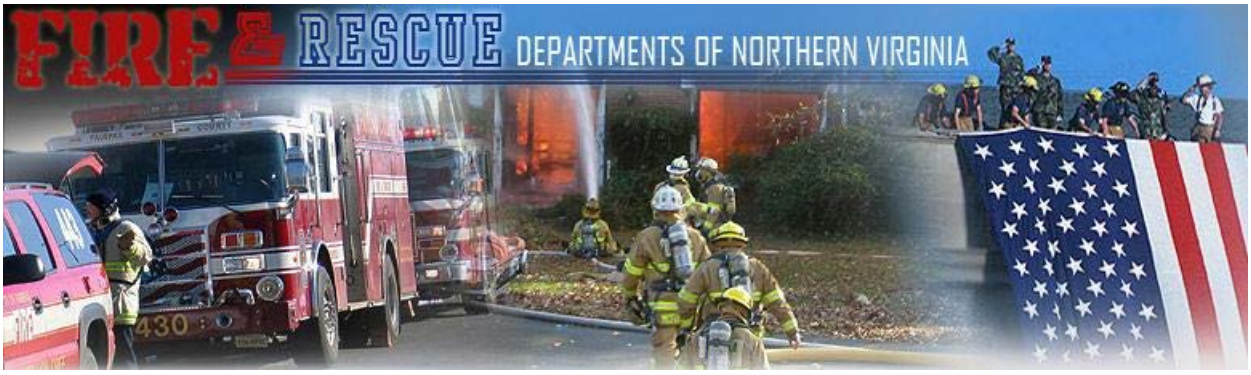

FIRE AND RESCUE DEPARTMENTS OF NORTHERN VIRGINIA FIREFIGHTING AND EMERGENCY OPERATIONS MANUAL

Single-Family Dwellings

Third Edition

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PREFACE

More than 2,500 people die each year and over 20,000 are injured as a result of fires in this country. The majority of these deaths occur in residential occupancies. Statistically, the fatalities in single-family dwellings in Northern Virginia seem to mirror the national average.

The purpose of this manual is:

- To describe single-family dwellings, which comprise a large portion of the structures throughout Northern Virginia.
- To point out the construction features of such buildings with regard to protecting life and extinguishing fires.
- To describe the hazards associated with these types of structures and recommend precautions that should be taken.
- To establish standard tactics for fires occurring in such structures.
- To establish tactics for operations for engine, truck, and rescue companies for fires occurring is such structures.
- To reduce the loss of life and property by establishing a standard method of operation for companies combating fires in single-family dwellings.

The following are key changes that are found in this third edition of the *Single-Family Dwelling Manual:*

- Expanded the definition of size up.
- Changed terminology from backup line to second line.
- Added content on soffit and deck attack.
- Added a description of cluster homes.
- Changed some of the tactics for basement fires.
- Added content on wind-driven fires.
- Expanded the section on attic fires.

DESCRIPTION AND CHARACTERISTICS

The phrase single-family dwelling is widely recognized throughout the fire service. In Northern Virginia, ***a single-family dwelling simply means a detached structure constructed to house one or more families in a single place of residence.***

The single-family dwelling may be found in several different settings, but most commonly found as part of a housing development surrounded by similar type dwellings. This type of structure may also be found situated somewhat alone on a property in a rural setting. Access may be simple or complex.

The interior area of the structure may also vary. The construction cost and value dictate the square footage. Expect many extremes throughout a typical first response district. Knowledge of the company's first response district is the only sure way to be familiar with these types of structures.

These types of dwellings may vary in height from one to three stories. The grading surrounding the dwelling may affect the height.

Single-family dwellings may be serviced by several utilities; water, sewer, gas, electric, and communications systems are most often found within these occupancies. In larger structures firefighters may find commercial utility installations or multiple installations of the same utility.

Construction Styles

There are several common types of single-family dwellings found in the Northern Virginia region: colonial, rambler or ranch, Cape Cod, split foyer, split level, balloon frame, hybrid, McMansions/estate homes, and cluster homes.

Large single-family mansion fires are not common, but require unique tactical considerations.

Colonial Style

This style of home usually has two stories above ground. This home may or may not have a basement. The front door leads into the main entryway and stairwell for the structure. All rooms will typically branch off of this entryway. Living and dining areas are usually on the first level and bedrooms are on the second floor. An example is shown in Figure 1.

Figure 1: Colonial style single-family dwelling.

Ranch or Rambler

Ranch or rambler style homes are usually one story and may or may not have a basement. The floor plan is typically very open and the presence of large windows should be expected. Additionally, these homes will often have large extended eaves. An example is shown in Figure 2.

Figure 2: Ranch/rambler style single-family dwelling.

Cape Cod

This style home is typically one-and-a-half stories above ground. The front door provides access to the main stairwell leading to the upper bedrooms and basement, if present. The top floor will contain knee walls and dormers. An example is shown in Figure 3.

Figure 3: Cape Cod style single-family dwelling.

Split Foyer

A split foyer style home is usually two stories with stairs at the foyer level, which will allow access to both levels of the home. The presence of living quarters could be expected on the basement level. An example is shown in Figure 4.

Figure 4: Split foyer single-family dwelling.

Split Level

A split level style home is two to three levels. The front entry is on one level between an upper and lower floor; a short set of stairs will be encountered upon entry that will lead upstairs and downstairs. Bedrooms are typically located on the second floor level. An example is shown in Figure 5.

Figure 5: Split level single-family dwelling.

Balloon Frame

This style home is similar to the layout of a colonial house with exception of the wall construction. Balloon frame construction walls are built with long, continuous studs that run from the basement to the attic. The presence of the fire stops between floors is non-existent, leading to rapid fire spread. An example of this type of construction is seen in Figure 6.

Figure 6: Balloon frame single-family dwelling.

Hybrid

Hybrid style houses are a new genre that is becoming more popular. They can be a variation of several different styles. Hybrid homes are typically wood frame and are two separate occupancies separated by a fire wall in a one story portion of the structure. This space can be a storage shed, garage or breezeway. Consideration shall be given to potential for extension to exposure occupancy. An example is shown in Figure 7.

Figure 7: Hybrid single-family dwelling from Side Alpha (left) and Side Charlie (right).

McMansion/Estate Homes

McMansion is a slang architectural term that describes the recent large-sized homes that have been populating the Northern Virginia region within the past 20 years. These homes can be encountered in subdivisions solely devoted to large homes or in subdivisions with existing homes much smaller than the McMansion. The square footage of these homes typically ranges from 3,000 to well over 6,000 square feet. An example is shown in Figure 8.

Regardless of their geographic location, these homes share common characteristics that affect fire ground operations; these structures are typically wood frame with a large amount of open space in the attic area. Additionally, due to the sheer square footage, they can have HVAC components in the attic area to facilitate the multiple zones necessary to heat/cool the area. This is a dead load that could have adverse effects on the companies operating below if fire involves this area.

The interior layout of the structure is similar to Colonial-style homes, but significantly larger. The first floor typically consists of living and dining areas with bedrooms being located on the upper floors. Most rooms will have large vaulted ceilings that will aid in the fire travel. Additionally, the presence of large open foyer area should be expected.

Figure 8: Single-family dwelling with large square footage, often referred to as an estate home or McMansion.

Due to the large footprint of the house, a lap by the first arriving engine officer may not be possible, but must be completed prior to entry. Consideration shall be given early into the incident for another company to view and report on conditions from all available sides to assist in developing a safe and effective firefighting plan.

Cluster Homes

Cluster homes are a community of single-family detached homes, usually constructed of lightweight building materials that are in a very close proximity to each other, usually ten feet or less, Figure 9. They are generally built using the frame method and typically have vinyl or wood siding, zero clearance chimneys, and narrow travel lanes separating each structure. These homes are spacious and have well-designed, open floor plans which can provide rapid fire spread throughout the structure. A high potential for lateral fire spread exists in cluster home developments because firewalls are nonexistent. There is a higher potential for collapse compared to other residential structures.

Figure 9: Cluster homes.

There are many types of cluster homes styles throughout Northern Virginia. These homes can be one to three stories in height with windows facing the exposures, leading to rapid horizontal fire spread. These homes present many challenges to the first alarm units depending on the involvement of the structure. Exposures are a major problem concern due to their close proximity, Figure 10.

Figure 10: Apparatus positioning is often difficult in cluster home communities.

CONSTRUCTION

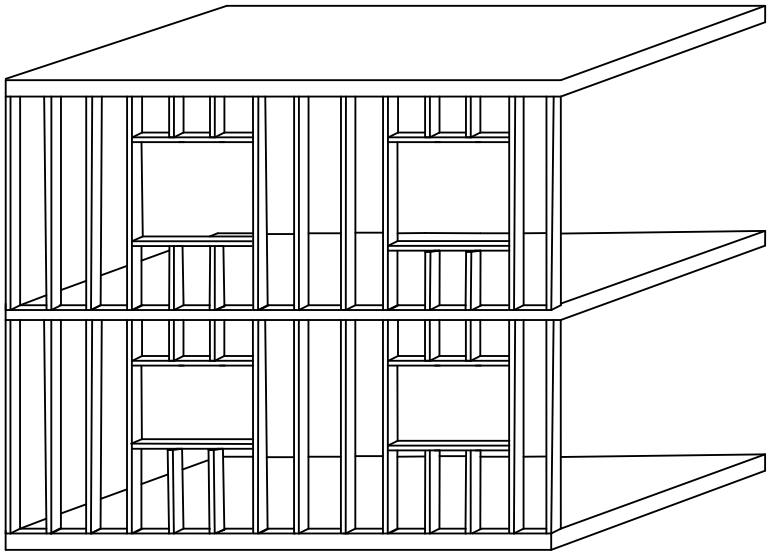
Types

Wood Frame construction is one of predominant construction types generally found throughout Northern Virginia. *The Firefighter's Handbook* describes **Type V Wood Frame Construction** as that "which the exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially of wood or other approved combustible material smaller than the material required for Type IV construction."[1]

Platform-frame construction, Figure 11, is the most common type; however, there are many balloon-frame-constructed homes in some areas, Figure 12. *The Firefighter's Handbook* describes platform-frame construction as, "a style of wood frame construction in which each story is built on a platform, providing fire stopping at each level," and describes balloon frame as, "a style of wood frame construction in which studs are continuous for the full height of a building."[2]

The use of lightweight trusses has become commonplace. The truss can be found in several applications in a single-family dwelling.

The most prudent action a company can take is to become familiar with the type of construction used during the building of homes in their response district.



Platform Frame Construction

Figure 11: Graphic representation of platform frame construction.

[1] *The Firefighter's Handbook*, Third Edition, 2008. Delmar Cengage Learning.
[2] Ibid.

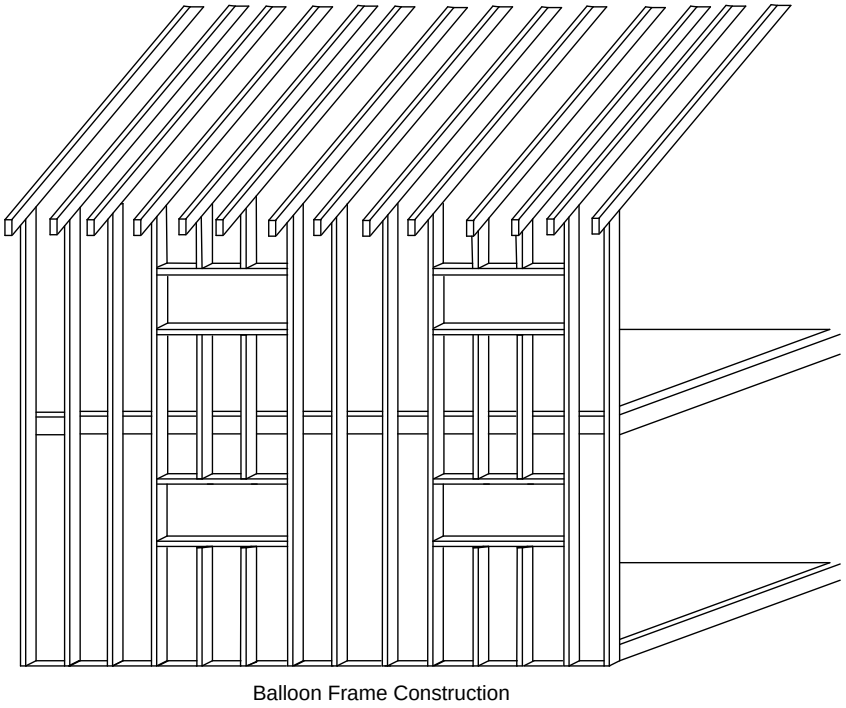


Figure 12: Graphic representation of balloon frame construction.

Roofs

Roof framing for these structures generally falls into two broad types: conventional and lightweight.

Roof decking will generally be 4’ x 8’ sheathing. Dimensional lumber, typically 1” x 6” or 1” x 8” boards, may be found in older structures.

Roof covering will generally be shingle over paper, or a variation thereof. The vast majority will be either asphalt shingles or cedar shakes.

The most common style of a roof is the peaked or gable roof, or a variation thereof. The pitch on this type of roof may vary.

Attics

Attics are generally of two styles. The attic space found when a roof is constructed of trusses is usually non-finished without a full floor. This space is commonly used for storage. The attic space found when a roof is constructed of rafters can be finished and floored. This space may be used for storage or as an occupied living area, usually a bedroom. In Cape Cod-style homes, the presence of knee walls should be suspected.

Most attics are used for storage only. Access can be gained by one of three ways: a scuttle located in the hallway outside the bedroom or in the master bedroom closet, a pull-down

stairway, or a constructed stairway (found mostly in older homes). Constructed stairways are normally accessed through a doorway and lead to a floored attic. In large homes or in remodeled homes there may be two or more access scuttles to one or more attic areas.

Walls

Dimensional lumber, 2” x 4” in size, is generally used for framing in wall construction. Larger sizes may be found where added insulation is desired. Metal studs may occasionally be encountered.

Exterior sheathing of many types may be used. Insulated material or wood are common types of sheathing.

Exterior coverings may include, but not limited to, wood, brick, vinyl, aluminum, and asbestos.

Interior coverings for walls are generally made of gypsum, which is commonly referred to as drywall. Lightweight paneling may also be found in some areas. Plaster and metal or wood lath wall construction may be encountered in some older homes.

Knee walls will be found in units with lofts and dormers and will contain voids or may serve as a storage area. Knee walls may contain hidden fire and must be opened early to check for fire extension, Figure 13.

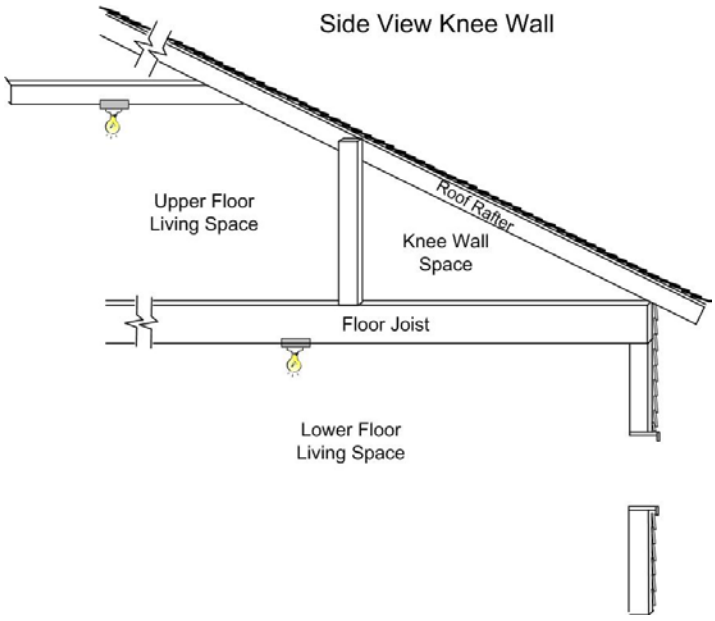


Figure 13: Cross section showing a knee wall.

The insulation material used within exterior walls is generally fiberglass; wood cellulose, rigid plastic foam**,** or other blown-in material may also be found.

Floors

Floor beams are generally of two types: wood timbers or steel I-beam, with engineered I-beams being the norm since the 2000s. Engineered I-beams exposed to fire fail within five minutes and all attempts need to be made to ensure whether they have been impinged upon. Wood or steel columns, or masonry walls or piers may support them**.**

Joists are generally of three types: dimensional lumber, truss, and plywood I-beams. Dimensions will range in size depending on the length of the span and the load the truss will carry. The truss is designed to carry a load over the greatest span using the least amount of material, Figure 14.

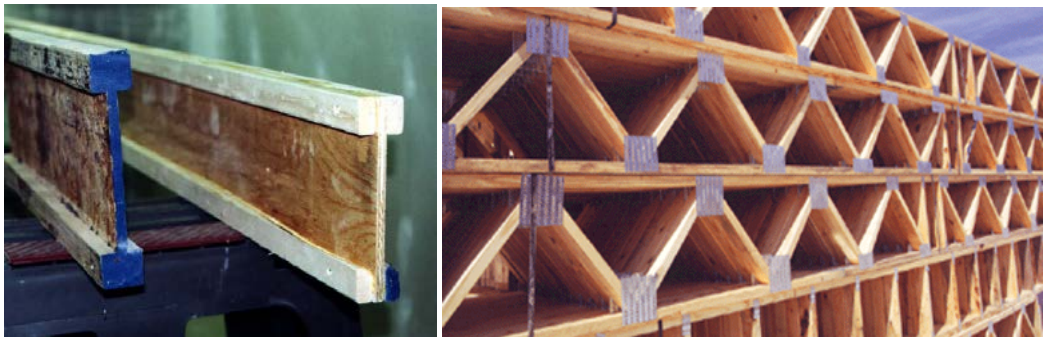


Figure 14: Examples of wooden I-beams and floor trusses.

Floor decking is generally of two types: hardwood boards or plywood sheets.

Floor covering may vary greatly depending on the builder's constraints or the buyer's preference. Common types are carpet, vinyl, or tile.

Basements

Single-family dwellings will be set on a concrete slab or will have a crawl space or full basement underneath. Basement entry may be from an exterior and/or interior stairway.

Slab and basement floors are commonly poured concrete. Crawlspace floors will usually be dirt or gravel.

Crawlspace and basement walls are generally built of block or poured concrete. If the basement is finished, wood or metal studs covered by drywall or paneling may be found.

Unfinished basements allow the fire to directly attack the structural components and quickly enter void spaces.

Some homes may have in-law apartments or rental apartments in the basement, which may or may not have access from the floor above and only have a separate exterior entrance. The access to the basement from the upper floor may be blocked by a locked door or have an illegally constructed wall at the base of stairway excluding fire department access.

Windows

A common style of window used in single-family dwellings is a double-hung, sliding-sash type. The glazing may be of single, double, or triple thickness. Personnel should be cognizant of the inherent design characteristics associated with triple thickness window construction will lead to elevated heat conditions. Many other styles of windows may be found and should be noted during preplanning and size-up opportunities.

Casement windows create a special hazard. These types of windows are found in construction dating from the late 1940s to the late 1960s. These windows have steel frames set in concrete or masonry. While breaking all the glass in the windows will ventilate the affected area, entrance and exit through the remaining window frame is physically blocked. The window must be opened by lifting a latch and rotating a crank. Removing the frame with force would be very difficult under adverse conditions, and would require the use of heavy forcible entry tools. Firefighters should note these windows in their size-up upon arrival at a structure fire.

Egress Window

Some homes are designed with sleeping quarters in the basement. By code there must be two exits for these bedrooms. The second exit may be a larger than normal size window.[3] When making your lap of a structure and egress windows are noted, this may indicate sleeping quarters in the basement. The height of the window installation is also important. The bottom of the window opening should be no more than 44 inches off the floor. Outside, an oversized window well is required, Figure 15. It will need to be at least 36 inches wide and extend 36 inches out from the window. The window well height is also limited to 44 inches, as measured from the well floor. If a deep basement forces a deeper window well, most codes will allow a concrete block on the floor of the well to serve as a step, as long as it doesn't interfere with the window's opening.

Figure 15: Egress window.

[3] An article describing basement egress windows can be found online at http://www.popularmechanics.com/home/improvement/1275596?page=2.

With security being a concern to many homeowners, some have installed bars over the window opening. Security bars or grates are an excellent deterrent to intruders but they also may trap occupants and firefighters who need to egress through these openings.

Normally, older style bars and grates were completely set into the exterior wall with no way of opening or removing them. Newer installations should have quick-release devices to allow them to be opened immediately in an emergency. Without compromising security, these devices are operated from inside and allow the bars to be opened for emergency escape. The quick-release devices are designed to be used without a key and are easy to operate. Manufacturers and installers of security bars offer several solutions to residents to protect themselves from crime and yet remain safe during a fire. Some solutions include a handle device or a push button device. Release devices vary by manufacturer, Figure 16.

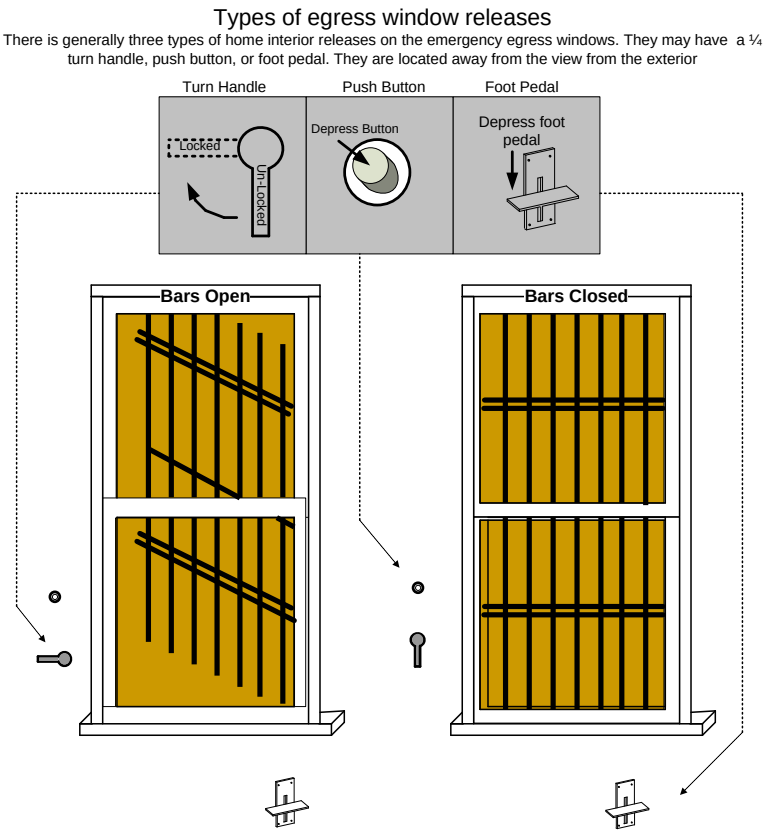


Figure 16: Egress window releases.

Doors

Exterior doors are generally of two types: solid wood or insulated metal. Exterior doors are inward opening. Conventional forcible entry will gain access in most cases. The hydraulic door opener is not recommended on single-family dwellings because of its lack of practicality. It is designed for multiple, inward-opening doors. If conventional forcible entry is required, standard entry methods will accomplish the task.

Interior doors are commonly hollow-core wood doors. Inward opening doors are typically bedrooms and bathrooms. Outward opening doors can be closets or the stairs leading to the basement.

There are three standard locks on exterior, single-family dwelling doors. These are mortise, rim, and tubular dead bolt. Mortise locks used to be exclusive on older construction but have become popular once again in newer homes.

Garages

Garages may be attached to or detached from a single-family dwelling. Attached garages are a greater concern to operations, as they can expose the entire structure to possible extension from a fire originating in a garage.

Garage floors will be of poured reinforced concrete, and may have a short masonry block wall on some of the sides. The remainder of the garage will be constructed in the same manner as the dwelling to which it is attached. This is most commonly wood frame construction.

The party wall shared by the garage and the living area is not required to be fire-rated, and should not be considered as such. According to the International Residential Code, "Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than $1^3/_8$ inches (35 mm) in thickness, solid or honeycomb-core steel doors not less than $1^3/_8$ inches (35 mm) thick, or 20-minute fire-rated doors, equipped with a self-closing device."[4]

The attic of the garage may not be floored and/or finished. If there is living space above the garage the ceiling is required to be fire-rated. A vehicle or contents fire in a garage with an unfinished attic will allow for rapid fire extension to other areas of the structure. The presence of a finished living area over the garage presents a serious life hazard.

The overhead entrance door to the garage and its mounting hardware will not be fire-rated. These types of doors are known to collapse when left open and exposed to fire.

Open garage doors have closed without warning due to fire conditions and have trapped firefighters inside. All garage doors should be secured to prevent this problem. A set of vice grips works well for this also this may be accomplished by placing a tool into the track. The most definitive option to securing the door open is to bend the track with a hand tool preventing the door from closing. Personnel may also be able to disable the door by removing power or disengage the driving motor.

General Features

Interior stairways may be open from the lowest living level to the highest. The type varies, but the most common is a straight run, vertically stacked stairway. Larger homes may have multiple

[4] http://publicecodes.cyberregs.com/icod/irc/2012/icod_irc_2012_3_par055.htm?bu2=undefined

stairways and may be remote from the front entrance (such as access stairs to upper floors from a kitchen area).

Despite the vast range of total square footage available in single-family dwellings, the degree of compartmentation created by the number of separated rooms (bedrooms, kitchens, etc.) makes the individual compartments relatively small.

Most single-family dwellings have four sides and are rectangular in shape. Two parallel exterior walls are load bearing and the other two are not. There is generally one interior load-bearing wall located centrally between, and parallel to, the exterior bearing walls. Except for unusual circumstances, the long wall will be the load-bearing wall.

Fireplaces and chimneys may be found in these types of dwellings. These may be constructed of masonry or metal, each having particular inherent hazards. The fireplace and/or chimney may be in the center of the structure, or as part of an exterior wall. Many of the newer constructed homes will incorporate zero-clearance chimneys into the home design for cost and aesthetic reasons. Personnel should recognize this construction feature and anticipate extension into void spaces if fire has involved the flue.

HAZARDS

Life Hazards

As stated in the beginning of this manual, most deaths related to structure fires occur in single-family dwellings. This fact dictates the priority of life safety when dealing with this type of occupancy and, thus, the need for information in executing tactics.

The potential for trapped occupants exists at all times (day or night) in a single-family dwelling. During the period when occupants may be sleeping their chance of survival is decreased due to their inability to quickly detect and flee from a fire.

The location of the fire in this type of dwelling affects the life hazard. Most fires in single-family dwellings start in the vicinity of cooking or heating appliances. This situation directly exposes the fire floor and those floors above (basically the entire home) and, more importantly, the bedrooms.

The age, physical, and mental abilities of the occupants affect the life hazard. It is common to find people with varying degrees of mobility within single-family dwellings.

The intended use of a single-family dwelling is for a place of residence. The possibility exists that the occupants may not be using the home as intended, therefore, creating other hazards that affect life safety such as a day care center or a clandestine drug lab.

Fire Hazards

The fact that single-family dwellings are generally constructed of wood adds greatly to the fire hazard.

The use of combustible interior finishes and the type of furnishings found within these structures, contributes to the fire loading. Generally, these types of occupancies are considered to have a relatively low fire loading. Fire flow estimates will be based on a flow rate of 10 GPM per 100 square feet of involved area. Therefore, attack lines should be 1¾ inches in size.

The presence of highly-combustible siding can greatly affect the fire hazard. Vinyl and asphalt siding may contribute to vertical and horizontal fire spread, and can create a severe exterior exposure problem. Additionally, the presence of fire involving vinyl siding greatly contributes to fire traveling into upper floors or the attic space via the roof soffit.

The presence of interior void spaces may add to fire spread. Vertical and horizontal openings allow smoke and fire to enter and attack the structure itself. Fire that has entered these voids will necessitate the opening of floors, ceilings, and walls. This is especially crucial in balloon-frame construction.

The presence of cooking, utility, and mechanical areas creates the potential for fire. It should also be recognized that in the residential setting, the potential for ignition exists from many sources that include space heaters, pilot lights and burners, and smoking materials.

The presence of fireplaces and chimneys may create a potential for fire extension to unwanted areas of the structure. Improper installation of degradation due to age may compromise the integrity of the components, allowing fire or heat to escape and ignite surrounding combustible members.

When the fuel oil tank or gas meter is located on the interior of a structure you can find its approximate location from the outside. The fuel oil tank will have a fill pipe and vent located on an outside wall near the tank. The interior gas meter will have a vent and may have a gray gas pipe going through an exterior wall to the interior where the meter is located.

Other Hazards

The potential exists for flashover to occur in these types of structures. The amount and type of combustible materials, rate of heat release of the burning materials, and an adequate supply of oxygen allow a fire to progress rapidly to the flashover stage.

The potential for collapse in single-family dwellings as a result of fire is related to two distinct factors: 1) the presence or absence of lightweight construction materials and 2) whether or not the fire is attacking the structural components or contents only.

The greatest collapse potential exists when fire is in the basement attacking the vital structural supports under the first floor. Since there may be no walls or partitions in the basement, large portions of the first floor can collapse into the basement fire area. This condition is exacerbated if plywood I-beams or other lightweight components are involved.

The presence of overhead electrical service wires to the dwelling should be suspected and their integrity assessed. The hazard of this service dropping into the yard is a common one. Should this occur, the Incident Commander (IC) must be advised and all companies operating made aware.

The McMansion or estate home can be larger than some commercial structures and may require commercial utility meters to accommodate the large square footage. It is not uncommon to find a commercial electrical transformer box supplying power to the structure. You may find more than one water meter supplying these structures, they may be together or one at each end of the home. When given the order to control utilities it may require more than one shut off for the water, gas, and electric.

FIRE OPERATIONS

Life safety is the highest priority at all structure fires. The potential for life loss is most prominent in residential occupancies. This objective should be achieved through interior fire containment and primary search. All operational tactics should be assigned to support this strategic goal.

When it has been confirmed that the occupants of the structure are accounted for (self-evacuated, evacuated with assistance, or rescued) the strategic goal should then focus on firefighter safety and fire extinguishment; this information is generally received by the first unit on the scene. Upon arrival, gather information from the occupants who left the building or neighbors standing outside and communicate this information to all incoming units.

In most cases, fire extinguishment should be achieved through proper tactics. At times, size-up will indicate otherwise; however, personnel should anticipate an offensive interior attack. The conservation of property without undue risk to firefighters should be a strategic goal throughout the entire incident.

The rescue problem should be addressed by a thorough interior primary search for life that focuses on the tenable areas adjacent to the fire area, as well as the bedrooms and means of egress. A hoseline should be assigned to the floor to protect crews conducting the search. Coordinated ventilation in this type of structure is critical in facilitating a primary search. This may be achieved through the removal or opening of selected windows where occupants might be located.

If the EMS unit is staffed with members trained as firefighters and there is no need for the treatment of trapped or injured occupants, this unit may be used as the “outside two,” or assigned to other duties as determined by the IC. If this action is taken, another EMS unit shall be requested to the incident for the treatment of injured firefighters or occupants.

The interior exposure problem should be addressed through rapid containment of the fire. This includes the advancement of an interior attack line to protect any occupants within the structure, focusing on the interior stairway if present or other vertical voids. The interior fire will be of two types: fires involving only the contents or fires that involve the contents as well as structural members. The latter scenario provides the means for fire to extend throughout the structure.

The exterior exposure problem should be addressed through the use of the proper tactics.

The confinement of the fire should be achieved through the use of the proper tactics. If it cannot be ensured that rapid extinguishment will be achieved, then it is imperative that the hoseline(s) is located in such a way as to protect the occupants. Personnel shall remain cognizant that crews operating above the fire will be considered occupants.

The extinguishment of the fire should be achieved through the proper selection, placement, and application of the attack line(s). The compartmentalization generally found within single-family dwellings and the fire loading suggests that the 1¾-inch attack line should be effective in

extinguishing most content fires. Fires involving structures of this type of occupancy may require the support of several equally effective and mobile lines.

When large GPMs are required on the exterior it is acceptable to use two 1¾-inch lines side by side. They will deliver more GPMs than one 2½-inch line with less staffing. The use of 2½-inch handlines for single-family dwellings is generally done only on the exterior due to mobility and the staffing. By using the two 1¾-inch lines initially on the exterior, the two lines can then be redeployed easily once the fire is knocked down.

The coordinated ventilation of this type of structure during a fire should generally be achieved through natural horizontal methods. The reason for venting should be identified and communicated to the assigned units.

The need for roof openings typically will only be required when the fire has entered the attic area or has gained access to vertical void spaces. Conventional construction provides the needed support to accomplish rooftop ventilation. Lightweight construction does not provide the support necessary and may result in early collapse. Crews ordered to perform rooftop ventilation in lightweight construction should be independently supported by the use of aerial devices or a roof ladder.

Fire travel within these types of structures will be affected by the method of construction. Balloon-frame and platform-frame construction methods are common, and each presents a different concern.

- Balloon-frame construction requires the checking of all levels within the structure. Fire should be suspected of having entered the exterior walls.
- Platform construction offers some level of fire stopping, but all affected vertical voids must still be checked for the presence of fire with attention given to the plumbing and heating areas.

RESOURCES FOR FIRES IN SINGLE-FAMILY DWELLINGS

The minimum resources assigned to incidents of reported fires in these types of structures are:

4 Engine Companies
2 Truck Companies
1 Rescue Squad
1 EMS Unit
2 Battalion Chiefs
1 EMS Supervisor
1 Command Aide

The assigned resources for fires in single-family dwellings in areas without hydrants should be modified to include a Tanker Task Force early into the incident:

3 Tankers
1 Engine Company
1 Battalion Chief

When reports of occupants trapped are received, the assigned resources should be modified to include ALS units, if not already dispatched. When multiple victims are reported additional resources shall be considered.

Utility-fueled fires will require the assistance of the involved utility company and the IC should request these resources as early as possible when the need is determined.

The rehabilitation of companies that have been operating may require additional resources for relief as well as to staff the medical unit that performs rehab.

Units encountering delays in responding should communicate this immediately, along with changes in arrival order that will affect assignments. This should be addressed on the tactical channel so incoming units can be made aware. The dispatcher shall notify the responding chief officer of these changes. The chief officer should be advised of and acknowledge companies becoming available and being added to the incident.

Reserve resources should be available in staging to meet contingencies as they occur until the fire is declared under control.

APPARATUS POSITIONING FOR FIRES IN SINGLE-FAMILY DWELLINGS

Typical positions and initial actions are listed below:

First engine – After viewing as many sides as possible, the first engine company should park in a position to allow for rapid advancement of hoselines into the structure, leaving priority position for the truck company. The following shall be communicated via radio: on-scene report, layout, size-up, 360˚ lap, and situation report. Primary actions will be deployment of initial attack line, search as the line is advanced.

Second engine – The second engine should ensure a water supply, ensure first line is operational, and deploy the second line.

Third engine – The third engine shall position to allow the crew rapid access to the structure while maintaining access and egress to the incident for additional resources. The engine should take a position to prepare for providing a secondary water supply and visual inspection of side Charlie and report findings to command, check for fire extension, and possible exposure line.

Fourth engine – The fourth engine shall position out of the way, so as to not block access for incoming trucks and assume the position of RIT. If needed, the driver may be assigned to supply water to the third engine.

First truck –preferred position for the first truck company at fires in single-family dwellings will be the most strategic location – normally in the front of the structure. This will allow for rapid deployment of ground ladders (front and rear) as a primary concern. Other duties will be to force entry, conduct a primary search, and coordinated ventilation.

Second truck – position as close as possible to the scene and assist the first truck with forcing entry, search, coordinated ventilation, and ladders. Perform a visual inspection of side Charlie. Ground ladders and truck operations in the rear will remain a priority.

Rescue squad –The rescue squad should position that affords rapid access to the structure, but does not block other companies. Primary responsibility is search and rescue, however if that task is being accomplished by another unit they may be needed for forcing entry, coordinated ventilation, or ground laddering.

Other units responding on the incident shall keep the front of the structure open for the truck. Units arriving after the truck should be cognizant of the possible need for access to the ground ladders and keep the rear open at least 50 feet for ground ladder deployment.

It is recognized that there are circumstances that will prevent units from positioning as preferred. At times, only one engine will be able to position in close proximity to the structure, as is the case with a home located at the end of a long narrow driveway.

After viewing as many sides as possible, the first engine should park in a position to allow for rapid advancement of hoselines into the structure, leaving priority position for the truck company. The addition of the 50-foot LDH pony sleeve allows for the engine companies to leave the front open for trucks even if the hydrant is directly in front of the structure.

The EMS crew should be assigned to initial EMS duties. The crew should assemble their EMS equipment onto a stretcher and proceed to an area that provides rapid access to potential civilian or uniformed members needing treatment. The crews should also canvas the crowd for injured victims. During a single family structure fire, EMS apparatus should position down the street or on an adjacent street with a clear egress path should transport become necessary.

If the EMS unit is staffed with members trained as firefighters, the crew should have their protective clothing and SCBA with them.

A dedicated EMS unit should be considered for the treatment of responders early in the incident. This unit should be positioned in a manner that will provide access to equipment and emergency egress should transport become necessary.

In some jurisdictions, it may be necessary to use the initial EMS unit personnel for initial firefighting operations. The IC should understand the firefighting capabilities of the personnel on the responding units. As necessary, and if properly trained, these personnel can be used to make a coordinated exterior fire attack while initial crews are preparing for coordinated interior operations. This can include deploying a hand line or master stream device to the fire area for a quick knock down of heavy fire, protection of exposures, etc.

The second chief officer should position the vehicle without blocking firefighting units in a position to support command and report to the incident command post with full PPE including SCBA.

The units staging should operate as outlined in the *Command Officer Operations Manual*.

ENGINE COMPANY TACTICS

Water Supply

When dispatched for a fire in a single-family dwelling, the first-due engine will lay supply line(s) to establish the water supply for fire attack. The location and method of the hose lay should be communicated to the second-due engine company.

A forward (or straight) hose lay of a supply line(s) shall be used when possible. Modifications to this procedure may be made to ensure sufficient fire flow to extinguish the fire. Personnel shall ensure that sufficient water supply for the volume of fire is established.

In areas where hydrants are not readily available, the procedure for relay or shuttle operations will be followed.

Third- and fourth-due engine officers must be cognizant of the need for a secondary water supply and identify the location of additional hydrants and alternative sources of water.

Size-up

The size-up is a continuous process which contains various benchmarks and decision points where information is obtained during an incident. Size-up info is provided on an ongoing basis and is included in:

1. Pre-incident (know what needs to be on a pre-plan, barriers, layouts, etc.)
2. Pre-arrival
3. On-scene report
4. 360° lap or walk around
5. Situation report
6. Interior size-up
7. Ongoing size-up

Pre-Incident Size-Up

Pre-incident planning is paramount to successful fireground operations. Knowing the building layout, construction type, hydrant locations, specific building features, locations of fire protections systems (standpipes, ventilation points), occupancy type, and building access options will expedite fireground operations.

Pre-Arrival Size-Up

Pre-arrival size-up is somewhat of a natural instinct for fire officers. Pre-arrival size-up considerations include: occupancy type, time of day, class of construction, weather conditions, and water supply access. Much of the pre-arrival size-up information can be known by company officers through pre-incident planning.

On-scene Report

The on-scene report gives the initial arriving company officer the opportunity to gather more detailed information. The on-scene report should paint an image of the building type and conditions upon arrival to other incoming units. The on-scene report should be concise, but provide sufficient information to incoming units to permit for proper apparatus placement and crew deployment. Information provided in the on-scene report should include: position of first-arriving apparatus (side of the building), what is evident upon arrival, occupancy type, and exposure concerns. (Refer to the *Command Officer Operations Manual.*)

360° Lap

The 360° Lap, or building walk around, will allow the all officer to view all sides of the building (if possible), and further paint a picture of the incident to incoming units. The lap will allow the initial arriving officer to determine the possible location of the fire, the presence of victims, best location for initial line deployment, and any obstacle present that may impede smooth fireground operations. The first-arriving engine officer shall conduct a thorough 360˚ lap of the structure prior to implementing interior firefighting tactics. If physical barriers make the 360˚ lap impractical, the lap may be assigned to another unit; however, interior tactics shall not commence until a report from Side Charlie is received.

In situations where a reported life hazard exists, and the initial company officer identifies the need for immediate interior firefighting actions, a radio report shall be transmitted identifying the need to bypass the size-up from Side Charlie.

Situation Report

The initial arriving officer will compile all of the information that was gathered through the pre-incident, pre-arrival, on-scene, and 360˚ lap. This compilation of information provides the tools to allow the first due fire officer to make the decisions necessary to mitigate the situation that is at hand. All information that is gathered is then relayed to units either on the scene or still responding, and dictates the actions necessary to bring together responding units and design a plan of action.

Interior Size-up

Interior size-up comes from all units that are working inside of the structure. This information can include: location and amount of fire, interior building layout, location of victims, hazards encountered, positioning of hoselines, and prioritization of search areas. With the continued effort of fire suppression activities and changing conditions, ongoing size-up is the next phase of fireground size-up.

Ongoing Size-up

It is incumbent on the officers that are involved in an interior fire attack to keep the IC informed on the outcome of the fire attack. The IC needs to know the progression of fire extinguishment, number of victims and progress of removal, status of the building (holes in flooring, collapse

potential, etc.), and the need for additional resources to mitigate the incident. Ongoing size-up will continue after the fire is knocked down with the intent of informing the IC of overhaul and salvage operations, CO levels in the structure, and any other pertinent issues that the IC may require.

An easy way to answer or transmit a progress report is the CAN report; CAN stands for Conditions, Actions, and Needs. By using this report model, the person giving the report easily identifies how well the team is doing, the conditions faced, and any support or resource needs.

C – Conditions
A – Actions
N – Needs

In order to use these principles, the engine company officer must have a comprehensive understanding of the size-up process and all elements. The elements of a size-up encompass the potential variables the engine company officer must factor into the decision-making process. During size-up, information and intelligence on the following elements should be obtained whenever possible:

- Building
  - Occupancy type
  - Residential vs. commercial
  - Location of points of access and egress
  - Ventilation access points
  - Fire protection features

- Construction type
  - Fire Resistive allowing for limited fire spread
  - Ordinary Construction, concerns for collapse potential
  - Lightweight Construction, issue of rapid fire growth and increased collapse potential

- Occupant Interview
  - Fire location (basement, upstairs, main floor)
  - Occupant report (rescue potential, location of fire)
  - Location of utilities

- 360° Lap
  - Elevation of structure (front vs. rear)
  - Location and extent of fire(identify the lowest level of smoke and fire)
  - Ventilation status
  - Access and egress points
  - Victim location

The information obtained during size-up will assist the engine company officer to determine, develop, communicate, and implement the initial incident action plan.

Initial Line

The initial attack line for most fires within this type of structure will be the 1¾-inch hoseline, allowing for the needed speed, mobility, and fire flow. The first engine crew will usually be responsible for deploying this line. An exception might be when the unit arrives alone, and an obvious need for an immediate rescue is indicated.

The advancement of the initial attack line should be through the appropriate entrance into the structure. In most cases, the hoseline will be charged prior to entering. The attack should be made from the unburned portion of the structure toward the seat of the fire. This may dictate entrance from a location other than the front door. The first engine will normally accomplish entry on its own. However, the forcible entry task, when needed, remains the responsibility of the first due truck or rescue.

The purpose of the initial attack line is to protect occupants, the interior stairway, and, if possible, advance to the seat of the fire for confinement and extinguishment.

The conditions found upon arrival and the information gained during the size-up may dictate changes in these tactics.

Second Line

The second line for most fires within these types of structures will be the 1¾-inch handline, allowing for the needed speed, mobility, and fire flow. The line should be of sufficient length to reach the location of the initial attack line or to be advanced to the area above the fire, if required.

The second line will generally be stretched from the first-due engine company apparatus. In most cases, the second-due engine company will accomplish this task.

This line shall be capable of delivering at least the same amount of water as the initial line. In the case of a 1¾-inch line, adjustments will have to be made to produce the higher flow. The need for advancement will be determined by the progress of the initial attack line. If the back-up line is not needed to support the attack line, it may be used as the line above the fire. Command must be informed.

Line Above the Fire

Officers should consider an additional hoseline for operations above the fire. There are two purposes of the line above the fire. The first is to protect the company doing the primary search of the floor above and the second is to extinguish vertical extension.

No more than two hoselines shall be stretched through any one entrance into a building. The advancement of additional lines should incorporate alternate means of entry.

The line assigned to the floor above the fire in these types of structures will generally be the 1¾-inch handline, allowing for the needed speed, mobility, and fire flow. This line should be of sufficient length to reach the area above the fire and into the attic, if required. The second or

third-Arriving engine company will be responsible for this task. The unit this line is deployed from will be determined by the unit officer assigned this task.

Sweeping the Eaves Prior to Entry

Eaves are a common structural feature of single-family homes that extend the ends of rafters or trusses of a pitched roof over exterior walls. Eaves are often enclosed by nailing a fascia (board) to the ends of rafters or trusses and a soffit to the underside. Enclosed eaves are usually an extension of the attic, making it very vulnerable to auto exposure. Fire burning out of the top-floor windows or up combustible siding is very likely to impinge on and penetrate the soffit, spreading fire into the attic. Fire extension by way of eaves is hastened when they are enclosed with lightweight vinyl or sheet metal soffits. Soffits are commonly penetrated by attic vents to reduce temperatures and prevent condensation between the roof and the top-floor ceiling.

Soffit vents provide a direct path for fire to enter the attic. Smoke pushing from soffit vents of an overhang is an indication that fire may have extended to or exist in the attic. Personnel must be proactive to prevent fire from impinging on the underside of eaves and spreading to the attic. Hoselines should be positioned in anticipation of fire threatening the eaves. It is entirely possible for one firefighter to stretch a 1¾-inch hoseline and position it at a corner to protect the soffits on two sides of a building. Wash the underside of the soffit by directing a straight stream close and parallel to the wall. This will provide maximum protection to soffits and prevent the stream from entering the window and striking the firefighters engaged in an interior attack. Directing a stream from this position will also protect soffits from a deck or rear porch fire. Additionally, water striking the underside of the overhang will cascade down the wall to extinguish burning exterior siding.

Soffit Attack

Attic fires can be rapidly knocked down from the exterior upon arrival using the soffit attack, Figure 17. To employ this method, the engine company will match their stream with the angle/pitch of the roof and flow under the gutter and through the soffit. A 1¾-inch attack line will normally provide the reach necessary to accomplish the soffit attack on most homes. For large, multistory homes or when attacking from the rear, a 2½-inch attack line be necessary to provide effective reach and penetration from the exterior of the structure. It may be necessary to use ground ladders to gain access to the soffit to provide a more effective means of extinguishment.

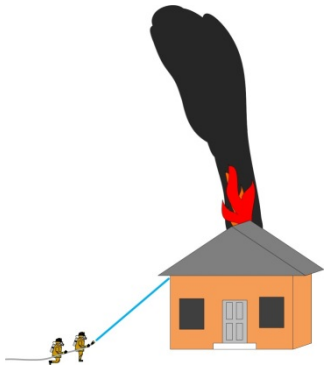


Figure 17: The Soffit Attack must be employed early into the incident, preferably by the first arriving engine company.

Deck Fire

In the event of a deck fire, the priority should be to get a hoseline on the deck side of the structure to extinguish the deck, the soffit, and eaves. If it is found that the deck is still structurally sound, the first engine may access the fire building through Side Charlie with the handline to check for extinguishment and fire extension investigation. It is okay to go from the burned portion of the structure to the unburned portion in this situation.

Exterior Fires Extending into the Dwelling

Due to recent building construction trends, the use of vinyl siding on lightweight wood construction dwellings has increased tremendously. Vinyl siding has become more prevalent as an exterior covering on homes due to its lower installation and maintenance cost, along with the longevity of use. The combination of vinyl siding and lightweight wood construction has shown to have a significant impact on firefighting operations, especially in fires originating on the exterior of the home. These exterior fires quickly ignite the vinyl siding and exterior sheathing then extended up the building and into the dwelling. Fire can enter the structure into the attic space through the soffit or into the home through a window or void space in a truss construction floor.

Many line-of-duty deaths and close calls have been the result of fires originating on the exterior of the dwelling involving the vinyl siding, the combustible sheathing, and/or environmental factors, such as high winds. The potential for rapid fire progression into the structure on multiple floors and the recent history of line of duty deaths and close calls in the United States, mandate that consideration be given to proper size-up, strategy, and tactics. The incident actions must be communicated by the first-arriving officer, and carried out by the subsequent crews, in order to safely and successfully extinguish this type of fire.

Mandatory actions for exterior fires extending into the dwelling:

1. The first hoseline is deployed to the fire location on the exterior of the structure to perform a quick knockdown of the fire in a sweeping fashion. Crews must use caution not to flow water into windows or doors whenever hoselines are operated from the exterior.

This tactic may force fire and the products of combustion into the dwelling toward the occupants.

2. Once the first hoseline is in place and operating effectively, the second line should be deployed to the interior of the dwelling. The crew must inspect the ceiling area and the floor condition at the point of entry. The use of a thermal imaging camera is highly recommended, Figure 18. This line will extinguish any fire within the dwelling and protect the occupants and the companies operating on the interior. In order to be successful more than one handline may be required.

3. Once fire is knocked down on the exterior of the dwelling, the hoseline may be re-deployed to the interior to assist the interior line or progress to upper floors to attack any fire.

4. The coordination of tactics and operations between the first engine and the special service units or additional engine companies must be completed before the special service units can enter the building.

Figure 18: Use of a thermal imaging camera to check ceiling area.

Basement Fires

Basement/below grade fires pose unique hazards and challenges. Two key characteristics make basement fires particularly challenging:

1. Limited access points and
2. The potential exists to have immediate, unimpeded fire impingement on the structural support for the floor above.

This exposure of structural elements is somewhat mitigated in the case of finished basements where drywall or some other barrier has been placed over structural beams or joists.

As with any fire event, size-up at a basement fire is critical. Initial arriving units must determine the location and extent of the fire, building construction, hazards, and points of access to the basement. If the fire is known to be in the basement, the officer must quickly determine if an exterior access to the basement is present. This exterior door most often will be in the rear.

Early determination must be made, if at all possible, whether the basement is unfinished. If so, fire has unimpeded access to the unprotected structural supports of the floor above.

The objective is to prevent the fire from extending vertically through containment and extinguishment. This will require two lines. **The need for both lines to be coordinated and rapidly get into position is of utmost importance.** Effective and coordinated ventilation of the basement and upper floors is necessary to support the fire attack.

It is incumbent on the first arriving engine company officer to identify where the handline will be deployed in a manner that best addresses the immediate needs of the incident. The location of the initial handline may be:

1. To the rear/exterior basement access to commence fire attack,or
2. To the front door to protect the interior stairs and upper floor(s).

The decision of where to deploy this line must be communicated on the operations channel.

The preferred point of attack for the initial handline is an exterior access point that leads directly into the basement.

A line must be stretched to the front door to contain the fire and protect any occupants and searching firefighters. This line can cover the first floor and protect the interior stairs. Crews should not operate above the basement without the protection of this handline unless there is a confirmed life hazard, Figure 19.

The crew must ensure there is not fire under the floor and determine its stability before proceeding. If the integrity of the first floor is compromised, the line should be positioned in a position of safety close to the entrance door. This change in hoseline and crew position should be communicated to command.

Figure 19: Attacking a basement fire.

The door to the basement should be closed, if feasible. If the basement door cannot be closed, is non-existent, or burned through, use a narrow fog pattern **aimed at the ceiling** over the stairway to contain the fire. It is imperative that this narrow fog stream is NOT directed downward into the stairwell. The main objective of this line is to stop vertical fire extension.

When advanced fire conditions are encountered and an exterior entrance is not present, the fire should be knocked down from outside the basement. This can be accomplished by:

- Applying a fire stream into the basement through a window opening, Figure 20.
- Removing the band board on the exterior. In most cases, this stream should be a straight or solid stream. The band board area is where the floor joists for the first floor meet the exterior wall. In the case of a well-involved basement, dark smoke may be pushing from this area. Opening this area in buildings of lightweight construction can normally be accomplished with hand tools or a chainsaw.
- Extend a window cut down an additional foot or two, the same band-board access point will be provided. This also creates another access/egress point which may be used later in the fire.
- Deploying a Bresnan Distributor Nozzle (may also be known as a cellar nozzle) from the exterior into the structure, placing the nozzle through a hole over the immediate fire area is preferred and most effective. Personnel must be proficient in the deployment and operation of this nozzle if it is used.

Officers must ensure that no firefighters have entered the basement. The primary purpose of the steam generated through the aforementioned methods is to extinguish the fire. If extinguishment is not possible, the fire must be knocked down so entry can be made from the interior stairs.

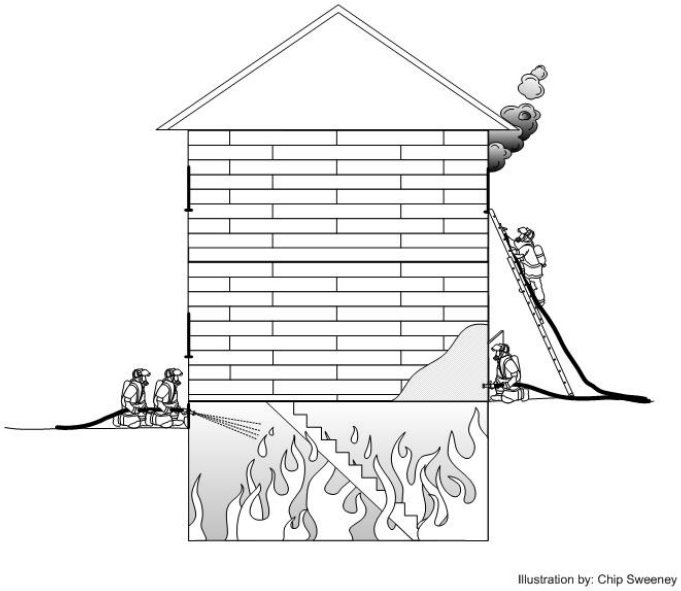


Figure 20: Hoseline placement for advanced basement fire conditions in a single-family dwelling basement with no exterior entrance.

If no exterior basement entrance or opening exists, and all other methods have been considered, an attack via the interior basement stairs may be the only option. Again, if the basement is well involved, every effort should be made to knock down the fire. Under these circumstances, the officer will need to determine if it is safe to attempt going down the basement stairs for a direct attack on the fire. The officer must carefully evaluate the structural stability, life hazard, and the fire and heat conditions at the top of the stairs. Good judgment must be exercised in deciding if it is safe to proceed down the stairs. In this case, a second handline must be in place and ready before fire attack, Figure 21.

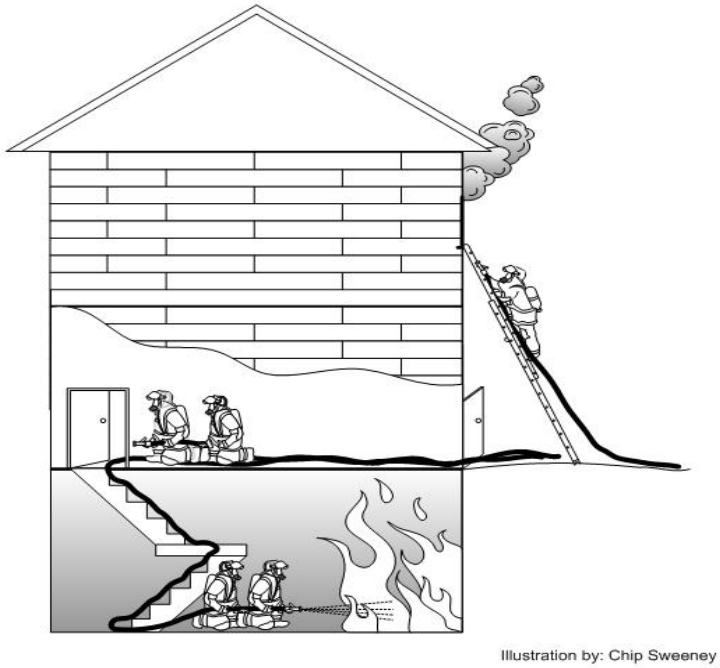


Figure 21: Hoseline placement for a basement fire in a single-family dwelling basement with no exterior entrance.

Should the fire building be of balloon-frame construction, early attention should be given to checking for vertical extension through the stud bays in the exterior walls. Fire should be expected to extend to all floors and the attic. Early attention should be given to the removal of siding as well as deployment of additional hand lines to upper floors to check for vertical extension.

Garage Fires

Knock down visible fire from the exterior and a coordinated interior attack may be initiated to extinguish the fire and any extension. Water streams do not push fire through a building, a misconception that has been disproven by national scientific studies.

The need for quick assessment of extension into the living area and attic is imperative. The attached garage fire is known for its ability to extend to upper floors and the attic. The need for companies to check these areas and have charged lines to support them is crucial.

The garage may be located under a living area. This area must be quickly checked for smoke and fire spread. Companies operating in this area should be cautious, as the fire below them has direct access to the floor members supporting them.

The fact that a garage may have two means of access offers two alternatives that may be used to proceed to the seat of the fire.

When the initial line is advanced through the overhead door, the status of the door leading to the living area must be known. The door from the garage to the living area must be closed and protected to prevent the spread of fire and/or smoke to the interior of the house. A hoseline must also be advanced through the house to the garage door to prevent extension. The fire attack must use a straight or solid stream. Firefighters should make sure the overhead door is chocked open.

If the decision was made to advance the initial line through the living area of the structure for the attack, the engine company must be ready to operate the line when the door is opened. If this door was left open at the time of the fire, the advancing engine company should anticipate encountering fire in the living area near that door. A second line should be advanced to back up the first or to proceed to the upper floors.

Many times the fire will have originated in a vehicle parked within the garage. Standard precautions associated with all vehicle fires, such as exploding bumper cylinders or ruptured fuel tanks, should be observed. An option may be to breach an exterior wall to accomplish initial knockdown. When flammable liquids are involved, they may be easily extinguished by using dry chemical extinguishers in conjunction with the hoselines. The use of foam may be employed.

Breaching the overhead door in the center about three quarters of the way up from the bottom, can, at times, provide access to the overhead door manual release. If the manual pull cord is still intact, it may be within reach of the opening made in the door. Pull the cord to disengage the door from the motor, allowing the door to then be raised.

Attic Fires

Attics are considered the space under the gabled roof. Cocklofts are considered the space under a flat roof. In both instances the size of the area will vary. Company officers should evaluate the area of involvement and gauge their tactics accordingly.

When selecting tactics for combating an attic fire, officers must evaluate the location and extent of the fire, the type of construction, and how the fire originated or extended into in the space.

The most common scenarios are:

- Fires in the living area or basement that have extended into the structural components and entered the attic via void spaces (balloon-fame construction).
- Interior fire that has vented through a window and exposes the vented soffit area.
- Fire that has originated on the exterior of the dwelling and has involved the siding and exposed the soffit area.
- Electrical fires that originate from ceiling fans, exhaust fans, and recessed lighting.
- Fire that has originated in the attic itself by natural occurrences, such as lightning strikes.
- Current or prior work done by roofers, plumbers, and/or painters.

To assist in containing the fire and slow the lateral spread, early roof ventilation should be considered. The location and extent of fire, along with construction type, must be considered. Truck positioning and the ability to vent from the aerial device or tower bucket are also factors for consideration, especially in lightweight wood frame construction.

Deployment of resources is going to be dictated by the type of construction and the degree of fire involvement. Several methods have proven successful:

1. Gaining access and placing a hose line at the level of the fire into the attic, Figure 22. This option is usually the most effective. An attic ladder needs to get to the top floor early when the officer has suspicion that fire has entered the attic space. When time is critical, consideration should be given to using available means/options of access to the attic until a ladder is available (use of a kitchen counter, dresser, bed, etc.)

2. Hooking the ceiling and directing the stream from below into the attic area. This method is not as efficient as the previous method of placing the hose stream at the level of the fire.

3. Placing a wide fog stream into an access hole is an effective method when the fire has not self-vented and the roof does not have a ridge vent. (Mass steam production.)

4. Access to the attic area by cutting an access through the gable end.

5. Distributor/cellar nozzle deployed through a hole cut in the roof while member is independently supported on a ladder or tower.

Figure 22: Gaining access to an attic fire.

In each case there must be an ongoing risk benefit analysis of maintaining an interior attack by both the IC and unit officers as to the progress of the fire and the structural integrity of the roof assembly. The interior officer should request a report from the command officer on the exterior to convey their observations as attack progresses. For example, a report of heavy steam production would indicate that the stream is effective.

In some situations, fire exposes the soffit area under the eaves, which is vented into the attic. This can be caused from fire emitting out windows, a doorway below, or from a fire that originated on the exterior of the structure. In these cases, the first task is to conduct a quick sweep of the soffit and eave line with a hose stream. This quick sweep is intended to knock down fire extending into the attic through the soffit vents. The steam conversion drawn into the attic

area can help deter fire advancement to this area before an attack on the seat of the fire is commenced.

Attacking the fire through an exterior gable vent should be considered when access to the attic area from the interior would be too time consuming due to the presence of flooring in the attic. Breaching the siding for nozzle access is also an option when interior access is not possible. A piercing nozzle, which typically flows over 100 GPM, is also an option, but the reach of its stream is very limited.

In Figure 23, several truss or joist bays have been exposed in the diagram to provide the firefighter area to project the hose stream into the attic. Projecting straight up into the space is not effective. The hose stream should be placed ahead of the fire to cut off the advance. This line is typically static, the stream is played toward the fire but the line is not normally advanced. The stream angle is often hampered by the 24 inches or less spacing of the roof joist.

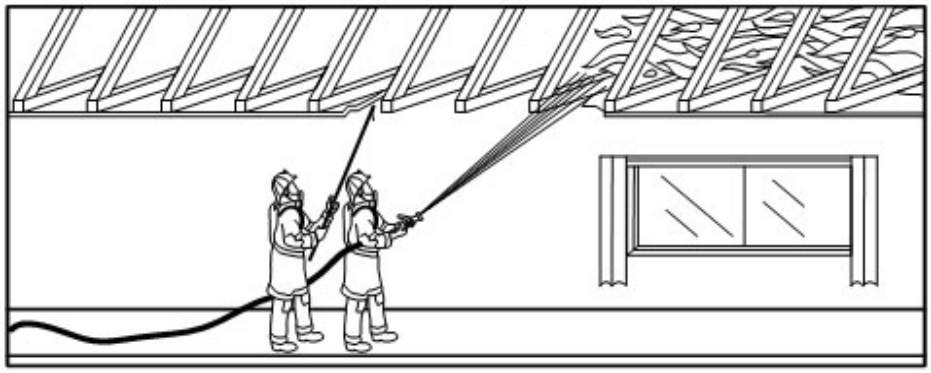


Figure 23: Projecting a hose stream into an attic.

Attic fires can be very fast moving. It is important to get a hose line ahead of the fire and into the attic as quickly as possible. Opening the ceiling and attacking the fire at the level of the fire must be accomplished in short order.

If there is active fire in the attic, multiple lines are preferred. Multiple companies will be needed to gain access to the attic area. The location of the access to the attic area must be appropriate to the situation regarding the percentage of fire involvement and structural integrity of the roof.

Company officers need to communicate the conditions in the attic to command. Command needs to keep companies on the top floor advised of changing exterior conditions. Fires in this particular area have a tendency to show differently, meaning that conditions on the interior do not “match” the exterior, and vice versa.

Pull-down attic stairs should not be used where fire has been present. These stairs are typically rated to only 250 pounds. Their integrity due to exposure to fire is questionable. An attic ladder may be needed, however in most situations the nozzle can be advanced through the opening in the 8-foot ceiling without ladders.

The IC must have an understanding of the "big picture" so the correct tactics can be employed or maintained. If the fire has overwhelmed companies operating lines on the top floor, or structural stability is questionable, crews should transition to an exterior attack. Consideration should be given to using heavy streams (preferably from a tower).

The standard gable roof has been the stage for many spectacular fires. In general, if not quickly extinguished, this roof design tends to "burn away." It represents a relatively low catastrophic collapse hazard. Companies should consider operating in areas of the structure without large dead loads above such as hallways, bathrooms, and bedrooms because the interior walls will give some protection of falling ceiling materials. Units should avoid working under open areas such as foyers due to the long, unsupported span of the truss. Keep in mind that with platform construction, the roof itself adds structural support to the top floor walls. If the roof has burned away the walls will be inherently weakened.

Members should be aware of the presence of furnaces and water heaters along with heavy storage in the unfinished attic areas. This is prevalent in larger homes with multi-zone HVAC systems. Check for multiple attics under one roof and any voids that may conceal a fire.

Wind-Driven Fires

In addition to the possibility of backdraft or flashover conditions, there is potential for wind-driven fires in residential structures, especially when windows are compromised. These fires pose a serious threat to firefighter safety. The intensity at which these fires can burn may quickly penetrate or destroy fire barriers. Numerous injuries and fatalities, both civilian and firefighter, are attributed to this type of fire. These hazardous conditions can exist with exterior winds as low as 10-20 mph. The use of mechanical or positive pressure ventilation (PPV) prior to extinguishment of the fire can also cause the same conditions of a naturally occurring wind-driven fire.

Five conditions must exist for a wind-driven fire to occur:

1. Fire in the structure.
2. Failed or open window to the outside in the fire area.
3. Presence of wind on the exterior of the structure.
4. Failed or open door to living area.
5. An unobstructed path to an outlet for the fire to vent. Example: Fire in the rear of structure venting through the front structure or fire originating outside the structure and traveling via siding into the attic space or compromised windows.

Recognition of a wind-driven fire from the street level along with proper tactical deployment of resources is critical for personnel safety. To aid in size-up of a wind-driven fire, personnel should be aware of the following:

- Presence and direction of the wind from street level.
- Failure of windows to the area of the fire.
- Lack of smoke and flames and/or intermittent smoke or flames pushing from the failed window (depending on wind/gusts).

- Presence of a large volume of fire within the fire area.

Once personnel arrive and conduct a 360° lap, they must ensure that they communicate the fire conditions to all units responding and operating on the fireground along with first due command officer. The situation report should include the volume of fire, intensity of heat felt, and temperatures observed through the use of a thermal imager, if possible. If personnel believe the fire is wind-driven, they must clearly communicate this to all units responding and operating on the fireground and the first due command officer.

If the officer or command determines an interior attack is warranted, personnel should consider doing so with the wind at their backs. This may require entering through the rear or side of the structure instead of the front door.

The National Institute of Standards and Technology (NIST) demonstrated several alternative tactics that showed positive results when personnel cannot make entry. They involve using an exterior attack:

1. Using elevated master streams through the fire window.
2. Via portable ladders.
3. With a large caliber stream and the wind at the back of the crew.

If any of these tactics are employed, communication is paramount and must be coordinated between interior and exterior companies. The exterior personnel preparing for attack must ensure that no fire department personnel are present in the structure prior to flowing water.

Coordinated ventilation is also critical to the suppression of a wind-driven fire given the intensity and behavior of these fires. ***If wind-driven fire conditions are present, no horizontal ventilation should be performed until directed by Command.***

Tactics in Large Estate Homes/McMansions

There is a huge difference in tactics from a 1200-square-foot ranch house compared to a 10,000+ square-foot mansion house, Figure 24. There are two types of large homes that we may encounter. One is a smaller house remodeled with a large addition, Figure 25. The other type is the new construction on a vacant lot or a tear down and replacement.

Figure 24: Tactics may change for single-family dwellings with large square footage.

Figure 25: Renovations can change the configuration and square footage of single-family dwellings drastically.

The larger the structure the greater the amount of contents that will be found. The building components themselves tend to be more ornate and elaborate using combustibles such as finished wood. A quick way of getting two handlines in service on the fire floor is by the use of the leader-line. Stretching the 200 feet of 2½-inch and gated wye to the fire floor landing and connecting the 1¾-inch standpipe pack hose to the gated wye will allow two handlines with minimal effort. Due to the size of these structures when using the stand-pipe pack, the distance from the wye to the fire room may require an extra section of 1¾-inch hose. An additional option is to stretch 3-inch hose and a gated wye to the fire floor landing. Companies that use a small pony sleeve on their crosslay can easily remove that crosslay and connect to a gated wye.

The larger homes can have large open foyers that can facilitate the rapid spread of smoke and fire from the lower floors to upper floors, Figure 26.

Figure 26: Open area created by high ceiling/open foyer.

Horizontal ventilation may not produce desired results due to the large open areas. Vertical ventilation from the roof may be your only option to vent the structure. The roofs and attics of these structures most often are lightweight. All lightweight roof operations must be done with members supported from the aerial.

Along with the open foyers and high ceilings it is almost impossible from below to gain access with pike poles to the attic. The region's longest pike poles either can't reach the ceiling or won't penetrate it.

Another consideration is ceiling collapse. If the fire has accessed the attic there is a good chance of ceiling collapse. With heavy HVAC units, hot water heaters in the attic, and large chandeliers, the probability of serious injuries from collapse is a major concern. If the fire has accessed the attic, stay away from the foyer area. The other areas of the structure without large dead loads above may have minor collapses because the interior walls will give some protection of falling ceiling material. Options to access the fire are to advance lines into windows over ground ladders or to use the utility rope and stretch a hoseline from the exterior. A firefighter can drop a rope from upper floors and hoist the hose up to the floor below the fire or adjacent rooms of the involved floor. If either of these tactics is used, pull plenty of hose into the room and tie it off so when the line is charged it doesn't slide out the window.

Note that these houses may have more than one kitchen. The newer homes may have a kitchen on the main level and an in-law suite in the basement. The remodeled home may have been enlarged to accommodate several families and two full-size kitchens may have been constructed to provide for numerous occupants

Firefighters may find only two people living in these large homes or you may find several families occupying the structure. A good indication of numerous occupants is the tendency to pave the entire front lawn to contain the amount of parked vehicles

Larger homes may have multiple stairways and may be remote from the front entrance (such as access stairs to upper floors from kitchen area). Some stairways may not lead to all floors and might not access the area of fire involvement. The size of the structure may require multiple fire divisions on each floor. A bottom to top foyer may lead you to divide the floor, for example, a second-floor Baker Division and a second-floor David Division.

Other considerations/ concerns in McMansions:

- Presence of indoor pool and/or spas
- Limited access
- Home theaters
- Multiple car garages
- Height of structure, in particular the upper floors out of reach of ground ladders
- Large buried propane tanks

Tactics/Considerations for Cluster Homes

These homes can offer a difficult challenge to the first alarm assignment depending on the involvement of the structure. Exposures are a major problem due to the close proximity of multiple Type 5 structures. Large diameter attack lines should be deployed as well as the use of fixed master streams. These streams can be used to darken down the fire and protect exposures. Water supplies should be preplanned. Multiple hydrants may be required to move a large volume of water in a very short period.

These neighborhoods must be preplanned with the companies that would be on the first alarm. They have very narrow alleys that can limit the access of large aerial devices. Issues can be worked out through training and an effective game plan.

Street frontage is often limited in these neighborhoods with very little access on the Charlie side. These narrow streets can provide little room for deployment of outriggers, which will make placement of the aerial device challenging. Apparatus positioning is important and room should be left for an aerial apparatus positioned on Side A of the fire building. Fire conditions may make it impossible to accomplish this without risking damage to the apparatus.

TRUCK AND RESCUE COMPANY TACTICS

NOTE: The rescue and truck company's functional duties on a single-family dwelling fire closely parallel one another. Tasks assigned, such as a search for victims and location of the fire, forcible entry, ventilation, and control of utilities, may be carried out by either of these units. Assignments specific to the truck would **normally** involve laddering. Success in preserving life and property hinges on the proficiency of the members performing these duties

Initial Actions

The initial actions of the first arriving truck or rescue will be determined by the plan of action developed from the size-up. After ensuring entry, these initial actions will generally be tactics focusing simultaneously on primary search and ventilation. Ventilation must be done to support the search as well as the advance of the attack.

Should the rescue company arrive at the same time as the truck, the rescue company will generally be assigned the task of entry and primary search and the truck is responsible for laddering, outside ventilation, and secondary search.

First Truck

The first due truck may be responsible for forcing entry into the structure. This may require only the front door or several entrances to assure efficient operations to mitigate the situation. They shall also coordinate ventilation for fire attack with the engine company.

This is usually accomplished by horizontal removing of window glass. If venting a first or second floor window, breaking windows is most efficiently accomplished by use of a pike pole. A pike pole is easy to handle and does a better job of removing all obstructions (drapes, blinds, screens, etc.) This is the preferred method when a series of windows must be taken out. Personnel shall ensure that the entire window assembly is removed and does not prove to be a hindrance to personnel attempting to vacate the structure.

Placement of ground ladders is also the responsibility of the outside crew. At times, a ladder will be used to knock out a window where the ladder is to be placed. A fire on the third floor may require the use of ground or aerial ladders and hooks. On the second and third floors, the most efficient means of accomplishing horizontal ventilation may be done by placing a ladder against the building and climbing with a pike pole that will reach two or more windows. It is acceptable to use the ladder to break the windows but remember all obstructions should be removed for maximum effect.

It should be noted that if there is a delay in the arrival of the rescue company that primary search and rescue shall be the first truck assignment. This crew shall also assist with finding the location of the fire.

Second Truck

The second arriving truck shall assist the first truck with accomplishing their assigned tasks. They will also perform salvage, utility control, checking for extension, and overhaul. They

should make a visual inspection of side Charlie of the structure and relay conditions to command. They may also assist with search and rescue.

Rescue Squad

The main objective of the rescue company will be the task of search and rescue. The primary search is often conducted before the fire is under control. This search is conducted quickly and thoroughly in areas of imminent danger. The search will normally begin in the area where the fire is located (fire floor) or the area directly above the fire, or sleeping areas.

If the rescue company is delayed, the search and rescue assignment may be assigned to one of the truck companies. When this happens, the rescue squad will be assigned other truck duties as appropriate.

Upon arrival of the other units, this officer is responsible for ensuring laddering and outside ventilation is accomplished.

Forcible Entry

The purpose of entry will be to initiate a primary search and allow access for the advancing engine company.

The task of gaining entry into single-family dwellings will generally be easily achieved using basic conventional methods.

The access point for the engine company should be at the appropriate location to initiate operations. In situations where the front door is not the primary access point, the front door should be forced but remain closed.

Rescue and Primary Search

The area close to the fire on the fire floor and the area directly above the fire, are considered to be the two most *dangerous* areas. Means of egress and sleeping areas are generally considered to be the most *critical* areas to search. The objective in a primary search will be to check these areas first. Various means may be used to arrive at these locations. Support for the primary search should include ladders to upper-story bedroom windows and hoselines engaged on the fire.

The task of executing the primary search should be accomplished quickly due to relatively small areas within most single-family dwellings. As the area to be searched increases in relation to size of the structure, there must be an equal increase in the resources to accomplish the task. This need must be identified early, and requested immediately.

When accessing the fire floor, crews should begin the search as they make their way to the fire area. Crews going to the floor above the fire must also begin searching immediately, but with the objective of quickly getting to the area over the fire first, and then searching outward from that point.

Should the tactic of vent, enter and search (VES) be used to search the bedrooms, the incident commander must be notified to avoid duplication of effort and possible injury.

The outcome of the primary search must be reported to the incident commander because this is the primary strategic focus of the operation.

Crews should also check for security barred windows. If found these should be opened either from the interior quick release or communicate to outside crews and have them removed or opened from the exterior.

> *Priority should be given to the sleeping areas and **consideration for VES must be given** if fire has possession of the stairs or the first floor is untenable.*

Ventilation

Ventilation on the fireground can be one of the most dangerous and most important tasks performed by firefighters. The technique of horizontal ventilation involves the opening or removal of windows in the structure and accomplishes several objectives aiding in the extinguishment of the fire. It permits rapid advance of the attack hoseline to the fire area while reducing the danger of heat or fire passing over or around the nozzle team by allowing heat and smoke to escape through the newly-created openings.

It is critical that all horizontal ventilation be coordinated between the ventilation team (inside or outside) and the advancing hose team. Uncoordinated, poorly located or ill-timed horizontal ventilation can cause the fire to spread rapidly, subjecting personnel inside to extreme heat and flashover conditions. The introduction of ANY additional ventilation into the structure will increase fire intensity and fire spread. We must maintain a vigilance regarding the ventilation status of the fire. Failure to recognize changes in the ventilation status can result in personnel being caught in a rapid fire propagation or flashover event.

Before any ventilation takes place, the ventilation team must answer the following questions:

- What is the location of the fire?
- What is the current ventilation status?
- Will adding additional ventilation openings affect fire conditions?
- Where is the hoseline?

Vertical, rooftop ventilation should be accomplished through common methods, when ordered by command. The discovery of a lightweight trussed roof should be made known and reacted to appropriately. Members MUST be independently supported when operating on lightweight construction. A viable and safer option is to vent the ends of a gable roof.

Mechanical and positive pressure ventilation (PPV) works well for smoke removal in these types of structures **after extinguishment**. PPV shall NOT be used in balloon-frame construction.

Ladder Deployment

The purpose of laddering is to provide access into the dwelling, and an escape route for firefighters operating within.

Laddering at a fire in a single-family dwelling should be done, at a minimum, to the front and rear of all floors above ground level, with attention given to the bedroom windows. This can generally be accomplished with ladders of 35 feet or less that are found on most apparatus at the incident scene. On large houses this may require the ground ladders from both trucks.

The need to ladder the roof at a fire in a single-family dwelling will depend on the extent and location of the fire. Generally, the roof will not need to be laddered unless the fire has entered the attic area, extended into the structure walls, nor has considerable hold of the top floor.

Before raising or extending any ladder on the scene the overhead must be checked for power lines. With enough voltage the ladder doesn't need to actually contact the wire to become energized.