Five major building types are identified by the building industry. These classifications are based on the materials used in the construction and the hourly fire-resistance rating of the structural components. Construction continues to differ in design, building method, roof types, and materials utilized and each structure will pose unique challenges to the firefighter.

The classification system for types of building construction considers only the materials involved in the construction. For example, the exterior walls, roof, structural frame, and shaft enclosures play a major role in deciding the type of construction and its fire resistant rating. The classification does not consider the occupancy type or use of the building. A building may contain the same features as another building and still be considered a different type structure to the other building. The features that are not considered in the building classification system include but are not limited to exterior exposure, location, occupancy, mechanical damage to fire protective material, and construction of interior walls. These, however, need to be accounted for in the overall fire safety design. For more information on building types, firefighters should refer to the California Building Code.

**Type I, Fire Resistant Construction**

A structure classified as a Type I construction will have the ability to withstand fire and any resulting damages much better than any other class. The Type I construction is commonly referred to as “fire resistant”. Most high rises are Type I construction. Structural members that are rated to be fire resistant characterize this class. Only noncombustible, or in some cases limited combustible, materials are permitted in fire resistant construction. Fire resistant material is defined as material that when subjected to fire or heat will not ignite, burn, support combustion, or release flammable vapors. Limited combustible material is defined as material that has a potential heat value not to exceed 3,500 BTU per pound. In contrast to this, pine sawdust releases over 9,600 BTU per pound.

Firefighters must recognize that fire resistant construction does not necessarily prevent loss of life or property damage during a fire. This type of structure will not fuel the fire and usually the chance of collapse is small. However, there are many documented cases of extensive interior damage and high loss of life from fire that did not structurally damage the Type 1 building but burned the contents within it.

**Type II, Construction**

A structure classified as Type II construction is commonly referred to as “noncombustible construction”. The main structural components are noncombustible but may have no fire resistance. Typically, this type of construction can be fire resistant, 1 hr. or no general requirement (i.e., constructed of metal frames, metal clad, concrete, steel, iron or masonry). In addition, unprotected steel framing a wide variety of
Building Classifications

assemblies are used to conform to this type of construction. Refer to California Building Code for additional information.

The key to this type of construction is that the structural supports do not contribute to the fire. Under fire conditions, unprotected structural steel may sag and then collapse due to heat. Collapse should be expected after 13 minutes of a well-developed fire, when steel supports begin to sag or when a column has become seriously weakened.

This class of construction is utilized where expected fire severity is minimal or in conjunction with fire suppression methods such as sprinkler systems. Usually, these structures are pre-designed, economical buildings.

**Type III, Ordinary Construction**

A structure classified as a Type III construction is commonly referred to as "ordinary construction". The bearing walls of this type of construction must have a minimum fire resistance rating of one hour. Both nonbearing and bearing walls are constructed of non-combustible materials while roofs, floors, and interior framing are constructed mainly out of wood that is smaller in dimension than that required for Type IV structures.

Type III construction is widely utilized and is often referred to as "brick, wood-joisted", or "brick joist" construction. The term "open joist" is defined as open or exposed interior combustible structural members. The main difference between Type III and Type IV construction is the dimensions of the supporting wood members. Another significant difference is that Type III ordinary construction may contain combustible concealed spaces that are created between floor and ceiling joists and between the studs in partition walls when they are covered with interior finish materials. These spaces provide a combustible path for the spread of fire throughout the building unless fire-stopping safeguards are utilized. This type of structure contains all the hazards associated with combustible wood buildings and few advantages to fire fighters.

**Type IV, Heavy Timber Construction**

A structure classified as a Type IV construction is commonly referred to as “heavy timber construction”. Like Type III construction, the exterior walls are normally of masonry construction and the interior structural members are combustible. Two significant distinctions exist between Type III and Type IV construction. First, in Type IV construction the beams, columns, floors, and roofs are made of solid or laminated wood with dimensions greater than in Type III construction. Second, in type IV construction concealed spaces are not permitted between structural members.

Generally, the columns, beams, and girders are constructed of heavy timber, however, other materials may replace wood members if they are the same dimensions and have a fire resistance rating of at least one hour. A heavy timber rating requires that all
columns be at least 8 X 8 inches and beams and girders at least 6 X 10 inches. Wood floors are commonly 3-inch tongue and groove or 4-inch laminated wood. Roofs are typically 2-inch tongue and groove or 3-inch laminated wood structures. All interior partitions enclosing stairways and other openings through floors must be designed to have a fire resistance rating of at least one hour.

The weakest points to consider in this type of construction during fire conditions are the edges, joints, and connections of timber members. It is generally accepted, however, that true heavy timber (Type IV) construction will withstand fire better than unprotected noncombustible structures.

**Type V, Wood Frame Construction**

A structure classified as a Type V construction is commonly referred to as “wood frame construction”. This construction class is defined as structures in which the exterior walls, bearing walls, partitions, floors, and roofs are either wholly or partly wood or some other combustible material. This class will not conform to either Type III or Type IV construction but can be considered protected if floors and roofs have a one-hour fire resistance and stability rating. To be made reasonably safe, proper attention must be given to fire protection systems, protection against exposure fires, and protection against spreading fires (e.g. in sheathed areas). Refer to page 4 of this chapter for a schematic of “wood frame construction”. For more information, fire fighters should refer to the current California Building Code.
BUILDING INTERIORS

There are three principal elements that determine the overall fire resistance of a building: the fire resistance of the building (construction type), contents or production processes within the building (occupancy), and the characteristics of the interior finish on the building. The interior finishes include but are not limited to wood, plywood, plywood paneling, plaster, gypsum wallboard, fibrous ceiling tiles, plastics, and a variety of wall coverings. Surface coatings may also exist such as paint, varnish, and acoustic spray that will add to fire characteristics. Interior finishes can affect a fire in four ways:

— They may influence the rate at which the fire build up reaches "flashover".
— They can contribute to fire extension by allowing the flame to spread over its surface.
— They may add to the intensity of the fire by contributing additional fuel.
They can add toxic gas and smoke that will contribute to life and property hazards. Once a fire has gained some headway, the upper portion (ceiling) will become extremely hot as the gases fill it. If this area becomes hot enough, the gases may ignite. This is commonly referred to as "Flashover". Thermal radiation transpires from the combustion heating the materials in the area rapidly. When the combustible materials have become heated to their ignition temperatures, simultaneous ignition will occur. An interior finish that absorbs and holds heat would be more preferable because it would inhibit flashover for a longer period of time.

Many burning interiors are dangerous not only because of the heat factor but also due to the smoke and toxic gases they release. In fact, fire tests have shown a greater threat to life because of toxicity and smoke inhalation. Fire fighters should use extreme caution when fighting interior fires so they and others are not overwhelmed by toxic gas or smoke.

Ideally, the best interior will be made of relatively thick noncombustible material. The material will be able to withstand very high temperatures, inhibit flashover, would not add fuel to the fire, will not allow fire to spread over its surface to other materials and will not produce smoke or toxic gas. Such materials include firewalls, doors, fire exits and escapes, windows, and noncombustible (fire) partitions.

**STRUCTURAL FEATURES INFLUENCING FIRE SPREAD**

In a study carried out by the NFPA, it was found that inferior construction, unprotected openings, large open areas, and inoperative fire doors were major determinants in the amount of damage done to a structure and its interior in fire conditions. These features were found to contribute to the spread of fire. Furthermore, it was determined the speed of flame spread over a substance is directly influenced by the amount of flammable vapors released by combustible materials when they are heated, their texture, and thickness. The following structural features will help limit the spread of fire if they are constructed properly as defined in the California Building Code). For more information on these features and other less common ones, refer to the current California Building Code.

**Fire Walls**

Fire walls are typically constructed out of concrete, structural clay tiles, or some other structurally sound and noncombustible material and must have a fire resistive rating of at least one hour. Furthermore, firewalls must be able to remain intact if and when there is collapse on either side. A firewall will be continuous from the foundation to a parapet above the roofline of the building. The height of the parapet portion is dictated to be at least 30 inches above the roofline. In addition, these walls must have a minimum thickness dictated by the type of construction (the California Building Code). All firewalls must have parapets, wing walls, be attached to the foundation, and have fire resistive ratings as required by location, type of construction, and occupancy.
Openings in firewalls must conform to the requirements of the building type and the requirements set forth in the California Building Code.

Some of the code violations fire fighters may encounter when dealing with fire walls include: Inferior construction materials, lack of thickness in the wall, no parapets, and openings that are not correctly constructed, inoperative, or blocked open. Fire fighters should always inspect firewalls during pre-fire planning and inspections to determine aspects of deterioration and imperfections that may create hazards during a fire.

**Fire Partitions**

Fire partitions are installed as a resistance to fire spread, but are not considered a firewall. They are constructed of noncombustible or protected combustible materials and are attached or supported by structural components having a fire resistant rating equal to or better than the fire partition (usually one to two hours). As with firewalls, openings must conform to the requirements set forth to provide adequate fire protection. The fire resistance of a fire partition will be governed by the type of construction used in the building.

**Fire Doors**

Typically, fire doors are used for protection of both vertical and horizontal openings. Fire doors can be horizontal or vertical sliding, single or double swinging, or overhead rolling. The most frequently used fire door is the horizontal sliding door. Any of these door types may or may not be counterbalanced. Often, fire doors are either self closing or automated. Self-closing doors will return to a closed position after opening. Automated doors may remain open after opening them, but will close when heat or smoke actuates the closing mechanism. Fire doors must not be locked though they may be latched. In addition, these doors should never be blocked, wedged or in a state that would prevent them from closing. Automatic closing doors must be kept in proper working order at all times. Fire doors can be considered safe if they contain a current label from the "Underwriters Laboratories" or "Factory Mutual Laboratories" as evidence of testing. For more information, refer to NFPA Standard # 80.

**Fire Windows and Fire Shutters**

For these types of enclosures to be effective in containing fire spread, they must be properly maintained and serviced. Often these openings are associated with exterior wall openings. There are locations where fire windows are covered by shutters (i.e. at three, one, and 11/2 hour openings). The shutters must carry a rating equal to or greater than the wall opening they are protecting. These fire shutters must either remain closed or must close automatically under fire conditions. Once closed, fire shutters must remain secure to be considered effective in reducing fire spread. Of the different types of fire
shutters, the automatic rolling shutters installed over windows on the interior sides of the building are considered the most useful and practical.

**Curtain Boards (Draft Curtains)**

Curtain boards are most generally found in large open areas of buildings. Their major purpose is to direct fire and smoke into a pre-designed area for rapid ventilation. At the same time, they are designed to prohibit flame and smoke spread in other directions. This is especially useful in sprinklered buildings to avoid water damage to unaffected areas. The operation of sprinklers can be localized to the fire area. For these fire resistive structures to be considered effective, they cannot be spaced more than 250 feet apart for low and moderately heated occupancies. In buildings that are subject to high heat sources, curtain boards must not be spaced any further than 100 feet apart. The depth of a curtain board must be a minimum of six feet but in some cases (under severe fire hazards) may be doubled or as close as 8 feet from the floor.

**Ventilation Devices**

These systems are designed to complement other fire safeguards and are not replacements for fire protection devices. Vents are very useful in smoke and heat dissipation, especially in buildings where vapors and dusts are highly combustible. For a venting system to be considered effective, it should be free of any human element. Rather, it should be automatic using fusible links, hinged dampers, and counterweights that are heat reactive. Types of vents include: monitor controlled, continuous gravity, unit type, sawtooth roof skylights, and exterior wall openings.

Monitors usually make use of a fusible links that are effective from as low as 165 degrees F to 212 degrees F or higher if so required. The fusible links operate vent doors that may be glass, metal panels, or louvered when heat containment is not a factor.

Continuous gravity vents are narrow slot openings that are attached to weather hoods on the roof. Many will have movable shutters, which will open automatically in the event of a fire. This style of vent is most common in buildings where high heat production is of concern.

Unit type vents are light weight metal frames or housing with built-in shutters that open in the event of high heat or fire (e.g. fusible links). This type of structure is most commonly associated with curtain boards.

Sawtooth roof skylights are sashes of glass usually non-wired that can be opened to form a vent. Often this style of venting device must be operated manually and is influenced by wind direction and force.
Exterior wall openings are most effective in structures where heat and smoke do not have to travel more than 60 feet. They are usually characterized by louvered, open vents but can also remain closed and automatically open in the event of fire.

**Fire Exits and Escapes**

Buildings and structures must have appropriate fire escapes and exits in accordance with the location, size, occupancy, type of construction, and fire protection available. Fire escapes and exits must be correctly marked, lighted in dark atmospheres, and prove the most accessible route to safety. Furthermore, they cannot be obstructed in any way that would prohibit a swift evacuation of the occupants. Exit doors shall be openable from the inside without the use of a key or any special knowledge or special effort. For more information on fire escapes and exits fire fighters should refer to NFPA 101, the Life Safety Code, and California Building Code.

**Fire and Smoke Dampers**

These are used to restrict fire and smoke to the involved area and away from unaffected areas. Fire and smoke dampers operate much like venting devices but in the opposite manner: Instead of allowing smoke to dissipate these devices will close under fire conditions. Like automatic vents many are controlled by fusible links, heat actuating switches, and in some cases, smoke detectors.

Fire dampers are generally automated and once closed, will remain closed until manually opened. These devices are required in number of circumstances, which include:

— Where a duct passes through a fire protected wall or partition or roof.
— At fresh air intakes.
— At branches in the main duct.
— Vertical ducts pass through fire resistive floors.
— When ducts have openings installed in a fire resistive ceiling.

There are other circumstances where fire dampers will be required and a number of exceptions that pertain to particular situations. For more information on fire dampers, fire fighters should refer to NFPA and the California Building Code.

Smoke dampers are commonly required in air conditioning systems and are intended to interrupt the flow of air or smoke through the system when the air conditioner is shut down.

**Fire Stops**

Fire stops are utilized to prevent fire spread within the hollow walls, floors, and other internally open areas in a building or structure. They are usually pieces of wood (2 X 4 inch) that are placed between wall studs, partitions, ceiling planks, etc., to cut off any
draft within the hollow areas. When fire stops are not used it's probable that a fire could rage through the structure, burning unexposed internal areas before it is ever discovered. The minimum fire stopping would include isolation of all hollow walls at the floors and ceilings, isolation of the ceilings at the walls and curtain boards. For more information on fire stopping refer to the California Building Code.