WOOD & THE FIRE RESISTANCE
REQUIREMENTS OF THE IBC

Dennis Pitts
Regional Director
American Wood Council

Learning Objectives

At the end of this program, participants will be:

1. Familiar with the general requirements that address fire resistance in the IBC
2. Familiar with specific methodology for determining fire resistance of wood construction
3. Familiar with the various details of the code that allow the use of combustible materials in building typically considered to be noncombustible.
4. Familiar with the specific provisions of the code that permit the wide use of fire retardant treated wood in lieu of noncombustible elements of buildings that are otherwise noncombustible.
AWC: American Wood Council

- ICC
- ASTM
- ASHRAE
- NFPA
- ASCE
- BSSCE
- State
- Regional
- Local

AWC Staff

- Engineering
  - Structural Engineering
  - Fire Engineering
  - Design Tools
  - Research
- Field Staff
  - Code Advocacy
  - Standards
  - Product Acceptance
  - 5 Regional offices

- Technology Transfer
  - Publications
  - Help Desk
  - Website
  - Software

AWC Publications

Internationally recognized standards for wood design & construction
Fire Resistance Rating

Section 703

The fire resistance rating of buildings shall be determined in accordance with

- ASTM E119 or UL 263
- Tabular methods
- Calculated methods
- Engineering analysis

The fire resistance rating of an assembly is independent of whether it’s of combustible or noncombustible material.
Fire Resistance Rating

Methods for determining fire resistance
• By tests (ASTM E119 or UL 263)
• Tabular
• Calculated
• Engineering analysis

Fire Resistance Rating

• Floor & wall assemblies
• Published by AWC
• Downloadable from awc.org
• ASTM E119 tests

Fire Resistance Rating

Methods for determining fire resistance
• By tests (ASTM E119 or UL 263)
• Tabular
  – IBC Table 719.1(1): Various structural members
  – IBC Table 719.1(2): Walls & partitions
  – IBC Table 719.1(3): Floors & roofs
  – Reflects tested assemblies
• Calculated
• Engineering analysis
Fire Resistance Rating

Methods for determining fire resistance

• By tests (ASTM E119 or UL 263)
• Tabular
• Calculated
• Engineering analysis

Calculated fire resistance

• Wood data developed by Nat’l Research Center, Canada
  – Review of more than 200 tests
  – Research on fire behavior of individual materials when combined
• Methodology recognized by IBC Section 722
• For new & existing assemblies
• Published in ASCE/SFPE 29-05

Calculated Fire Resistance

• Published by AWC
• Downloadable on awc.org
• Repeats much of what’s in IBC but has other material

Calculated fire resistance

• Time assigned to protective membrane
  – Membrane assumed on exposed side
  – Based on ability to stay in place during fire tests
  – Not to be confused with finish rating
• Time assigned to studs and joists
  – Based on time-to-failure after failure of protective membrane
• Times are additive (exposed membrane + stud/joist)
• Code limit of 60 minutes
Fire Resistance Rating

**Calculated fire resistance:**
Time assigned to protective membranes

<table>
<thead>
<tr>
<th>Description of Finish</th>
<th>Time (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot; Douglas-fir plywood, phenolic bonded</td>
<td>5</td>
</tr>
<tr>
<td>1/2&quot; Douglas-fir plywood, phenolic bonded</td>
<td>10</td>
</tr>
<tr>
<td>5/8&quot; Douglas-fir plywood, phenolic bonded</td>
<td>15</td>
</tr>
<tr>
<td>3/8&quot; Gypsum board</td>
<td>10</td>
</tr>
<tr>
<td>1/2&quot; Gypsum board</td>
<td>15</td>
</tr>
<tr>
<td>5/8&quot; Gypsum board</td>
<td>20</td>
</tr>
<tr>
<td>1/2&quot; Type X gypsum board</td>
<td>25</td>
</tr>
<tr>
<td>5/8&quot; Type X gypsum board</td>
<td>40</td>
</tr>
<tr>
<td>Double 3/8&quot; gypsum board</td>
<td>25</td>
</tr>
<tr>
<td>1/2&quot; + 3/8&quot; gypsum board</td>
<td>35</td>
</tr>
<tr>
<td>Double 1/2&quot; gypsum board</td>
<td>40</td>
</tr>
</tbody>
</table>

(Footnotes apply in code table)

Fire Resistance Rating

**Calculated Fire Resistance – Exposed Members**

- Originally published by AWC as an evaluation report
- Methodology recognized by IBC Section 722
- Recently published in ASCE/SFPE 29-05
- AWC proposing to delete this in 2015 IBC.
Calculated Fire Resistance – Exposed Members

- Applicable to members of large cross-section

Heated zone

Charred wood

- Depth and width of beam/column
- Load factor
  - Unsupported length/span
  - End condition – fixed or free
- Ratio of allowed load to actual
- Different process for exposure on 3 or 4 sides

This document is downloadable from awc.org

Contains code information but also added material

Suggested fastener protection

Development of methodology

Calculations vs. experiments

Detailed design procedures

Application guidelines

Examples

Design aids

Downloadable (awc.org)
Fire Resistance Rating

Methods for determining fire resistance

• By tests (ASTM E119 or UL 263)
• Tabular
• Calculated

• Engineering analysis
  – Based on comparison with assemblies complying with ASTM E119 or UL 263

Flame Spread

Flame Spread – ASTM E84 or UL 723
Flame Spread of Wood Products

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Flame Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0 - 25</td>
</tr>
<tr>
<td>Fire retardant treated wood</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>26 - 75</td>
</tr>
<tr>
<td>Redwood</td>
<td></td>
</tr>
<tr>
<td>Cedar</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>76 - 200</td>
</tr>
<tr>
<td>Most other species</td>
<td></td>
</tr>
<tr>
<td>Softwood plywood</td>
<td></td>
</tr>
<tr>
<td>Hardwood plywood</td>
<td></td>
</tr>
<tr>
<td>Particleboard</td>
<td></td>
</tr>
</tbody>
</table>

Flame Spread

- Published by AWC
- Downloadable from awc.org

Combustibles in Noncombustible Buildings

Types I & II Construction

- Definition: Types of construction in which structural frame, bearing & nonbearings walls, floor & roof construction are noncombustible.
- Exceptions:
  - Section 603
  - Various places elsewhere in code
Combustibles (Wood Related)

• Confusing in earlier editions of IBC
• IBC Section 603.1
  – Fire retardant treated wood
  – Millwork
  – Interior wall & ceiling finish
    • Subject to Ch. 8
  – Stages & platforms
    • Subject to Sec. 410

Combustibles (Fire Retardant Treated Wood)

• IBC Section 603.1
  – Nonbearing partitions ≤ 2-hr fire resistance
  – Nonbearing exterior walls with no fire rating
  – Roof construction (including framing & decking)
    • EX: Type IA > 2 stories where distance from upper floor to roof < 20 ft.

Combustibles (Wood Related)

• IBC Section 603.1 (continued)
  – Exterior wall coverings, balconies, projections (Chapter 14)
    • Wall coverings: thickness & height limited (higher w/ FRTW)
    • Quantity limited near property line
    • Balconies: limited in fire resistance & limited percentage of perimeter
    • Lots of exceptions
  – Heavy timber
    • Roof construction Types I-B & II where ≤ 1-hr fire resistance
      – Table 601 (ftnote c): Also can be exposed
      • Exterior columns & arches > 20 ft from property line

Combustibles (Fire Retardant Treated Wood)

• Table 601 (ftnote b): Fire resistance protection not required where every part of roof assembly > 20 ft above floor. FRTW allowed in exposed members. Ex. for some occupancies.
• Sec. 1405.5: Height limit on combustible veneers increased 50% with FRTW.
• Sec. 1406.2: Where ≤ 5 ft from property line, no limit on amount of FRTW veneer.
• Sec. 1406.3 (balconies & projections):
  – FRTW exempt from fire resistance requirements
  – FRTW permitted for bay & oriel windows on buildings ≤ 3 stories
QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

Dennis Pitts
American Wood Council
dpitts@awc.org