

Fire Protection of Floor Systems

Statistical Overview

Advantages of Engineered Components

- Many homeowners expect larger, more open homes than ever before.
- Engineered components (I-Joists and Trusses) allow for longer spans with fewer bearing points as compared to dimensional lumber.
- Engineered components allow for concealment of mechanicals within the floor container, reducing the need for bulkheads.
- Engineered components provide exceptional quality and known, consistent performance in structures.
- Construction is often much faster using engineered components as compared to “stick framed” structures.

What the Code States

- 2012 IRC
 - R501.3 – Fire protection of floors.
 - Floor assemblies shall be provided with a 1/2" gypsum wallboard membrane
 - Alternatively, 5/8" wood structural panels may be applied.
 - Exceptions:
 - Floors directly over areas with fire sprinklers
 - Floors located over a crawl space with no storage or fuel fired appliances
 - Small floor areas (Less than 80 sq. ft.)
 - Floor assemblies constructed with dimensional lumber or structural composite lumber of 2x10 or larger materials.
 - This means that most floors constructed of I-Joists or Trusses would now require sheathing on the bottom face.

What Do Actual Burn Tests Show?

- Tests show loaded floor systems (with no bottom sheathing) failure times

ASTM E119 Assembly Tests at Full Design Load²

Test	Structural Member	Spacing (inches o.c.)	Structural Failure (min:sec)	Average Deflection at Floor (inches)	Loading (psf) - Percent Design Stress
FM FC 209	2x10	24	13:34	2.83	62.1 - 100%
FM FC 212	2x10	24	12:06	3.58	62.4 - 100%
NBS 421346 (2)	2x10	16	11:38	2.7	63.7 - 100%
NBS 421346 (4)	2x10	16	11:38	3.3	63.7 - 100%
FPL	2x10	16	6:30	4.0	79.2' - 100%
FM FC	12" Truss**	24	10:12	11.5	60.0 - 100%
FM FC 208	7¼ Steel C-joist	24	7:30	7.0	69.8 - 100%

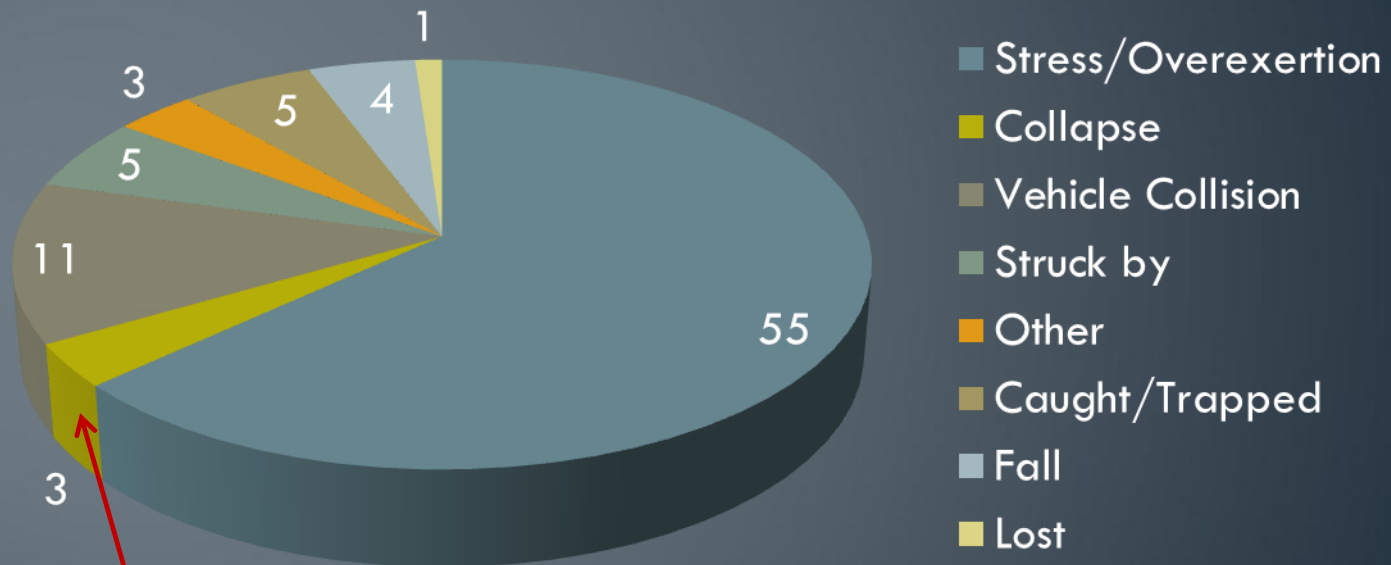
*This load may be greater than 100% of design load. **Refers to a Metal Plate Connected Wood Truss.

Table 1: ASTM E119 Assembly Tests at Full Design Load

- 2x10 performance varies from 6 min 30 sec to 13 min 34 sec.
- 12" deep truss failure at 10 min 12 sec – Well within 2x10 failure range
- Other studies have shown that structural failures of floor systems collapse times can likely be doubled for any floor system with sheathing attached to the bottom face.

Statistics - 2010

Firefighter Fatalities 2010



- Total 3 of 87 deaths from a collapse (3.4%)
 - 1 death from roof collapse
 - 2 deaths as a result of a bearing wall failure

Statistics Continued

- 2009 – 2 fatal injuries from collapse out of 77 total fatalities
 - Both firefighters died when a floor of a commercial building collapsed.
 - 2x dimensional lumber with no bottom sheathing.
- 2008 – 5 fatal injuries from collapse out of 107 total fatalities
 - Two firefighters died from smoke inhalation after the residential floor collapsed
 - 2x10 dimensional lumber – No mention of bottom sheathing.
 - One firefighter died from a brick façade collapse on a commercial structure
 - 2 incidents of a residential roof collapse with the firefighter in the attic.
- 2007 – 7 fatal injuries from collapse out of 118 total fatalities
 - 2 of these fatalities resulted from residential floor collapses
 - 1 floor was constructed of dimensional lumber – No mention of bottom sheathing
 - 1 floor was constructed of engineered products – No bottom sheathing

Statistics Recap

- 389 Firefighter deaths in 2007-2010
 - 212 deaths due to Stress or Overexertion (Heart Attacks)
 - 17 deaths due to collapse
 - 6 deaths due to floor collapse
 - Of these 6, 4 were residential floors
 - Of the 4 residential floors, only one would require sheathing per section R501.3
- There has been no conclusive evidence that shows that engineered wood product assemblies are likely to collapse in a substantially shorter period of time as compared to 2x10 or larger wood framing assemblies.

References

- 2012 International Residential Code – May, 2001
- APA Technical Topics TT-015D – July 2010
- http://www.sbcindustry.com/images/fireinsights/Fl_Equivalency_Testing.pdf?PHPSESSID=r19ndep8dm208oins286dnk3e6
- http://www.usfa.fema.gov/downloads/pdf/publications/ff_fat10.pdf
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