Fire Protection

ISO Classes of Building Construction

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Abstract

This report provides an introduction to the Insurance Services Office (ISO) construction classifications used in the Specific Commercial Property Evaluation Schedule (SCOPES). These classifications are widely used in the property insurance industry.

Introduction

The classification of a building construction is one of the many factors used to determine the fire risk of a building. The construction classification can provide an indication of the potential damage that can occur from a fire. There are a variety of code organizations that identify specific construction classifications, including the Building Officials Conference of America (BOCA), International Codes Council (ICC), and the National Fire Protection Association (NFPA). In addition, many insurance companies, loss control organizations, and local governments have their own classifications and terminology. While there are many similarities between these classifications, all are somewhat different.

The building construction classification system used most widely in the insurance industry is the Specific Commercial Property Evaluation Schedule (SCOPES) of the Insurance Services Office, Inc. (ISO). The ISO construction classification is one of the primary factors used in determining a basic premium rate for a building's insurance coverage.

Classes of Building Construction

ISO divides building construction into six basic classifications based on their degree of resistance to fire. These are:

- Frame (Class 1)
- Joisted Masonry (Class 2)
- Non-Combustible (Class 3)
- Masonry Non-Combustible (Class 4)
- Modified Fire-Resistive (Class 5)
- Fire-Resistive (Class 6)

There are also three additional classifications, which are variations of the above. These classifications (7, 8, and 9) are not directly related to fire exposure.

Frame - Construction Class 1

A building of Frame construction is typically a wooden building. Specifically, it is a building in which wood or other combustible materials are used to construct the walls, floors, and roof. A structure with non-combustible or slow-burning exterior walls and combustible floors and roof is also considered frame construction. Frame construction (Figure 1) is widely used for residential dwellings and is also popular for small mercantile and commercial buildings.

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Figure 1. Frame Construction

The use of combustible materials in frame construction enables fire to spread rapidly. Since combustible materials are readily consumed by fire, Frame construction is highly damageable, and the building may become structurally unstable under fire conditions. Extensive concealed spaces, such as stud and joist spaces, exist where fire can burn and spread undetected for considerable periods of time.

Joisted Masonry - Construction Class 2

In Joisted Masonry construction, the floors and the roof are wood or other combustible material. Exterior bearing walls are either masonry or a non-combustible material that has a fire-resistance rating of not less than one hour. These walls are self-supporting in that they stand independent of the floors or roof. Because these walls are load-bearing, it is rare to find masonry joisted construction greater than three stories high. This type of construction is common for many older mercantile buildings and stores and, more recently, for convenience stores. Joisted Masonry construction (Figure 2) can be found in most major metropolitan areas, especially the northern states.

Figure 2. Joisted Masonry Construction

Joisted Masonry construction may also be referred to as ordinary construction, brick, or brick joisted. Heavy Timber or Mill construction is also considered to be a type of joisted masonry construction. Heavy Timber or Mill construction utilizes wood structural members considerably larger than those found in Frame or Joisted Masonry construction. This results in heavy, solid wood masses with smooth flat surfaces and the elimination of concealed spaces. The heavy mass of the timber beams tends to help it resist fire so that only the surface chars.

Joisted Masonry construction provides improved structural stability during a fire, compared with frame construction. It is still considered combustible construction because of the extensive use of combustible materials.

Non-Combustible - Construction Class 3

In Non-Combustible construction (Figure 3), the exterior walls, floors, and roof are constructed of and supported by non-combustible or slow-burning material - a fire-resistance rating is not required for any part of the construction. The simplest and most common example of this type of construction is the all-steel building.

Figure 3. Non-Combustible Construction

Roof insulation on the underside of the deck or supports must be non-combustible or slow-burning. Roof insulation on the top of the deck may be non-combustible, slow-burning, or combustible.

While the building construction materials will not readily burn, they are susceptible to failure if exposed to temperatures of 1,200°F (649°C) or more. For example, if a building is filled with combustible contents, the structural integrity of the building may be at risk during a fire.

Masonry Non-Combustible - Construction Class 4

Masonry Non-Combustible construction (Figure 4) is similar to Non-Combustible construction; however, in Masonry Non-combustible construction, the exterior walls are non-combustible and have a fire-resistance rating of not less than one hour or are of masonry materials not less than 4 in (10.2 cm) thick.

Figure 4. Masonry Non-Combustible Construction

Interior structural members also must be of non-combustible or slow-burning materials. This means that, theoretically, fire-retardant treated wood may be utilized; if so, the construction may appear to be very similar to Joisted Masonry construction.

Modified Fire-Resistive - Construction Class 5

In Modified Fire-Resistive construction (Figure 5), masonry or non-combustible materials must be used for exterior and interior bearing walls or structural supports, floors, and roof. This class of construction is very similar to Fire-Resistive construction, which is discussed below.

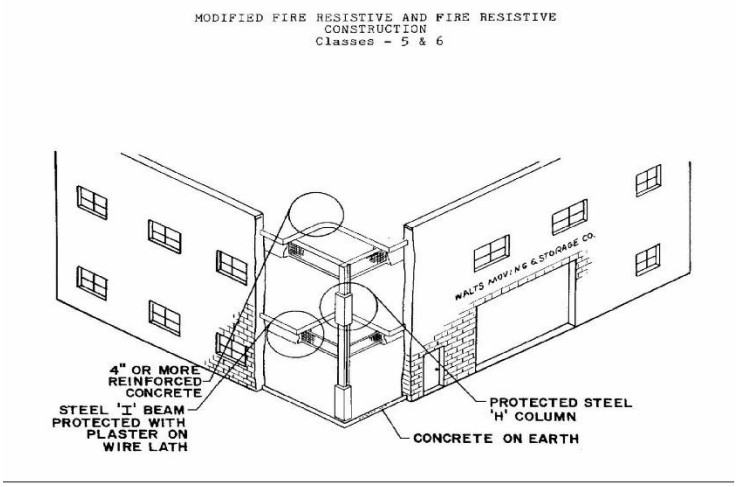

Figure 5. Modified Fire-Resistive Construction

The non-combustible materials in Modified Fire-Resistive construction have a fire-resistance rating of between one and two hours. In addition, masonry materials are of lesser thickness than is required for Fire-Resistive construction. Modified Fire-Resistive construction has exterior walls, floors, and roof of masonry materials, which are not less than 4 in (10.2 cm) in thickness, and a fire-resistance rating of not less than one hour.

Fire-Resistive - Construction Class 6

Fire-Resistive construction (Figure 6) has floors, roof, and exterior bearing walls or the exterior structural frame that are either of non-combustible materials, with a fire-resistance rating of not less than two hours, or are a masonry material meeting certain thickness requirements.

Figure 6. Fire-Resistive Construction

For exterior walls or the exterior structural frame, the following requirements apply:

- Solid masonry materials, including reinforced concrete, should not be less than 4 in (10.2 cm) in thickness.
- Hollow masonry materials should not be less than 12 in (30.5 cm) in thickness or, if less than 8 in (20.3 cm) in thickness, have a listed fire-resistance rating of not less than two hours.
- Assemblies should have a fire-resistance rating of not less than two hours.
- Panel or curtain wall sections may be of any thickness.

- Horizontal and vertical load-bearing protected metal supports, including pre-stressed concrete units, should have a fire-resistance rating of not less than two hours.
- Floor and roof assemblies should have a fire-resistance rating of not less than two hours.
- Monolithic floors and reinforced concrete roofs should be slabs that are not less than 4 in (10.2 cm) in thickness. Certain concrete slabs which utilize integral concrete joists or beams may be less than 4 in (10.2 cm) in thickness, but not less than 2.75 in (6.9 cm).

While the building materials used in Fire-Resistive construction resist heat longer than materials in other construction types, they cannot resist heat forever nor can they prevent fires from occurring. Fire can still damage or even destroy a building of Fire-Resistive construction.

Mixed Construction

In general, where a building is of mixed construction types, the final designated construction type must make up at least twothirds of the total bearing-wall area and at least two-thirds of the total floor and roof areas (See Figure 7). Alternatively, where several consecutive types make up two-thirds or more of the areas, the final designated construction type is the least fire-resistive type of the series. In buildings constructed as defined in two or more classes above, the appropriate Commercial Statistical Plan (CSP) Construction Class shall be determined as follows:

Fire-Resistive (Class 6)

A building would be classified as Modified Fire-Resistive if two-thirds or over of the total wall area, and if two-thirds or over of the total floor and roof area are constructed as defined in CSP Construction Class 6.

Modified Fire-Resistive (Class 5)

A building would be classified as Modified Fire-Resistive if:

- Two-thirds or over of the total wall area, and if two-thirds or over of the total floor and roof area are constructed as defined in CSP Construction Class 5; or
- Two-thirds or over of the total wall area, and if two-thirds or over of the total floor and roof area are constructed as defined in CSP Construction Classes 5 and 6, but with neither type in itself equaling 66 2/3% or over of the total area

Masonry Non-Combustible (Class 4)

A building would be classified as Masonry Non-Combustible if:

- Two-thirds or over of the total wall area, and if two-thirds or over of the total floor and roof area are constructed as defined in CSP Construction Class 4; or
- If not qualifying as Class 6 or Class 5, and having two-thirds or over of the total wall area, and two-thirds or over of the total floor and roof area are constructed as defined in two or more of CSP Construction Classes 4, 5 and 6, but with no single type in itself equaling two-thirds or over of the total area.

Non-Combustible (Class 3)

A building would be classified as Non-Combustible if:

- Two-thirds or over of the total wall area, and if two-thirds or over of the total floor and roof area are constructed as defined in CSP Construction Class 3; or
- If not qualifying as Class 6, Class 5, or Class 4, and having two-thirds or over of the total wall area, and two-thirds or over of the total floor and roof area are constructed as defined in two or more of CSP Construction Classes 3, 4, 5 and 6, but with no single type in itself equaling two-thirds or over of the total area.

Joisted Masonry (Class 2)

A building would be classified as Joisted Masonry if not qualifying as:

- Class 6, Class 5, Class 4, or Class 3, and having two-thirds over of the total wall area constructed as described in CSP Construction Class 2; or
- Class 6, Class 5, Class 4, or Class 3, with two-thirds or over of the total wall area, and two-thirds or over of the total floor and roof area constructed as defined in two or more of CSP Construction Classes 2, 3, 4, 5 and 6, but with no single type in itself equaling two-thirds or over of the total area.

Frame

A building would be classified as Frame if not qualifying as:

Class 6, Class 5, Class 4, Class 3, or Class 2, or any building with over one-third of the total wall area of combustible construction, regardless of the type of construction of the balance of the building.

Flow Chart for Classifying Mixed Construction

Figure 7. Flow Chart for Mixed Construction Classes provides guidance on how to determine the proper class of a structure.

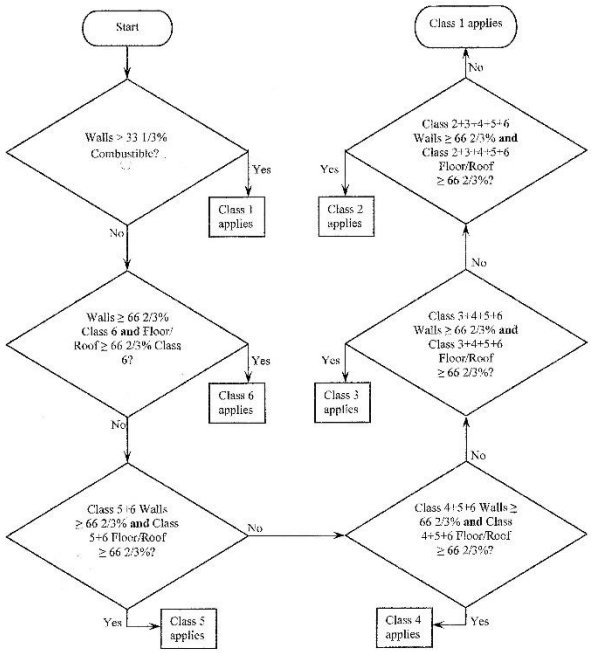

Figure 7. Flow Chart for Mixed Construction Classes

Non-Fire-Related Classifications

There are three construction classifications that are weather-related. They are presented here for informational purposes.

Construction Class 7

This type of construction is essentially a building of heavy timber, joisted masonry construction that meets the criteria for Joisted Masonry construction and the entire roof is supported by wood beams and girders not less than 6 in (15.2 cm) in any dimension and has a roof deck that is either: 1-in (2.9-cm) thick tongue and groove plywood decking; 2-in (5.1-cm) thick solid wood planking; or 3-in (7.62-cm) thick laminated wood planking.

Construction Class 8

This type of construction is essentially a building of Non-Combustible construction, and the roof deck: is a masonry material at least 2-in (5.08-cm) thick and is on protected or unprotected metal supports; is constructed of 22-gauge or heavier metal on protected or unprotected metal supports; or has a documented wind uplift classification of 90 or equivalent.

Construction Class 9

This type of construction is essentially a building of Masonry Non-Combustible construction, and the roof deck: is a masonry material at least 2-in (5.08-cm) thick and is on protected or unprotected metal supports; is constructed of 22-gauge or heavier metal on protected or unprotected metal supports; or has a documented wind uplift classification of 90 or equivalent.

Fire-Resistance Ratings

Fire-resistance ratings of materials and assemblies are determined by standard tests. The material or assembly is placed in a special furnace and exposed to a standard fire. A fire-resistance rating of one hour means that the material or assembly survived at least one hour in the furnace. This does not mean, however, that such material or assembly will survive that long in an actual fire. A variety of factors may affect the performance of a material or assembly during an actual building fire.

For further information, see Fire Protection Reports FP-30-00, *The Spread of Fire and Smoke*, and FP-32-01, *Fire Resistance and Construction Terminology*.

References

1. Engineering and Safety Service. *The Spread of Smoke and Fire*. FP-30-00. Jersey City, NJ: ISO Services, Inc., 2011.

2. Insurance Services Office, Inc. (ISO). *Specific Commercial Property Evaluation Schedule (SCOPES).* Jersey City, NJ: ISO, 2011.