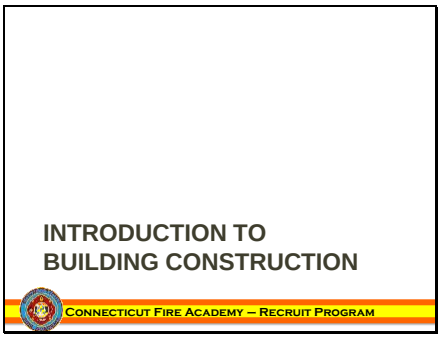
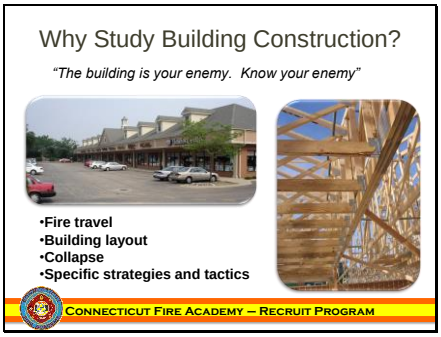
Slide 1

Slide 2

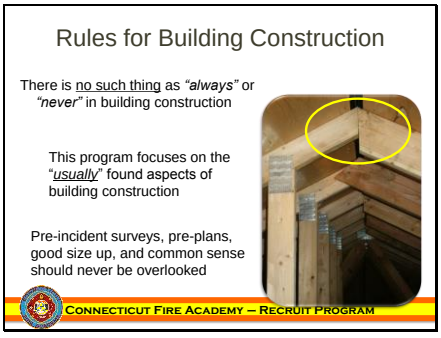


Slide 3



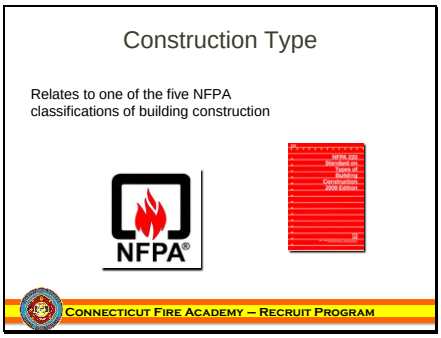
Start a discussion on why Brannigan's statement is so important to us as firefighters.
From the second a building is built, it wants to do nothing but fall down. Fire and heat will only accelerate how fast it falls.
All of our strategies, tactics, and tasks revolve around building construction and fire behavior.
Knowledge of building construction will show us- how and where fire will travel, how and where buildings will collapse, and how buildings are laid out.

Slide 4



Homeowners and "fly-by-night" contractors often do things during remodeling or construction that are generally unacceptable by building codes.

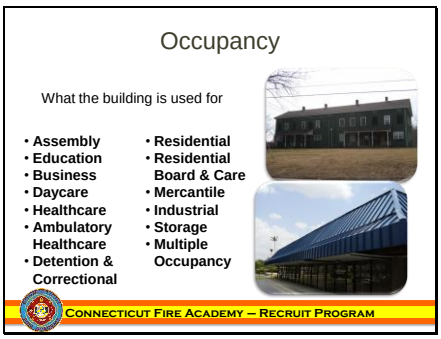
Slide 5



As stated in NFPA 220.

Slide 6

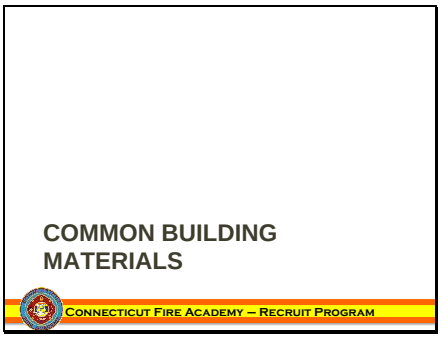
Slide 7



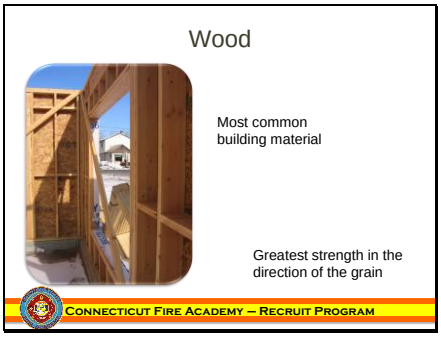
Students don't need to memorize these, just understand that different occupancies present different hazards

- Assembly- gathering for 50 or more persons
- Education- used for educational purposes. Occupies 4 or more hours per day
- Daycare- where 4 or more clients receive care by other than family members
- Healthcare- where 4 or more persons receive medical treatment
- Ambulatory healthcare- 4 or more patients on an out-patient basis
- Detention or correctional- 4 or more persons housed under varying degrees of restraint
- Residential- provide sleeping accommodations for other than detention or health care
- Residential board and care- boarding of 4 or more persons for personal care services
- Mercantile- used for the display and sale of merchandise
- Business- used for account and record keeping or the transaction of business other than mercantile
- Industrial- where products are manufactured, processed, mixed, assembled
- Storage- used for the sheltering of goods
- Multiple occupancy- where 2 or more classes of occupancy exist

Slide 8



Slide 9

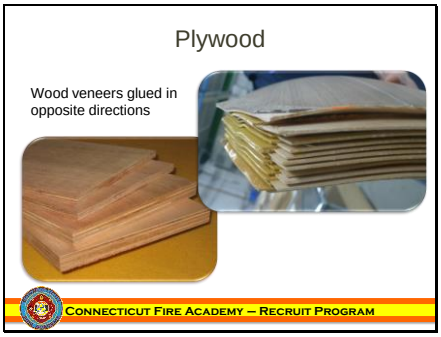


- Contributes to the fuel load.
- With larger trees becoming unavailable, manufacturers have come up with ways to use smaller pieces of wood to make structural components.
- OSB, plywood, & Glu-Lam discussed on the following slides. Their increased use & dangers posed to firefighters warrant a more in depth discussion.

Slide 10

- Allows manufacturers to use every bit of each tree that they cut.
- Used in beams, floors, and walls. Used as a part of some lightweight construction.
- Glues contribute to the fuel load. Ignition temperature of the glue is the same as the wood (around 450°)

Slide 11



- Wood veneers are "peeled" off of the logs.
- Used as parts of beams, floors, and walls. Used as a part of some lightweight construction.
- Glues contribute to the fuel load. Ignition temperature of the glue is the same as the wood (around 450°)

Slide 12

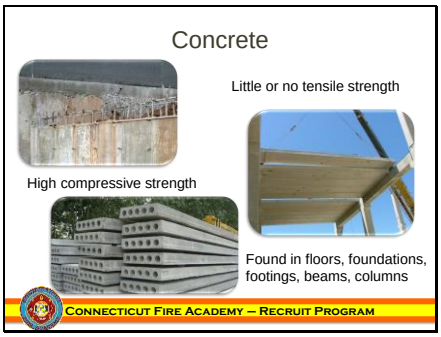
- Allows large spans with few supporting columns.
- The individual pieces of wood can easily be seen in this example.
- The beam on the right is basically a large dimension piece of OSB

Slide 13

Expansion can cause exterior walls to fail.

- If the steel can not expand, it will twist and fail.

Slide 14



Concrete alone can only be used support loads in compression

- In order to support loads in any other configuration, rebar must be added
- Post- and Pre- tensioning also adds support

Slide 15

Spalling is caused by the expansion of the moisture in concrete when heated above 212°

- Minor surface spalling has little or no effect on the concrete
- Once the rebar inside is exposed to enough heat that is loses its strength, the concrete may fail

Slide 16

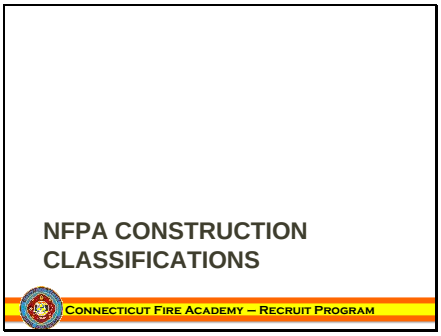
When the heat levels are enough to fail the wallboard, the fire is well advanced and will rapidly begin deteriorating the structural members behind it.

- Its high water content makes it a great insulator.
- Gypsum is also being used as a panelized roofing material
- The panels are typically 2" thick and 2'x8'. Each weighs approximately 135lbs.

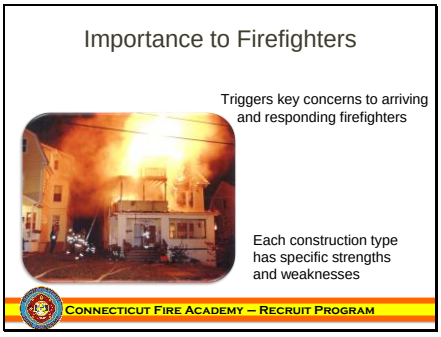
Slide 17

- May be wire reinforced, tempered, or laminated.
- Wire reinforced glass may be found in limited amounts in fire doors. Prevents products of combustion from travelling to uninvolved areas.
- A 90 minute fire door can have up to 100 square inches of wired glass.

Slide 18



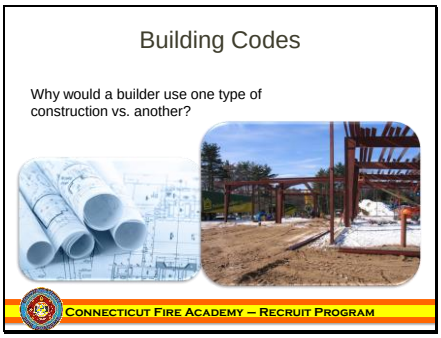
Slide 19



An initial radio report from a first arriving company should include, among other things, the type of building construction.

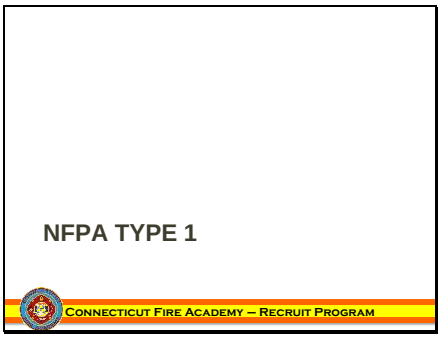
- If unable to determine for sure, assume the worst case scenario. (i.e. non- combustible vs. fire resistive. Without pre-plans or previous knowledge of a building, it may be difficult to determine.)

Slide 20



- Builders are going to use the cheapest method possible to build a building
- Trade offs can often be made during the plans review process
- Trade sprinklers for adding a fireproof coating or more exit doors
- Whichever protection is cheapest, is the one the builder will use

Slide 21



Slide 22

Some combustible finishes are for interior finishes, roof coverings and structures, trim, nailers, windows, & doors.

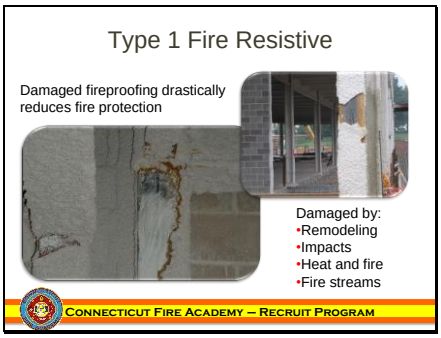
- Only buildings that are required by law to be fire resistive will be made so.
- Examples of requirements- some hotels, some schools, some hospitals.
- Height, occupancy, fire protection, and size are all determining factors in whether or not a building needs to be fire resistive.

Slide 23

This fireproofing provides up to 4 hours of fire protection depending on application (in laboratory conditions)

The fireproofing can be a spray on lightweight concrete coating, a gypsum based coating, or multiple layers of sheetrock.

Slide 24

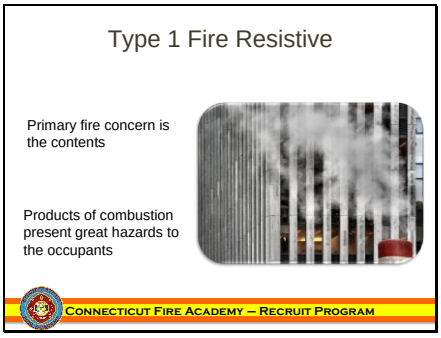


Slide 25

HVAC systems in fire resistive buildings are required to have duct smoke detection. Activation of one of these detectors will shut down the HVAC system and close dampers prohibiting smoke travel.

- Must have self closing fire doors

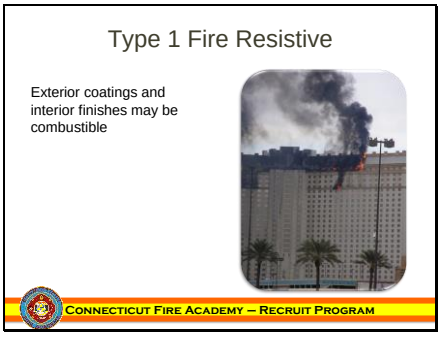
Slide 26



No building is fireproof.

- If fire doors are blocked open or if HVAC systems malfunction, fire can travel from the area of origin.
- Buildings of this construction often have a high life hazard (high rise, large assembly, non-ambulatory people).
- Failure of the fire protection systems or poor construction in these buildings can have devastating outcomes and high loss of life.

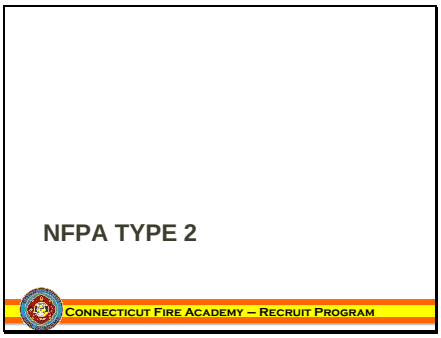
Slide 27



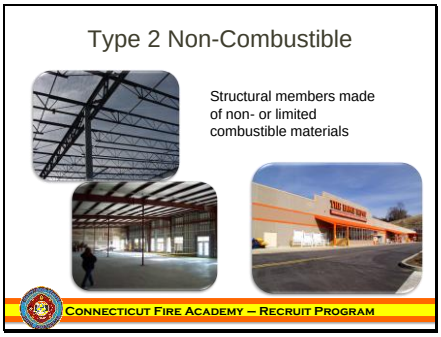
Picture is from a hotel fire in Las Vegas in 2008

- Fire started outside around the 30th floor due to welders and burned up and across the building due to the foam like finish coating

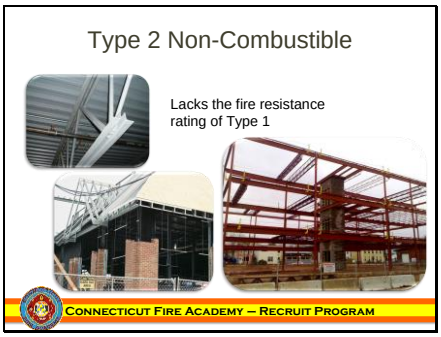
Slide 28



Slide 29

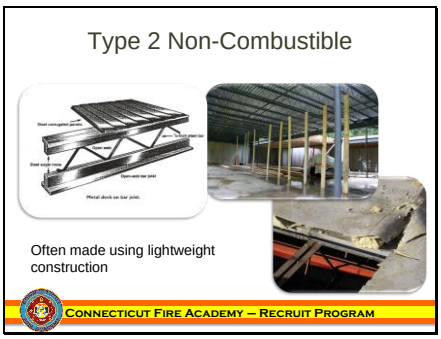


Slide 30



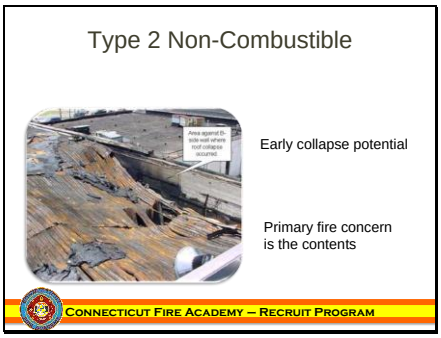
Steel columns and beams as well as metal studs are used in construction.

Slide 31



Understand that just because a building is a type 2, does not necessarily mean that it is made with lightweight construction.

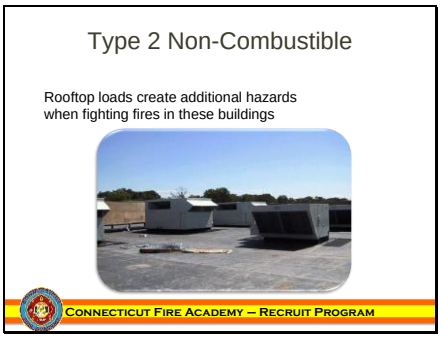
Slide 32



Uncontrolled fire in any Type 2 building can and will lead to collapse of the roof.

- Don't be confused- just because a building is type 2 construction does not mean that we don't fight fire in these buildings. We must simply weigh all of the factors when deciding whether or not to make an interior attack.

Slide 33



Often times, loads are added to roofs after remodeling without engineering studies to determine if the roof can withstand the load.

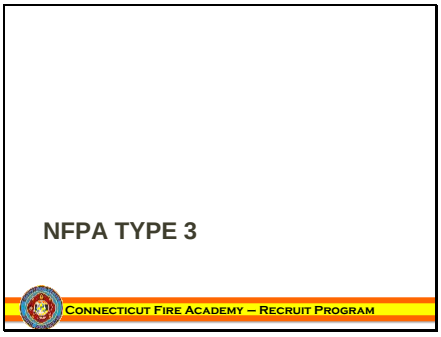
- The increased weight combined with heat & fire will cause these roofs to fail even faster.
- Command / interior companies must be notified if rooftop loads are discovered by roof firefighters.
- These HVAC units are common among type 1 through 4 buildings

Slide 34

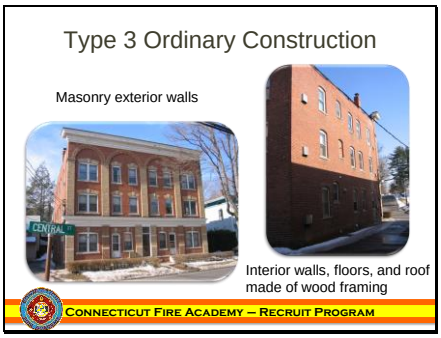
Roof purlins twist and fail rapidly due to heat and fire.

- Large open spans inside the building.
- May have panelized or masonry walls.

Slide 35



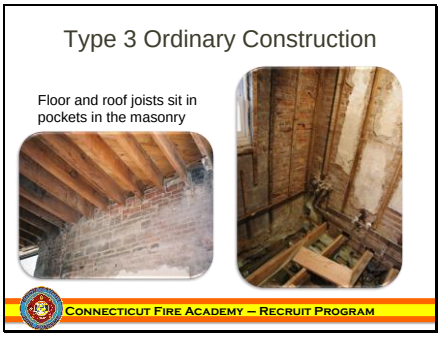
Slide 36



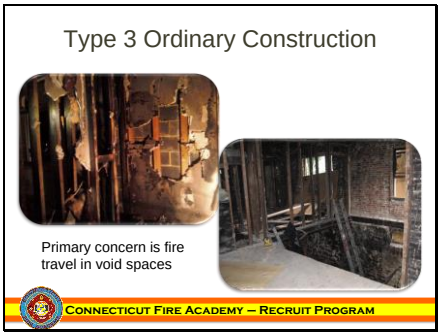
Generally early to mid- 1900's construction.

- Generally the type of construction used in "taxpayer" style buildings.
- In "modern" construction this type of construction has given way to non-combustible construction due to costs.
- Generally not taller than 6 stories because the exterior walls would have to be extremely thick to be able to support the load above. The tallest is 16 stories tall and has walls at the base that are 6' thick to support the weight above. (Chicago)

Slide 37



Slide 38



Due to the age of these buildings, most have been remodeled numerous times, creating void spaces for hidden fire to travel.

- Fires beyond the room / area of origin can be significant in these buildings.

Slide 39

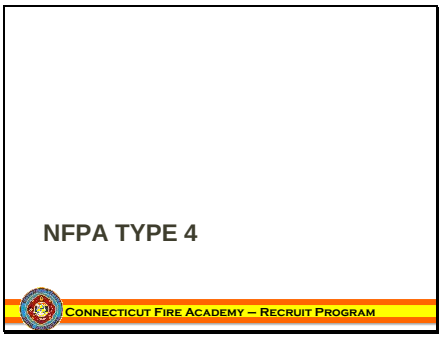
This is a tin ceiling found under a suspended ceiling. These buildings generally had tall ceilings. To reduce the amount of living space that needed to be heated or cooled, the ceiling height was lowered.

Tin ceilings were common in this era of construction. They would help limit fire spread, but once compromised, they were very difficult to overhaul.

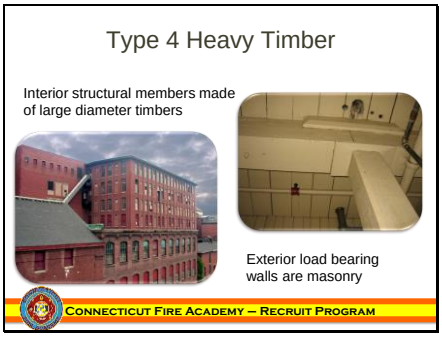
Slide 40


Type 3 Ordinary Construction
Typically flat, built up roofs over larger size joists
Remodels may use lightweight materials
CONNECTICUT FIRE ACADEMY – RECRUIT PROGRAM

Slide 41

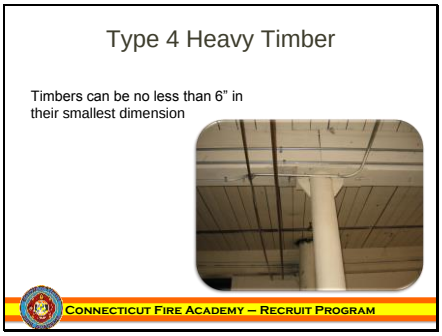


Slide 42



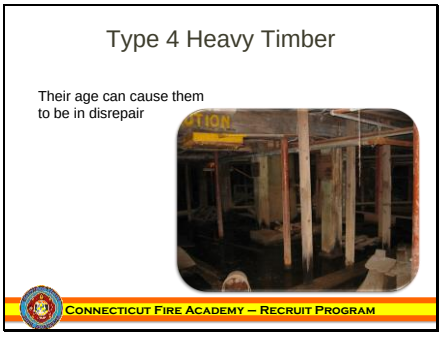
Often referred to as "old mill" construction.
These buildings get frequently remodeled and re-zoned.
What once was one large factory, may now be divided up into several small occupancies.
Many developers are creating apartments and condos out of old mills.

Slide 43



Columns can be no less than 8"x8" for supporting floors, and 6"x8" for supporting roofs.
Floor beams can be no less than 6"x10".
Roof framing can be no less than 6"x8".
Floor decking not less than 3" thick for tongue & groove and 4" thick for planks.
Roof decking can be no less than 2" thick for tongue and groove and 3" for planking.

Slide 44

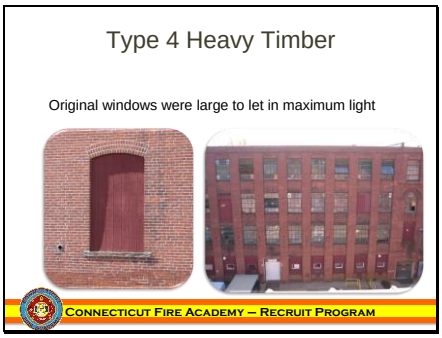


These buildings tend to hold up well to even large fires, but the sheer amount and size of combustibles in these buildings create huge fire loads.

Slide 45

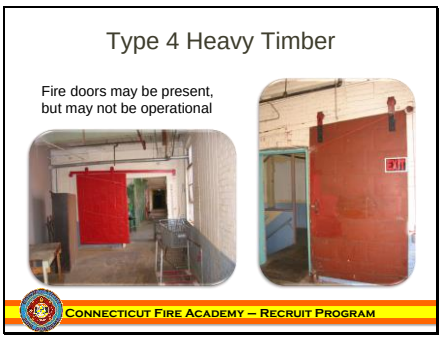
Manufacturing processes may have left behind oils which increase the combustibility of the flooring. The oils used to waterproof the floors are also flammable

Slide 46



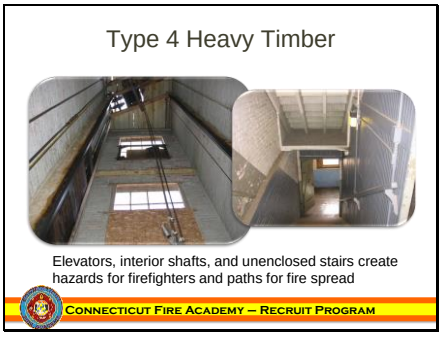
As occupancies change, windows may be boarded up and walled over on the inside. This is a serious safety concern for interior firefighters.
The size of the windows may also be reduced to save on energy. Now the large amount of heat generated by a fire only has smaller exit opening to vent from.

Slide 47



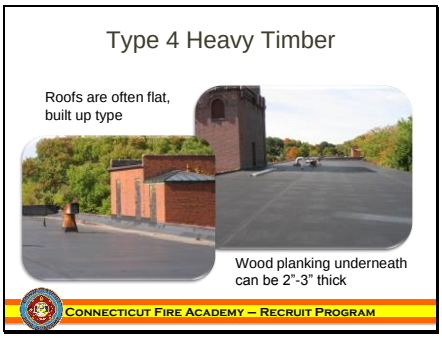
A heat activated fusible link is supposed to actuate these doors.
Many have been blocked or wired permanently open.

Slide 48



•These buildings were built before modern building codes. Stairways were often unenclosed and would allow fire to travel vertically with ease.

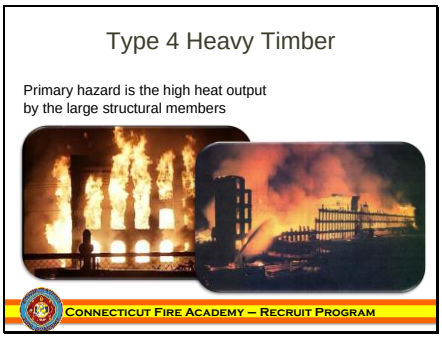
Slide 49



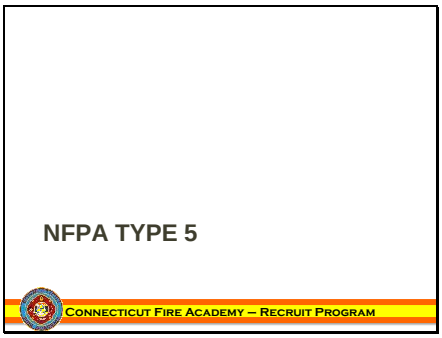
•Rubber membrane roofs have frequently been added over existing tar and asphalt roofs.

•Vertical ventilation is time and manpower intensive.

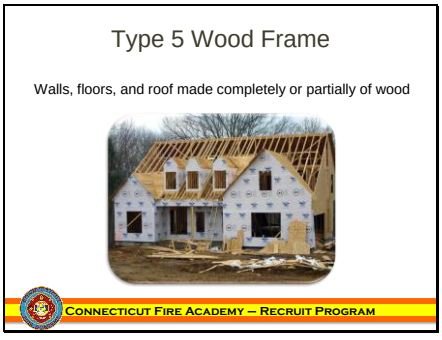
Slide 50



Slide 51

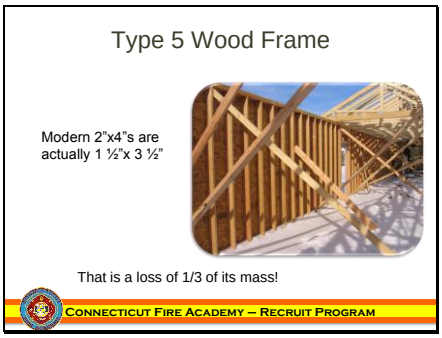


Slide 52



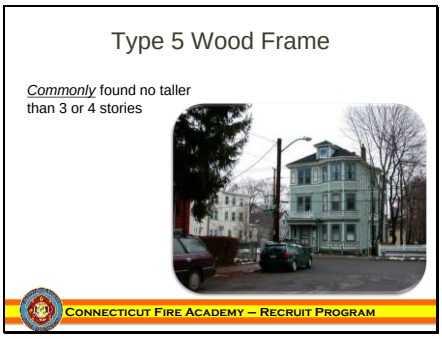
The majority of our fires are fought in wood frame, residential occupancies.

Slide 53



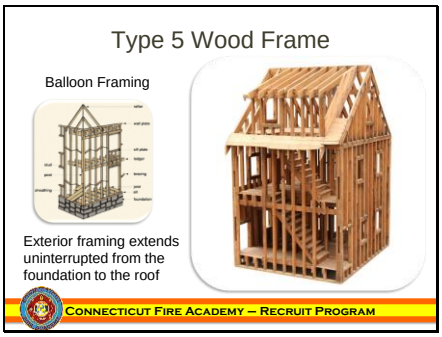
These dimension size changes seem to have occurred in the 1960's.
This loss of mass is part of the reason why older frame homes stand up better and longer under fire conditions.

Slide 54



Some manuals (IFSTA) state that these buildings may be up to 7 stories tall.
While it is possible, it is extremely rare to build a wood frame building that tall.

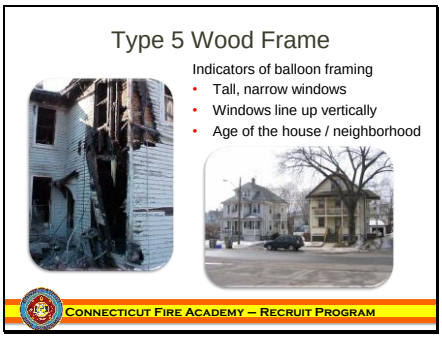
Slide 55



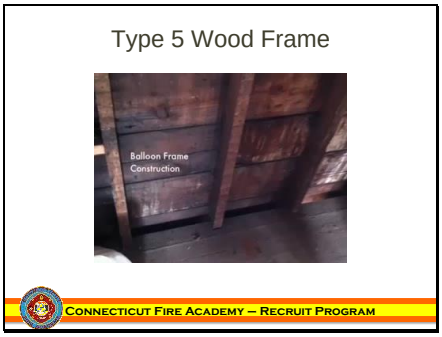
Click on the picture on the right and it will link to a larger picture
Exterior framing studs extend from the top of the foundation all the way to the roofline.
This creates large void spaces for fire to travel
Lumber used was actually 2"x4".
Balloon framing was phased out in the mid- 1950's due to the lack of the long framing members needed to make them.

Slide 56

Slide 57

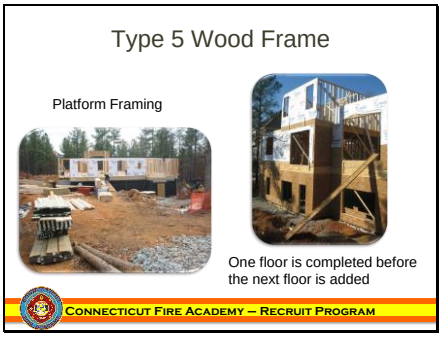


Slide 58



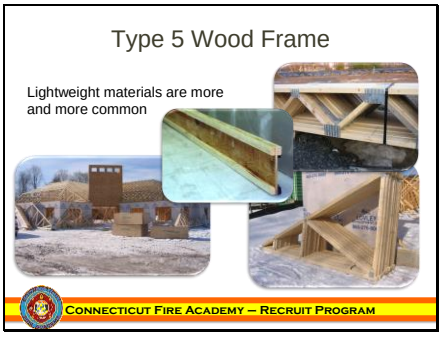
Video clip showing inside balloon framing

Slide 59



One floor is completed before beginning the next floor.
This prevents the large open void spaces running floor to roof.
There may still be void spaces, just not as many
Pipe chases, duct work chases, etc

Slide 60



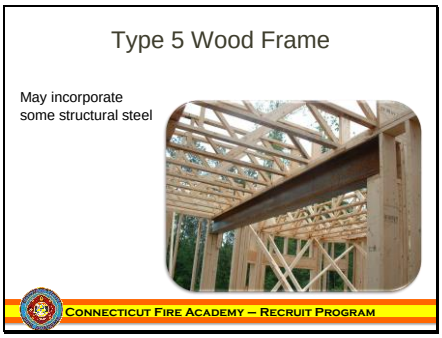
•Lightweight construction will be discussed in depth later in the class

•Lightweight construction is nothing new! It has been around since the 1980's.

•Most condo developments are sure to have lightweight wood trusses in the roof.

•Fires in newer or recently remodeled homes are almost certain to have some elements of lightweight construction.

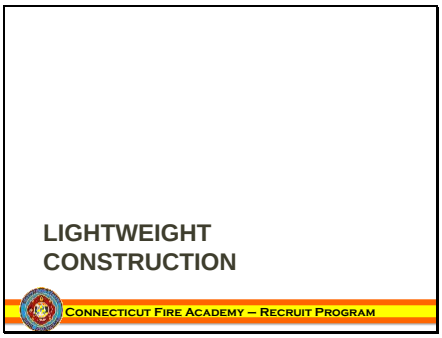
Slide 61



•The presence of a steel beam does not change the classification of construction. This is still considered a wood frame building.

•The steel may elongate and cause failures elsewhere in the structure.

Slide 62



Slide 63

•Video shows the difference between a fire in a conventionally framed house and a lightweight constructed house.

Slide 64

A.K.A. parallel chord truss.
Because of the small dimensions of the materials used, these joists can fail within 10 minutes of exposure to fire
Used to support floors or roofs.
Engineered to only support a specific load. If one fails, then the next joists must share the increased load.

Uses triangle shapes for strength.
Commonly used in type 1 and 2 construction.

Slide 65

From Sacramento, California. Firefighters had only a second to recognize that the roof was collapsing.

Slide 66

•Although rare, some architects are using them in construction

Slide 67

•Gusset Plates have ¼" to 3/8" prongs that penetrate into the wood.
•They are prone to early failure.
•Finger joints are milled into the lumber than attached with glue.

Slide 68

•No ridge pole. The ridge pole in rafter construction re distributes the load of a failed member to all of the other rafters.
•If one truss fails, the neighboring trusses must now share the increased load (an increase of 50% of its engineered load).
•Improper storage and handling can cause the weakening of the fasteners.

Slide 69

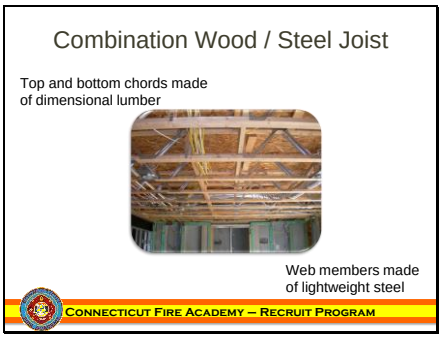
•The separation of this one member renders the entire joist useless.

•Notice the sagging that occurred after the separation of one gusset plate.

Slide 70

•Video shows a time lapse difference between a lightweight truss roof and a conventionally framed roof under fire conditions.

Slide 71



The steel web members have a gusset plate style fastener to attach them to the top and bottom chords. Joists like this create a "cockloft" under the floor. Once fire penetrates it, it can run freely throughout.

Slide 72

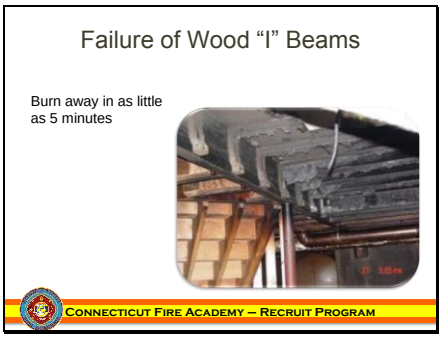
•They provide excellent strength in non fire conditions.

•Able to bridge long spans.

•Cheap and efficient use of natural resources.

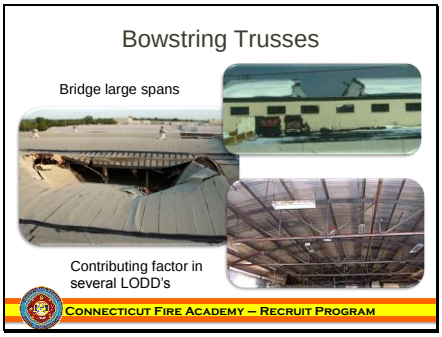
•The OSB is oriented vertically, which allows it to burn faster.

Slide 73



Wood I beams can completely burn away in as little as 5 minutes.
They are often at the point of failure just as we are entering to make a search or attack.
The glues in the plywood and OSB contribute to the fire load of the material.

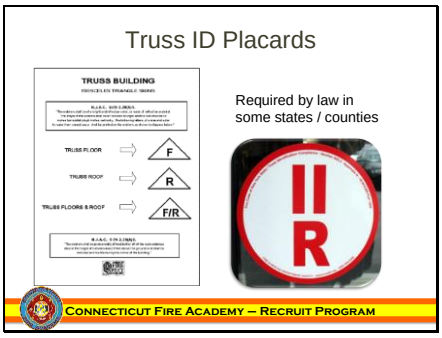
Slide 74



Firefighter fatalities have been attributed to bowstring truss failure.

Hackensack, NJ 1988 (5 LODD)
Waldbaums fire, FDNY 1978 (6 LODD)

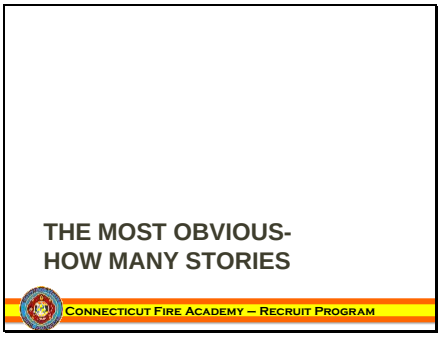
Slide 75



The state of New Jersey requires these on new construction.
Many other counties / cities / towns throughout the country require them on a local level.

Slide 76

Slide 77



Slide 78

The colonial on the bottom left is obviously 2 stories

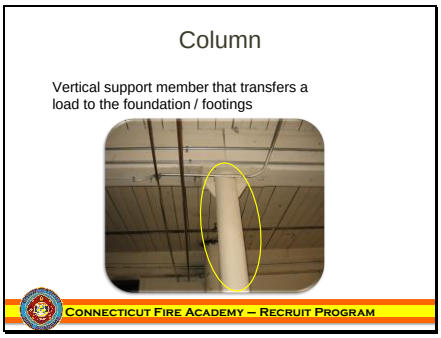
- Confusion comes when we look at homes like split levels, raised ranches, apartments where you enter at a stair return (halfway between floors)
- The raised ranch and split level are actually 2 story homes
- The true term half story is discussed on the next slide

Slide 79

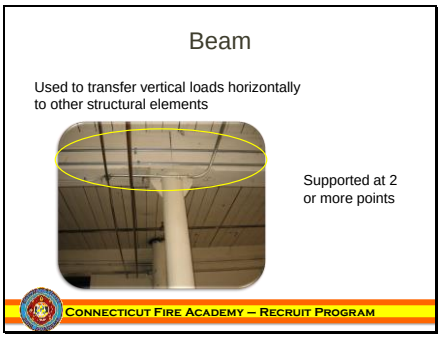
The term half story has nothing to do with how much of the house is sticking out of the ground

- It has everything to do with the amount of usable living space within
- The top floor has approximately half of the usable living space as the other floors
- Capes, 2 ½, 3 ½ frames are examples of half story homes
- The picture on the bottom left is a 2 ½ frame, the right is a 1 ½ frame

Slide 80

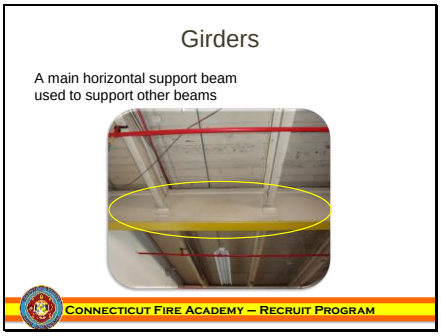


Slide 81



May support floors, ceilings, or roofs.
Loads are transferred to columns or load bearing walls.

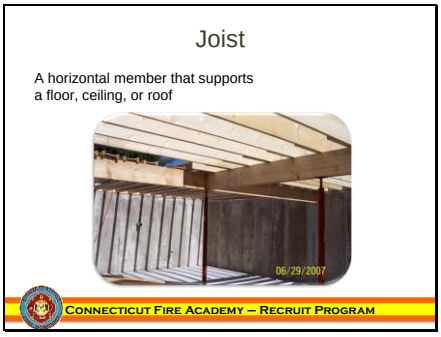
Slide 82



Girders support beams.

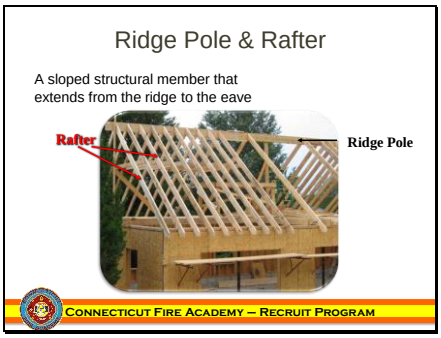
- Usually larger in dimension than the beams that it carries.
- Runs perpendicular to the beams in the building.
- May be steel or wood.

Slide 83



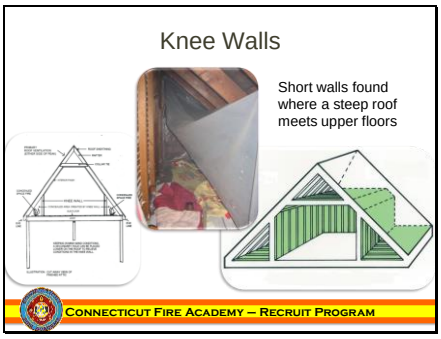
- Made of wood, steel, or concrete.
- May run wall to wall or wall to beam.
- Usually laid in the narrow dimension of the building.
- The larger the span, the larger the joist.
- Note the metal bracing that prevents twisting of the joists.
- May be weakened by plumbing or electrical work passed through the joist.

Slide 84



- Typically made of wood.
- Note the ridge pole.
- These roofs are the strongest we can work from
- In the event of a joist failure, the ridge pole transfers the load to the other rafters

Slide 85



Commonly found in buildings with steep roofs (capes, 2 ½ frames, contemporary, etc.).

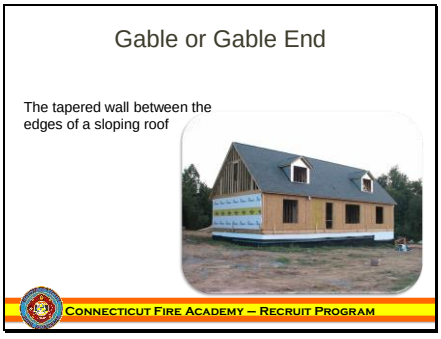
- Fire that may have extended on the outside can easily enter the soffit under the eaves and run through these spaces.
- Many have small access doors in the attic / apartment space for access. There may also be a fire load present because they are often used for storage.
- Contributing factor in a LODD in Bridgeport in 2010

Slide 86

The shaded areas indicate the areas behind knee walls

- Any fire extending out windows on the left or right side will quickly travel into the knee walls

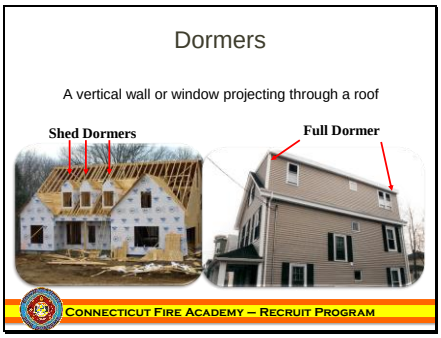
Slide 87



Gable ends often have vents for the attic space.

- These are a good indicator of fire in the attic and/or knee walls.

Slide 88



Firefighters do not need to know the difference between the many types of dormers, but simply realize what they are and how they can be useful for us

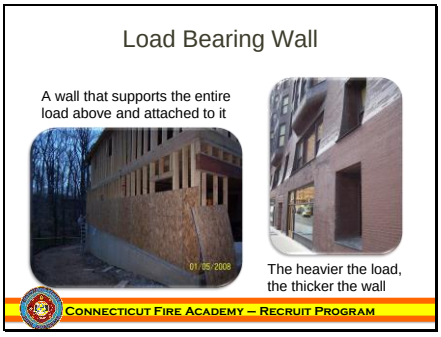
- Dormers can be a give away to the presence of knee walls, and *typically* enter into bedroom or living areas.
- Full dormers offer a low pitch roof which is much easier to operate on, but may require a longer ladder to reach.
- Shed type dormers can provide a good foothold when operating on a roof.

Slide 89

Older soffits were made of solid wood and provided some fire stopping.

- Newer homes and remodels are being sealed with vinyl soffit which melt away in seconds.
- Smoke issuing from these soffits are an indicator of the need to vent a roof.

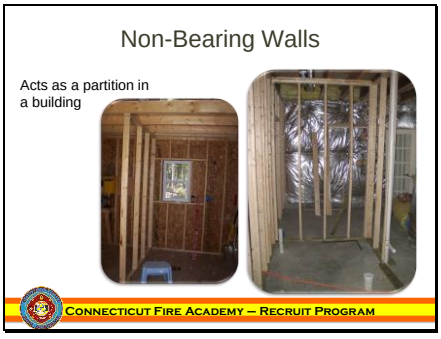
Slide 90



Generally exterior walls and interior walls that are directly above and parallel with the main carrying beam(s) in the building.

The building on the right is the Monadnock building in Chicago. It is the tallest ordinary constructed building in the US. The base walls are 6' thick.

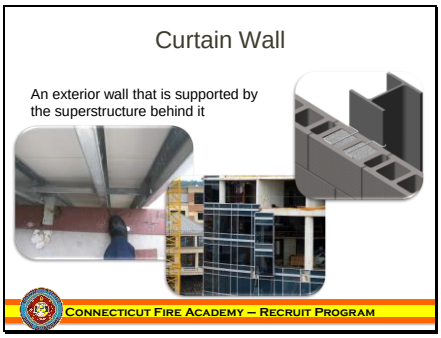
Slide 91



Non-Bearing walls are intended to support only their own weight.

- Used to hide plumbing, wires, etc.
- In the event of a roof collapse, they will support the falling roof members, preventing them from falling all the way to the floor onto firefighters.
- In a roof collapse (i.e. a wood truss roof), the safest place to be is in the hallway because the close proximity of the walls prevents truss members from falling to the floor

Slide 92



Used in buildings that are supported by a separate framework underneath (not just high rises).

- Home Depot, Walmart, etc
- It provides little or no support to the building.
- It's purpose is to keep the outside out – and keep the inside in.

Slide 93

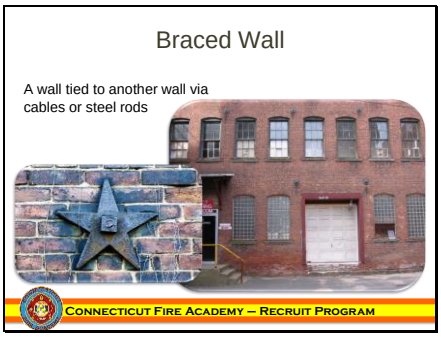
Common in ordinary construction buildings

- The joist pockets extend into the adjacent structure allowing a path for fire travel
- Collapse in one building can offset this wall causing additional collapse

Slide 94

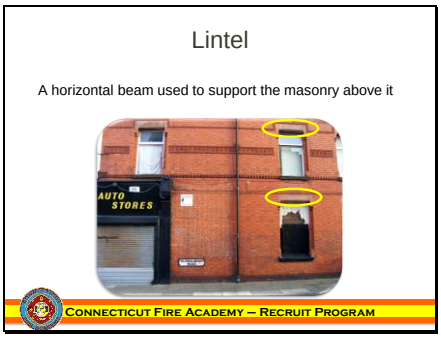
- These walls can be compromised by contractors that may run plumbing or wires through the wall and not seal the holes they make.
- Codes vary depending on occupancy on the spacing and height of these walls.
- Apartments may require one every 4 units, where condos and townhouses may be every unit
- Often can be used to assist confinement of the fire at the strategic level

Slide 95



- These cables or rods are unprotected and can elongate and weaken when exposed to fire
- These reinforcing stars or plates are an indication that the building is possibly already weakened.
- If they line up symmetrically, they were probably added during initial construction to strengthen the building
- If they seem placed sporadically, they were added to prevent the building from falling down
- This does not necessarily mean that the building is unstable, but merely something for an officer or IC to consider when choosing strategies

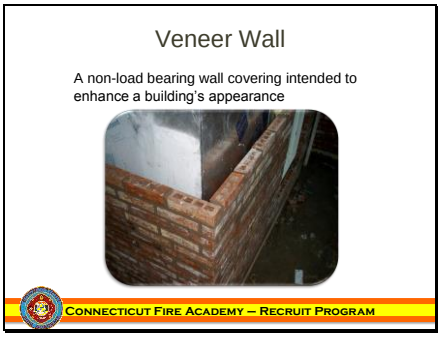
Slide 96



May be wood, stone, steel, cast iron, granite, marble, or reinforced concrete.

- Failure of a several lintels can cause the collapse of the masonry above it.

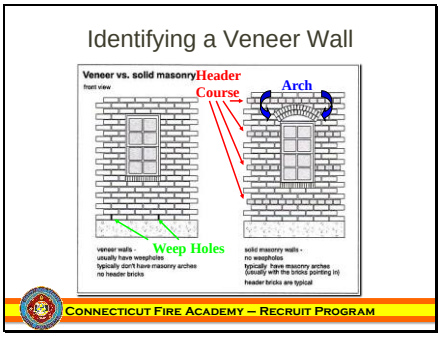
Slide 97



Generally uses lightweight brick or stone.

- Veneers may cover wood frame or concrete (cinder) block walls.
- A vapor space is left between the brick and the wood behind it
- Tied back to the underlying wall using metal straps

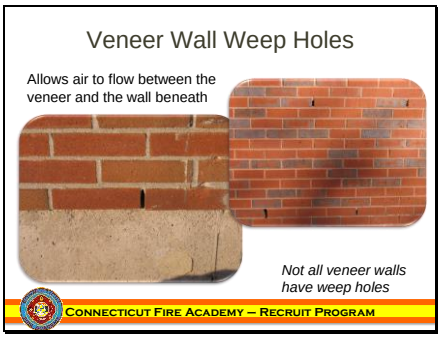
Slide 98



There are several cues to help determine if a wall is veneered or not.

- Veneer walls have weep holes on the lowest course to allow the vapor space to breathe.
- Veneered walls do not have header courses every 6 or 7 rows.
- Veneered walls do not have arched lintels above the windows.
- These rules of thumb apply 99% of the time, but some exceptions occur.
- Identifying a veneer wall can help determine what type of building we are dealing with
- A load bearing brick wall is an ordinary or heavy timber building
- A veneer wall will be on wood frame, non-combustible, or fire resistive buildings

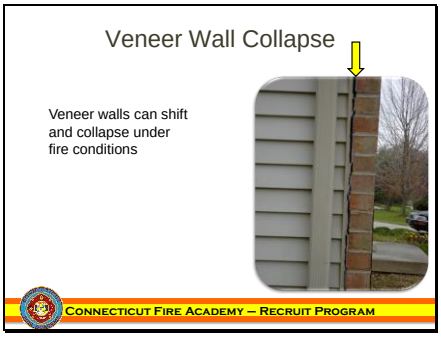
Slide 99



This picture shows a weep hole in a brick veneer on a wood framed apartment building.

- Brick veneers placed over concrete block may not require weep holes.
- Veneer walls pose collapse hazards if fire travels in the void space behind the wall.

Slide 100



Although veneer brick is lighter than structural brick, a collapse of one of these walls will certainly hurt firefighters.

Slide 101

Commonly used in balconies and overhangs.

- If the supporting wall is compromised by fire or collapse, these can be prone to early failure.
- Cantilevers can be present as interior balconies inside homes.

Slide 102

Provides an easy way for fire to extend to upper floors.

- Trash can collect in the bottom creating a fire hazard.
- Smoke from fires on lower floors can show from the roof, giving a perception that the fire may be on an upper floor.
- Firefighters operating on the roof can fall into a shaft if visibility is obscured by smoke.
- Interior firefighters may become disoriented by thinking a window they found leads outside the building

Slide 103

Numerous firefighters have been injured or killed by falling mansards.

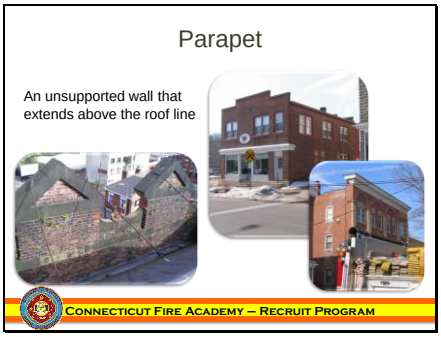
- Interior companies egress can be blocked by the collapse of these on the outside.
- Video of a collapse on the next slide

Slide 104

Video shows a mansard collapse on 2 firefighters in Phoenix.

- Both survived but sustained burns

Slide 105



May be only on the front, or may extend along the sides of a building.

- May extend up to several feet above a roof line.
- Scuppers visible from the exterior are a good indication of the height of a parapet.
- Collapse video on the next slide

Slide 106

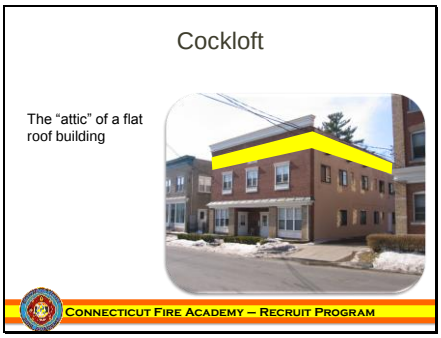
Parapet collapse in NYC

Slide 107

An overhang that extends from the roofline

- The picture on the left shows one made of wood that is original construction
- The roof joist tails were left long in order to make the decorative cornice
- Typically strong in this type of building
- The picture on the right shows a wood cornice which was added after construction
- A firefighter stepping onto this may dislodge it, especially id it has been exposed to fire
- Some of these are made of Styrofoam and glued to the building

Slide 108



Cocklofts typically have no fire stops

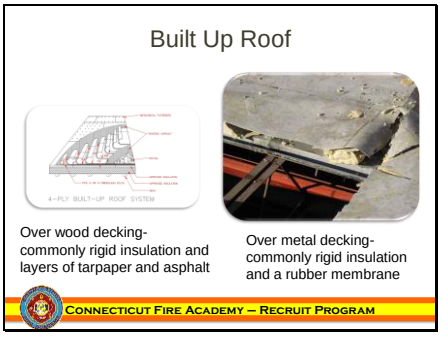
- Fire can travel through pipe chases from the basement or lower floors into the cockloft

Slide 109

When used in a flooring application, concrete will be poured directly on to the decking.

- When used in roofing applications, this is the base layer of a built up roof. It will be covered with insulation, tar paper, rubber membrane, and/or roofing tar.
- The ribs should run perpendicular to the joists.
- The seams do not need to meet over a joist. This is hazardous for vent teams operating on the roof. When cutting, the decking can give way when cut across a seam. We can still ventilate, but integrity should be checked after each cut.
- To prevent from cutting with seams surrounding you, cut a diamond shape in the roof instead of a square.

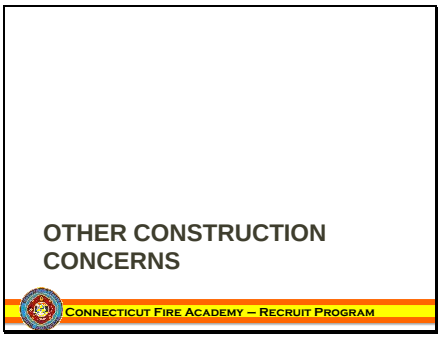
Slide 110



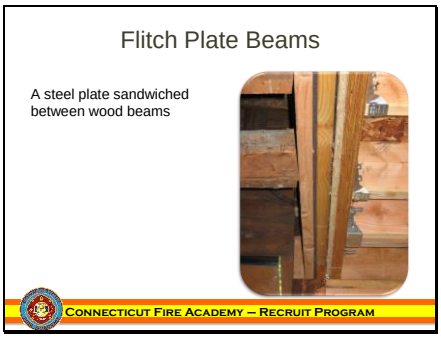
A built up roof is made with a base of either plywood or metal decking covered by a layer of insulation, then several layers of tarpaper covered by asphalt or a rubberized membrane.

- Fires in membrane and built up roofs can cause fires in the spaces below by dropping molten tar and rubber onto the contents below.
- These roof coverings are not limited to type 2 buildings, they are common among types 1 through 4

Slide 111



Slide 112



- This is done to reinforce the beam and add strength, allowing larger spans with fewer columns.
- The sandwich is held together with carriage bolts.
- If these bolts fail because of heat and fire, the beam will twist and fall catastrophically, taking all of the floor joists with it.

Slide 113

- Called gasoline shingles, not because they contain gasoline, but because their vertical arrangement on the side of a building causes them to ignite and spread rapidly.

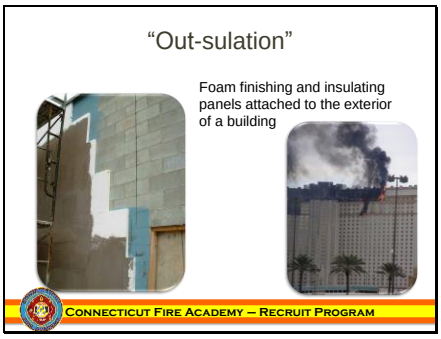
Slide 114

- Video shows fire encompassing the gasoline shingles on the “B” side of a 2 ½ story wood frame.
- Original fire was self vented out 1 window but quickly took over the siding.

Slide 115

- Small metal brackets hold one panel to the next. These can easily fail in fire conditions.
- The orange brackets are only temporary until all walls and roof members are in place.
- These panels rely on each other for support.
- If one fails, the others can be expected to fail.
- Serious collapse potential in buildings under construction.

Slide 116



- The foam has a low flame spread rating, but it produces large amounts of dense black smoke.
- When arranged vertically, the flame spread obviously increases.

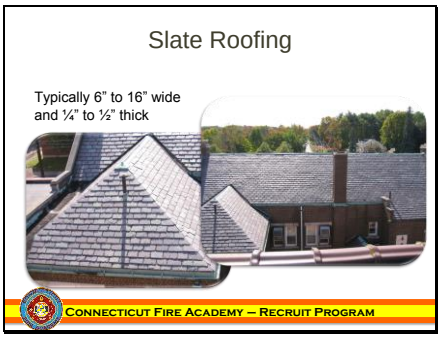
Slide 117

- A roof added over an existing flat roof for the purposes of shedding water & snow.
- The roof on the left has a few cues to the presence of a rain roof 1- the chimney has been extended 2- the metal fascia is still present from the built up roof.
- Can often be a cheaper alternative than replacing a complete flat roof.
- This creates a huge void space for fire to travel.
- Vertical ventilation to the occupied areas is impossible.

Slide 118

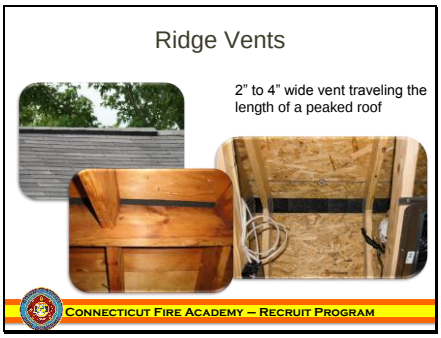
- Metal roofs are becoming more popular, especially in northern areas.
- Installed over wood sheathing.
- May be steel, copper, or aluminum.
- Found in thicknesses of up to .03 (three hundredths of an inch).
- These can still be cut using an aggressive toothed blade on a rotary type saw.
- Very slippery when wet.

Slide 119



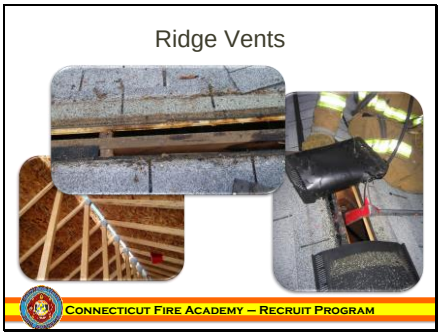
- Adds increased load to the roof (between 1000 and 2000lbs. Per square (10'x10'area)). As fire progresses in the attic space, the roof structure will not be able to support the weight.
- Use a sledgehammer, flat head axe, or TNT tool to smash the tiles. A wood saw will then be needed to cut the decking underneath.
- The fork of a Halligan bar can be slid upward under the tiles to break them free
- Very slippery when wet.

Slide 120



- Smoke issuing from ridge vents is a good indicator that fire has traveled into the attic space.
- In the event of a saw failure, the attic space can be vented by pulling off the ridge vent.
- A 4" gap over the length of a 40 foot roof has roughly the same area as cutting a 4ft x 4ft hole.
- Lifting the ridge vent will reveal to the roof firefighter if it is conventionally framed or of lightweight construction.
- More on next slide

Slide 121



- Looking down from the removed ridge vent, it you can see a piece of lumber spanning the entire peak of the roof, it is ridge and rafter construction
- If you only see the tops of framing members ever 16", then its truss

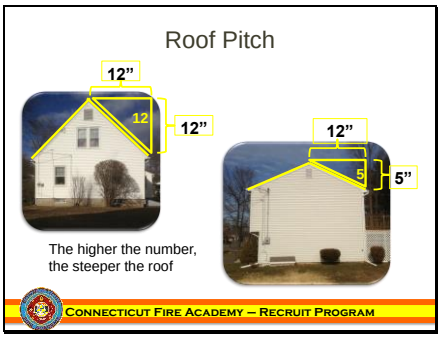
Slide 122

- Lowering ceiling height creates less space that needs to be heated or cooled.
- These systems are often held up by light metal tracks supported by aluminum or thin steel wires.
- Fire in these spaces can cause the ceiling to drop, trapping firefighters (Charleston, SC.).
- The wire and track material creates a large entanglement hazard.
- Rarely sprinklered above the ceiling.
- May hide other hazards above
- Some may provide a limited fire resistance rating to the structural members above (provided they are intact and in good shape).

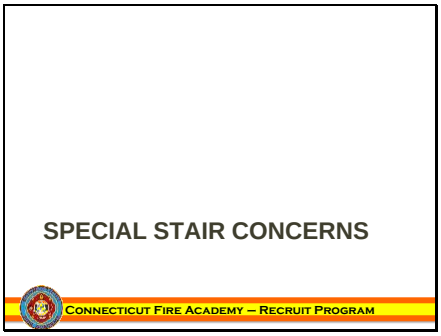
Slide 123

- A skylight on a steeply pitched roof will only ventilate the upper living space
- On lower pitched and flat roofs, the sheetrock in the return portion of the skylight must be removed in order to ventilate the attic / cockloft space

Slide 124



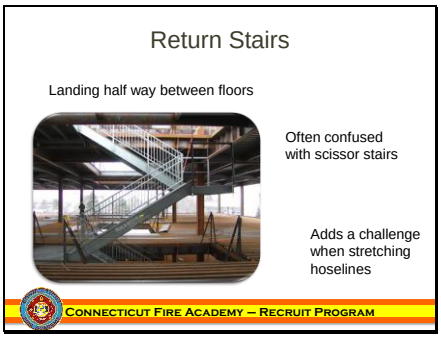
Slide 125



Slide 126

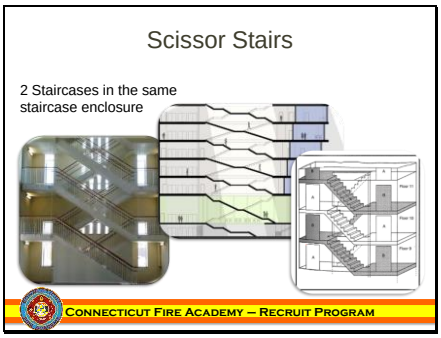
- The simplest to advance hose lines up

Slide 127



- Spaces in between the staircases may provide room for a "well hole stretch"

Slide 128

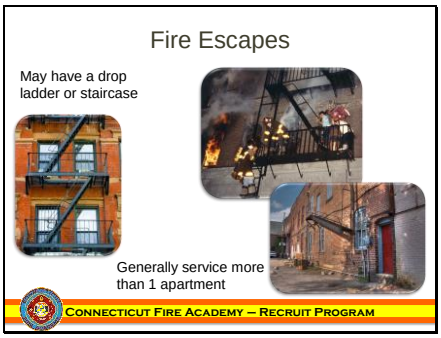


- Scissor stairs enter each floor on opposite ends
- Recon can help determine the best staircase to use for hose stretching

Slide 129

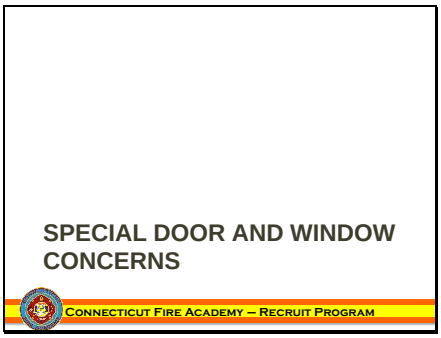
- The rule of 50' of hose per floor will not work
- Usually 60'-75'

Slide 130



- The presence of fire escapes is generally an indicator that there is only 1 interior staircase

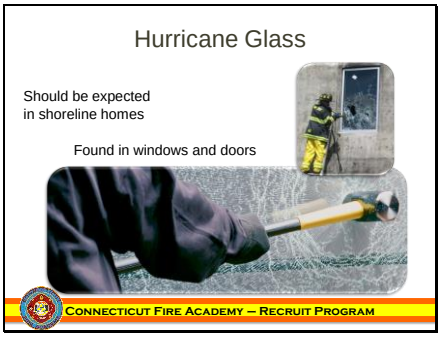
Slide 131



Slide 132

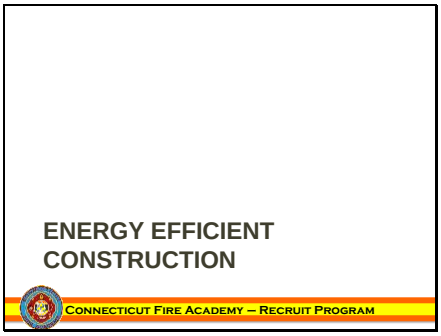
- Forcible entry requires a saw
- Cut 3’ up from the bottom on the handle side of the seam to cut the latch

Slide 133



- Laminated type glass
- Often times it may be easier to attack the window frame than the glass

Slide 134



Slide 135

- SIP's are made by sandwiching a thick layer of foam (5 ½" to 7 ½") between two layers of OSB.
- There are no structural elements built into the panel except at the seams. 2-by will be placed as a splice at the seams.
- These panels will be on all exterior walls and roofs.
- Excellent insulating properties.
- These homes are build air tight. Potential for back draft is enormous.
- You may arrive at a fire in one of these and find nothing showing.
- The OSB and the foam contribute significantly to the fire load.

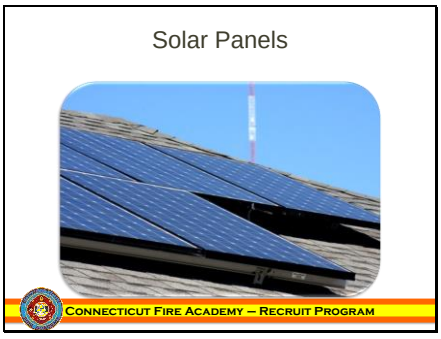
Slide 136

- Similar to SIP's, but instead of OSB, sheets of lightweight concrete surround the insulation.
- Usually use a denser type of insulation which allows thinner panels.
- These homes will hold their heat and allow superheating inside.

Slide 137

- Inner panes may fail due to heat, but outer panes hold.
- These windows can be extremely difficult to vent.
- If venting with a ground ladder, you can lay the ladder in on it's beam with some force and break the glass.

Slide 138

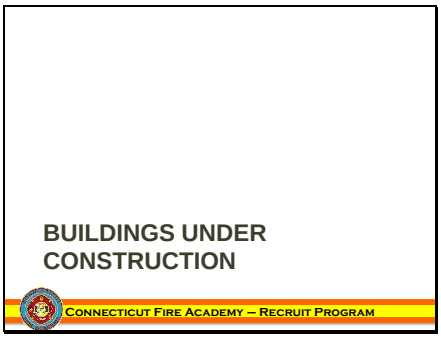


- At 30 to 50 pounds per panel, they can add an unintended load to the roof.
- Use caution when working around them. Don't ever smash these panels. They produce up to 600 volts DC when strung together in series (24-48 volts each panel).
- They are always energized during daylight hours, even on overcast days.
- Scene lights will NOT energize these panels.
- If you need to vent vertically, you may have to put the hole in an area that is not optimum.

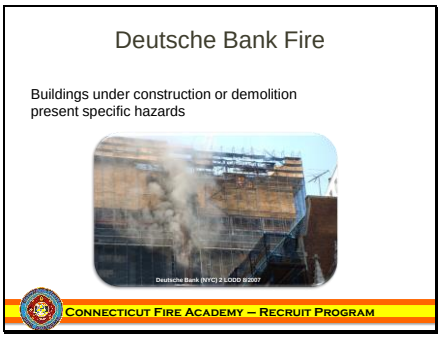
Slide 139

- Fire will burn away the insulation, leaving a "slinky" hanging from the ceiling
- This creates a huge entanglement hazard

Slide 140



Slide 141



- Two firefighters killed at this fire.
- Plastic sheeting and plywood for asbestos abatement created a heavy fire load and maze like conditions.
- Standpipes were disabled, fire walls were non existent, no compartmentalization, no working elevators.

Slide 142

- Fences, construction equipment, and other barriers can limit our access.

Slide 143

- Workers can intentionally disable alarm systems, leaving occupants with no alarm systems
- Occupants may not be alerted to the presence of fire

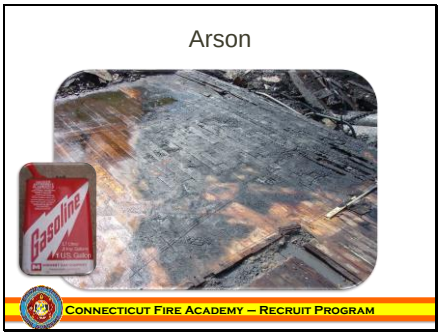
Slide 144

- Exits may be blocked by equipment or materials left on site.

Slide 145

- Openings in wall can be made from adding or removing plumbing, HVAC, or electrical work.
- Looters can breach the walls to remove copper pipe for scrap

Slide 146

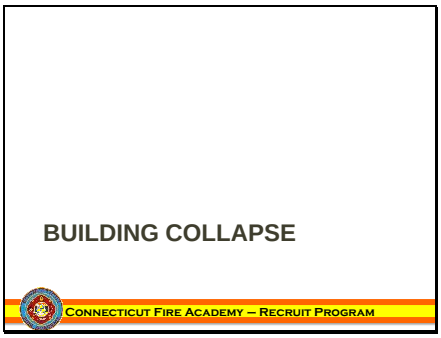


- Arson is a common occurrence, especially when funding for the remodeling runs out.

Slide 147

- Removed or temporary structural members can fail causing early collapse.
- Snow loading can cause structural failure without fire ever being present

Slide 148



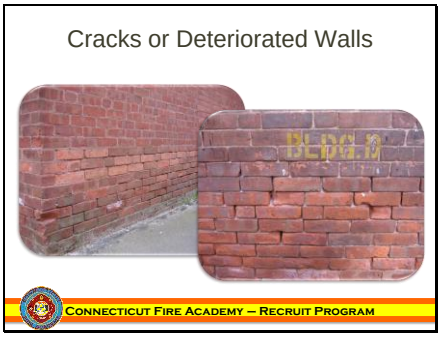
Slide 149

- Old buildings have the potential to be remodeled numerous times creating void spaces and weaknesses throughout.
- Deteriorated structural members can fail earlier.
- Just because a building is old, does not mean its weak
- If its old and unoccupied for a long period, then its safe to assume that its integrity is compromised

Slide 150

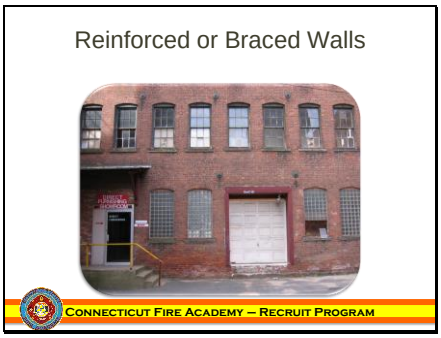
- Both fire damage and previous firefighting efforts can decrease the structural integrity of a building.
- Risk vs. benefit on whether to initiate another interior attack on a building.

Slide 151



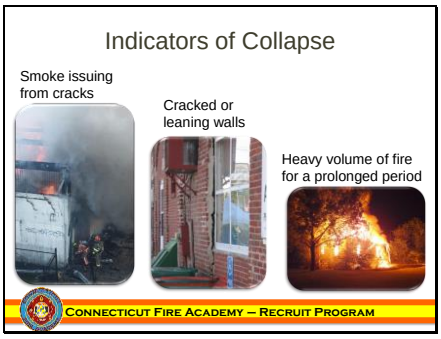
- Over time, mortar can be worn out of walls from weather. ¼” to 3/8” gaps are now formed between each brick.
- The settling that occurs can seriously throw the wall off balance.

Slide 152



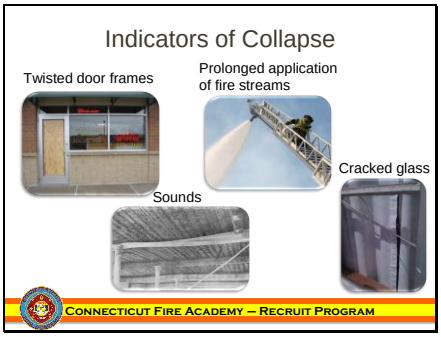
- As stated earlier, the presence of reinforcements in walls does not necessarily equal instability, however heat generated from a fire can cause these wall ties to expand, allowing the walls to lean outward.
- Remember steel expands 1” every 10’.

Slide 153



- The fact that smoke is coming through cracks in masonry tells you that 1- the mortar is cracked / missing / damaged and that 2- something inside / below/ above shifted causing the cracks.

Slide 154

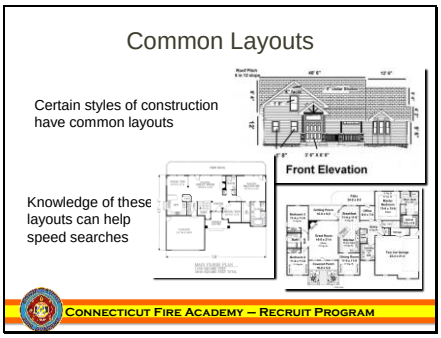


- Doors that opened at the beginning of the incident, but no longer move indicate a shift in the structure.
- Master streams put 8,000lbs of water per minute into a building.
- Listen for any sounds that may indicate the structure is shifting.
- Glass that has cracked can indicate that the structure has shifted.

Slide 155

Slide 156

Slide 157



- The following slides go through common layouts

Slides 158-159

- Click on the picture to link to a larger view

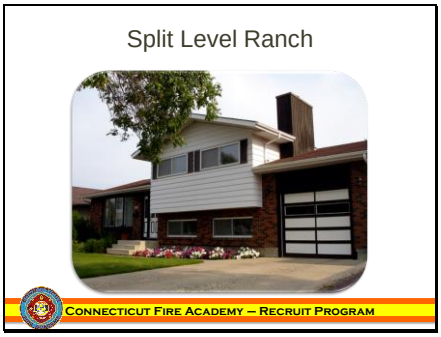
Slides 160-161

- Click on the picture to link to a larger view

Slides 162-163

- Click on the picture to link to a larger view

Slides 164-165



- Click on the picture to link to a larger view

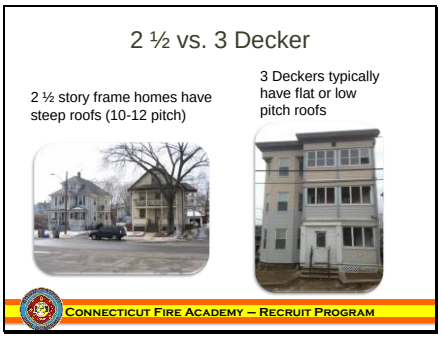
Slides 166-167

- Click on the picture to link to a larger view

Slides 168-169

- Click on the picture to link to a larger view

Slides 170-172



- Click on the picture to link to a larger view

Slides 173-175

- Click on the picture to link to a larger view

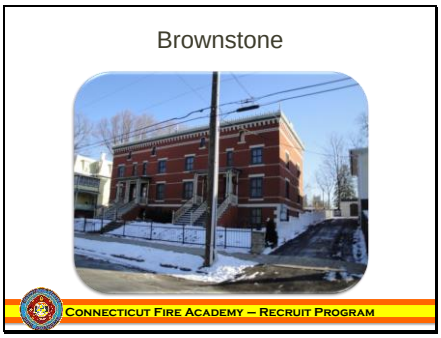
Slides 176-177

- Click on the picture to link to a larger view

Slide 178-179

- Click on the picture to link to a larger view

Slides
180-181



- Click on the picture to link to a larger view

Slides
182-183

- Click on the picture to link to a larger view

Slides
184-185

- Click on the picture to link to a larger view

Slides
186-187

- Click on the picture to link to a larger view

Slides 188-192

- Click on the picture to link to a larger view

Slides 193-197

- Click on the picture to link to a larger view

Slides 198-199

- Click on the picture to link to a larger view
- This 2 ½ wood frame actually has 12 apartments in it!
- 2 basement, 4 on the 1st floor, 4 on the 2nd floor, and 2 on the 3rd floor

Slides 200-204

- Click on the picture to link to a larger view

Slides
205-207

- Click on the picture to link to a larger view