Significant Changes to AWC’s 2015 NDS® and the 2015 SDPWS
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Course Description

• AWC’s 2015 National Design Specification® (NDS®) for Wood Construction and Special Design Provisions for Wind and Seismic (SDPWS) standards are referenced in US building codes and used to design wood structures worldwide. The current editions, designated ANSI/AWC NDS-2015 and ANSI/AWC SDPWS-2015, were approved as ANSI American National Standards in 2014. This presentation will provide an overview of changes in the 2015 NDS and SDPWS relative to previous editions. Significant changes relate to the incorporation of cross laminated timber, open front diaphragms and cantilever diaphragms.
Objectives

Upon completion, participants will be:
1. Discuss significant changes between the 2012 and 2015 NDS.
2. Discuss significant changes between the 2008 and 2015 SDPWS.
3. Be able to identify the lateral resisting systems and understand where to obtain design provisions for these systems.
4. Discuss the overall format and content within the 2015 NDS and 2015 SDPWS.

Outline

- Overview
- NDS
  - Chapter-by-chapter discussion
  - Changes from previous editions
- SDPWS
  - Chapter-by-chapter discussion
  - Changes from previous editions
- More Info

Governing Codes for Wood Design

2015 NDS referenced in 2015 IBC
ANSI Accreditation

- **AWC – ANSI-accredited standards developer**
- **Consensus Body**
  - Wood Design Standards Committee

### 2015 NDS – Primary Change

**New Provisions to Address CLT**

- Charging Language
- Design Values
- Design Equations
- Product Chapter
- Connection Design
- Fire Design

### 2015 NDS Chapter Reorganization

<table>
<thead>
<tr>
<th>2012 NDS</th>
<th>2015 NDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 General</td>
<td>1-3 General</td>
</tr>
<tr>
<td>4-9 Products</td>
<td>4-10 Products +CLT</td>
</tr>
<tr>
<td>10-13 Connections</td>
<td>11-14 Connections</td>
</tr>
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<td>14 Shear Walls &amp; Diaphragms</td>
<td>Shear Walls &amp; Diaphragms</td>
</tr>
<tr>
<td>15 Special Loading</td>
<td>15 Special Loading</td>
</tr>
<tr>
<td>16 Fire</td>
<td>16 Fire</td>
</tr>
</tbody>
</table>

### Outline

- **Overview**
- **NDS**
  - Chapter-by-chapter discussion
  - Changes from previous editions
- **SDPWS**
  - Chapter-by-chapter discussion
  - Changes from previous editions
- More Info
Chapter 1 - Terminology

\[ f_b \leq F_b' \]

*Reference* design values (\( F_b, F_t, F_v, F_c, F_{c\perp}, E, E_{\text{min}} \))

*Adjusted* design values (\( F_b', F_t', F_v', F_c', F_{c\perp}', E', E_{\text{min}}' \))

Chapter 1 - Design Loads

- Reference loads
- Minimum load standards
- ASCE 7 – 10

Chapter 1 – CLT Charging Language

NDS – Chapter 2
2015 NDS

**Format Conversion Factor $K_f$**

$$R_N = C_{RD} R_{ASD}$$

$$R_N = \phi \lambda K_F R_{ASD}$$

$R_{ASD}$ reference strengths

---

Chapter 2 – CLT Design Values

### 2.2 Reference Design Values

Reference design values and design value adjustments for wood products in 2.1.1 are based on methods specified in each of the wood product chapters. Chapters 1 through 10 contain design provisions for solid lumber, glued laminated timber, poles and piles, and panel-constructed wood-framed structural composite lumber, and the design values are defined in 2.2.1.2, 2.2.1.3, 2.2.1.4, 2.2.1.5, 2.2.1.6, and 2.2.1.7, respectively.

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Chapter 3 – CLT Design Equations

### 3.5 Bending Members – Deflection

#### 3.5.1 Deflection Calculations

If deflection is a factor in design, it shall be calculated by methods of engineering mechanics, considering bending deflections and, where applicable, shear deflections. Consideration for shear deflections is required when the reference moduli of elasticity have not been adjusted to include the effects of shear deflections (see Appendix F).

#### 3.5.2 Long-Term Loading

Where total deflection under long-term loading must be limited, bending moment size is to be used where the time dependent deflection (see Appendix F) is calculated as follows:

$$\Delta_D = K \Delta_M + \Delta_T$$

Where:

- $\Delta_T$ = time dependent deflection (from Appendix F)
- $K = 1.5$ for measured lumber, structural glued laminated timber, prefabricated wood joists, or structural composite lumber used in dry service conditions as defined in 3.1.4, 3.2, 3.4, 5.1.1, and 5.2.2

$\Delta_T$ for the chapter deflection load in a combination of loads that is not continuous. All applicable load combinations provide extra stiffness to allow for this time dependent deformation (see Appendix F). Total deflection $\Delta_T$ shall be calculated as follows:

$$\Delta_T = K \Delta_M + \Delta_T$$

**New**
Chapter 3 – CLT Design Equations

2.7.1.5 The column stability factor shall be calculated as follows:

\[ C_p = \frac{1 + (F_{cm}/h_s)}{2c} \sqrt{\frac{1 + (F_{cm}/h_s)}{2c} - \frac{F_{cm}}{c}} \] (2.7.1)

where:

- \( F_{cm} \) = reference compression design value parallel to grain multiplied by all acceptable adjustment factors except \( C_p \) (see 2.3.3).
- \( F_{cm} \) = reference design value parallel to grain for each member.
- \( c = 0.9 \) for non-structural glued laminated timber, structural composite lumber, and open-laminated lumber.

New

NDS Commentary – guidance on \( C_p \)

---

Chapter 4 – Lumber

Design values

- Visually graded lumber
- MSR / MEL
- Timber
- Decking

---

NDS – Chapter 4

SAWN LUMBER

| 42 | General... | 29 |
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Table 4.3.1 Applicability of Adjustment Factors for Sawn Lumber

| 42.1 | Adjustment Factors for Sawn Lumber | 29 |
| 42.2 | ASD and LRFD | 29 |

---

Chapter 4 – Lumber

Lumber adjustment factors

| 42.1 | Adjustment Factors for Sawn Lumber | 29 |
Chapter 8 – Structural Composite Lumber

- Design Values
- Evaluation Reports
  - Contain proprietary design

Chapter 8 – Structural Composite Lumber

- New products
  - Laminated Strand Lumber (LSL)
  - Oriented Strand Lumber (OSL)
  - ASTM D5456
Chapter 9 – Wood Structural Panels

Design values - obtain from an approved source

- $F_{bS}$
- $F_{tA}$
- $F_{vA}$
- $F_s$
- $F_{cA}$
- $EI$
- $EA$
- $G_{fv}$
- $F_{cl}$

---

Chapter 9 – Wood Structural Panels

Adjustment factors

Table 9.3.1: Applicability of Adjustment Factors for Wood Structural Panels

<table>
<thead>
<tr>
<th>Adjustment Factor</th>
<th>AND (mob)</th>
<th>ASD and LRFD</th>
<th>LRFD only</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_{bS}$</td>
<td>$F_{tA}$</td>
<td>$F_{vA}$</td>
<td>$F_s$</td>
</tr>
<tr>
<td>$\times$</td>
<td>$\times$</td>
<td>$\times$</td>
<td>$\times$</td>
</tr>
<tr>
<td>2.54</td>
<td>0.85</td>
<td>2.70</td>
<td>0.80</td>
</tr>
</tbody>
</table>
Chapter 10 – Cross-Laminated Timber

10.1 General

10.1.1 Application

10.1.1.1 This chapter applies to engineering design with performance-graded cross-laminated timber.

10.1.2 Design procedures, reference design values, and other considerations apply only to performance-graded cross-laminated timber produced in accordance with ANSI/AMERICAN WOODS TRUSSTIA STANDARD DESIGN FOR CROSS-LAMINATED TIMBER.

10.1.2 Definition

Cross-Laminated Timber (CLT) is a prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or laminated veneer lumber where the adjacent layers are cross-graded and bonded with structural adhesives to form a solid-wood element.

10.1.3 Standard Dimensions

10.1.3.1 The net thickness of a laminated timber panel is defined as the sum of the thicknesses of the layers of solid-sawn lumber or laminated veneer lumber, minus the thickness of the adhesive used to bond the layers together.

10.1.4 Specification

All material reference design values shall be found in the specification section.

10.2 Reference Design Values

10.2.1 Reference Design Values

Reference design values shall be used with design section properties provided by the cross-laminated timber manufacturer.

10.2.2 Design Section Properties

Reference design values shall be used with design section properties provided by the cross-laminated timber manufacturer.

10.3 Adjustment of Reference Design Values

10.3.1 General

Reference design values such as $F_{LAM}$, $F_{LAM}$, and $F_{LAM}$ shall be multiplied by the adjustment factor found in Table 10.3.1 to determine adjusted design values.

10.3.2 Load Duration Factor, $D$ (ASD only)

All reference design values except stiffness, $E_{LAM}$, $E_{LAM}$, and $E_{LAM}$ shall be multiplied by load duration factors, $D$, obtained from Table 10.3.1.
Yield Limit Equations

<table>
<thead>
<tr>
<th>Yield Mode</th>
<th>Single Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>( Z = \frac{D_f}{R_e} ) (11.3-1)</td>
</tr>
<tr>
<td>II</td>
<td>( Z = \frac{D_f}{R_e} ) (11.3-2)</td>
</tr>
<tr>
<td>III</td>
<td>( Z = \frac{k_s D_f}{(1 + k_s R_e) R_e} ) (11.3-3)</td>
</tr>
<tr>
<td>IV</td>
<td>( Z = \frac{k_s D_f}{(1 + k_s) R_e} ) (11.3-4)</td>
</tr>
<tr>
<td>V</td>
<td>( Z = \frac{k_s D_f}{[(1 + k_s R_e) R_e]} ) (11.3-5)</td>
</tr>
<tr>
<td>VI</td>
<td>( Z = \frac{k_s D_f}{[(1 + k_s) R_e]} ) (11.3-6)</td>
</tr>
</tbody>
</table>

- 4 Modes of failure
- 6 Yield equations
- Single & double shear
- Wood-to-wood
- Wood-to-Steel
- Wood-to-Concrete

Chapter 12 – Dowel-type Fasteners

12.2.1.5 Where lag screws are loaded in withdrawal from the narrow edge of cross-laminated timber, the reference withdrawal value, \( W \), shall be multiplied by the end grain factor, \( C_w = 0.75 \), regardless of grain orientation.
Chapter 12 – Dowel-type Fasteners

12.2.2.4 Wood screws shall not be loaded in withdrawal from end-grain of laminations in cross-laminated timber (C_{w}=0.0).

12.2.3.6 Nails and spikes shall not be loaded in withdrawal from end-grain of laminations in cross-laminated timber (C_{w}=0.0).

12.2.3.6 Dowel Bearing Length

12.2.3.6.1 Dowel bearing length in the side members and main member, \( l_{m} \) and \( l_{m-adj} \), shall be determined based on the length of dowel bearing perpendicular to the application of load.

12.2.3.6.2 For cross-laminated timber where the direction of loading relative to the grain orientation at the shear plane is parallel to grain, the dowel bearing length in the perpendicular plies shall be reduced by multiplying the bearing length of those plies by the ratio of dowel bearing strength perpendicular to grain to dowel bearing strength parallel to grain \((\sigma_{b}/\tau_{b})\).

Example: ½" bolt in southern pine 3-ply CLT with 1-½" laminations

\[
\begin{align*}
\ell_{m} &= t_{1} \parallel + t_{2} \perp + t_{3} \parallel = 3(1.5) = 4.5" \\
\ell_{m-adj} &= t_{1} \parallel + t_{2}(\sigma_{b}/\tau_{b}) + t_{3} \parallel \\
&= 1.5 + 1.5(3650/6150) + 1.5 = 3.9"
\end{align*}
\]

Chapter 12 – Dowel-type Fasteners

12.3.3 Dowel Bearing Strength

12.3.3.5 Dowel bearing strengths, \( F_{b} \), for dowel-type fasteners installed into the panel face of cross-laminated timber shall be based on the direction of loading with respect to the grain orientation of the cross-laminated timber ply at the shear plane.

12.3.3.6 Where dowel-type fasteners are installed in the narrow edge of cross-laminated timber panels, the dowel bearing strength shall be \( F_{b} \) for D=1/4" and \( F_{b} \) for D=1/4".
Chapter 12 – Dowel-type Fasteners

12.5.2 End Grain Factor, C_{eg}

12.5.2.2 Where dowel-type fasteners are inserted in the end grain of the main member, with the fastener axis parallel to the wood fibers, reference lateral design values, Z, shall be multiplied by the end grain factor, C_{eg} = 0.67.

12.5.2.3 Where dowel-type fasteners with D>1/4" are loaded laterally in the narrow edge of cross-laminated timber, the reference lateral design values, Z, shall be multiplied by the end grain factor, C_{eg}=0.67, regardless of grain orientation.

NDS – Chapter 13

NDS – Chapter 14
Chapter 15 – Special Loading

- Fire resistance up to two hours
  - Columns
  - Beams
  - Tension Members
  - ASD only

Chapter 16 – Fire (ASD)

- Fire resistance up to two hours
  - Columns
  - Beams
  - Tension Members
  - ASD only
- Products
  - Lumber
  - Glulam
  - SCL
  - Decking
  - CLT - NEW
Chapter 16 – Calculated Resistance

- Fire resistance of exposed wood members may be calculated using the provisions of NDS Chapter 16

Chapter 16 – Fire Design - CLT

16.2.1.3 For cross-laminated timber, the effective char depth, \(d_{\text{eff}}\), shall be calculated as follows:

\[
d_{\text{eff}} = 1.2 \left( \frac{d}{h} \right) \left( t_{\text{char}} \right) \left( 1 - \left( \frac{d}{t_{\text{char}}} \right) \right)
\]

New

<table>
<thead>
<tr>
<th>Table 16.2.1B Effective Char Depths (for CLT with ( t_{\text{char}} = 0.6) in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Fire Exposure (hr)</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>0.5-hour</td>
</tr>
<tr>
<td>1-hour</td>
</tr>
<tr>
<td>3-hour</td>
</tr>
</tbody>
</table>

Chapter 16 – Fire (ASD)

Technical Report No. 10
- Background on NDS provisions
- Design examples
- Floor assembly lumber joist provisions

Chapter 16 – Fire (ASD)

Code Updates - Design of Fire-Resistive Exposed Wood Members

http://www.awc.org/publications/download.php
NDS – Appendices

- New Southern Pine Design Values
- ALSC approves design values
- June 1, 2013
- AWC compiles them
- NDS Supplement
- More information
  - www.spib.org
  - www.southernpine.com

2015 NDS Supplement

2015 NDS – Summary

New Provisions to Address CLT
- Charging Language
- Design Values
- Design Equations
- Product Chapter
- Connection Design
- Fire Design

Outline

- Overview
- NDS
  - Chapter-by-chapter discussion
  - Changes from previous editions
- SDPWS
  - Chapter-by-chapter discussion
  - Changes from previous editions
- More Info
Code Acceptance of Standard

- 2012 IBC
  - References 2008 SDPWS in Section 2305 for lateral design and construction
- 2015 IBC
  - References 2015 SDPWS in Section 2305 for lateral design and construction

General Overview

Outline

- Chapter 1: Flowchart
- Chapter 2: General Design Requirements
- Chapter 3: Members and Connections
- Chapter 4: Lateral Force Resisting Systems

Chapter 1 – Designer Flowchart

Outline

- Special Design Provisions for Wind and Seismic
- Select a Total Design Method
- Design Method
  - Design Category – ASD
    - Allowable Stress (Sections 19 and 6-B)
  - Design Category – LRFD
    - Factored Resisting (Sections 19 and 4-B)
- Design Considerations
  - Applicable Load Effect
- Strength Criteria Satisfied
Chapter 2 – General Requirements

• General

2.1.3 Sizes

Wood product sizes are stated in terms of standard nominal, standard net, or special sizes. For wood structural panels produced in accordance with PS 1 or PS 2, use of the term “nominal panel thickness” in this standard refers to the “Performance Category” value for these products.

Chapter 2 – General Requirements

• Terminology

Definitions

OPEN FRONT STRUCTURE. A structure in which any diaphragm edge cantilevers beyond vertical elements of the lateral force-resisting system.

SUBDIAPHRAGM. A portion of a diaphragm used to transfer wall anchorage forces to diaphragm cross ties.

• Flexible and Rigid Diaphragm removed

Chapter 3 - Members and Connections

MEMBERS AND CONNECTIONS

3.1 Framing 8
3.2 Sheathing 8
3.3 Connections 10
Chapter 3 - Members and Connections

• Framing
• Sheathing
• Connections

• Covers out-of-plane wind load resistance of shear walls and diaphragms

Chapter 3 - Members and Connections

• Framing – walls
  • Accounts for composite action
  • Strength and Stiffness
  • Applies now to EI

New

Table 3.1.1.1 Wall Stud Repetitive Member Factors

<table>
<thead>
<tr>
<th>Stud Size</th>
<th>System Factor</th>
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<tbody>
<tr>
<td>2x4</td>
<td>1.50</td>
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<tr>
<td>2x6</td>
<td>1.35</td>
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<td>2x8</td>
<td>1.25</td>
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<td>2x10</td>
<td>1.20</td>
</tr>
<tr>
<td>2x12</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Extension of 1.15 repetitive member factor, C_r

Chapter 3 - Members and Connections

• Uplift Resisting Systems

3.4 Uplift Force Resisting Systems New

3.4.1 General

The proportioning, design, and detailing of structural wood systems, members, and connections requir-
ing uplift shall be in accordance with the requirements of 3.4.1. Uplift force resisting systems shall be designed to transfer all forces from the point of application to the final point of resis-
tance.

3.4.2 Design Requirements

Uplift force resisting systems shall comply with the following:

1. Metal connectors, continuous tie rods, or other similar connection devices used in the wind uplift load path shall be of adequate strength and stiffness to transfer induced forces to supporting elements.

2. The design strength and stiffness of wood members and connections used in combination with metal connectors, continuous tie rods, or other similar connection devices shall be determined in accordance with 3.3.

3. Where uplift load path connections are not aligned from point of load application to point of resistance, additional forces and de-

New
Chapter 4 – Lateral Force-Resisting Systems

Chapter 4 – Anchorage of Concrete or Masonry Walls

4.1.5.1 Anchorage of Concrete or Masonry Walls to Diaphragm

SDC C, D, E, or F

New

4.1.5.1 Anchorage of Concrete or Masonry Structural Walls to Diaphragms: In Seismic Design Categories C, D, E, or F, diaphragms shall be provided with continuous ties or struts between diaphragm chords to distribute concrete or masonry structural wall anchorage forces in accordance with Section 12.11.2 of AWC T into the diaphragms. Sub-diaphragms shall be permitted to be used to transmit the anchorage forces to the main continuous courses. The maximum length-to-width ratio of the structural sub-diaphragms shall be 2.5:1. Connections and anchors capable of receiving the prescribed forces shall be provided between the diaphragms and the attached components.

4.1.5.1.1 Anchorage shall not be accomplished by use of nails subject to withdrawal or ties with nails or wood lath or framing held in place against sheathing or cross-grain tension.

4.1.5.1.2 The diaphragm sheathing shall not be considered effective in providing the ties or struts required by this section.

Chapter 4 – Nominal Design Value

Revised

Table 4.2C Nominal Unit Shear Capacities for Wood-Frame Diaphragms

Unbraced Wood Structural Panel Diaphragms

<table>
<thead>
<tr>
<th>Shading Code</th>
<th>Comment</th>
<th>Wind Loads</th>
<th>Vertical</th>
<th>Lateral</th>
<th>Vertical</th>
<th>Lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>SB/SMB</td>
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<td>10.0</td>
<td>7.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>WIND</td>
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<td>10.0</td>
<td>7.0</td>
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</table>

<table>
<thead>
<tr>
<th>Shading Code</th>
<th>Comment</th>
<th>Wind Loads</th>
<th>Vertical</th>
<th>Lateral</th>
<th>Vertical</th>
<th>Lateral</th>
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</tbody>
</table>

Source: WoodWorks
Chapter 4 – Nominal Design Value

- Diaphragm Configuration Figures
  - Direction with respect to load of
    - Continuous panel joints
    - Framing members
  - Independent of panel orientation

Chapter 4 – Horizontal Distribution

Revised

4.2.5 Horizontal Distribution of Shear

- Idealized as Flexible
  - ASCE 12.3.1.1, or
  - \[ \Delta_{\text{DIAPHRAGM}} > 2 \times \Delta_{\text{SHEARWALLS}} \]

- Idealized as Rigid
  - ASCE 12.3.1.2, or
  - \[ \Delta_{\text{DIAPHRAGM}} \leq 2 \times \Delta_{\text{SHEARWALLS}} \] (NEW)

- Relative lateral stiffness of vertical LFRS
- Semi-rigid – complex analysis or “envelope” (NEW)

Chapter 4 – Lateral Force-Resisting Systems

Revised

4.2.5.1 Torsional Irregularity

- SDC A - Exempt
- WSP diaphragms L/W < 1.5:1
- Diagonal Lumber (single or double layer) L/W < 1:1
- Maximum story drift < ASCE 7 allowable story drift

Chapter 4 – Open Front Diaphragms

Revised

Figure 4A Examples of Open Front Structures

- Diaphragm supports
- Structural elements
- Open front diaphragm connections
4.2.5.2 Open Front Structures
• Not Torsionally Irregular
  • WSP diaphragms $L'/W' < 1.5:1$
  • Diagonal Lumber (single or double layer) $L'/W' < 1:1$
• Torsionally Irregular
  • $>1$-story $L'/W' < 0.67:1$
  • $1$-story $L'/W' < 1:1$

4.2.5.2.1 Open Front Structures – 1 story
• $L' \leq 25'$
• $L'/W' \leq 1:1$
• Idealized as rigid - distribution of torsional shear

Chapter 4 – High Load Diaphragms
Blocked Diaphragm Configuration Figures
• Direction with respect to load of
  • Continuous panel joints
  • Framing members
  • Independent of panel orientation

Revised
4.2.7.1.2 High Load Blocked Diaphragms

4. The depth of framing members and blocking into which the nail penetrates shall be 3" nominal or greater.

4.5. The width of the nailed face of framing members and blocking at boundaries and adjoining panel edges shall be 3" nominal or greater. The width of the nailed face not located at boundaries or adjoining panel edges shall be 2" nominal or greater.

Footnotes to High-Load Diaphragm Table

Loads were limited by lumber splitting

2 x 4

Chapter 4 - Design Value Format

- Nominal design values tabulated for shear walls
- ASD
  - reduction factor (2.0)
- LRFD
  - resistance factor 0.80

4.3.3 Unit Shear Capacities

The ASD allowable unit shear capacity shall be determined by dividing the tabulated nominal unit shear capacity, modified by applicable footnotes, by the ASD reduction factor of 2.0. The LRFD factored unit resistance shall be determined by multiplying the tabulated nominal unit shear capacity, modified by applicable footnotes, by a resistance factor of 0.80. No further increase shall be permitted.

Chapter 4 - Lateral Force-Resisting Systems

4.3.3.4 Shears Walls in a Line: same materials and construction

- Individual full height shear walls provide all same deflection, $\delta_{sw}$
  - Exception:
    - WSP $h/b_s > 2:1 \quad \nu_s x 2b_s/h$
    - Fiberboard $h/b_s > 1:1 \quad \nu_s x (0.1 + 0.9b_s/h)$
    - Shear distribution proportional to capacities
    - Shear capacity reduction not combined with aspect ratio adjustment (4.3.4.2)

| Aspect Ratio | Factor |
|--------------|--------|}
| 2:1 unless $\nu_s = 2(b_s/h)$ | 1.00 | 0.67 | 0.57 |
Chapter 4 – Aspect Ratios & Capacity Adjustments

4.3.4.2 – Shear Wall Aspect Ratio Factors
- $h/b_w > 2:1$  WSP
- $v_s \times (1.25 - 0.125(h/b_w))$
- $h/b_w > 1:1$  Struct. Fiberboard
- $v_s \times (1.09 - 0.09(h/b_w))$

<table>
<thead>
<tr>
<th>Aspect Ratio</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:1</td>
<td>1.00</td>
</tr>
<tr>
<td>3:1</td>
<td>0.875</td>
</tr>
<tr>
<td>3½:1</td>
<td>0.813</td>
</tr>
</tbody>
</table>

2:1 unless $v_s = (1.25 - 0.125(h/b_w))$

What’s Missing for CLT?

Seismic Design!
- ASCE 7 Minimum Design Loads for Buildings and Other Structures
- Response Modification Coefficient, $R$
  - CLT not recognized system in ASCE 7 Table 12.2-1
- Options
  - Performance-based design procedure per ASCE 7
  - Demonstrating equivalence to an existing ASCE 7 system
  - ASCE 7-10, FEMA P695, and FEMA P795
- Quantification of Building Seismic Performance Factors; Component Equivalency Methodology
Outline

- Overview
- NDS
  - Chapter by chapter discussion
  - Changes from previous editions
- SDPWS
  - Chapter by chapter discussion
  - Changes from previous editions
- More Info

Availability

- www.awc.org
  - PDF versions
    - Free view-only
    - Buy a printable PDF
  - Spring 2015
    - Commentary
    - Printed version

Technical Articles

- Structure Magazine
  - 2015 NDS
    - January 2015
  - 2015 SDPWS
    - February 2015
- www.awc.org
  - What's Changed?

Wind & Seismic Standards

- More details on changes
- Wood Design Focus papers
  - 2008 Special Design Provisions for Wind and Seismic
  - Use of Wood Structural Panels to Resist Combined Shear and Uplift from Wind
- Download free at www.awc.org
Webinars

- February 19, 2015

Questions?

- This concludes The American Institute of Architects Continuing Education Systems Course

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