What is Conventional Construction?

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Conventional Construction

Prescriptive Requirements

- Provisions referred to as “Conventional Construction”
- IBC contains conventional construction section
- Most provisions taken from the IRC
- Two codes similar in some ways and different in others
Conventional Construction

- One of 4 design methodologies recognized in 2012 IBC Chapter 23
- Time-tested prescriptive framing methods
- Design primarily for residential construction
- Permitted to be used without design analysis or load calculations
- What if NOT using Conventional Construction?

Section 2301 – National Design Specification

- Allowable Stress Design/LRFD
- Standards become part of the code “to the prescribed extent” of the reference only
- Editions are specific
  - 2009 IBC references 2005 NDS
  - 2012 IBC reference 2012 NDS
Section 2301 – 2012 WFCM

- Wood Frame Construction Manual
- 2012 WFCM uses ASCE 7-10 wind design provisions

Section 2301.2

- 2301.2 Standard ICC 400-12 – Standard on the Design and Construction of Log Structures
Conventional Construction

- One of 4 design methodologies recognized in 2012 IBC Chapter 23
- Time-tested prescriptive framing methods
- Design primarily for residential construction
- Permitted to be used without design analysis or load calculations

Conventional Construction

- IBC Chapter 2 – Definition of “conventional light-frame construction”
  - “A type of construction whose primary structural elements are formed by a system of repetitive wood framing members.”
Conventional Construction

- **IBC Section 2308 - Limited application also defines conventional construction**
  - Maximum 3 stories above grade plane
  - Maximum floor-to-floor height of 11’-7”
  - Bearing wall height limited to 10 feet
  - Roof spans of 40 ft or less
  - Low-wind only
  - Applies in SDC A – E (added requirements for high SDCs)
  - Loads are limited

Conventional Construction

- **IBC generally limited to nonresidential**
- **IBC 2308 Conventional Framing**
  - Dwellings outside scope IRC & nonresidential
- **IRC dwellings**
  - Detached one- and two-family dwellings
  - Multiple single-family dwellings (townhouses)
  - < 3-stories
  - Separate means of egress
Conventional Construction

- IRC – Versions of the term used but not defined
- IRC – “Defined” by scope of the code
  - 1- & 2-family dwellings
  - Multiple single-family dwellings (townhouses)
  - Limit of 3-stories
  - Low-wind application
  - Loads limited
  - 2012 IRC
    - live/work units – Section 419 IBC
    - owner-occupied lodging houses – 5 or fewer guest rooms

Derived From …

- Generally consistent loading
- Traditional materials
- Relatively small structures with
  - Small spans
  - Moderate wall heights
  - Regular floor plans
Derived From …

- Larger structures which also had
  - Small spans
  - Moderate wall heights
  - Regular floor plans

High-Wind Design

**IBC & IRC:** Design wind speed limit of ≤110 mph (3-second gust) in hurricane-prone areas & ≤ 100 mph in others
High-Wind Design

For greater wind loads use
- Design per ASCE 7
- ICC 600, “Standard for Residential Construction in High-wind Regions”
- AWC’s Wood Frame Construction Manual for One- & Two-Family Dwellings (WFCM)

High-Seismic Design

- Prescriptive limits of Seismic Design
  - IBC and IRC: SDC A, B, C, D₁, D₂, and E
- Irregular structures
  - IBC: Not for use in SDC D &E
  - IRC: Not for use in SDC C & D
- Beyond IRC limits
  - Design using ASCE 7
  - AWC WFCM
Design of Portions

- IRC and IBC 2308 allows use of non-prescriptive elements if those elements are professionally designed
Conditions Not Addressed

Very Large Buildings

... Although there may be some conventional elements
Heavy Timber Framing

Glued Laminated Timbers

Not addressed but permitted
Trusses

Design required

Engineered Wood Products

Design required
Alterations of EWPs

- Alterations Prohibited
  - R502.8.2 (floors)
  - R802.7.2 (roofs)
- Unless specifically permitted
  - Manufacturer’s recommendations
  - Professional design

And Whatever ...
Code Limitations

- **IBC** prescriptive limits (IRC applies in most cases)
  - Wind: \( \leq 100 \text{ mph (3-second gust)} \) in hurricane-prone areas. \( \leq 110 \text{ mph elsewhere} \)
  - Seismic: Seismic Design Categories A - E
  - Snow: 50 psf (ground snow load)
- **IRC** prescriptive limits
  - Wind: \( \leq 100 \text{ mph (3-second gust)} \) in hurricane-prone areas. \( \leq 110 \text{ mph elsewhere} \)
  - Seismic: Seismic Design Categories A - E
  - Snow: 70 psf (ground snow load)
ASCE 7 Wind Speeds

Table C1.2 Wind Speed Conversion Table

<table>
<thead>
<tr>
<th>ASCE 7-05 Basic Wind Speeds (mph)</th>
<th>85</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent ASCE 7-10 Basic Wind Speeds (mph)</td>
<td>110</td>
<td>116</td>
<td>129</td>
<td>142</td>
<td>155</td>
<td>168</td>
<td>181</td>
<td>194</td>
</tr>
</tbody>
</table>

| | 110 | 115 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 195 |

Code References

- **IRC Section R301.1.1**
  - Accepted as an alternate to formal design for snow, wind, and seismic loading

- **IRC Section R301.2.1.1 & Figure R301.2(4)B**
  - Accepted as one of several wind design criteria
Background

- **1995 Edition**
  - Initially referenced by Standard Building Code
  - Based on SBC low-rise wind provisions
  - Addressed wind loading only
  - Referenced in 2000 editions of IBC & IRC
- **2001 Edition**
  - Based on IBC loads
  - Wind, seismic & snow loading
  - Referenced in 2009 IBC & IRC
- **2012 Edition**
  - Referenced in 2012 codes

Scope

- **1- & 2-family dwellings**
- **Maximum 3 stories**
- **Roughly rectangular shape**
- Anything outside of this scope requires acceptable engineering practice
**Scope: Design Loads**

- **Systems sized using IBC load provisions**
- **Loads**
  - Ground snow: 0 – 70 psf
  - Wind: 85 – 150 mph (3-second gust)
  - Seismic: Seismic Design Categories A - D

**Scope: Building Dimensions**

MEAN ROOF HEIGHT = 33’

Wind design: Exposure B
MRH adjustments for other exposures
Scope: Building Dimensions

**ASPECT RATIO & BUILDING DIMENSIONS**

- Max. 80’ Span
- Max. 80’ L
- Minimum L/W = 1:4
- Maximum L/W = 4:1

Scope: Floor Systems

**VERTICAL FLOOR OFFSET FIGURE 2.1i**

- Offset ≤ d
- Connect as req’d to transfer shear in both directions
- Cut sheathing for connector installation
- Band joist
Scope: Floor Systems

- **L2/L1 ≤ 4**
- FLOOR & ROOF DIAPHRAGM ASPECT RATIO LIMITS

Scope: Floor Systems

- **O2 ≤ Lesser of 12 ft or L2/2**
- **O1 ≤ Lesser of 12 ft or L1/2**
- FLOOR & ROOF DIAPHRAGM ASPECT RATIO LIMITS
Scope: Wall Systems

Shearwall

Maximum 4’ offset

SHEARWALL LINE OFFSET

Scope: Wall Systems

OFFSETS > 4’
Scope: Wall Systems

SHEARWALL STORY OFFSET FIGURE 2.1d

- Story offset \( \leq d \)
- Shearwall
- Blocking
- Floor joist

Scope: Wall Systems

SHEARWALL SEGMENT ASPECT RATIO LIMITS

- \( H/L \leq 3-1/2 \)
- \( H \)
- \( L \)
Organization

Table of Contents

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   1.2 Materials Standards
   1.3 Definitions
   1.4 Hypotheses
   Figures

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   2.2 Connections
   2.3 Floor Systems
   2.4 Wall Systems
   2.5 Roof Systems
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   Appendix A

3 Prescriptive Design
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   3.2 Connections
   3.3 Floor Systems
   3.4 Wall Systems
   3.5 Roof Systems
   List of Figures
   List of Tables
   Appendix A

Supplement

References

WFCM Commentary bound separately

WFCM Table 1
Applicability Limitations

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Limitation</th>
<th>Reference Section</th>
<th>Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING DIMENSIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Roof Height (MRH)</td>
<td>33'</td>
<td>1.1.3.1a</td>
<td>1.2</td>
</tr>
<tr>
<td>Number of Stories</td>
<td>3</td>
<td>1.1.3.1a</td>
<td>-</td>
</tr>
<tr>
<td>Building Length and Width</td>
<td>80'</td>
<td>1.1.3.1b</td>
<td>-</td>
</tr>
<tr>
<td>LOAD ASSUMPTIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(See Chapter 2 or Chapter 3 tables for load assumptions applicable to the specific tabulated requirement)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Type</td>
<td>Load Assumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partition Dead Load</td>
<td>0.8 psf of floor area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall Assembly Dead Load</td>
<td>11-18 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Dead Load</td>
<td>10-20 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof/Ceiling Assembly Dead Load</td>
<td>0-25 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Live Load</td>
<td>20-40 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Live Load</td>
<td>20 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling Live Load</td>
<td>10-20 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground Snow Load</td>
<td>0-70 psf</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Wind Load                  | 110-195 mph wind speed (700-yr. return period, 3-second gust)
|                            | Exposure B, C, and D |
| Seismic Load               | Seismic Design Category (SDC) | SDC A, B, C, Dp, Dq, and Ds |

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WFCM Chapter 2: Engineered

- Provides loads for floor/wall/roof systems
- Permits building designer to engineer various building elements using same criteria as used in Prescriptive Design section
- Information provided in tables and figures
- Includes provisions for use of wood I-joists & parallel cord trusses
- Commentary provides explanation of how loads were derived
WFCM Chapter 2: Engineered

Loadbearing Wall Loads from Snow or Live Loads
(For Wall Studs, Headers, and Girders)
Dead Load Assumptions: Roof Assembly DL = 20 psf, Wall Assembly DL = 12 psf, Floor Assembly DL = 10 psf, Floor LL = 40 psf

<table>
<thead>
<tr>
<th>Ground Snow Load or Roof Live Load (psf)</th>
<th>RLL</th>
<th>GSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>280</td>
<td>300</td>
</tr>
<tr>
<td>30</td>
<td>307</td>
<td>320</td>
</tr>
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<td>40</td>
<td>370</td>
<td>380</td>
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<tr>
<td>50</td>
<td>473</td>
<td>480</td>
</tr>
<tr>
<td>60</td>
<td>505</td>
<td>510</td>
</tr>
</tbody>
</table>

Unit Header/Girder Beam Loads (psf)

<table>
<thead>
<tr>
<th>Roof Span (ft)</th>
<th>Unit Header/Girder Beam Loads (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>320 350 400 435 477 500 535 565 595 625</td>
</tr>
<tr>
<td>24</td>
<td>565 610 640 660 680 700 720 740 760 780</td>
</tr>
<tr>
<td>36</td>
<td>800 840 870 890 900 910 920 930 940 950</td>
</tr>
</tbody>
</table>

Organization: Prescriptive Design

- Prescriptive building element design
- Information in tables & figures
- For building elements that don’t fit into prescriptive provisions – design using Engineered Design section
- Commentary provides guidance in how the prescriptive solutions were derived
- Wind design based on Exposure B but there is an additional section for Exposure C
- Slightly more conservative, but simpler to follow
WFCM Chapter 3: Prescriptive

• Example: Headers and supporting studs
  • 30 psf ground snow load
  • 115 mph wind speed (3-sec. gust), Exposure B
  • building width 36 feet
  • header span of 4-0”
    • Is a 2-ply 2x10 header adequate?
    • Required number of jack studs?

Header - exterior load bearing wall header supporting roof, ceiling, and two center bearing floors

Figure C.3.4.1.4.1 Dropped and Raised Headers

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**WFCM Chapter 3: Prescriptive**

- **Is a 2-ply 2x10 header adequate for gravity?**
  - Yes. 2-ply 2x10 span is 4’-2” > 4’-0” (from Table 3.22D1 – dropped header)
  - Yes. 2-ply 2x10 span is 4’-4” > 4’-0” (from Table 3.22D2 – raised header)

**WFCM Chapter 3: Prescriptive**

- **Underlying calc’s for gravity**
  - \( D + 0.75 \text{ Floor Live} + 0.75 \text{ Snow} \) combination controls
  - unbalanced snow controls, load = 1,712 plf (WFCM Table 2.11)
  - raised header \( C_t \) factor = 1.0 (per NDS)
  - dropped header \( C_t \) factor = 0.86 (per NDS)
WFCM Chapter 3: Prescriptive

- Are 2 jack studs on each end adequate?
  - Yes
  - 2 jack studs required at each end (from WFCM Table 3.22F)

WFCM Changes

- White paper
  - major changes from 2001 edition summarized

WFCM Addendum

- 2013 Addendum (May 2013)
  - revised span tables to account for Southern Pine design value changes


WFCM Availability

EVALUATION SERVICE REPORTS

- INTERNATIONAL STAPLE NAIL AND TOOL ASSOCIATION or ISANTA
  - ESR-1539 Dictates fastener equivalency to 16d, 12d, 10d, 8d, Common or Box, regular or pneumatic nails, etc.
  - WFCM states Common Sizes (16d=0.162” diameter x 3.5”)
  - Make sure you are aware of what you, your carpenters, & your subcontractors are using!

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[Map of the United States with contact information for AWC Field Staff members]
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    • http://awc.org/codeconnections

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