INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

IMPROVING RESIDENTIAL SIZE-UP: BUILDING CONSTRUCTION

Apr. 2, 2026

COURSE OBJECTIVES

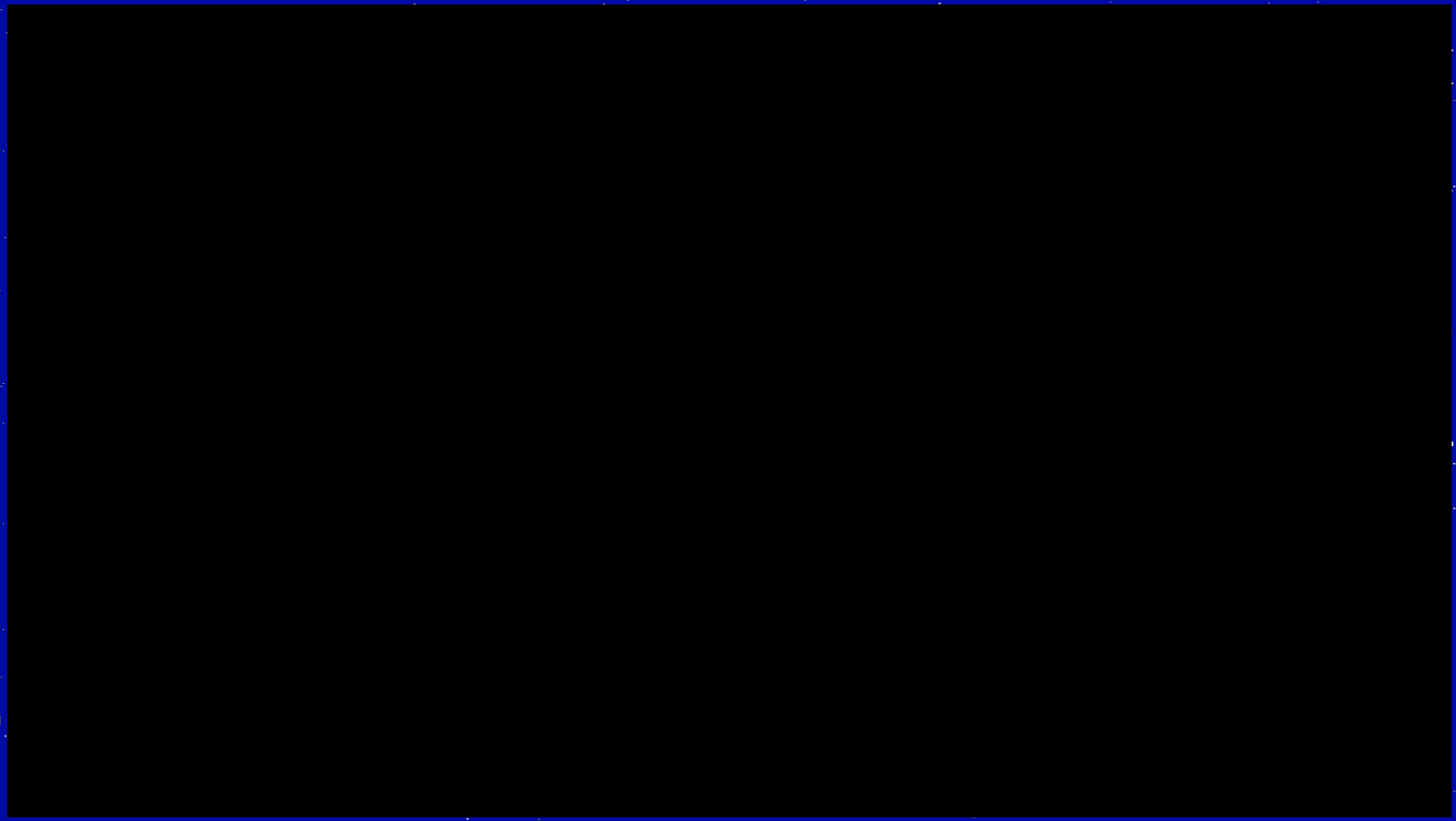
- Explain the importance of understanding residential building construction and its impact on fire ground operations.
- Describe a structured framework to assist fire fighters in effectively sizing up residential construction.
- Identify tactical considerations for residential structure fires based on the building's era, materials, and use.

BACKGROUND

AUGUST 13th 2006

GREEN BAY, WI
IAFF LOCAL 141
LINE OF DUTY DEATH
LT. ARNIE WOLFF

NIOSH REPORT F98-15



“

Fire departments should ensure fire fighters are trained to recognize the danger of operating above a fire and identify buildings constructed with trusses.”

— NIOSH F98-15

“

Additionally, municipalities, building code officials and local authorities having jurisdiction should consider modifying the current codes to require that lightweight trusses are protected with a fire barrier on both the top and bottom.”

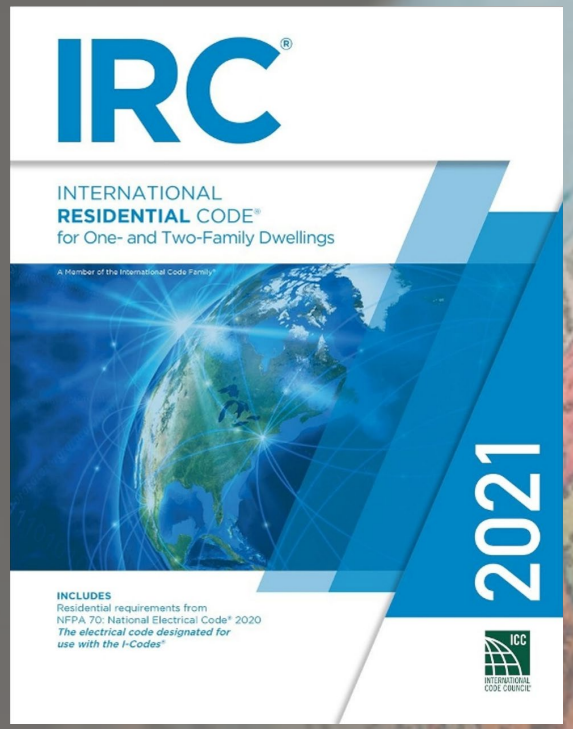
— NIOSH F98-15

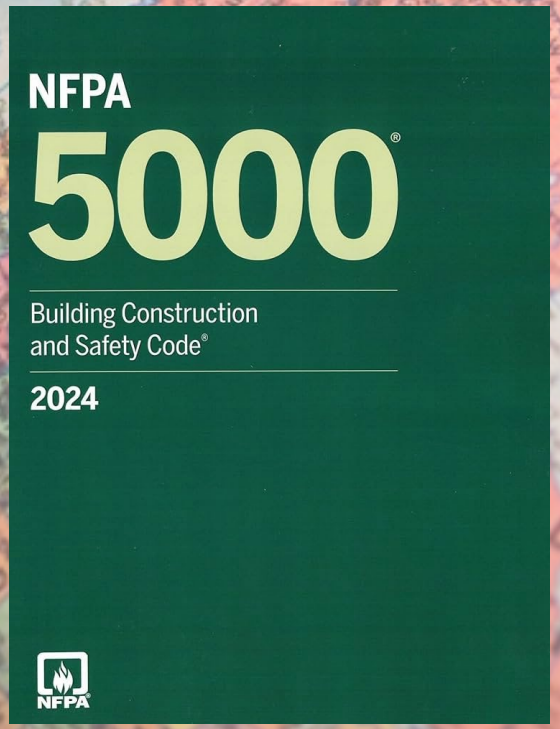
FSRI

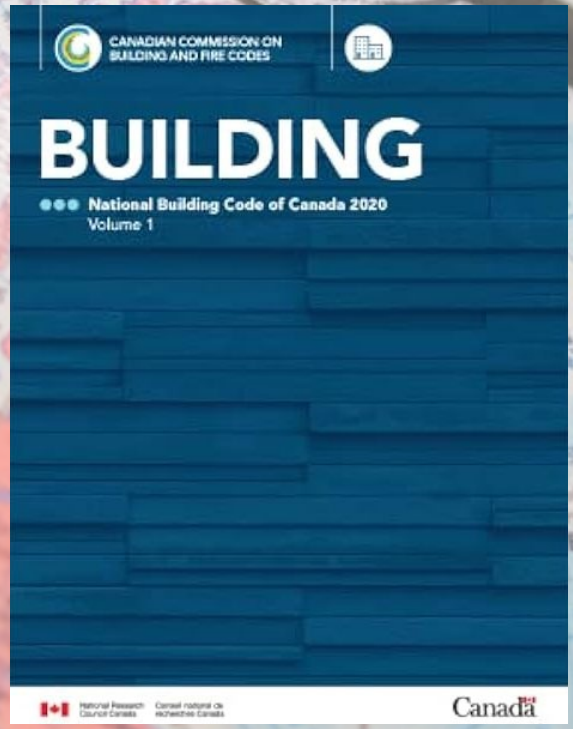
TRAINING

Assembly	Structural Element	Type	Ceiling	Protective Membrane Breach	Fire Fighter Breach (min : sec)
1	2x10 Joist Floor	Legacy	None	0:00	18:35
2	Wood I Joist Floor	Lightweight	None	0:00	6:00
8	2x10 Joist Floor	Legacy	Lath and plaster	74[1]	79*
3	2x10 Joist Floor	Legacy	Regular gypsum wallboard	23:30	44:40
4	Wood I Joist Floor	Lightweight	Regular gypsum wallboard	17:45	26:43
5	Metal Gusset Truss Floor	Lightweight	Regular gypsum wallboard	16:30	29*
6	Finger Joint Truss Floor	Lightweight	Regular gypsum wallboard	16:00	26:30
7	2x6 Joist & Rafter Roof	Legacy	Regular gypsum wallboard	15:45	38[2]
9	Metal Gusset Truss Roof	Lightweight	Regular gypsum wallboard	13:45	23:10

BUILDING CODES

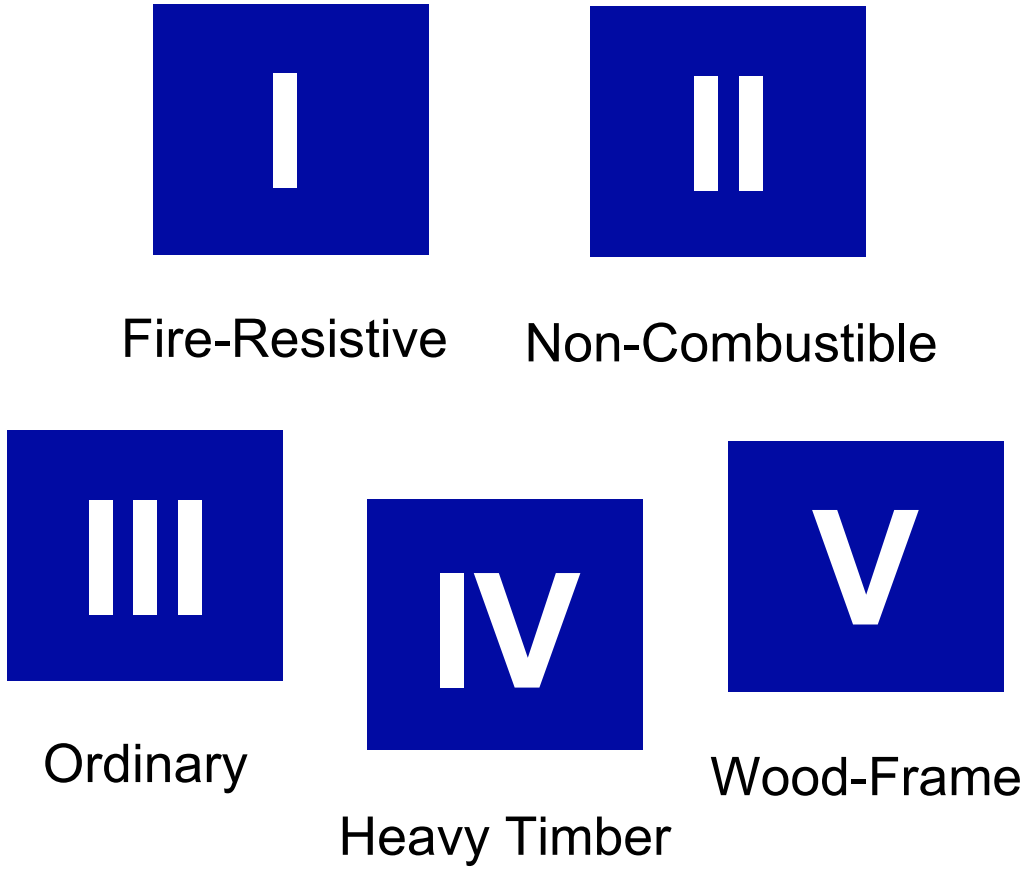






5 TYPES OF CONSTRUCTION

The 5 Types of Construction is a system of classifying buildings that is used in most model codes throughout North America.



FIRE-RESISTIVE

All structural components are non-combustible and protected from direct fire impingement.

Most commonly constructed utilizing concrete or fire-protected steel.

Examples: High-rises, hotels, hospitals, detention centers, care facilities.

NON-COMBUSTIBLE

All structural components are non-combustible or approved limited combustible materials.

Examples: Box stores, warehouses, strip malls, schools, shopping malls.

ORDINARY

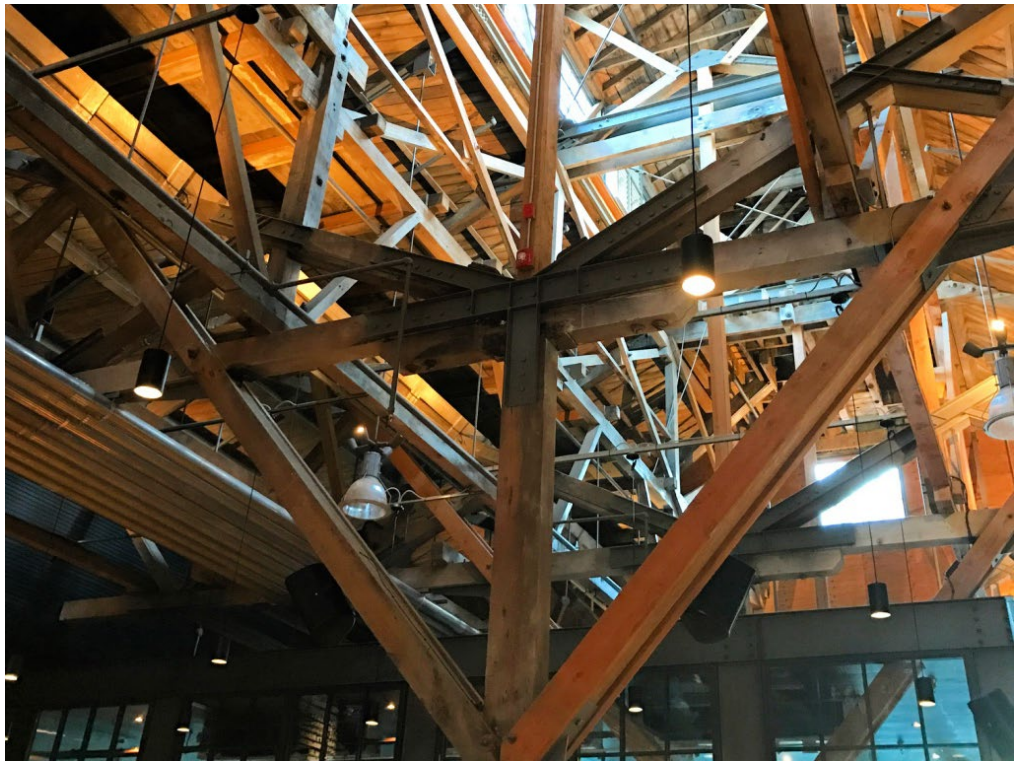
Load bearing exterior walls constructed of non-combustible materials. Interior partition walls, floors, and roofs can utilizes combustible materials.

Examples: Older commercial buildings, apartments, ”taxpayers”, small warehouses.

HEAVY TIMBER

All structural components are constructed with wood timbers of a minimum prescribed dimension. This can include laminated wood.

Examples: Churches, mill buildings, warehouses, modern high-rises.



WOOD-FRAME

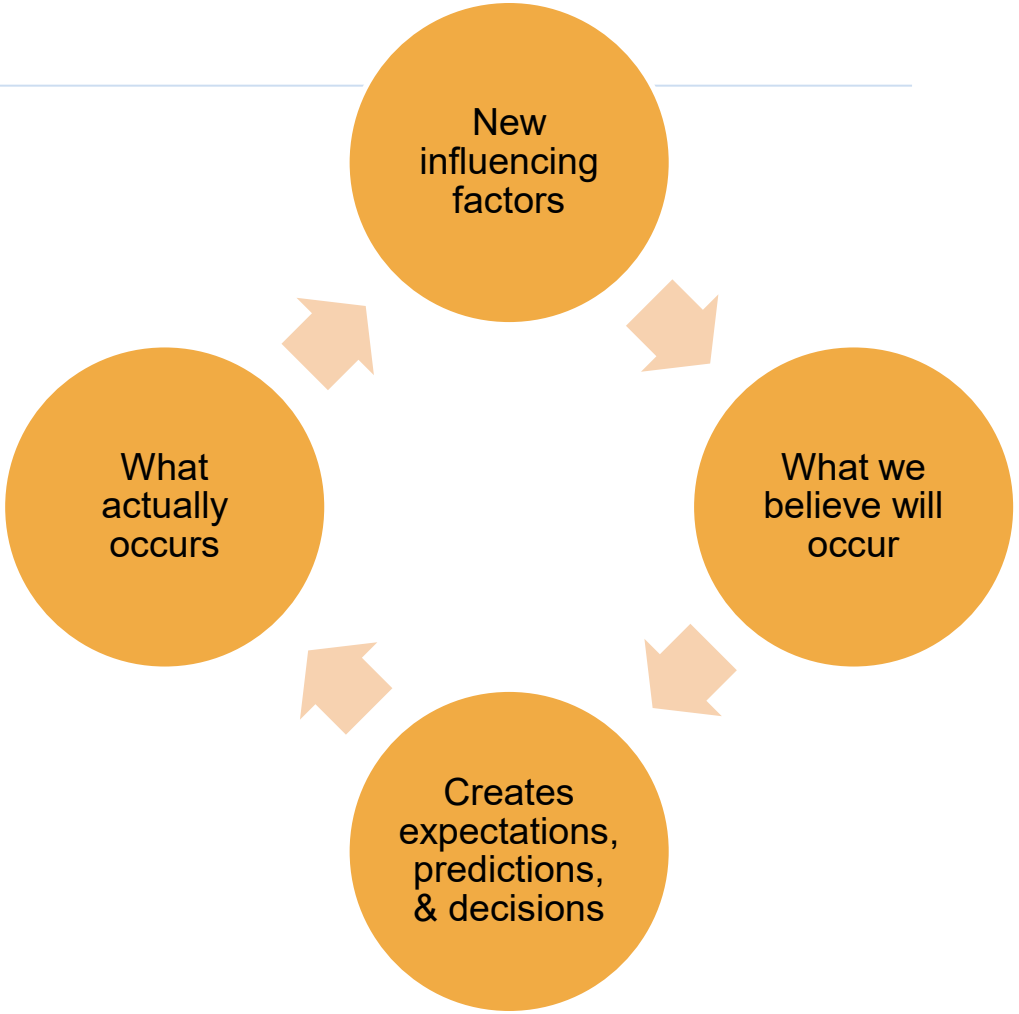
All structural components are wood or other approved combustible materials.

Examples: Single-family homes, multi-family residential.

SIZE-UP

MENTAL MODEL

- Improve decision-making in complex situations with confidence.
- Combine intuition and analysis for superior results.
- Leverage experience to recognize patterns effortlessly.
- Engage in mental simulations to predict outcomes accurately.
- Assess options rapidly based on prior knowledge.
- Make swift decisions in high-stakes environments with assurance.



SIZE-UP

ERA
MATERIALS
USE

All three of these characteristics come together to help paint a picture of what can be expected within the building

ERA MATERIALS USE

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

ERA

IDENTIFY THE APPROXIMATE AGE OF THE BUILDING

PRE-WAR	Up to 1940
POST-WAR	1941 to 1974
MODERN	1975 to Current

PRE-WAR

Common Characteristics

- Balloon framing
- Braced framing
- Actual dimension lumber in wall, floor, and roof assemblies
- Shiplap sheathing and decking
- Lath and plaster interior coverings
- Livable attic space/half-stories
- Knee walls found in converted attics/ half-stories
- Compartmentalized interior layout
- Unreinforced masonry construction

PRE-WAR

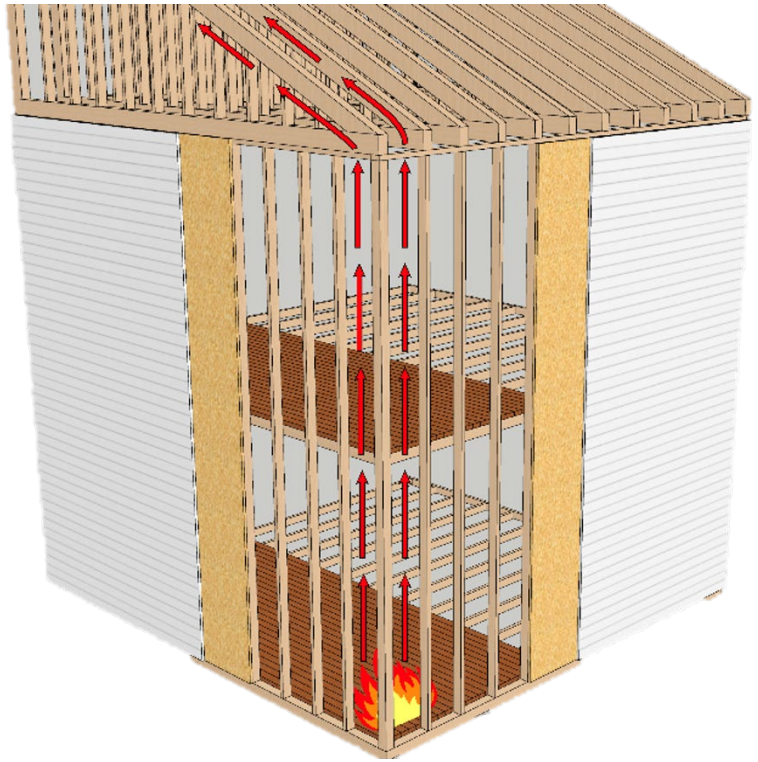
PRE-WAR

PRE-WAR

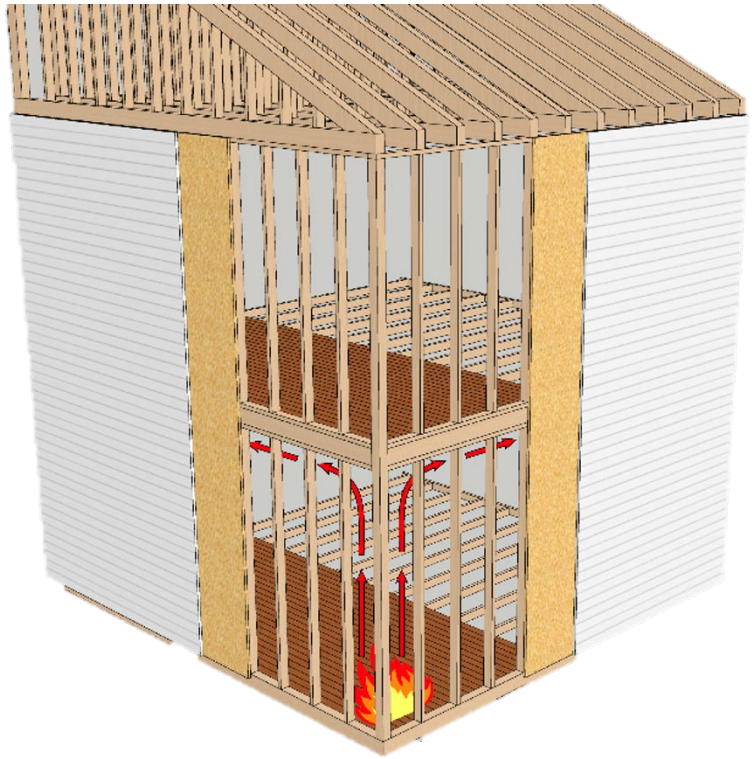
TACTICAL CONSIDERATIONS

WHEN OPERATING IN A HALF-STORY OR CONVERTED ATTIC SPACE, FIRE FIGHTERS SHOULD ENSURE TO OPEN UP AND LOCATE FIRES THAT MAY BE HIDDEN BEHIND KNEE WALLS.

BALLOON FRAMING VS PLATFORM FRAMING



Balloon Framing



Platform Framing

POST-WAR

Common Characteristics

- Platform framing
- Nominal dimension lumber in wall, floor, ar
  roof assemblies
- Introduction of:
  - Plywood sheathing and decking
  - Gypsum board interior coverings
  - Wood wall panel interior coverings
- Compartmentalized interior layouts

POST-WAR

POST-WAR

POST-WAR

MODERN

Common Characteristics

- Platform framing
- Nominal dimension lumber in wall, floor, and roof assemblies
- Introduction and use of:
  - Oriented Strand Board sheathing and decking
  - Lightweight roof and floor assemblies
  - Engineered lumber in wall, floor, and roof assemblies
- Open concept interior layout

MODERN

MODERN

MODERN

TACTICAL CONSIDERATIONS

FIRE FIGHTERS SHOULD ALWAYS CONFIRM THAT INTERIOR LAYOUT AND SPACES MATCH THE INITIAL EXTERIOR SIZE-UP

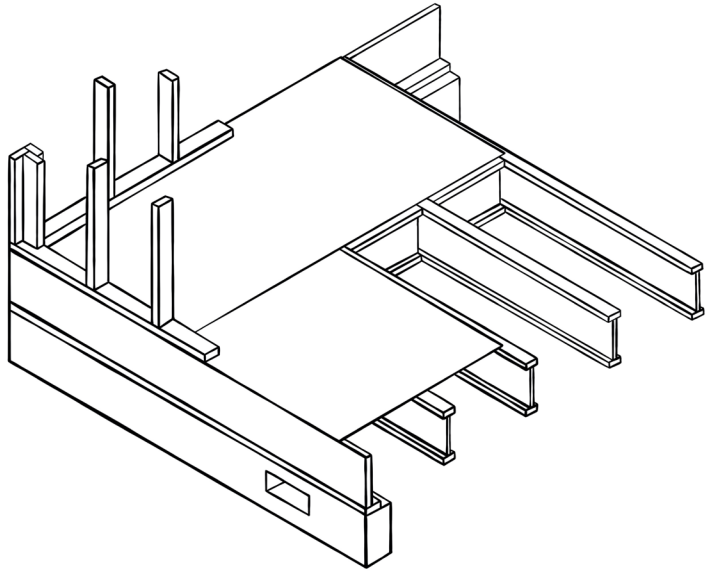
TACTICAL CONSIDERATIONS

ERA MATERIALS USE

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

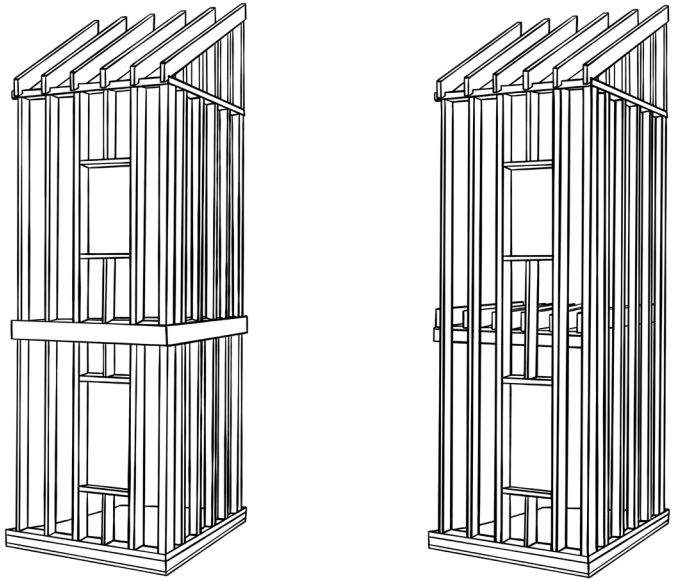
MATERIALS

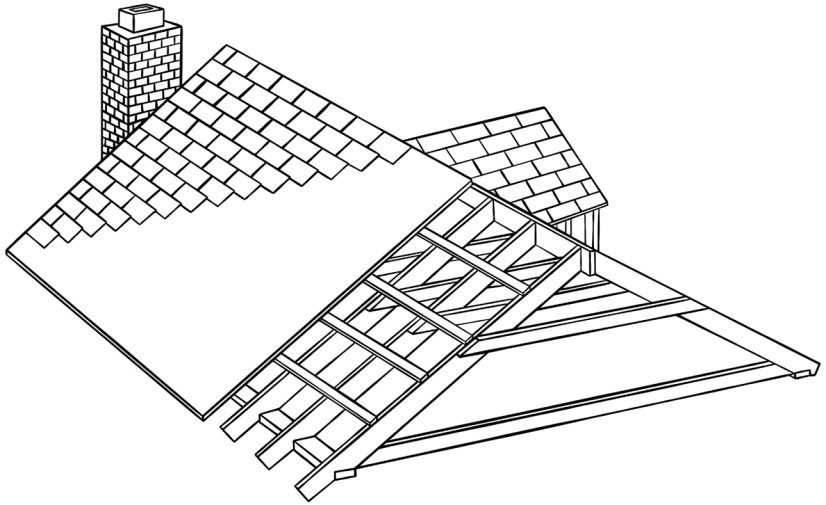
IDENTIFY THE STRUCTURAL ASSEMBLY MATERIALS



FLOOR ASSEMBLIES

WALL ASSEMBLIES





ROOF ASSEMBLIES

TACTICAL CONSIDERATIONS

FIRE FIGHTERS SHOULD CONSIDER HOW THE STRUCTURAL ASSEMBLIES IMPACT FIRE SPREAD THROUGHOUT THE STRUCTURE

TACTICAL CONSIDERATIONS

BEEN	Where has the fire been?
AT	Where is the fire at?
GOING	Where is the fire going?

MATERIALS

IDENTIFY THE STRUCTURAL ASSEMBLY MATERIALS

WOOD	Conventional, Engineered, Lightweight, Mass Timber
STEEL	Structural, Lightweight
MASONRY	Unreinforced, Veneer
CONCRETE	Cast-in-place

WOOD – CONVENTIONAL

- Lumber dimension and strength has changed over the years.
- **Actual dimension lumber** is true to size (e.g. 2 inches by 4 inches).
- **Nominal dimension lumber** used in modern buildings is smaller (e.g. 1.5 inches by 3.5 inches).

WOOD – CONVENTIONAL

WOOD – ENGINEERED

Glued Laminated Timber

Parallel Strand Lumber

Laminated Veneer Lumber

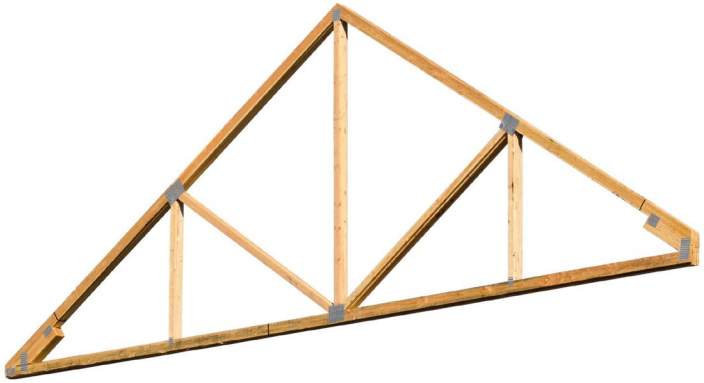
Laminated Strand Lumber

WOOD

MASS OVER MATH

WOOD - LIGHTWEIGHT

Wood
I-Joist



Roof
Truss

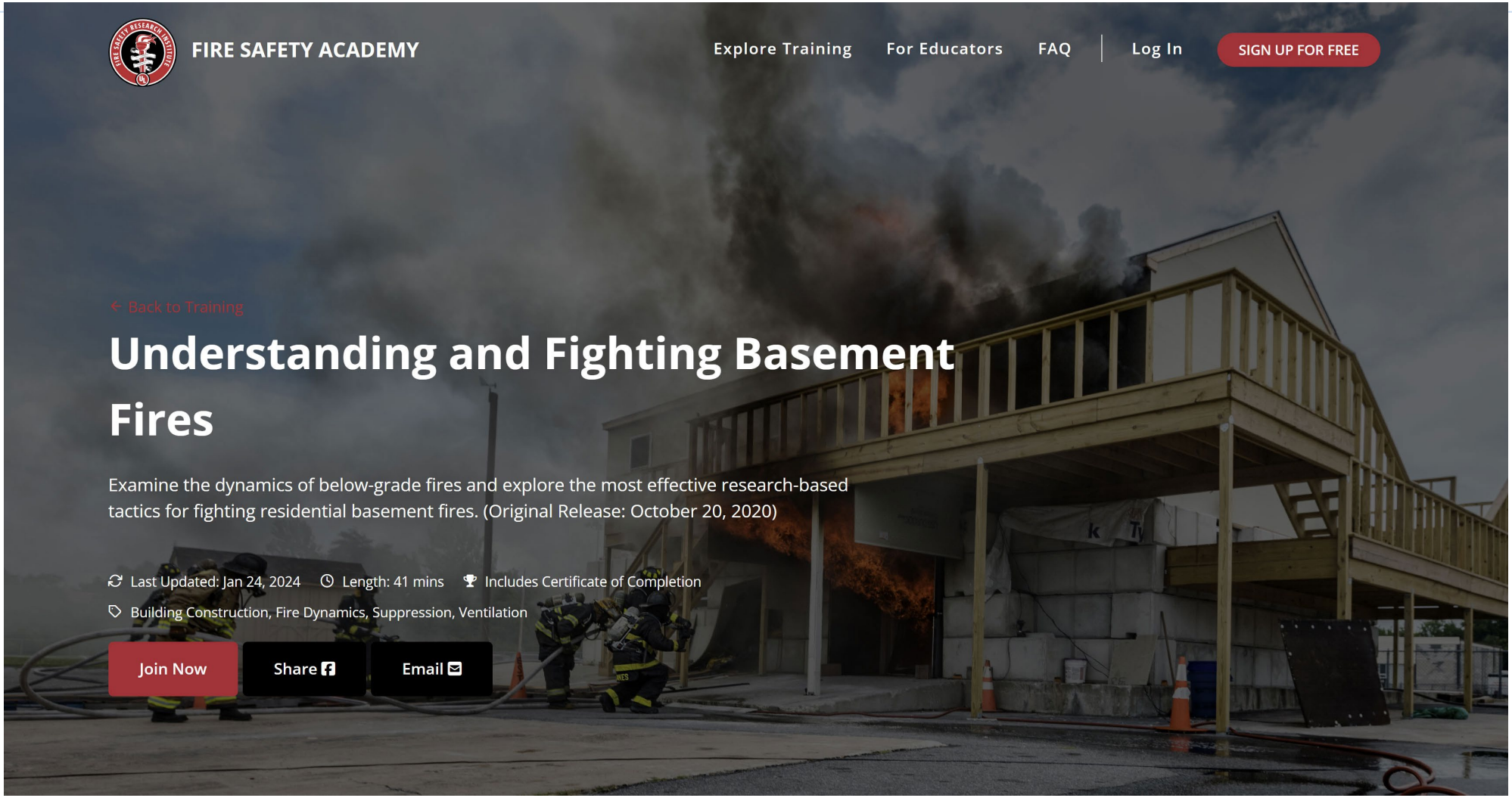
Parallel
Chord
Truss

WOOD - LIGHTWEIGHT

TACTICAL CONSIDERATIONS

FIRE FIGHTERS SHOULD ALWAYS ATTEMPT TO IDENTIFY THE PRESENCE OF BASEMENTS, CELLARS, OR OTHER BELOW GRADE INTERIOR SPACES PRIOR TO MAKING ENTRY

UNDERSTANDING & FIGHTING BASEMENT FIRES



TACTICAL CONSIDERATIONS

FIRE FIGHTERS SHOULD NOT RELY ON SOUNDING ALONE TO ASSESS LIGHTWEIGHT FLOOR ASSEMBLIES FOR STRUCTURAL STABILITY.

Video courtesy of FSRI

TACTICAL CONSIDERATIONS

WOOD - MASS TIMBER

- Mass Timber construction is an engineered system, utilizing modern heavy timber.
- Up to 18 stories is permitted by code in both Canada and the United States for residential occupancies.
- Some buildings now allow for certain floors to be without gypsum board encapsulation.
- Void spaces not permitted.

WOOD – MASS TIMBER

MASONRY - UNREINFORCED

- Unreinforced masonry is found in “Pre-war” era of buildings.
- Exterior walls are constructed with multiple courses of brick with no additional reinforcing.
- Prone to collapse under both fire and seismic events.

MASONRY - UNREINFORCED

- *Kings row* every 5-7 rows.
- Arched masonry header or lintels above doors and windows.
- Deep recessed window and door openings.
- Presence of rafter tie-plates.
- May be covered with other materials such as stucco, acrylic coatings, etc.

MASONRY - VENEER

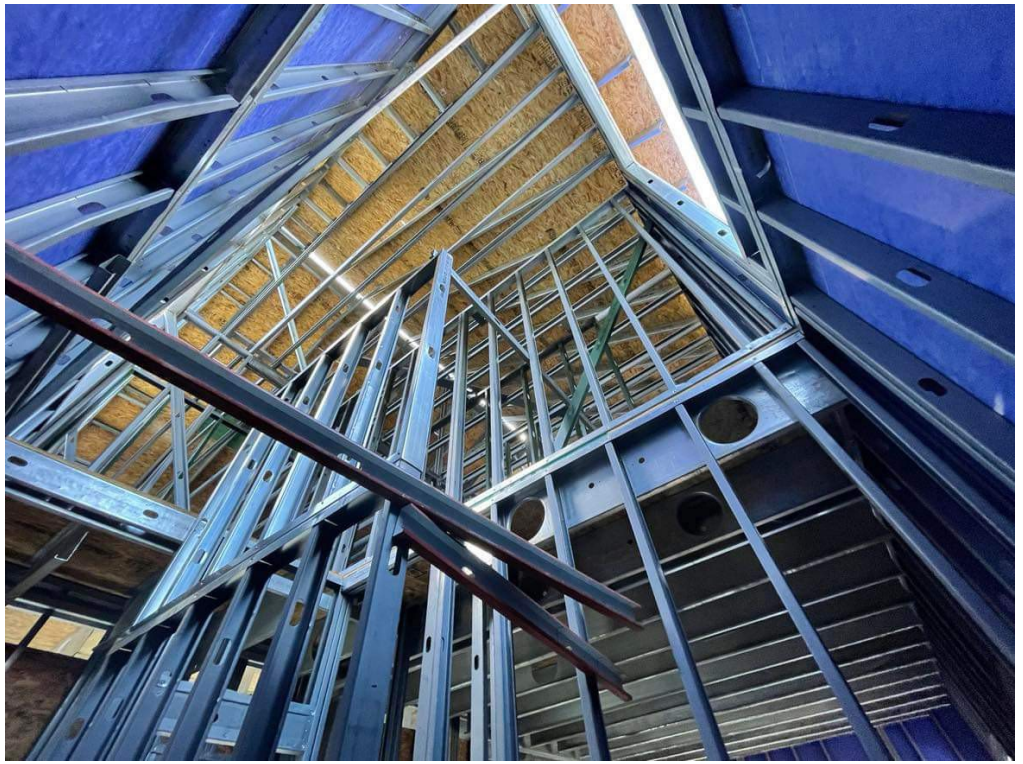
- Common in post-war and modern era.
- Constructed by placing a masonry “veneer” wall in front of an existing framed wall.
- Tied back to the structural wall in various manners.
- Although they can still collapse, this veneer rarely affects the overall structural stability of the building.

STEEL - LIGHTWEIGHT

- Lightweight steel construction is becoming more common throughout North America.
- Pre-planning is essential to see if it is in your areas.

STEEL - LIGHTWEIGHT

- Lightweight steel construction in all structural assemblies (floor, wall, roof).
- Plywood or Oriented Strand Board (OSB) used for roof and floor decking.



TACTICAL CONSIDERATIONS

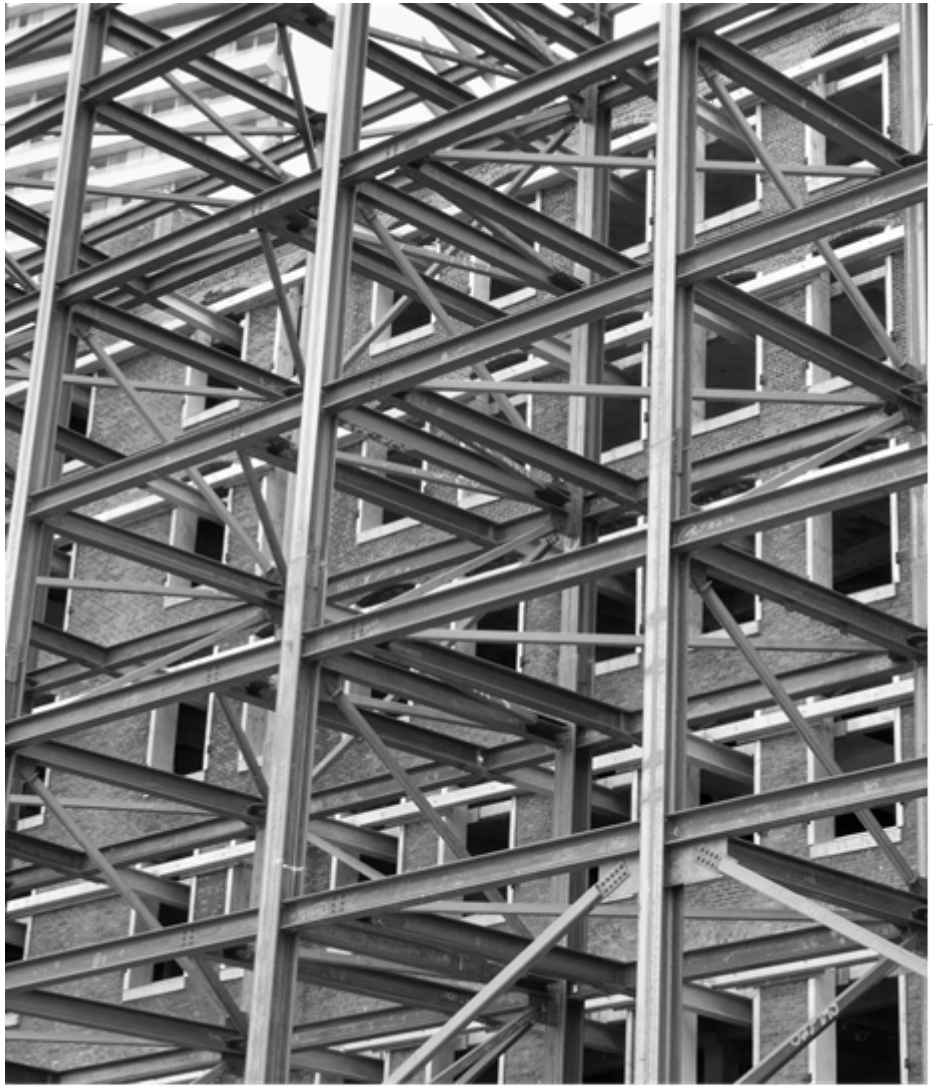
FAILURE OF WOOD IS A RESULT OF TIME.

FAILURE OF STEEL IS A RESULT OF TEMPERATURE.

TACTICAL CONSIDERATIONS

STEEL– STRUCTURAL

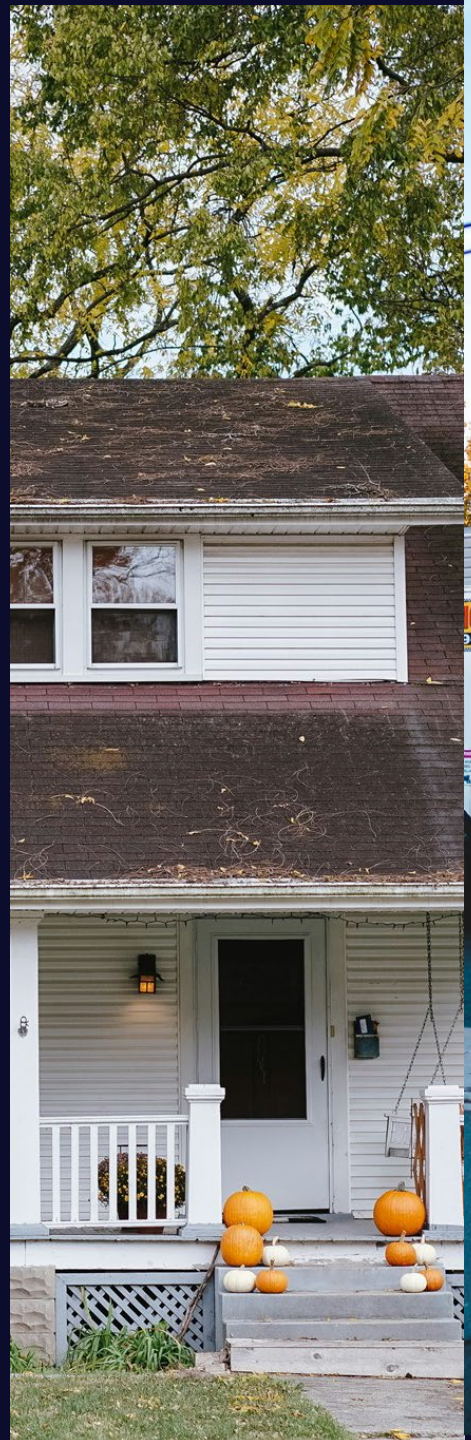
- Used extensively in commercial buildings
- In residential, mostly found in steel high-rise building
- Individual structural steel components may be used in conjunctions with other construction types such as:
  - Beams
  - Headers
  - Lintels



CONCRETE – CAST-IN-PLACE

- Created by pouring concrete into formwork
- Entire structure is connected together as a monolithic structure
- Fire-resistive
- Does not contribute to fire as fuel

ERA MATERIALS USE



INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

USE

IDENTIFY THE OCCUPANCY OR USE OF THE BUILDING

RESIDENTIAL

COMMERCIAL

RESIDENTIAL OVER COMMERCIAL

RESIDENTIAL

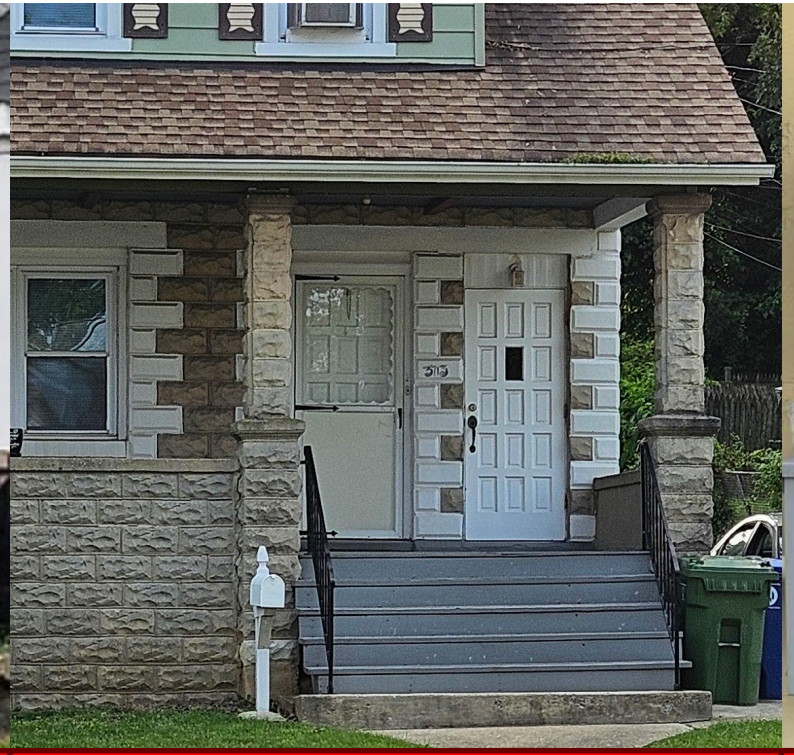
- Identify if the building is single-family or multi-family.
- **Single family** – One defined dwelling space
- **Multiple family** – Two or more defined dwelling spaces in the same building

TACTICAL CONSIDERATIONS

FIRE FIGHTERS SHOULD ALWAYS LOOK FOR ADDITIONAL DWELLING SPACES AS PART OF THEIR INITIAL SIZE-UP

MULTI-FAMILY CLUES

MULTIPLE MAILBOXES

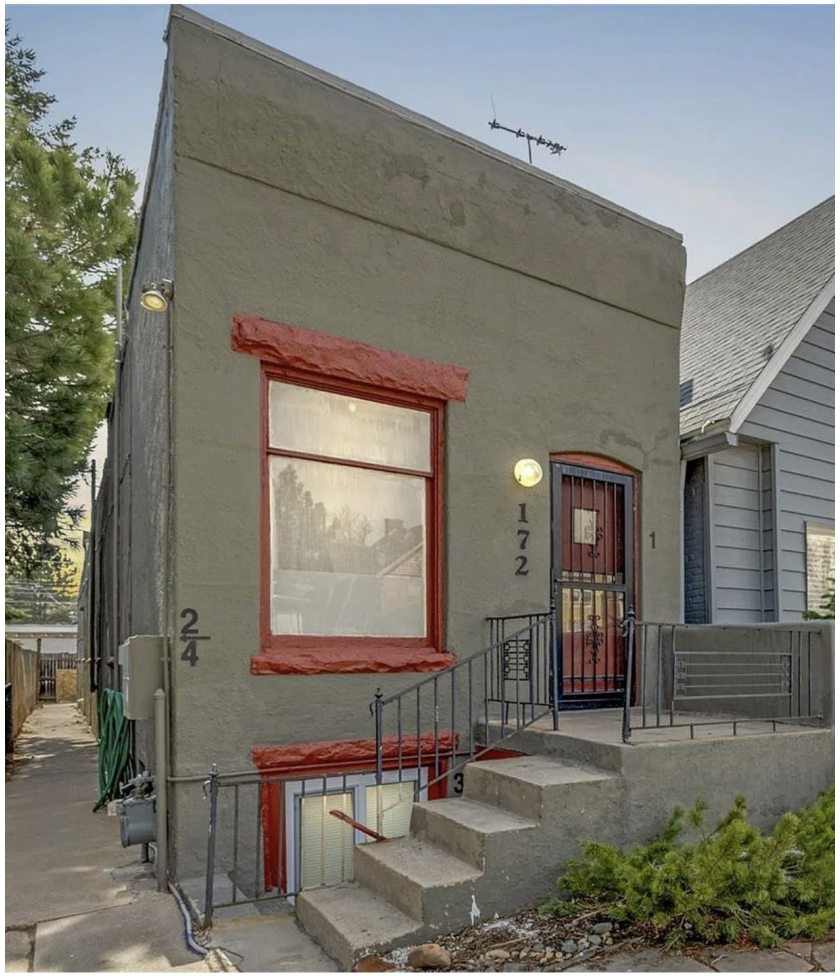


MULTIPLE DOORS

MULTIPLE METERS

HOW MANY OCCUPANCIES?

HOW MANY OCCUPANCIES?



COMMERCIAL

- Identify what is the building used for?
- Pre-existing knowledge of the building can be extremely beneficial for understanding what the building was originally designed for.

RESIDENTIAL OVER COMMERCIAL

- Identify the Residential occupancy as single-family or multi-family.
- Identify the **USE** of the commercial occupancy.
- Modern **podium** buildings most often have:
  - Multi-family residences
  - Different construction materials between the residential and commercial sections

RESIDENTIAL OVER COMMERCIAL (PODIUM)

RESIDENTIAL OVER COMMERCIAL (TAXPAYERS)

- Older **taxpayers**
- Single-family or multi-family
- Typically shares the same construction materials throughout the residential and commercial sections.

PRACTICE

PRACTICE

ERA?

Pre-war
(1899)

MATERIALS?

Wood
(Balloon frame, actual dimension lumber)

USE?

Residential
(Single-family)

PRACTICE

ERA?

Post-war
(1955)

MATERIALS?

Wood
(Platform frame, nominal dimension lumber)

USE?

Residential
(Multi-family)

PRACTICE

ERA?

Modern
(2006)

MATERIALS?

Wood & Concrete
(Platform frame, lightweight, engineered)

USE?

Residential over Commercial
(Multi-family/Retail)

PRACTICE

ERA?

Modern
(2007)

MATERIALS?

Wood
(Platform frame, lightweight, engineered)

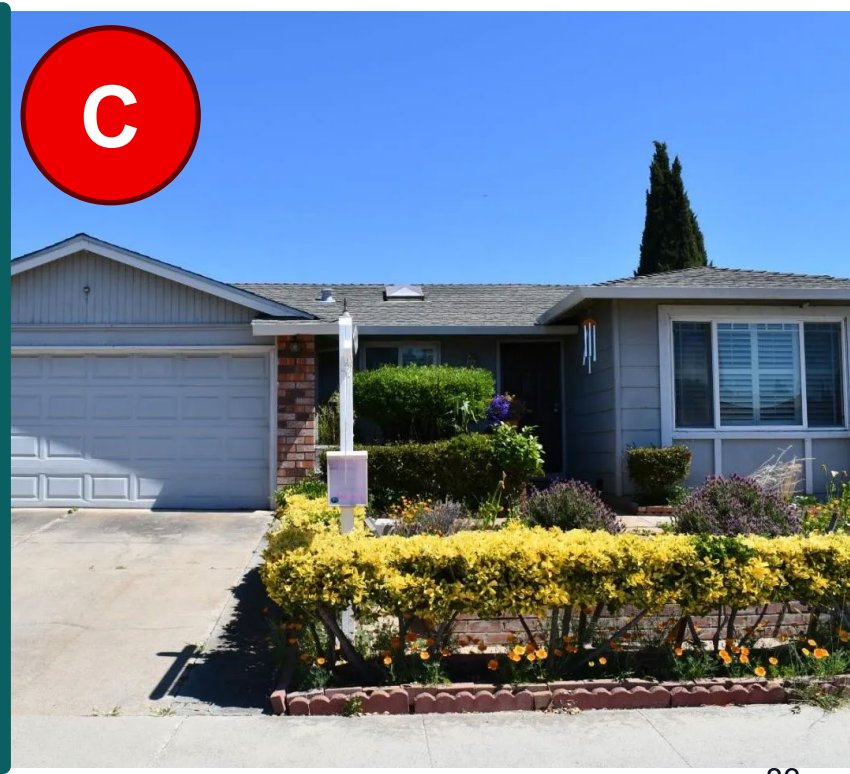
USE?

Residential
(Single-family)

- **How confident are you identifying these features from a quick exterior view?**

PRACTICE

Which building was most likely constructed during the pre-war era?



PRACTICE

MATERIALS?

Masonry & Wood
(Unreinforced masonry, actual dimension lumber)

USE?

Residential over Commercial
(Multi-family/Retail)

Pre-war
(1914)

PRACTICE

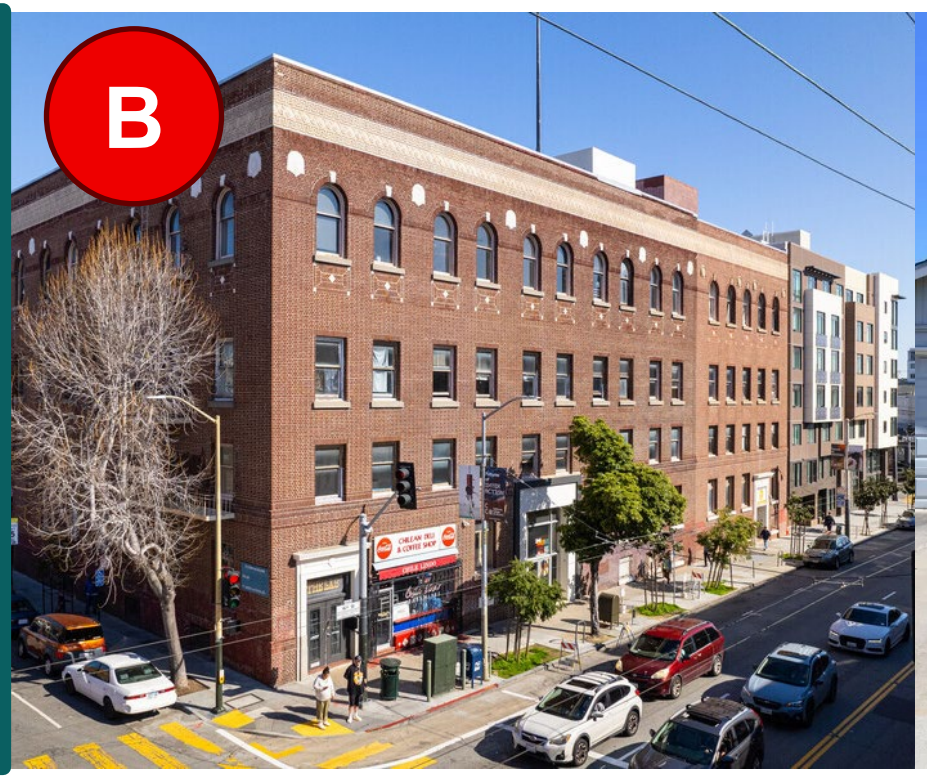
Which of the following is a characteristic of unreinforced masonry buildings?

- Single layer of brick in front of a framed wall
- Bound only by mortar
- Tied back to the structural wall
- Oriented Strand Board (OSB) sheathing

Pre-war
(1914)

PRACTICE

Which residence is most likely constructed using wood I-joists and lightweight roof trusses?



PRACTICE

What materials were most likely used to construct this building?

- Engineered lumber
- Nominal dimension lumber
- Masonry veneer
- Conventional lumber

ERA?

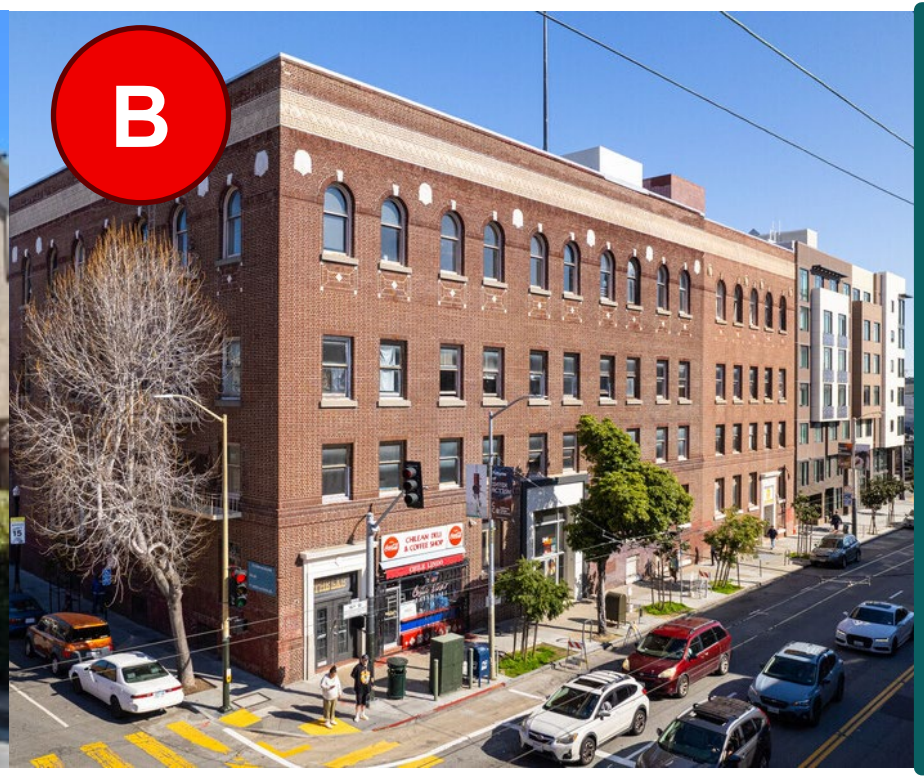
Modern

USE?

Residential (Single-family)

PRACTICE

Which residence was constructed during the post-war era?



PRACTICE

What are common characteristics of this residence?

- Nominal dimension lumber
- Shiplap sheathing
- Plaster interior coverings
- Compartmentalized layouts

ERA?

Post-war (1973)

USE?

Residential (Single-family)

PRACTICE

What best describes the type of framing used in Post-War construction?

- Balloon frame using actual dimension lumber
- Platform frame using nominal dimension lumber
- Platform frame using lightweight engineered wood
- Steel stud frame

CONSTRUCTION ERAS AND MATERIALS REVIEW

Spec/Material	Pre-War	Post-War	Modern
Framing	Balloon	Platform	Platform
Lumber Dimensions	Actual	Nominal	Nominal
Wood	Conventional	Conventional	Conventional Engineered Lightweight Mass Timber
Steel	Structural	Structural Lightweight	Structural Lightweight
Masonry	Unreinforced	Veneer	Veneer
Concrete	Cast-in-Place	Cast-In-Place	Cast-In-Place

PRACTICE

Which building is most likely a single-family residence?

PRACTICE

What type of floor plan do you expect to find in this building?

Open concept

MATERIALS?

Wood
(Platform frame, lightweight, engineered)

ERA?

Modern
(2000)

USE?

Residential
(Single-family)

PRACTICE

Which building most likely uses actual dimension size lumber?

PRACTICE

Based on your observation, how many residences are found in this home?

2 – Two front doors are visible

Why is it important to recognize indicators of multiple residences in a single building during your initial size-up?

Helps to identify potential complications to interior operations such as unexpected room configurations or altered pathways.

PRACTICE

What is a fire behavior concern with balloon-frame construction?

Rapid vertical fire spread through wall cavities

MATERIALS?

Wood (Balloon frame, actual dimension lumber)

ERA?

Pre-war

USE?

Residential (Multi-family)

PRACTICE

Which building most likely belongs to the Post-War era?

PRACTICE

During a fire in this type of structure, what is one advantage of platform framing compared to earlier methods?

- It limits vertical spread between floors
- It eliminates concealed spaces
- It prevents all lateral fire movement
- It uses noncombustible materials throughout

PRACTICE

Why is it important to identify if a basement is present?

- Basements often contain valuable utilities that can aid in extinguishment.
- Hidden fires in basements can weaken floor assemblies, leading to collapse.
- Checking for basements helps estimate how long the fire has been burning.
- Basement fire are easier to ventilate from above

PRACTICE

Which building most likely belongs to the Modern era?

PRACTICE

What is the most significant collapse hazard for fire fighters operating inside a modern single-family home like this?

Heat-weakened lightweight components failing rapidly

MATERIALS?

Wood
(Platform frame, lightweight, engineered)

USE?

Residential
(Multi-family)

Modern
(2008)

- **What do you know now that you didn't know at the beginning of this course?**

- **What's one detail or clue you'll pay closer attention to on your next call?**

THANK YOU!
ANY QUESTIONS?

James Johnson
james@iaff18.org