&quot; x 10&quot;</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>19-1</td>
<td>17-3</td>
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<td>17-4</td>
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<td>2&quot; x 12&quot;</td>
<td>2&quot; x 12&quot;</td>
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<td></td>
<td>12</td>
<td>23-3</td>
<td>21-0</td>
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<td>16</td>
<td>21-1</td>
<td>19-1</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>18-5</td>
<td>15-11</td>
</tr>
</tbody>
</table>
Refer to the IRC table on page 115 of IRC 2012 for floor joist spans

- Code book ,IRC 2012, page 120 identifies floor framing, allowable girder spans, amount of bearing on wood or metal (1 ½”).
- R502.7 calls for full depth solid blocking for lateral restraint at supports.
- R502.7.1 identifies BRIDGING
- Cutting, notching and drilling of floor joists is clearly explained in R502.8
EWP Mfg’r. spells out what can be done. Is this acceptable?
Wood Floor Trusses are covered in R502.11

- Refer to pages 120-123 in the IRC 2012 for specific matters related to floor trusses and the modification, alteration and required bracing.

- SBCA, and BCSI, Building Component Safety Information have free information related to bracing floor and roof trusses for safety.
Floor trusses along a girder beam
Good floor truss example
Is this a good installation of a floor truss?
Floors, R502.6 Bearing

• To paraphrase the section;
• The ends of each joist, beam or girder shall have at least 1- ½” of bearing on wood or metal, or by the use of approved joist hangers.
• There are code listed joist hangers for a wide range of applications and load bearing conditions and lumber and beam sizes.
Some hanger styles

- Face mount hangers
  - JL
  - JLIF
  - SUH
  - JUS
  - MUS Similar
  - HUS
  - HD
  - HDQIF

- Top mount or top flange and specialty hangers
  - KB
  - KLB
  - HDO
  - SW
  - SWH
  - KHW
  - HL
  - JH
Some other specialty hangers

- Some used for skewed angle joists.
- Some for purlins or saddle joists.
Here is a good bridging example
Can you find any problems?
This is not a trick, any issues here?
Floor joist supported by a bolted header on a CMU wall. Good or bad?
How about this one?
C’mon man ????
Chapter 5-507 Decks

• We are pleased to advise that there is a separate 1.0 hour presentation devoted entirely to decks, deck footings, stair spans, joist spans etc.
• We will be pleased to address future opportunities to share Safe residential Deck design and Construction,
• Now on to Walls, Chapter 6.
Wood wall framing R602.1

• Of the surface components of a residential structure, the walls are the intermediate component, that carries the load path from roof structure to the floor and on to the foundation.

• The walls are also the BIG wide area that is prone to catching the effects of wind, whether it be straight line, tornadic or gusts of varying intensity.
Wood framed walls Cont’d

• This entire chapter is classic “how to do it correctly” and prescriptively.

• A frequently overlooked detail is the defined fasteners for a variety of substrates attached to studs and the stud to plate and built up studs and creating double top plates.

• IRC2012 references nail diameters that are common to power driven, NOT a typical “COMMON” nail diameter.
Compliant fasteners for walls

- Built up studs-face nail 24”o.c. 10d 3”x.135
- Built up header, 2 piece w/1/2” spacer 16d 16”o.c. 3 ½”x.135
- Rafter or truss to plate toe nail 3-16d or 3 10d common nails, 2 on one side and one on opposite side
- Top or sole plate to stud end nail- 2 - 16d 3 ½”x.135
- Sole plate to joist or blocking 16d – 16” o.c. defined as 3 ½” x .135
- Plywood panels ½” or < use 6d 2”x.113 6”o.c. edge and 12” o.c. field. Use 8d 2 ½”x.131 in roof plywood.
Footnotes are important

• Particularly, note on page 151;
• Point “d” 4x8 or 4x9 panels shall be applied vertically.
• Point “f” 110mph winds speeds call for deformed shank nails, ring or screw shank must be used where mean roof ht. is 25’ or more.
• Questions?? Comments??
Walls with minimal sheathing can be braced by using a factory engineered panel like these.
Braced wall lines and Braced wall panels are a whole hour long separate course

- We invite you to consider setting aside approx. 1.5 hours to a separate Lateral Wall Bracing presentation
How do we secure the braced wall panels to the foundation?

- One way is via Pre Deflected Hold-downs
- Tension Ties are an accepted method also, there are others too.
R602.10 metal wall bracing is OK

- Metal wall bracing is acceptable in lieu of LIB
- A saw kerf is cut into studs and a “T” is driven in and nailed off
Will plumbers hanger strap suffice?
Is this good, bad or just poor workmanship?
Is this going to pass or fail?
How about this one?
OK, Tell us what’s right or wrong?
R602.6.1 Notching a top plate

- When a top plate is notched or cut to 50% or more of its width, it must be reinforced with a **GALVANIZED** strap of 16 ga, 1 ½” wide and extend 6” on each side.

- There is an exception for wood sheathed walls on the side of the notch. (rarely happens on that side) see the next slide
Typical reinforced top plate

• The code does not require a double strap as is indicated here, a single Galv. Strap nailed per code is adequate.
Will this be allowed?
Major manufacturers have solutions for notched top and bottom plates

- Internat’l code plate that is 5” x 16” galv.
- Internat’l. code plate that is 5”x8” galv.

Typical ICPL516-TZ installation

Typical ICPL58 installation
R602.6 Drilling and notching of studs

• An exception is permitted with use of an approved stud show installed in accordance with manufacturers instructions.
Roof-Ceiling Construction, Chapter 8

• Manufacturers make a variety of rafter connections to accommodate framing styles preferences
• R802.2 refers to framing details apply to roofs with 3/12 minimum pitch or greater.
• Where the pitch is less than 3/12, joist and rafter supports shall be designed as beams
• Collar ties or ridge straps to resist wind uplift must be connected in the upper 1/3 of the attic space.
Ceiling joist and rafter spans tables are included on pages 379-398

- Spans differ with lumber species.
- 2x6 ceiling joist 16”o.c. of #3 Hem fir is 13’9” whereas same size #2 SYP is 17’8” these are maximum spans used as an example.
- It is crucial to verify the grade of lumber in use, some suppliers buy down a grade to attempt to have a price advantage at the expense of safety.
Rafter table comparison

This example is from table R802.5.1(4)

• This assumes a dead load of 10 psf and 16”o.c. and a ground snow load of 30 psf.
• The tables have many varying conditions included for environmental conditions.
• 2x8 #3 Hem-Fir span is 11’5” max
• 2x8 #2 SYP rafter span is 16’2” maximum
Many framing practices drive the variety of connectors available.

- R802.3.1 both dwgs.
- Manufacturers address I joists for rafters too
Rafter to plate connection loads

- Note the different load capacities with various species of wood.
R802.9 Framing of openings

• This section details the framed openings into an attic or area over ceiling joists.
• When the header joist is 6’ of greater, approved hangers must be used for the header to trimmer joists.
Framed opening

• Dows this conform?
R802.10 Wood Trusses

- Have any of you witnessed a truss roof collapse during construction?
- Bracing is required!!!!!! !!! !!!!
- Per R802.10.1, truss design drawings must include permanent truss member bracing locations.
- R802.10.3 says trusses must be braced to prevent rotation, see the note related to SBCA
Plans for safety

- Using steel straps
- More steel braces
SBCA Building Component Safety Information guide
Roof Tie Downs R802.11

• Trusses must resist wind uplift.
• Toe nailing is acceptable in CERTAIN instances.
• Please see the table in chapter 6 R602.3.(1)

• Individual rafters must be attached to supporting wall assemblies to resist loads imposed by various wind speeds as shown in table R802.11
Many ways to the same end

Typical RT15 truss/rafter to double plate installation

Typical RT16A truss/rafter to double plate installation

Typical RT16AR truss/rafter to double plate installation

Typical RT16-2 truss/rafter to double plate installation

Typical RT20 truss/rafter to double plate to stud installation
Girder roof ties

- Uplift girder tie (double) on left, corner on right
Other wall types

• 4Ply on masonry
Looks nice, is it good?
Skewed connections
Is this a good rafter strap?
High 5 to the person who can I.D. this malady
Special devices for maintaining dimensional integrity

- This allows for trusses to move up and down with snow or other loads while keeping aligned O.C. on the NON BEARING plate.
They don’t make a connector for that!

- Don’t believe it!
- We hear about the local metal shop making connectors to hold weird beams and angles, welded right there near the site, based on the information given.
- It’s about this long, about this high and spans about 13 feet.
- It will hold about X, are you comfortable with (about) engineering. Major manufacturers can solve most applications as long as an engineer can provide accurate dimensions and calculate the loads imposed on the joint.
Questions? Comments

• Any particular area you would like to visit?

• Can you share brief examples of errors in framing and how you helped get it fixed?