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Continuing Education Course

A Side-by-Side Comparison of New and Old Construction

BY SCOTT JOERGER

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A Side-by-Side Comparison of New and Old Construction

Educational Objectives

On completion of this course, students will

1. To recognize that light weight wood construction can be found everywhere. Even in two houses that sit next to each other and look similar from the exterior.
2. To understand that light weight wood construction lacks mass in structural components as compared to older construction using dimensional lumber.
3. To understand why a basement fire in a structure using light weight wood construction will be prone for early collapse.
4. To identify and understand the function of a rim board in light weight wood construction and how this can be used to in firefighting operations.
5. To determine why it is necessary to open a small inspection hole upon entering the first floor of a light weight wood structure to check for trusses and fire spread.
6. To understand the function of a vented soffit and roof ridge vent.
7. To understand the difficulty of accessing a fire in the attic when roof trusses are used and how quickly the fire will spread.
8. To learn new tactics for firefighting when operating in structures using light weight wood construction.

BY SCOTT JOERGER

MANY CITIES AND TOWNS HAVE HOUSES THAT were built 100 or more years ago, and fires in these buildings presented common problems firefighters faced related to building construction. Firefighters face new and different challenges with houses built with modern construction materials and methods. These buildings burn with an all new set of challenges, and firefighters cannot apply time-tested tactics to these newly constructed homes. Nowhere are these differences more apparent than at 10 and 12 Washington Avenue, where two houses sit side by side and look alike from the outside. Because of differences in how each was constructed, they are dramatically different under fire conditions.

The structure at 10 Washington Avenue was built of balloon-frame wood construction around 1900. The wood-frame members are made up of dimensional lumber using 2- × 4-inch to 2- × 10-inch lumber. It is a three-family dwelling with two separate apartments on the first floor and another apartment on the second floor.

The structure at 12 Washington Avenue was first built around the same time and sat vacant in the late 1990s. The city demolished the building a few years ago, hoping to reduce the crime and arson problem that developed in the area. In 2006, the open lot was taken on by a catholic charity group to provide affordable housing. The house was completed in 2008. Lightweight structural members are made up of engineered lumber and lightweight wood parallel chord and peak-roof trusses. This article addresses key construction differences, how they relate to firefighting, and suggested tactics for firefighting in buildings using lightweight wood construction (photo 1).

(1) The two structures: 12 Washington Avenue is on the left; 10 Washington Avenue is on right. (Photos by author unless otherwise noted.)

THE BASEMENT

10 Washington Avenue

The house at 10 Washington Avenue uses 2- × 10-inch dimensional lumber floor joists for the first floor. They are framed 16 inches on center with a wooden beam in the center of the house that runs from front to back to support the floor joists. This beam is supported by a wooden column. The beam

(2) Wood floor trusses like those in the 12 Washington Avenue structure.

and column are constructed of thick 6- × 8-inch lumber. The floor decking is constructed of 1- × 6-inch boards finished off with carpet, tiles, or hardwood flooring. The ceiling height is less than five feet, and there are all sorts of hazards like low hanging wires and ductwork from the furnace. Bedrooms and living areas in the basement are uncommon but not unheard of because of ceiling height, dampness, and 100 years of spider and rodent inhabitance.

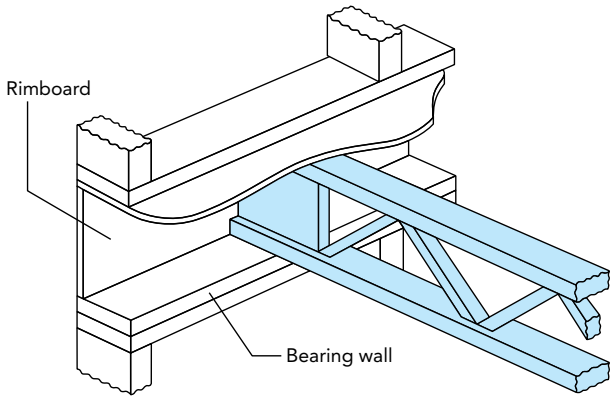
A fire in the basement can spread quickly across the basement because of the open design and unprotected wood floor supports and decking. A firefighter working on the floor above the fire may fall completely through the floor, but it is more likely that he would step through the floor deck but remain supported by the relatively massive joists and beam that could burn for a considerable time and still retain sufficient strength.

12 Washington Avenue

The house at 12 Washington Avenue uses 2- × 4-inch and 2- × 3-inch wood trusses as support for the first floor. The trusses can span the entire width of the basement without any supporting beams or columns. The web members of the truss are smaller, nondimensional 1¾-inch pieces of wood that are fastened by finger joint and glued in place (photo 2). Floor decking is ¾-inch oriented strand board (OSB) finished off with carpet or linoleum. In other homes, the floor decking can be only ⅝-inch thick and finished off with additional surfaces such as hardwood flooring and tiles. The trusses consist of a top and bottom chord made of long 2- × 4-inch or 2- × 3-inch dimensional lumber (photo 2).

Many structural engineers and manufacturers state that fire tests done on truss connections show that they hold up well in fire because the glue in the finger joint does not break down in temperatures below the ignition of the wood members.[1] Keep in mind that temperatures in a structure fire will be significantly higher than this and so that information is not relevant. These lightweight engineered trusses are very strong but lack the mass necessary to withstand direct fire exposure for more than a few minutes. The small dimension of the truss chords and web members expose a considerable amount of surface in relation to their mass as compared to conventional

Figure 1. Rim Board



The rim board is nailed to the wood floor trusses around each side of the house. It is above a wall top plate, or foundation sill plate, and below the next floor level. Here you can see the floor decking from the ground floor above the rim board and the wood sheathing (oriented strand board) of the wall. The rim board will be the same height as the wood trusses used to support the floor.

dimensional lumber. A fire in the basement can spread and attack all sides of the trusses. In tests, failure occurs in about 10 minutes, but some tests show failure in even less time when exposed to a free-burning fire. The smaller web members and the bottom chords were destroyed before the top chords and floor decking. As a result, the floor began to sag and failed shortly thereafter.[2]

A firefighter working on the floor above the fire will fall to the floor below. A rapid intervention team will experience great difficulty in rescuing a firefighter from the basement because of the unstable floor and heat and smoke rising through the hole created by the floor's failure. An incident similar to this occurred outside of Syracuse, New York, in 2002; two firefighters were killed in the line of duty.

These wood trusses run side to side perpendicular to the long side of the house, the B and D and the load-bearing sides. A rim board ties these trusses together on all four sides of the house. The top and bottom chords of the wood trusses are toe-nailed from the exterior to the rim board; the rim board is a structural component.[3] The rim board is 1¾ inches thick and runs between the sill plate above the foundation and the bottom of the ground-floor decking. The board cannot be seen from the exterior because it is covered by siding.

The rim board is almost always engineered lumber, such as laminated veneer lumber or oriented strand lumber. A common thickness is 1¼ inches. It must be the same height of the truss—in this case, 12 inches. Manufacturers of engineered lumber claim that their product will not shrink over time as it dries out the way dimensional lumber will[4] (Figure 1). There is also a rim board around the house for the trusses between the first and second floors. Rim boards are also used with wooden I-beams.

There is more headroom in the basement as compared to 10 Washington Avenue because ductwork, pipes, and wires are all run inside the triangular spaces formed by the web members between the top and bottom chords. With these relatively high

(3) The wood trusses in the attic are 24 inches on center and use gusset plates. (4) Cardboard is used to maintain an opening between attic trusses from the vented soffits for air movement.

ceilings, it may be tempting for homeowners to build living spaces such as single-room occupancies and bedrooms in the basement. To be compliant, an exit door or a basement escape window or basement escape window well is required. If living spaces are built, a suspended ceiling is usually the easy choice to install and hang from small wires attached to the wood truss. Suspended ceilings can fail very quickly under fire conditions, trapping anyone who is below.

THE FIRST FLOOR

The first floor of 10 Washington Avenue is two living units with no stairs to the second floor inside the apartments. On the front porch, there are two doors leading to the first-floor apartments. By the B side is a door that leads to stairs for the second-floor apartment. A second set of stairs is in the rear through a back door adjacent to the kitchens of both first-floor apartments. These stairs also lead to the basement. A fire in a first-floor apartment can spread to the second-floor apartment and attic by autoexposure or from void spaces inside the walls caused by balloon construction. Ceilings and walls are constructed of plaster and lathe with the wood lathe attached to wood studs, helping to contribute to the fire load inside the wall or ceiling void space.

A fire in a room will first enter these void spaces from openings in the walls and ceilings from light fixtures, wall switches, electric outlets, heat registers, and poor construction around wood trim. A fire in the void space will initially remain in that void space but can eventually spread as it travels vertically and horizontally through the void spaces.

The first floor of 12 Washington Avenue contains an open stairway to the second floor. Like most single-family homes, living areas are found on the first floor, and the bedrooms are on the second floor. The ceiling and walls are constructed of ½-inch drywall. The drywall does not have a fire rating but does provide some degree of membrane protection to the wood structural members. If a fire on the first floor gets into the ceiling, the open design of the wood trusses could cause the fire to quickly spread throughout the entire space between the first-floor ceiling and the second-floor decking. The small web members of the truss will burn away first, which could drop the entire floor and contents of the room above on firefighters operating on the first floor. This could happen in rooms that are remote from the fire origin area.

For example, in this house, the kitchen is in the rear. A stove fire could enter the ceiling from a poorly constructed vent, a light fixture in the ceiling, or a bad drywall joint. The fire will travel up and over to the front of the house where there is a large family room. There may not be much smoke or heat in this room, and there is no warning that a raging fire burning in the concealed space above could cause a collapse. Section R302.12 of the *International Residential Code* requires draft stopping in this type of ceiling if the concealed space exceeds 1,000 square feet. (4) In this case, the concealed space is less than 1,000 feet.

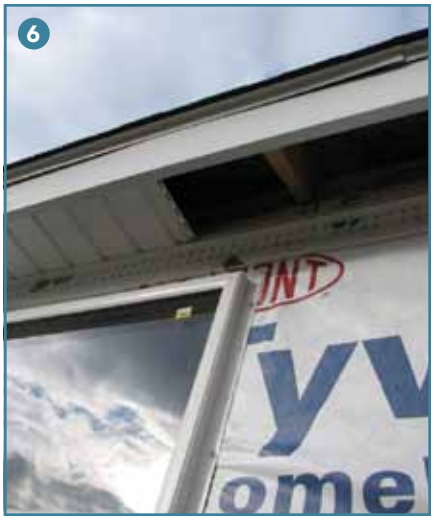
A fire that originates in or extends to a wall may be at least temporarily confined because the top plate used in platform-frame construction provides a firestop in the voids between studs. This top plate, consisting here of a 2- × 4-inch board, can have openings to allow wires, plumbing lines, and HVAC ducts to extend to the second floor. This violates the inherent fire stopping of the top plate and allows fire in the wall to follow the utilities and spread from floor to floor.

THE SECOND FLOOR

The second floor of 10 Washington Avenue contains the upper apartment. This apartment does not have the same layout as first-floor apartments. There are two bedrooms in the front of the house; the kitchen is in the rear. From the front, firefighters could perform vent-enter-search and victim removal for these bedrooms.

In the hallway leading to the front bedrooms is the door to the attic. It is not always easy to tell which door leads to the attic; in this case, the bedroom doors open in, whereas the attic door opens out, and the first step up is right behind the door.

The second floor of 12 Washington Avenue contains bedrooms, closets, and a bathroom. The drywall ceiling above has bats of fiberglass layered insulation and is attached to the underside of the roof trusses. This ceiling is different from the ceilings in the basement and first floor in that fire enter-



(5) Flames from the window vent out and spread along the vertical obstruction of the soffit. The soffit is made of wood and is not vented, so flames outside of the window will spread to the attic, but not immediately. (Photo by Mike Edelstein, Pittsford Fire Department.)

(6) You cannot stop the flames venting out of this window from immediately entering the attic above.

ing from a vertical opening in the drywall will not spread as quickly because of the barrier the insulation creates. From the front of the house, you can see three second-floor windows. One is noticeably smaller than the other two, which are right next to each other. This smaller window leads to a closet. There is a porch roof below this window, which may also serve as an operating platform for firefighters.

If the gable roof supported by lightweight trusses were to collapse, a firefighter could take refuge in this corner windowed closet, which would be a safer place than the middle of a room. Although the opening is small, firefighters going into this corner closet would be able to get out of the small window. At the other end of the house, the larger double window leads to a bedroom. This double window has a bowed-out, steep pitched roof below. This roof will make it difficult to place a ladder to the window for access or rescue.

The scuttle opening to the attic is in the closet. To access the attic, you will need a ladder. The sides bordering the sides of the scuttle opening are built up to provide for the layers of insulation put down over the second-floor ceiling. There is little chance of entering the attic with turnout gear and self-contained breathing apparatus given the limited access and the lack of a quick way out.

THE ATTIC

The attic at 10 Washington Avenue is easily accessible from the stairs. It is wide open so there could be a noncode-compliant bedroom up there, or it could be cluttered with storage. The attic floor is constructed of tongue-and-groove wood boards. This floor extends all the way to the exterior walls. It will be difficult to fight an attic fire by pulling ceiling from the floor below because of the tongue-and-groove boards. In some cases, the attic floor does not extend to the exterior walls. When pulling ceiling from the floor below and you encounter floor boards, try moving to an exterior wall that converges with the slope of the roof, to pull ceiling there and extinguish fire. This may not work for many reasons; one is knee walls. So, it is always best to look for the attic access door, pull-down stairs, or a scuttle. When an attic floor and large attic windows are present, most times, there is a large, easy way to access the attic.

Attic windows are on the A, B, and C sides; they can be removed if attic ventilation is needed. The pitched roof is constructed to 2- × 10-inch dimensional wood rafters. Rafters run from the ridge board to the bearing wall, making the roof strong enough for vertical ventilation.

However, this roof has a lot of weight on it. This is an old roof where asphalt roof shingles were placed right over the older wood-shake shingles. There are at least five layers of roofing materials built up over the roof's history. Before you start vertical ventilation, assess the roof's stability and safety. The bottom layer of roof wood shingles is nailed to spaced 1- × 4-inch boards and is partially exposed from below. A fire in the attic can spread quickly to these wood shingles, and they will be difficult to extinguish. These shingles contain many void areas where fire can remain. During overhaul, these shingles may need to be removed to avoid a rekindle.

Paper cellulose blown-in insulation is below the wood floor and in between the second-floor ceiling joists. This is essentially ground-up newspaper that may have been treated to be fire resistant but not fireproof. This was added years ago. Although it does not burn with intensity, it smolders and will spread fire to other combustibles. Any time this insulation has been exposed to fire, overhaul should include removal to the exterior.

This house was built before the importance of attic ventilation was realized, and there are no soffit vents. The lack of natural ventilation openings makes the attic a dangerous concealed space that can fill with flammable fire gases deprived of oxygen. Normal firefighting operations can change this, causing air movement and the introduction of oxygen that can cause a backdraft or at least a rapid intensification of fire.

A chimney effect occurs after vertical or horizontal ventilation is accomplished at the attic level and the door or access to the attic from the second floor is opened. Air moves through this opening and up into the attic, feeding the fire with oxygen, causing the fire to intensify. You should anticipate this; you can knock down the fire from the stairs and by pulling the ceiling from below, if possible. A handline can make it up the stairs and into the attic. Firefighters should knock the fire down before entering the attic, especially when vertical ventilation cannot be accomplished to relieve the space of flammable fire gases.

The attic at 12 Washington Avenue is not used for storage.

Access is from the scuttle hole from the second-floor closet. Six-inch rolled-in fiberglass insulation is between trusses throughout the area; another six inches of blown-in white fiberglass insulation has been added above this. This blown-in insulation meets ASTM E136 and is noncombustible. The roof trusses are constructed of 2 × 4s, using metal gusset plate connectors. The trusses are spaced 24 inches on center (photo 3).

According to the National Institute for Occupational Safety and Health, roof truss systems are used in more than 60 percent of roofs built in the United States today.[5] The use of peaked roof trusses offers little opportunity for storage, and habitation of the attic space is almost impossible. There is plenty of air movement because of the ridge vent across the peak of the roof and the soffits on the load-bearing side of the house. The soffits are built open and are covered with perforated, vented vinyl siding to allow air movement. To maintain the attic ventilation, a piece of cardboard is attached between trusses and to the top of the wall, which creates an opening. This way, insulation stays below the opening and does not block air movement (photo 4).

A fire in the attic space can be intense and spread quickly because of the large open area, the ease of air movement, and the large surface-to-mass ratio of the lightweight trusses. This lightweight truss-constructed roof could collapse in significantly less time than it would take for the conventional "stick-built," rafter-supported roof on 10 Washington Avenue to collapse. Vertical ventilation here will need to be evaluated and should be performed from an aerial ladder or the basket of an elevated platform apparatus. The ridge vent provides some degree of ventilation and, if more is needed, the roof is probably not going to be safe to work on because of the 2- × 4-inch trusses and the thin ½-inch OSB decking. Accessing this area will also be difficult. As stated before, the scuttle opening in the closet is not made for firefighters to enter. It is a good place to direct a stream of water from a handline to begin the fire attack, but personnel with hand tools and additional handlines will be needed to open up multiple areas into the second-floor ceiling for effective fire control.

THE EXTERIOR

The exterior of 10 Washington Avenue is covered with 1-× 6-inch wood clapboard siding covered with years of paint coatings and attached to the 2- × 4-inch framing. The paint on the wood siding does not always burn quickly; in most cases, it provides a slight barrier to the combustibility of wood siding, slowing vertical fire extension. This does not last long but is helpful compared to the windows. The windows are old and break easily. They quickly break in a room-and-contents fire, which will provide oxygen in and fire out. Once the flames begin to vent out a window, if there is a window directly above, which is common with balloon construction, the window on the floor above may break and allow fire to enter. Flames venting out of second-floor windows can spread up to the soffit or roof overhang and then spread along this vertical obstruction (photo 5). Eventually, this causes fire to spread into the attic.

The exterior of 12 Washington Avenue is made up of vinyl siding over a ½-inch foam siding underlayment. Under this is a moisture barrier membrane of home wrap, stapled to the 4- ×

(7) The basement window can be effective for applying water from a hose stream from the exterior into the basement and trusses or I-beams. (8) The tip of the gooseneck applicator is removed, and the water stream has reach and penetration.

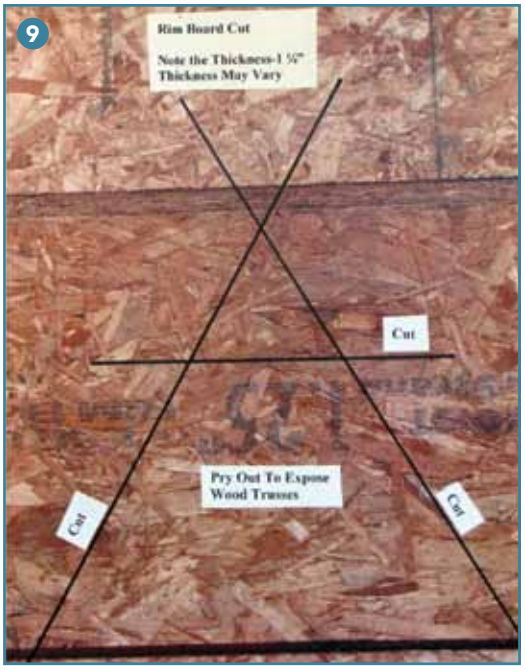
8-foot sheets of ½-inch OSB sheathing and attached over the 2- × 4-inch framing. The windows are double-hung thermal pane glass, which do not easily break. A room-and-contents fire usually needs intensity or time to break out these windows. Once the window breaks, the fire will extend. The vinyl siding melts and burns, as do the foam underlayment and moisture barrier. The exposed OSB now quickly ignites, and fire travels up the outside wall of the home. It may move so fast that it initially passes over a thermal pane window above as it spreads up. On the B and D sides of the house, the load-bearing sides, a fire will quickly extend up the exterior and enter the attic through the soffit vents on the B and D sides of the house (photo 6).

When fire vents out the second-floor exterior from windows on the B or D side, it immediately spreads into the attic. Any significant fire on the exterior of this home will cause firefighters to face multiple fire fronts all at once, including the following:

1. The fire origin area or room of origin.
2. The fire on the exterior wall.
3. Exposure to the room above, if there is fire below.
4. Fire in the attic area.

Multiple attack and backup handlines to interior locations will be needed, as well as one hoseline, such as a portable

monitor gun or a 2½-inch handline, for the exterior. The portable monitor gun or 2½-inch handline will be used to stop the spread of fire along the exterior and to the attic. It will shut down after the fire is knocked down so interior crews can perform search and rescue and extinguish the fire. This fire requires a large number of personnel working together and coordinating an interior and exterior fire attack from different locations. Interior crews must complete tasks quickly and see notable progress or be removed to the exterior for defensive operations.



(9) After removing the vinyl siding, foam underlayment, and moisture barrier, make a triangular cut in the rim board. Then open this cut to expose the wood trusses so that you can direct a stream from a hoseline into the basement.

FIRE TACTICS FOR HOMES USING LIGHTWEIGHT CONSTRUCTION

The first and most important thing for firefighters is to recognize that lightweight construction is present. In many cases, except on Washington Avenue, streets are built using the same construction features. You should be getting out in your district to see the construction methods and materials employed in your area for new construction and renovations. You may be surprised and find two structures right next to each other with different construction features. It is difficult to see differences between the two buildings once they are completed. The fire tactics used on these houses must be different. First, Command and all firefighters working at a fire should be notified of the presence of trusses and other lightweight building construction features as soon as possible. The best way to identify lightweight construction is by preincident planning. Once on the scene of a fire, pull ceiling at the entrance door to expose structural members, or look in the basement. It may have structural members exposed, but future building codes may require ceilings in the basement except in the area of the furnace.

Below are some suggested tactics when fighting fires in homes built with lightweight construction using wood trusses or wooden I-beams.

1 Do not enter the house without sizing up all sides of the exterior. It is especially important to try to determine what the fire is doing to the structure based on its location and extent. You do not want to enter the house and find out too late that the fire has attacked and weakened floors, trusses, wooden I-beams, or the roof.

2 If you are unsure of the fire's location, try to rule out the basement. Use a tool to break a basement window to look and feel inside for smoke, heat, and fire.

3 If the fire is in the basement that has a walk-out basement door, think about starting the fire attack from this opening at grade. From the door opening, use the reach of the stream to knock down fire, if possible. Assess damage to trusses or wooden I-beams before entering.

4 If the fire is in the basement, break the basement windows to apply water from an exterior hoseline. The windows should be below the trusses or wooden I-beams, so a water stream directed up, if possible, should be effective (photo 7). If basement windows are not an option, cut a triangular hole from the exterior of the house into the rim board. Start this procedure by first removing the exterior siding, the foam underlayment, and any moisture barrier to expose the rim board; this should be just above the masonry foundation wall where the siding starts.

Once this material is removed, cut a triangle into the rim board with the point up and to the top of the rim board. You may need to cut only the two sides of the triangle because the bottom of the board is sitting on top of the foundation wall sill plate and is only toe-nailed in. The hole should be just large enough to direct a hose streaming from the outside. Pry the cut piece of the rim board out to expose wood trusses and direct a water stream in to knock down fire. You could cut another hole on the same side of the house, but space it out at least 10 feet. You could also cut additional holes for fire attack on other sides of the house as well. These cuts should not greatly affect structural stability as compared with the fire's burning and destroying the wood trusses.

Another effective way to apply water from the outside opening into the basement is to use a gooseneck applicator. Unscrew and remove the tip to produce a better stream with reach and penetration with a tip pressure of 50 psi. The applicator can be maneuvered to spray water up, down, and side to side (photo 8).

After the fire is knocked down, assess damage to the trusses before entering (photo 9). In some cases, you can make this triangular cut for the attack lines where a rim board is not used to brace and tie together the trusses, wooden I-beams, walls, and floor. To determine if this is possible, cut a small inspection hole into the wood sheathing just above the foundation. Expand it into a triangle, cutting all three sides so that you can direct a water stream in to the knock down the fire.

5 If you find fire on the exterior of the house, consider placing the first hoseline here to control vertical fire spread. Do this even if you are planning an interior attack. It is especially important on the load-bearing sides of the house with vented soffits, where exterior fire will quickly spread to the attic. Do not direct the hoseline into windows or doors. This may push fire and steam inside and harm trapped occupants or firefighters operating in the interior, especially if a fog stream is used. Direct a stream against the underside of the eaves; this will allow water to enter the attic through the

(10) The gable could be an effective way to apply water into an attic fire from the exterior. From a ground or an aerial ladder, use a hand tool to cut a hole from the exterior below the gable and just above the top floor to direct a stream into the attic.

soffit vents, and water cascading down the wall will extinguish fire climbing the exterior wall.

6 If you find fire on the exterior of the house and it has entered the attic by burning past the vinyl siding-vented soffit, direct water into the area with a portable monitor gun or a 2½-inch hoseline. The larger hoseline is needed to apply a greater quantity of water and for deeper penetration. This application will have to be stopped if an interior attack begins on the second floor, but only after the exterior line has had a chance to knock down the fire.

7 For the well-involved, defensive attack attic fire that is difficult to access from the ground, consider using an aerial device or ground ladder and positioning it above the top-floor ceiling and low into the attic space. Use an ax or a halligan bar and remove the siding to create a hole into the thin OSB sheathing and spray water in. Direct the stream upward to deflect it off the underside of the roof and throughout the area. This is not a ventilation hole, so applying water in from a ladder pipe or handline can be effective (photo 10). This is much more effective than directing a stream through a hole that burns through the roof.

8 If making an interior attack, check the floor stability. This can be done by sounding the floor with a hand tool and by chopping a small inspection hole into the floor with a hand tool. The hole should be just large enough to check for smoke, heat, and fire. This can be done from the outside doorway before your weight is on the floor. This can also be done at different points throughout the house during fire operations. A cellar pipe nozzle placed into the inspection hole could be an effective way to extinguish fire in the wood trusses or I-beams.

9 An inspection hole is also needed for first- and second-floor ceilings. There is a large void space here that should be checked for fire spread. Use a pike pole or hand tool to make a small inspection hole just large enough to check for smoke, heat, and fire. The first floor can be done from the outside before making entry, except at the front door where there is a foyer with no first-floor ceiling. Do this at different points throughout the house during fire operations.

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Wood truss and I-beam floors are lightweight construction, but they are very strong and generally more cost effective compared to dimensional lumber. The open spaces in wood trusses allow plumbing and HVAC work to be placed inside the truss web member space instead of below the truss, maintaining high ceiling heights and open spaces. For these reasons, engineers, architects, builders, contractors, and homeowners will continue to use them. Wooden I-beams, or joists, have many of the same benefits and are becoming more commonly used because they cost less than trusses.

A recent change in engineered wooden I-beams, or joists, has cutouts in the web members so vents, pipes, ducts, and everything else can run through the web of the joist instead of below or having to cut through the joist. For firefighters, fires in new buildings mean less time to failure or collapse because the plywood and OSB used today as sheathing or decking is thinner than in the past and lightweight structural components used today have less mass than in the past.

There are going to be times when firefighters will need to enter these homes for fire suppression and search and rescue, but not without new training and an understanding of lightweight building construction. This must lead to a change in safety and firefighting tactics. It is impossible to tell from the outside of the house how it is constructed. Perhaps, as the fire service, we should get behind building codes that require an identification system for firefighters at homes using lightweight construction. Labels or signs could be placed on or next to entrance doors that are small, with single letters to identify lightweight building hazards. This way, the trained eye would have information, and the untrained eye might find it unobtrusive.

No matter where you protect, we need it all—training, a change in safety and firefighting tactics, and an identification system for homes built with new construction. For those not convinced, all they need is to be shown that Washington Avenue exists everywhere. New homes of lightweight construction or existing homes with lightweight construction renovations will be completed soon. These new homes are sandwiched between old homes. Chances are that there is a Washington Avenue in your district. ●

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COURSE EXAMINATION

1. The use of light weight wood construction in a structure can be determined from the exterior
   a. Because most houses and structures in an area follow common construction features.
   b. Because vinyl siding and windows are new construction features and only used in new construction.
   c. By performing pre-incident surveys during construction.
   d. By the presence of a roof ridge vent.

2. One area of concern for newly constructed homes is the floor because?
   a. The width of the OSB used as decking can be 5/8" to ¾" thick as compared to older construction where 1" thick boards are used.
   b. OSB used as decking burns much faster than decking made of plywood or boards.
   c. OSB used as decking is significantly weaker when compared to plywood of the same thickness.
   d. Floor decking is not an area of concern in newly constructed homes.

3. The problem with finger joint wood trusses when exposed to fire is?
   a. They must be spaced closer together in order to support longer spans and that contributes to extra fuel load.
   b. They contain more mass and density than dimensional lumber which contributes to extra fuel load.
   c. Glue used to hold web members together always fails first causing a collapse of the entire truss.
   d. The smaller web members can burn on all four sides and will fail quickly.

4. Why is there a difference in basement fires for light weight constructed homes as compared to older homes where dimensional lumber is used?
   a. Light weight construction homes have basements that are usually open design and causes rapid fire spread.
   b. Light weight construction sags slightly before a collapse as an indicator that a collapse may follow.
   c. Light weight construction may sag slightly and then fail quickly after this giving firefighters little chance for escape.
   d. Light weight construction houses have no fire protection of the ceiling supports causing rapid fire spread throughout the ceiling.

5. What is the function of the rim board?
   a. It is found at the top of a wall and can be used as a header for window and door openings.
   b. It ties wood I beams and trusses together on all four sides of the house.
   c. It is found on basement walls to support wood I beams or trusses.
   d. It is found at the end of a wood I beam or truss and extends above this the support floor decking.

6. How is a rim board used to fight basement fires when light weight wood construction is used?
   a. The rim board is exposed at the foundation and a small triangular hole is cut where water can be applied from the exterior to knock down the fire.
   b. The rim board is a structural member and if damaged will lead to failure of the truss horizontally.
   c. The entire rim board can be removed along the foundation for ventilation.
   d. The rim board is usually 1 ½" thick and provides for good fire stopping between wood I beams or trusses.

7. The open void space created in a ceiling using wood trusses can be no larger than _____ according to the IRC?
   a. 2,000 square feet.
   b. the combined area of the floor space below.
   c. 500 square feet.
   d. 1,000 square feet.

8. When vented soffits and roof ridge vents are used, firefighters must
   a. Vertically ventilate the roof to prevent build up of smoke, gases and heat.
   b. Enter the attic area through the scuttle to control fire spread.
   c. Open the soffit to provide for additional ventilation.
   d. Consider placing an exterior hose to the area of the fire to control vertical fire spread into the attic.

9. Attic spaces in homes built with light weight wood construction are?
   a. Easy to access from the upper floor.
   b. Open and lead to a problem of creating living spaces without a compliant secondary means of egress.
   c. Extremely likely to have rapid fire spread because of the wood trusses contributing to the massive fire load and the ease of air flow into area.
   d. None of these answers are correct.

A Side-by-Side Comparison of New and Old Construction

10. The first and most important tactic when fighting fires in an occupied light weight wood construction house is

a. Size up the building on all sides to determine location and extent of the fire.
b. Have RIC established.
c. Fight the fire defensively if the fire has attacked and weakened structural members.
d. Immediately search areas of possible trapped occupants.

11. According to the article, which statement about basements is correct?

a. Living spaces in basements of older homes are common because of high ceiling heights.
b. Living spaces in newer construction are code compliant when an exit door or a basement escape window or basement escape window well is present.
c. Living spaces in basements of older homes are usually kitchens.
d. Living spaces in newer construction are not common because of low ceiling heights.

12. According to the article, which statement about drywall is correct?

a. Drywall does not have a fire rating but does provide some degree of membrane protection to wood structural members.
b. Drywall that is ½" thick has a one hour fire protection rating.
c. Drywall does not have a fire rating and provides no membrane protection to wood structural members.
d. Drywall provides better membrane protection to wood structural members as compared to plaster.

13. When an attic floor and large attic windows are present in a house this usually indicates what?

a. There is a bedroom in the attic.
b. There are knee walls in the attic.
c. There is a scuttle access to the attic.
d. There is an easy way to access the attic like a set of stairs.

14. According to the National Institute for Occupational Safety and Health, roof truss systems are used in more than _____of roofs built in the United States today.

a. 75%
b. 60%
c. 50%
d. 25%

15. What statement about windows is correct?

a. Old windows in older homes fail in fire conditions before new thermal pane glass windows.
b. New thermal pane glass windows fail in fire conditions before old windows in older homes.
c. Attic windows in homes built with light weight wood construction can be large because of the support the roof truss system provides.
d. Thermal pane glass windows can be explosive when broken during firefighting operations because of the gas used between glass panes.

16. The article states to break a basement window during size up for a home built with light weight wood construction for what reason?

a. The vent below the fire before entering.
b. To determine which door of the house to enter.
c. To remove carbon monoxide from the basement heating system.
d. To rule out a basement fire.

17. An alternative way to apply water to a basement fire in a home built with light weight wood construction is?

a. Increase the pressure to a hand line to bounce water up and off the opposite wall from a broken basement window.
b. Use the pick head axe to create several small holes on the floor above and then flood the room with water to rain down onto fire.
c. Use a fog stream from a broken basement window to apply an indirect fire attack.
d. Use a gooseneck applicator with the tip removed from an outside opening.

18. If using a hose line to control the spread of exterior fire on the load bearing side of a home built with light weight wood construction

a. Direct the stream to the underside of the soffits to allow water enter the attic space and cascade down to extinguish exterior fire.
b. Direct the stream throughout the exterior and into windows to control fire spread.
c. Use a fog stream to improve coverage.
d. First place a crew with a hand line to the attic to check for fire extension.

19. When making an interior attack in a home built with light weight wood construction it is important to

a. Stay to the outside walls to avoid collapse.
b. Try to begin fire attack on the non-load bearing side of the house.
c. Check the floor for stability by sounding with a tool and chopping a small inspection hole.
d. Use a 2 ½" hand line to improve reach and penetration.

20. Light weight wood construction is found mostly

a. In new construction areas.
b. In older areas where older homes are being replaced with new homes.
c. In older homes that are being renovated.
d. All are correct.

Notes

A Side-by-Side Comparison of New and Old Construction

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Should you have additional questions, please contact Pete Prochilo (973) 251-5053 (Mon-Fri 9:00 am-5:00 pm EST).

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3.	❑ A	❑ B	❑ C	❑ D	13.	❑ A	❑ B	❑ C	❑ D
4.	❑ A	❑ B	❑ C	❑ D	14.	❑ A	❑ B	❑ C	❑ D
5.	❑ A	❑ B	❑ C	❑ D	15.	❑ A	❑ B	❑ C	❑ D
6.	❑ A	❑ B	❑ C	❑ D	16.	❑ A	❑ B	❑ C	❑ D
7.	❑ A	❑ B	❑ C	❑ D	17.	❑ A	❑ B	❑ C	❑ D
8.	❑ A	❑ B	❑ C	❑ D	18.	❑ A	❑ B	❑ C	❑ D
9.	❑ A	❑ B	❑ C	❑ D	19.	❑ A	❑ B	❑ C	❑ D
10.	❑ A	❑ B	❑ C	❑ D	20.	❑ A	❑ B	❑ C	❑ D

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