



**Essentials of Fire Fighting**  
**6<sup>th</sup> Edition**  
**Firefighter I**

**Chapter 4 — Building Construction**




**Learning Objective 1**

Describe the impact of fire on common building materials.


4-1 

**A wide variety of building materials are used in construction.**

All react differently to heat of fire



Courtesy of Ron Moore and McKinney (TX) FD

4-2 

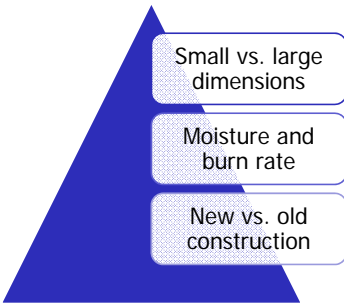
**Wood is the most common material used in North America.**




Also main component in structural assemblies

4-3 

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



4-4 

**Each type of masonry shows signs of deterioration in different ways.**



Brick
Stone
Concrete/Concrete Block

Courtesy of Ron Moore and McKinney (TX) FD

4-5 

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

Cast Iron



Wrought Iron



(Cont.)

4-6



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

Courtesy of Ron Moore and McKinney (TX) FD



(Cont.)

4-7



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

4-8



Reinforced concrete typically performs well under fire conditions.

Courtesy of Ron Moore and McKinney (TX) FD



- Fortified with rebar
- Loses strength through spalling

4-9



Gypsum has excellent heat-resistant and fire-retardant properties.

Known as drywall, Sheetrock®

High water content

Breaks down gradually under fire conditions

4-10



The process of lath and plaster can present unique challenges during an incident.

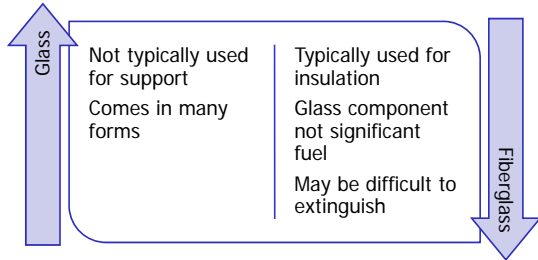


- May be replaced with wire mesh
- Can be difficult to penetrate
- Can conceal fire in cavity
- May add fuel

4-11



**Both glass and fiberglass react to heat in different ways.**



4-12

**DISCUSSION QUESTION**



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

4-13

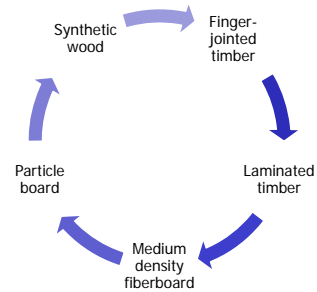
**Plastic typically melts and contributes to the content load during an incident.**



- Exterior uses
- Water, sewer pipes
- Decorative use

4-14

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



4-15

**REVIEW QUESTION**



What impact can fire have on common building materials?

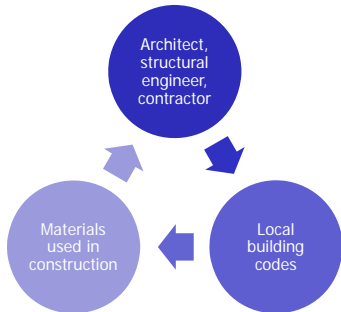
4-16

**Learning Objective 2**

Explain the impact of fire on construction classifications.

4-17

**Construction classification type is determined by several factors.**



4-18



**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

4-19



**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

4-20



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



Type I



Type II

Courtesy of Ron Moore and Mackenzie (TM) FD

(Cont.)

4-21



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



Type III

(Cont.)

4-22



**DISCUSSION QUESTION**



What types of renovations are commonly found in your jurisdiction?  
How can firefighters monitor these?

4-23



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



4-24



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

Built in factory

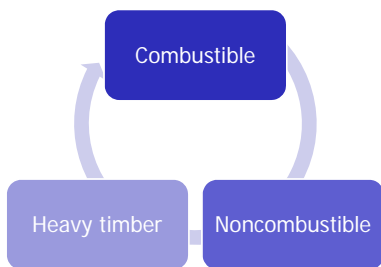
Must conform to U.S. HUD standard

Fire-resistance may vary

4-25



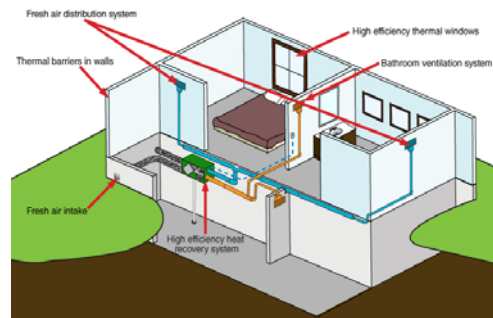
There are three types of construction defined by the National Building Code of Canada.



4-26



Canadian construction may also be designed with the *Novoclimat standard*.



REVIEW QUESTION



How are different construction classifications affected by fire suppression?

4-28



Learning Objective 3

List the main types of occupancy classifications.

4-29



Occupancy classifications are defined by building and life safety codes.



Single-use



Separated use

4-30



## REVIEW QUESTION



What are the main types of occupancy classifications?

4-31



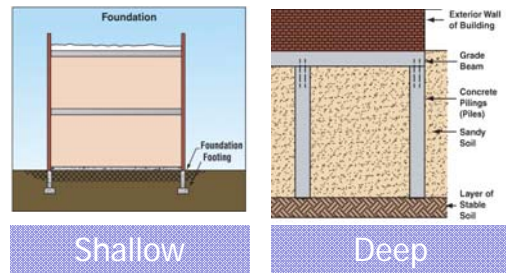
## Learning Objective 4

Describe the basic construction of building components.

4-32



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



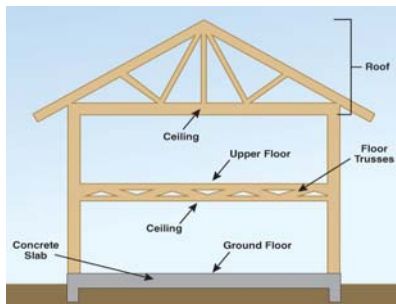
Shallow

Deep

4-33



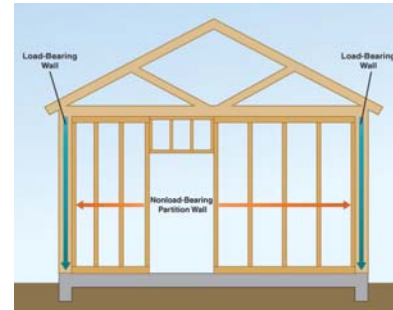
Floors and ceilings form the top and bottom of the compartment.



4-34



Walls define the perimeter of a building and divide it into compartments.



4-35



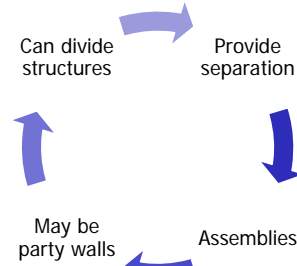
**Wall types and ratings vary depending on several factors.**



4-36



**Fire walls are constructed of a variety of masonry materials.**



4-37



**Penetrating walls should only be performed when needed.**

**Exterior and fire walls**

- Most difficult
- Forcing entry into or escaping

**Interior walls**

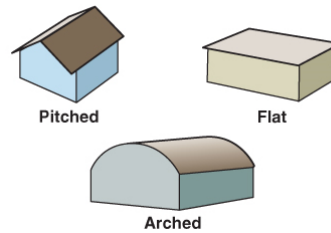
- Only to locate hidden fires or create escape path

4-38



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

**Common Roof Types**

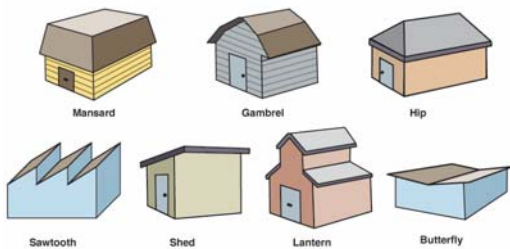


(Cont.)

4-39



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



4-40



**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?

4-41





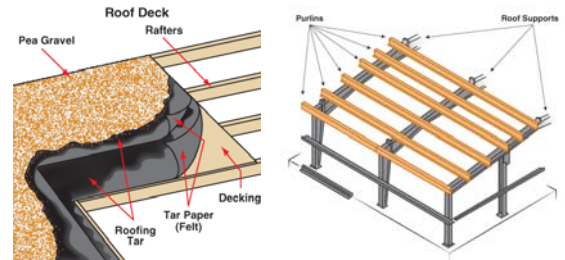
**Roof construction is based on three main components; one is roof supports.**



4-42



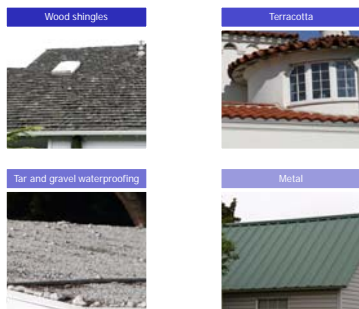
**Roof decks are another component in roof construction.**



4-43



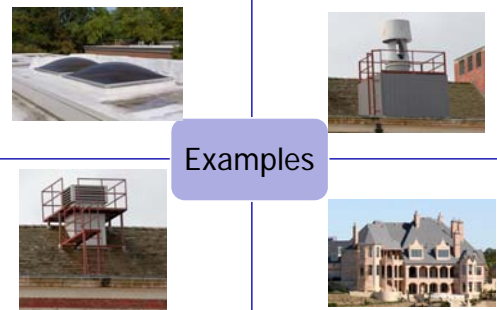
**Roof coverings, the final main component, come in a variety of styles.**



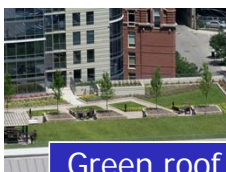
4-44



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



**Observing the presence of roof obstructions can help when ventilating.**



Green roof



(Cont.)

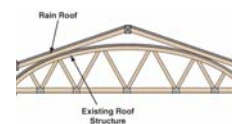
4-46



**Observing the presence of roof obstructions can help when ventilating.**



Photovoltaic roof



Rain roof

4-47





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



4-48



### WARNING

Unauthorized security modifications create extreme life safety hazards for firefighters.

4-49



### 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

4-50



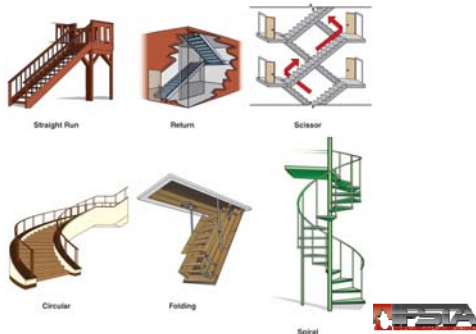
### Roof-mounted equipment can add a live load to the dead load on a roof.



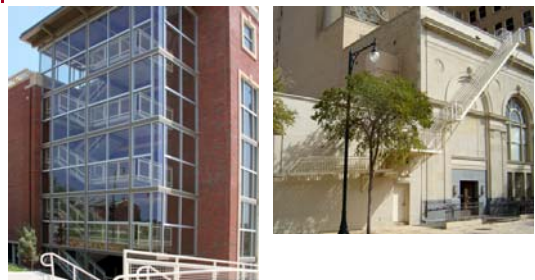
4-51



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



### Exterior stairs and fire escapes provide access and egress in different ways.



4-53



DISCUSSION QUESTION



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

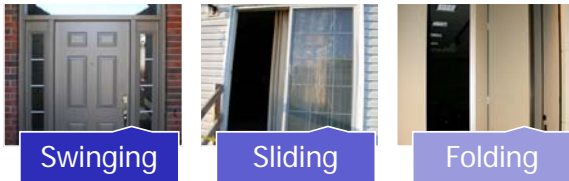
4-54

Smokeproof and unprotected stairs provide different levels of protection.



4-55

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



Swinging

Sliding

Folding

(Cont.)

4-56

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

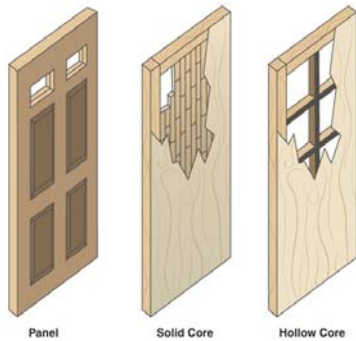


Vertical

Revolving

4-57

Wood panel and flush doors are constructed using similar components.

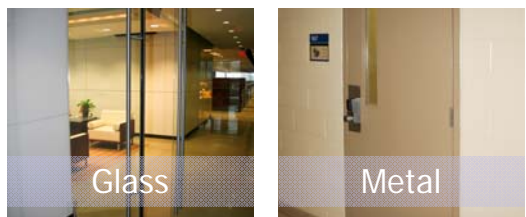


Panel

Solid Core

Hollow Core

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



Glass

Metal

4-59

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



Fire door



Rolling fire door



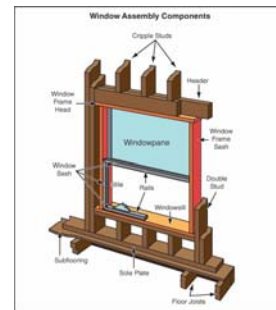
Sliding fire door

*Courtesy of Ron Moore and McKinney (TX) FD*

4-60



**Window construction uses the same components for many styles.**



4-61



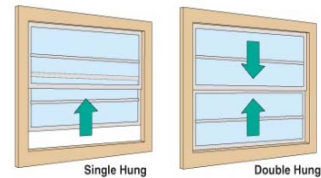
**Fixed windows are nonoperable, these may be called display windows.**



4-62



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



(Cont.)

4-63



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

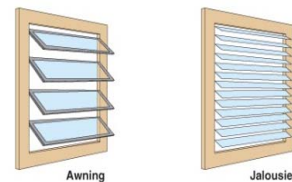


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4-64



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

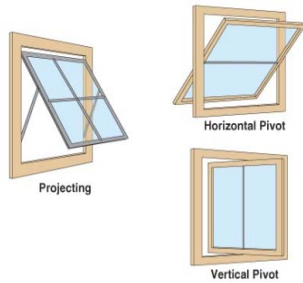


(Cont.)

4-65



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



4-66



Security windows also come in different configurations.



4-67



## REVIEW QUESTION



In what ways can building components impact fire suppression efforts?

4-68



## 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.

4-69

