

Fire Protection of Lightweight Floor Systems — Options & questions to consider



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Act I of 2011 / House Bill 377

- Effective April 25, 2011
- Removed the sprinkler mandate for one and two family dwellings
 - Townhouses still must have sprinklers
- Requires some floor assemblies to have fire protection
- Only required in new home construction

Act I – Retroactivity

- Elimination of sprinkler requirements
 - Retroactive to January 1, 2011
- Addition of floor protection requirements
 - Not retroactive – apply April 25, 2011 forward
- Consequence – houses with permits applied for or issued January 1 – April 25, 2011 are not required to have sprinklers OR floor protection

Mandatory Sprinkler Offer

A builder shall, before or at the time of purchase contract:

- Offer the buyer the option to install an automatic fire sprinkler system in the dwelling unit
- Provide the buyer with information regarding the initial and ongoing cost of the sprinkler system
- Provide the buyer with information on the possible benefits of an automatic sprinkler system
 - As provided by the State Fire Commissioner website

Fire Protection of Floors - Overview

- For floor assemblies not required to be fire-resistance rated (i.e. stacked units)
 - The underside of the floor framing members shall be provided with:
 - 1/2-inch gypsum wallboard membrane
 - 5/8-inch wood structural panel membrane
 - Or “equivalent”
 - On underside of floor framing

Fire Protection of Floors - Overview

- Fire protection of floors shall **not** apply to the following:
 - Floor assemblies located directly over a space protected by a NFPA 13D/P2904, or other equivalent sprinkler system
 - Floor systems located directly over a crawl space
 - Must not be intended for storage
 - No fuel-fired appliances
 - Floor systems using dimensional lumber of $\geq 2 \times 10$
 - Floor systems of structural composite lumber $\geq 2 \times 10$ (e.g. LVL)
 - Portions of the floor that:
 - Do not exceed 80 SF per story
 - Fire blocking in accordance with R302.11.1 installed along perimeter of unprotected portion

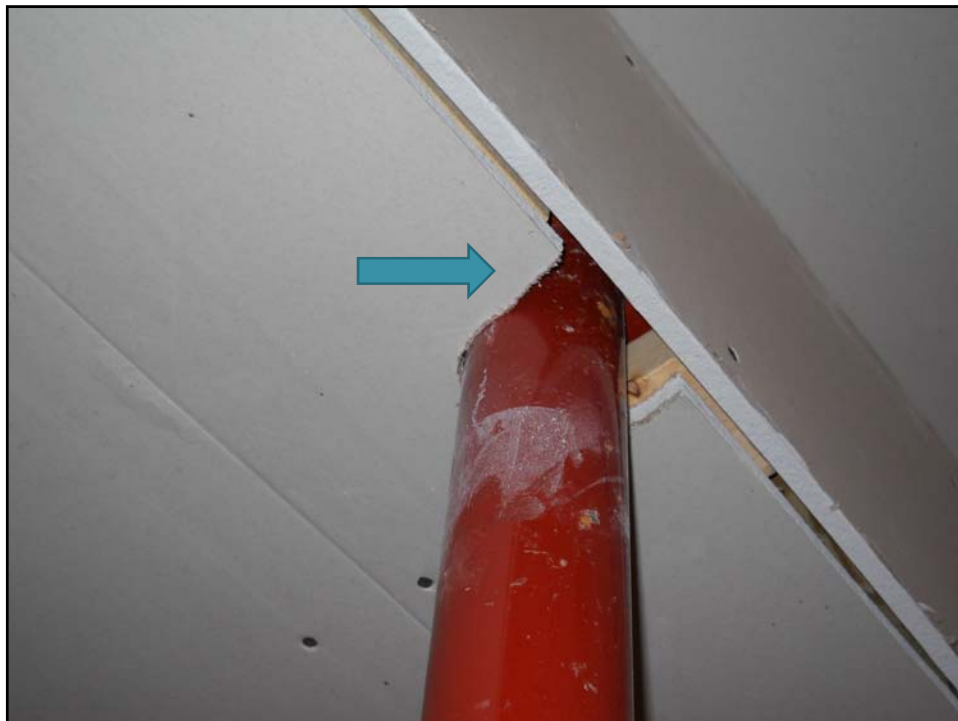
Wallboard & Structural Panel Membrane Option

- Joints – Are they required to be taped?
 - Nothing in the bill indicates that gyp board or wood structural panel joints need to be finished or sealed



Wallboard & Structural Panel Membrane Option

- Penetrations – are they required to be sealed?
 - Nothing in the bill indicates that membrane penetrations need to be sealed
 - But...at what point does the penetration become an unprotected portion (i.e. requires perimeter blocking)



Wallboard & Structural Panel Membrane Option

- **Basement Stairs – Are the underside of the stairs required to be covered with gypsum/wood membrane?**
 - Are the stairs considered part of the floor assembly?
 - Probably not, but...
 - If area below stairs is enclosed
 - No question – stairs need to be covered per IRC 302.11 #3 (1/2" gypsum board)



Wallboard & Structural Panel Membrane Option

- Be aware of anything that might be concealed that requires access (e.g. shut-offs, clean-outs)
- Areas cannot be left unprotected unless perimeter blocking is installed (more later)

Wallboard & Structural Panel Membrane Option



Equivalent Methods

- How is equivalency determined?
- One idea...
 - IBC Section 721.6 provides a calculation methodology for establishing a fire-resistance rating of wood assemblies (in lieu of testing per ASTM E 119)
 - Table 721.6.2(1) lists burn times for gypsum board and wood structural panels
 - If a product can provide equivalent burn times to Table 721.6.2(1) for 1/2" gyp or 5/8" WSP, it would follow that it is equivalent.
 - Should be listed for intended use

TABLE 721.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANES^{a, b, c, d}

DESCRIPTION OF FINISH	TIME ^e (minutes)
3/8-inch wood structural panel bonded with exterior glue	5
1 1/2-inch wood structural panel bonded with exterior glue	10
1 3/4-inch wood structural panel bonded with exterior glue	15
3/8-inch gypsum wallboard	10
1/2-inch gypsum wallboard	15
5/8-inch gypsum wallboard	30
1/2-inch Type X gypsum wallboard	25
5/8-inch Type X gypsum wallboard	40
Double 3/8-inch gypsum wallboard	25
1/2-inch + 3/8-inch gypsum wallboard	35
Double 1/2-inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

- a. These values apply only when membranes are installed on framing members which are spaced 16 inches o.c.
- b. Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except 3/8-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.
- c. On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.
- d. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.
- e. The time assigned is not a finished rating.

1. Test product per ASTM E 119
2. Achieve ≥ 15-minute rating

Note: This would seem to be a conservative approach.

- Table 721.6.2(1) times are based on:
 - Framing 16 inches o.c.
 - Edges supported
 - Long dimension perpendicular to framing
 - Joints finished
- Act 1 does not specify any of the above, so its provisions probably provide less than 15 minutes
 - Thus, a product providing 15 minutes is probably providing more protection
- Other tests may be used to demonstrate equivalence – up to AHJ

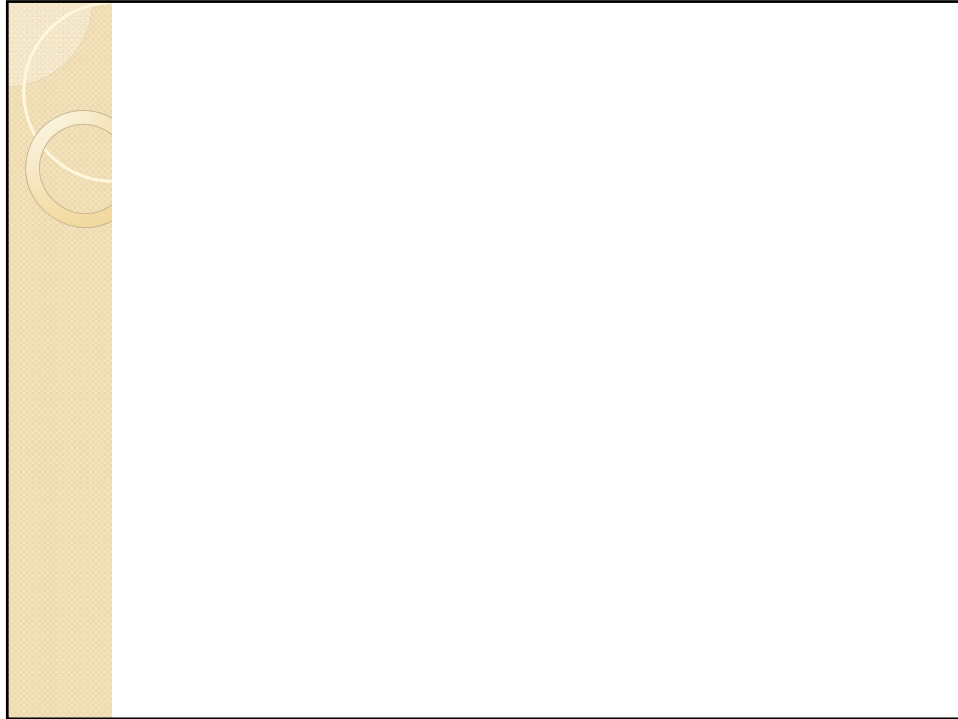
Equivalent Methods

Potentially Equivalent Products:

- Flame retardant sprays
- Intumescent coatings
 - Swell to a thick rigid char when exposed to heat
 - Creates thermal resistance
- Fire resistance treated wood
- Dropped ceilings

Unprotected Floor Allowances

- 80 SF of floor are allowed to remain unprotected
 - Requires perimeter fire blocking to separate the unprotected portion from remainder of floor assembly
 - Blocking per R302.11.1
 - Unprotected portions may comprise multiple areas – does not have to be one mechanical room
 - Potentially more restrictive for larger houses – max area is absolute, not proportional



Unprotected Floor Allowances

- Fireblocking materials from R302.11.1
 - two-inch nominal lumber
 - two thicknesses of one-inch nominal lumber with broken lap joints
 - one thickness of 23/32-inch wood structural panel joints backed by same material
 - one 3/4-inch particleboard with joints backed of same material
 - one-half-inch gypsum board
 - one-quarter-inch cement-based millboard
 - batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place

Unprotected Floor Allowances

- Do crawl spaces require floor protection?
 - Floor protection not required if crawl space is
 - not designed for storage, AND
 - does not include a fuel fired appliance,
- Crawl space open to basement?



Unprotected Floor Allowances

Partial sprinkler systems

- Floor protection requirements of Act I do not apply to:
 - A floor assembly located directly over a space protected by an automatic sprinkler system in accordance with IRC P2904, NFPA 13D, or other equivalent sprinkler system

Side Note on Partial Systems

- New language in 2012 IRC P2904.1 says:

Partial residential sprinkler systems shall be permitted to be installed only in buildings not required to be equipped with a residential sprinkler system.

Note: The 2012 IRC is not in effect in PA, and this language is not specifically referenced in Act I.

Sprinkler Review

- P2904/NFPA 13D sprinkler heads:
 - Must be new
 - Listed residential sprinklers only
 - Installed in accordance with manufacturer installation instructions
 - Temperature rating between 135° - 170° for standard sprinklers
 - Must be separated from heat sources per manufacturer installation instructions

Sprinkler Review

- A thermal barrier is required to protect plastic pipes:
 - 3/8-inch gypsum wallboard
 - 1/2-inch plywood veneer
 - 15 minute thermal barrier material
 - Suspended membrane ceiling with lay-in panels or tiles having a minimum weight of not less than 0.35 lbs/ft²

Sprinkler Review

- General flow and volume requirements
 - 2 heads operating simultaneously
 - 13 gallons per minute per head (typical)
 - 10 minute duration (7 for single story)

$$2 \times 13 \text{ gmp} \times 10 \text{ min} = 260 \text{ gallons}$$

- Required pressure varies per design, but should be low for basement-only installation

Sprinkler Review

- Residential sprinklers are designed with a "flat" spray distribution pattern.
 - When they operate, all surfaces within 28 inches of the ceiling must get wet.
 - This shape cools the thermal plume and ceiling jet to prevent flashover.
- Discharge from sprinkler may not be blocked or obstructed unless additional sprinklers installed

Sprinkler Review

Sprinkler obstructions

- Non-continuous:
 - Hanging light fixtures
- Continuous:
 - Beams
 - Bulkheads
 - Duct trunk lines and branches
 - Plumbing
 - Partition walls

◦ SUMMARY

