IRC Fire Protection of Floors Code Language

2012 IRC R501.3
2015 IRC R302.13
Floor assemblies, not required elsewhere in this code to be fire resistance rated, shall be provided with a ½ inch gypsum wallboard membrane, 5/8 inch wood structural panel membrane, or equivalent on the underside of the floor framing member.

[IBC Section 722.6.2 defines “Time Assigned to Wallboard Membranes” – ½ inch gypsum wallboard being 15 minutes plus the time of what it is attached to.]

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA13D, or other approved equivalent sprinkler system.

2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies can be unprotected when complying with the following:

3.1 The aggregate area of the unprotected portions shall not exceed 80 square feet per story.

3.2 Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.

4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.
IRC Fire Protection of Floors

2012 Report and Test Results by UL
Fire Protection of Floors

Global Fire Research Site

UL Report Findings (PDF)

Improving Fire Safety by Understanding the Fire Performance of Engineered Floor Systems and Providing the Fire Service with Information for Tactical Decision Making

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March 2012
UL Residential 2x10 Floor Construction Fire Test Video
Floor Collapses at 6:55 minutes

2 by 10 Dimensional Lumber
### Furnace Test Results

<table>
<thead>
<tr>
<th>First Column -- Time Of Structural Failure for the Assembly (m/s)</th>
<th>Second Column – Failure of Load Bearing Capacity for the Assembly (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Engineered I Joists with Openings</td>
<td>8:10 6:10</td>
</tr>
<tr>
<td>2. Engineered Wood and Metal Hybrid Trusses</td>
<td>5:30 4:20</td>
</tr>
<tr>
<td>3. Engineered I Joists (100% Load)</td>
<td>2:20 2:20</td>
</tr>
<tr>
<td>4. Engineered I Joists w/ Fire Retardant Coating</td>
<td>8:40 7:50</td>
</tr>
<tr>
<td>5. Nominal 2&quot; by 10&quot; Dimensional Lumber (100% Load)</td>
<td>7:04 7:04</td>
</tr>
<tr>
<td>6. 1940 Legacy Nominal 2&quot; by 8&quot; Dimensional Lumber (100% Load)</td>
<td>18:05 17:40</td>
</tr>
</tbody>
</table>
IRC Fire Protection of Floors

2015 Confirmation Testing by SBCA
UL and SBCA ASTM E119 100% Design Load
Fire Test Data is Aligned – Says Protect Everything

**UL ASTM E119, Unprotected Floor Assembly, 100% Design Load Fire Endurance Performance Benchmark Tests**

<table>
<thead>
<tr>
<th>Test Member Recent UL Test Data</th>
<th>UL Test [% design load]</th>
<th>Time of Total Structural Failure</th>
<th>Time of Failure Load Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today’s 2x10 Dimension Lumber</td>
<td>UL Data [100%]</td>
<td>7:04 (min:sec)</td>
<td>7:04 (min:sec)</td>
</tr>
<tr>
<td>9-1/2” I-Joist</td>
<td>UL Data [100%]</td>
<td>2:20 (min:sec)</td>
<td>2:20 (min:sec)</td>
</tr>
</tbody>
</table>

**SBCA ASTM E119, Unprotected Floor Assembly, 100% Design Load Fire Endurance Performance Benchmark Tests**

<table>
<thead>
<tr>
<th>Test Member March 2015 SBCA Test Data</th>
<th>NGC Test [% design load]</th>
<th>Total Applied Load (psf)</th>
<th>Time to Failure (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x10 Southern Pine (16” o.c.)</td>
<td>NGC FC-853 [100%]</td>
<td>42.0</td>
<td>10:35 (min:sec)</td>
</tr>
<tr>
<td>12” Trusses no SP (24” o.c.)</td>
<td>NGC FC-858 [100%]</td>
<td>48.5</td>
<td>6:54 (min:sec)</td>
</tr>
<tr>
<td>9-1/2” Flak Jacket I-Joist (19.2” o.c.)</td>
<td>NGC FC-857 [100%]</td>
<td>75.5</td>
<td>6:37 (min:sec)</td>
</tr>
<tr>
<td>12” Trusses no SP (24” o.c.)</td>
<td>NGC FC-854 [100%]</td>
<td>48.5</td>
<td>6:02 (min:sec)</td>
</tr>
<tr>
<td>9-1/2” I-Joist (19.2” o.c.)</td>
<td>NGC FC-855 [100%]</td>
<td>84.0</td>
<td>4:25 (min:sec)</td>
</tr>
<tr>
<td>12” Trusses w/SP (24” o.c.)</td>
<td>NGC FC-856 [100%]</td>
<td>52.3</td>
<td>3:33 (min:sec)</td>
</tr>
</tbody>
</table>

2. SP = splice joint. This test had strong-back to bearing.
3. SP = splice joint. This test had strong-back but not to bearing.
4. Flak Jacket was ICC-ES ESR -1153 approved 2013 product from market to be sold inventory. ICC-ES approved design values and holes were incorporated.
5. ICC-ES approved design values and holes were incorporated.
IRC Fire Protection of Floors
2012 Report Recommendations by UL
All of these experiments were started with a flaming ignition. The average collapse times of all of the engineered floor systems were prior to the arrival of the fire service with the 50th percentile response time of 5 minutes (9 minutes total including 4 minutes to begin the response). All of the engineered floor system experiments, including the maximum times to collapse occurred prior to the arrival of the 90th percentile response time of 11 minutes (15 minutes total including 4 minutes to begin the response). The average collapse time of the dimensional lumber floor system experiments also occurred at the time of the arrival of the fire service with the 90th percentile response which emphasizes the importance of protecting all types of flooring systems, including dimensional lumber. Regardless of the unprotected floor system type no factor of safety can be assumed, doubling the average collapse time of all of these experiments still results in a collapse time that could occur within the operational timeframe of any fire department with any response time. It is important to note that these times are when the fire service would arrive to begin their operations, not the time it takes to mitigate the incident.
9. Summary of Findings:

Basement fires are challenging and dangerous. Firefighters can be in a position where they are operating above the fire and in some cases without knowing it. When above a basement fire with an unprotected wood floor assembly a number of challenges exist. Often the fire service has no idea how long the fire has been burning, no information on the type of floor system and no means of assessing the structural integrity of the floor system. There are little if any warning signs of collapse so it is very important to understand the hazards associated with a basement fire because the consequences of falling through a floor into a basement fire are pinnacle. To increase fire fighter safety UL accomplished several objectives with this research project.
UL Research Finding (Pages 3 & 68 on collapse times, Page 64 Section 8.1 on Exception 4 for Context)

- Collapse times of all unprotected wood floor systems are within the operational time frame of the fire service regardless of response time.

Based on the collapse times from these experiments there is little to no safe operating time for firefighters in a structure with an unprotected dimensional lumber floor system.

dimensional lumber even though its dimensions were actually smaller. While the fire service suggests that the factor of safety provided by older dimensional lumber was acceptable the experimental results show that new dimensional lumber is significantly different in terms of performance under fire conditions. Protecting the dimensional lumber as well as engineered lumber floor systems in future code requirements would eliminate this fire performance change in dimensional lumber and provide a more reasonable factor of safety for the fire service.
Relevant Minnesota Law
SECTION R101 GENERAL

R101.1 Title. These provisions shall be known as the Residential Code for One- and Two-family Dwellings of [NAME OF JURISDICTION], and shall be cited as such and will be referred to herein as “this code.”

R101.2 Scope. The provisions of the International Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, ...... detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures....

R101.3 Intent. The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, .... energy conservation and safety to life and property from fire... attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.
Current MN 1300.0030 Purpose and Application

- **1300.0030 PURPOSE AND APPLICATION.**

- Subpart 1.

- **Purpose.**

- The purpose of this code is to establish minimum requirements to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to **provide safety to firefighters and emergency responders during emergency operations.**

- The purpose of the code is not to create, establish, or designate a particular class or group of persons who will or should be especially protected or benefited by the terms of the code.
325D.49 CITATION.

• Sections 325D.49 to 325D.66 may be cited as the Minnesota Antitrust Law of 1971.

325D.52 ESTABLISHMENT, MAINTENANCE, OR USE OF MONOPOLY POWER.

• The establishment, maintenance, or use of, or any attempt to establish, maintain, or use monopoly power over any part of trade or commerce by any person or persons for the purpose of affecting competition or controlling, fixing, or maintaining prices is unlawful.
326B.106 STATE BUILDING CODE; APPLICATION AND ENFORCEMENT

- **326B.106 GENERAL POWERS OF COMMISSIONER OF LABOR AND INDUSTRY.**

- Subdivision 1. Adoption of code. Subject to sections 326B.101 to 326B.194, the commissioner shall by rule and in consultation with the Construction Codes Advisory Council establish a code of standards for the construction......governing matters of structural materials, design and construction, fire protection......

- The code must be based on the application of scientific principles, approved tests, and professional judgment.

- To the extent possible, the code must be adopted in terms of desired results instead of the means of achieving those results, avoiding wherever possible the incorporation of specifications of particular methods or materials. To that end the code must encourage the use of new methods and new materials.

- Except as otherwise provided in sections 326B.101 to 326B.194, the commissioner shall administer and enforce the provisions of those sections.
326B.02 POWERS

• 326B.02 POWERS.

• .......

• Subd. 3. Definition of responsibilities. For purposes of subdivision 1, responsibilities include powers, duties, rights, obligations, and other authority imposed by law.......

• Subd. 4. State fire marshal cooperation. The state fire marshal shall work with the commissioner to improve the delivery of services to the public through the coordination of services and utilization of technology.

• Subd. 5. General rulemaking authority. The commissioner may, under the rulemaking provisions of chapter 14 and as otherwise provided by this chapter, adopt, amend, suspend, and repeal rules relating to the commissioner's responsibilities under this chapter, except for rules for which the rulemaking authority is expressly transferred to the Plumbing Board, the Board of Electricity, or the Board of High Pressure Piping Systems.......
Summary of UL and SBCA Research and Testing Work
UL States Clearly – All Unprotected Floor Systems are Dangerous – UL and SBCA Testing Confirms these Facts

• There is no safe operating time with an unprotected 2x10 floor system.

• The collapse time of 2x10 fire test experiments occurred within the time of the arrival of the fire service.

• 2x10 fire test performance emphasizes the importance of protecting all types of floor systems, including dimensional lumber.

• Regardless of what the floor system is made of, no factor of safety can be assumed, if the floor system is unprotected.
SBCA Research Findings and Key Recommendations are Fully Aligned with those of UL

- **SBCA’s Views on Creating a Consistent and Fair Public Policy and Code Language**
  - Option #1-- Protect all floors with a 15 minute membrane – [IBC Chapter 7](#)
    - Assuming membrane not removed – fire service can expect consistent factor of safety.
  - Option #2 -- Leave all structural products unprotected
    - Fast burn times, no factor of safety, but consistent fire ground performance
    - Least safe – fire ground decision making then has to be conservative
    - Same as when single membrane removed by any owner.
  - Option #3 -- Use at least NFPA 13 D sprinkler system; by legislation plumber allowed to install so install is most cost effective. Proven and best fire safety, most expensive.

- Fire performance policy needs to be consistent, fair, safe and simple to remember.
To Reduce Most if not All Downstream Unintended Consequences
SBCA Recommends the Following R501.3 Modification

Floor assemblies, not required elsewhere in this code to be fire resistance rated, shall be provided with a ½ inch gypsum wallboard membrane, 5/8 inch wood structural panel membrane, or equivalent on the underside of the floor framing member.

[IBC Section 722.6.2 defines “Time Assigned to Wallboard Membranes” – ½ inch gypsum wallboard being 15 minutes plus the time of what it is attached to.]

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Any Questions Please Call
For NGT Test Reports and Additional Support Information
Please call 608-217-3713 as Needed