Describe the impact of fire on common building materials.

A wide variety of building materials are used in construction.

Wood is the most common material used in North America.

The size and moisture content of wood affects how it reacts to fire.

Each type of masonry shows signs of deterioration in different ways.
The effect of heat on metal depends on the type and exposure.

**Cast Iron**

**Wrought Iron**

The effect of heat on metal depends on the type and exposure.

**STEEL**
- Used for structural support
- Lengthens when heated
- Failure at near or above 1,000°F (538°C)
- Keys to keep in mind when firefighting

The effect of heat on metal depends on the type and exposure.

**Aluminum**
- Many uses
- Affected by heat more rapidly than steel

**Tin**
- Used for ceiling tiles, roofs

**Copper**
- Found in wiring, pipes, gutters, decorative elements

**Lead**
- Found in pipes, flashing, stained or leaded glass windows

Reinforced concrete typically performs well under fire conditions.
- Fortified with rebar
- Loses strength through spalling

Gypsum has excellent heat-resistant and fire-retardant properties.
- Known as drywall, Sheetrock®
- High water content
- Breaks down gradually under fire conditions

The process of lath and plaster can present unique challenges during an incident.
- May be replaced with wire mesh
- Can be difficult to penetrate
- Can conceal fire in cavity
- May add fuel
Both glass and fiberglass react to heat in different ways.

Glass:
- Not typically used for support
- Comes in many forms

Fiberglass:
- Typically used for insulation
- Glass component not significant fuel
- May be difficult to extinguish

**DISCUSSION QUESTION**

What types of insulation are commonly found in your jurisdiction? Why is this important to know?

Plastic typically melts and contributes to the content load during an incident.

- Exterior uses
- Water, sewer pipes
- Decorative use

Composite materials are made by combining two or more distinctly different materials.

- Synthetic wood
- Finger-jointed timber
- Particle board
- Medium density fiberboard
- Laminated timber

**REVIEW QUESTION**

What impact can fire have on common building materials?

**Learning Objective 2**

Explain the impact of fire on construction classifications.
Construction classification type is determined by several factors.

- Architect, structural engineer, contractor
- Materials used in construction
- Local building codes

Building codes are adopted and sometimes modified to meet local requirements.

- Locally or nationally developed
- Major US models
  - NFPA
  - ICC
- Canadian code
  - Adopted by provincial or local government

Some buildings may be exempt from following local codes and renovations can also change structures.

- May be exempt
  - Manufactured homes
  - Federal- or State-owned buildings

- Renovations
  - Contain more than one construction method
  - May improve fire safety
  - May create potential hazards

The IBC® and NFPA® classify five types of construction.

- Type I
- Type II

DISCUSSION QUESTION

What types of renovations are commonly found in your jurisdiction?
How can firefighters monitor these?
The IBC® and NFPA® classify five types of construction.

Type IV

Type V

Manufactured homes are not required to conform to model building codes.

Built in factory

Must conform to U.S. HUD standard

Fire-resistance may vary

There are three types of construction defined by the National Building Code of Canada.

Combustible

Heavy timber

Noncombustible

Canadian construction may also be designed with the Novoclimat standard.

REVIEW QUESTION

How are different construction classifications affected by fire suppression?

Learning Objective 3

List the main types of occupancy classifications.
Occupancy classifications are defined by building and life safety codes.

**Single-use**

**Separated use**

<table>
<thead>
<tr>
<th>REVIEW QUESTION</th>
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<tbody>
<tr>
<td>What are the main types of occupancy classifications?</td>
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**Learning Objective 4**

Describe the basic construction of building components.

| Foundations are designed to support the weight of the building and its contents. |

- **Shallow**
- **Deep**

| Floors and ceilings form the top and bottom of the compartment. |

| Walls define the perimeter of a building and divide it into compartments. |
Wall types and ratings vary depending on several factors.

Fire walls are constructed of a variety of masonry materials.

Can divide structures 
Provide separation

May be party walls 
Assemblies

Penetrating walls should only be performed when needed.

Exterior and fire walls
• Most difficult
• Forcing entry into or escaping

Interior walls
• Only to locate hidden fires or create escape path

Roofs primarily protect a structure and its contents from the effects of weather.

Common Roof Types
- Pitched
- Flat
- Arched

DISCUSSION QUESTION

How does knowing that arched roofs contribute to firefighter casualties impact your need to understand building construction?

What types of arched roofs are common in your jurisdiction?
Roof construction is based on three main components; one is roof supports.

Roof decks are another component in roof construction.

Roof coverings, the final main component, come in a variety of styles.

Roof penetrations and openings may indicate the locations of some rooms.

Observing the presence of roof obstructions can help when ventilating.

Green roof

Cold roof

(Cont.)

Photovoltaic roof

Rain roof
Security measures on roofs and other areas can cause obstructions as well.

- Mounted over doors, windows
- May be on skylights
- May be installed by owner

WARNING

Unauthorized security modifications create extreme life safety hazards for firefighters.

Structural modifications should, but do not always, meet local building codes.

- Permitted modifications
  - Stay aware of those in your response area

- Nonpermitted modifications
  - Can inhibit effective ventilation and increase risk of collapse

Roof-mounted equipment can add a live load to the dead load on a roof.

Stairs provide access to or egress from different levels of a structure.

- Exterior stairs and fire escapes provide access and egress in different ways.
DISCUSSION QUESTION

Why might fire escapes not be able to support the weight of a firefighter?

Smokeproof and unprotected stairs provide different levels of protection.

Doors vary widely in operation, style, design, and construction.

Swinging  Sliding  Folding
(Cont.)

Wood panel and flush doors are constructed using similar components.

Panel  Solid Core  Hollow Core

Glass and metal doors can be constructed in a variety of ways.

Glass  Metal
Fire doors can be effective at limiting fire spread when properly maintained.

Window construction uses the same components for many styles.

Fixed windows are nonoperable, these may be called display windows.

Movable windows come in a variety of styles, depending on the structure's requirements.
Movable windows come in a variety of styles, depending on the structure’s requirements.

Security windows also come in different configurations.

REVIEW QUESTION

In what ways can building components impact fire suppression efforts?

Summary

- Your safety when fighting fire depends on your ability to know how the building will contribute to and even control the spread of fire.
- You must also understand the effect fire and heat have on structural components and materials to be able to anticipate results.