Construction Concerns: Types of Construction

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National Fire Protection Association (NFPA) 220, *Standard on Types of Building Construction*, 2012 Edition, classifies buildings according to the fire resistive characteristics of the construction materials and methods used with the following:

- Type I: (fire resistive).
- Type II: (non-combustible).
- Type III: (ordinary, or brick and joist).
- Type IV: (heavy timber).
- Type V: (wood frame).

Types I, II, III, and V are each subdivided into two subtypes according to the relative fire resistance of their materials and methods. These subtypes correspond to the “protected” and “unprotected” classifications used in building codes and in the older versions of the National Fire Incident Reporting System (NFIRS) form NFIRS-3, Section I. The “protected” and “unprotected” classifications refer to protection from heat and fire damage that is permanently applied to structural members and assemblies; not to the presence or absence of automatic fire sprinkler systems.

Types I, II, III, and IV are still constructed with materials and methods similar to those which have always been used for them. However, some of these buildings have been remodeled using manufactured wood materials, trusses, I-joists, and lightweight connection methods, which result in more rapid spread of fire and structural collapse than we would expect in buildings of these types. Some newer buildings have been constructed using manufactured lumber products such as laminated timbers, trusses, and I-joists rather than the traditional sawn timbers and joists.

Type V wood frame construction includes structures of balloon-frame, platform-frame, log cabin, post-and-frame, and plank-and-beam and all of their variations that today
include manufactured wood materials, trusses, I-joists, and lightweight connection methods. Photo 1 shows both wood trusses and I-joists used in the same floor system with multiple trusses used as a girder. Photo 2 shows I-joists used as rafters with a ridge board of laminated veneer lumber (LVL).
Type V also includes such varied construction methods as the following:

- **Panelized construction** (photo 3)—Wall or floor panels preassembled in factories including studs, plates, and sheathing, and set in place and connected at the job site.
- **Prefabricated construction**—Wall or floor-ceiling panels completely assembled in factories including studs, plates, sheathing, and interior drywall board.
- **Modular construction**—Wall, ceiling, and floor panels assembled into room or multiple room assemblies at a factory, and connected to each other at the job site to complete the building.
- **Double-wide structures**—Similar to modular, except that they are transported on their own wheels rather than on trucks.

The documentation, video recordings, and educational materials based on tests by the National Institute of Standards and Technology and Underwriters Laboratories Firefighter Safety Research Laboratory show that the failure of wood frame structures using these lightweight materials and methods is significantly earlier than in conventionally constructed wood frame buildings, often when the first fire companies are expected to begin their interior operations.

There is little hard data available in the NFIRS system on the materials and construction methods involved in the fires that are reported beyond the five types described in NFPA 220 and whether they were protected by automatic fire sprinklers or smoke detection and alarm systems and whether these systems worked as designed.
As the fire service moves in its public education efforts toward providing programs for contractors, architects, engineers, and other building professionals, it will need data on the behavior of fire in remodeled buildings of Types I, II, III, and IV to support its proposals. It will also need additional subcategories of Type V Wood Frame construction to reflect the substitution of adhesives for mechanical fasteners, the types and levels of prefabrication that are used, the methods of connection of the assemblies, and the concealed (void) spaces that are created. These individually and in combination can affect the behavior of fire in these structures. This data is essential to provide for the safety of building occupants and for the safety of the emergency response personnel who respond to incidents in them.

The NFIRS system exists for collection fire incident data nationwide. Several subcategories need to be added to the NFIRS-3 form, in or around Section I, to provide data on fire in buildings of different construction materials and methods. One possible arrangement:

### A. Construction method:

1. Balloon framed.
2. Platform framed.
3. Log cabin.
4. Post and frame.
5. Plank and beam.
7. Pre-fabrication:
   - Panelized construction.
   - Pre-fabricated wall and ceiling panels.
   - Modular construction, including double-wide housing.

### B. Construction materials:

1. Legacy materials (sawn lumber, timbers).
2. Manufactured wood (plywood, laminated studs/joists, oriented strand lumber, parallel strand lumber, LVL, and so on.).
3. Wood trusses or I-joists (photo 1).
4. Connection by nails or screws.
5. Connection by sheet-metal joist hangers and stirrups (photo 1).
6. Connection by adhesives.
7. Firestopping or draft stopping in concealed spaces.
After a number of years, collection of data by NFIRS, data analysis will be possible; it will be more possible to educate firefighters, builders, and design professionals in the construction of fire-safe buildings.

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