



**Vincent Dunn**  
Deputy Chief F.D.N.Y.( Ret.)  
For lecture information call 1-800-231-3388



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**By VINCENT DUNN, DEPUTY CHIEF, FDNY. (RET)**



## **FIREFIGHTING AND STAIRWAYS**

In 1995, six people died on the upper floors in the stairway of a burning high-rise apartment house in Ontario, Canada. In 1998, New York City four people were killed in a smoke filled stairway on the 27th floor during a high rise apartment house fire. In 1998, three FDNY firefighters died, in a smoke and heat filled 10-floor hallway, of a high rise senior citizens residence. In Chicago, 2004, six office workers where killed in a smoke filled stairs attempting to escape fire in a high rise building. Stairways and hallways can be deadly spaces during a

fire. Fires from high rise apartment and office buildings spread to public halls. Smoke, heat and toxic gases fill up the stairways.

One of the first dangers firefighters are taught in rookie school is being trapped above a fire in a stairway. Safe firefighting practices teach members never to go to the roof of a multi-story building up through the interior stairs during a fire. If stairways are so dangerous, why don't firefighters and people avoid them during a fire? We can't. We must use stairways in our strategy and tactics. Occupants of buildings must use stairs to escape the fire. Firefighters use stairs during a fire:

- To attack a fire
- To evacuate people trapped above a fire
- To vent smoke during a fire,

The following are some guidelines for safe use of stairs and halls during firefighting operations:

### **Attacking a Fire from a Standpipe Outlet in a Stair**



At a serious fire, firefighters are advised to connect the hose to the standpipe outlet on the floor below the fire-not on the fire floor. After all the hose lengths are connected together, stretch ups the stairs to the fire floor from the floor below. This way, if flames from the fire sweep out into the stair enclosure on the fire floor and they cannot be extinguished by the hose-stream; firefighters can back down several steps and continue to discharge water into flaming doorway. The pressure and volume can be safely controlled by a firefighter from the standpipe outlet from the floor below the fire. Also firefighters up at the nozzle directing the hose stream can maintain a defensive position in the stairway below the flames sweeping out, and up the stairs enclosure. If the attack hose-line was connected to the standpipe on the same floor as the fire, flames coming out the door could force firefighters to abandon the hose-line due to spreading fire and heat. Flames also could burn the hose off the standpipe outlet and possibly trap smoke-disoriented firefighters in the hallway. It is safer to connect hose to a standpipe on the floor below.

### **Evacuate People from Above a Fire down a Stair**

As soon as possible when arriving at a serious fire, stairs must be divided up for use when there are two stair enclosures in a building. Determine your strategy, which stairs will be used for stretching the hose-line to attack the fire and which stair will be used for occupant evacuation? The attack stairs should not be used for evacuation because it will be full of smoke and heat. There should be no smoke in the evacuation stair. The door from the evacuation stair to the fire should not be opened during the fire attack. During a fire in a high rise commercial building, which has a large open floor area where flames may spread, people must be ordered to leave the vicinity of the blaze; usually this includes the fire floor and the floor above the fire. All others are directed to remain in place on the other floors, and not exit the building until

notified by the fire chief or if smoke enters their floor. At a high rise residence building fire, the strategy for people removal is different. Because residence apartments are subdivided by fire-resistive walls all people (except for the fire apartment occupants) are directed to stay in their apartments and not attempt to enter hallways and stairways. High rise buildings both commercial and residential are supposed to be fire resistive construction. Low rise buildings are not generally fire-resistive construction. People in low rise buildings are advised to immediately leave during a fire. Unlike high rise buildings which are fire resistive construction, low rise buildings are combustible and the walls will not stop flame, or protect people during a defend in place firefighting strategy.

Generally, the stair with the standpipe outlet will be the stair used to attack the fire. Also generally the smoke-proof tower (Fire tower) if present will be used for removing people from floors above the fire. Firefighters must keep the "attack stair" door open, to stretch a hose from the standpipe to the fire. As a result smoke and heat rise up this stair. The door from the stair used as evacuation should not be opened if smoke will enter the stair.

The chief in charge of the fire must warn the occupants not to use the stairway being used by firefighters to attack the fire. To do this, there must be a public address system in the building that allows the fire chief to speak to the people trapped above the fire. If there is no public address system in the high rise building to instruct occupants how to react to a fire in a high rise building, people may tragically attempt to escape the fire and leave a safe apartment and enter a deadly smoke filled hallway or stairway.

## **Helicopter myth**

Some of the people mentioned in the first paragraph of this article who died in the stairs (not the firefighters) were discovered dead in the in the stair landing above their apartments. This indicates they were attempting to go to the roof of the building. They may have erroneously thought they should escape a fire by going to the roof of the burning high rise building where a helicopter may save them. Helicopter rescue is often seen on television during floods and some high rise fires. Rescue from a high rise fire by helicopter rescue is deadly misconception of people who live and work in high rise buildings. People should never go up a stairway to the roof during a high rise fire. First of all many stairs in high rise office building do not go to the roof. They dead end at a lower floor. Other stairs in office buildings terminate on top floors and have ladders and locked hatch cover which can not be opened. Some other stairs lead into a mechanical machinery room. Smoke and deadly gas will be waiting for the people at the top of the stairs during a high rise fire, not safety. Also helicopters can not land on roof of most high rise buildings in America. And if the people are taken off the roof, they will be swinging from the end of a cable, which may present more danger than the fire in the building, only two or three people can be removed and the helicopter must take them to ground level and then proceed back up to the roof. This will take approximately one hour. Most high rise fires are extinguished within this time. Helicopter rescue is a myth and unfortunately it has become a common erroneous urban myth. And this misconception is why more people will die in smoke filled hallways and stairs of high rise buildings. People must be advised what action to take during a high rise fire. There must be a public address system in a building to direct people during a high rise fire. And finally after a high rise fire firefighters must search all stairs from the fire floor level up to the roof.

## Using a Stairway to Vent a Fire

Most low-rise buildings have only one stair enclosure. This stair immediately must be vented to prevent built-up smoke and heat. However, in low or high rise buildings with two stair enclosures, during a fire before ordering roof venting, the officer in command of the fire must consider the following factors:

- **What stair is being used for fire attack?** The attack stair must be vented because it will fill up with smoke as the firefighters attack the fire. The evacuation stair should not need to be vented. There should be no smoke in the evacuation stair because the door from this stair enclosure to the fire floor should remain closed to prevent smoke from entering.
- **Will the stack effect create a wind tunnel up the stairs?** The stack effect is the natural air movement inside a high rise building.
- **Has the stair designated for ventilation been cleared of all occupants or are unconscious or disoriented people in the smoke filled stair?** The stair used by firefighters (attack stair) is the stair designated for ventilation
- **Has smoke stratified in a stair enclosure between the fire floor and the roof, requiring positive pressure fans for effective venting?** In tall building rising smoke loses heat to surrounding walls and stops rising. It stratifies in the stair enclosure at intermediate floors.

At many fires fireground commanders do not have all this information and yet we must vent the smoke and heat from the stairs.

### **A non -attack fire**

It is rare but possible that an uncontrolled, spreading, fire in a high rise office building containing thousands of occupants could be beyond control of the local fire company. In this situation the strategy would be, to not attack the fire but, evacuate all the occupants. This would also be the strategy if several thousand people trapped above the fire were coming down all the stairs attempting to escape a fire. In this scenario, the fireground commander could decide that not to attack the fire. But keep all doors close to protect people above the fire descending down the stair enclosures. (This was the strategy at the world trade center, south tower on 9-11 after the second terrorists' plane crashed into tower number 2.)

Instead, all stairs would be used by firefighters to evacuate people from floors above the fire. Stair doors leading to the fire occupancy would be kept closed; confining the fire and preventing smoke from entering stairways trapping large numbers of people above the fire. Firefighters would assist people from the floors above down past the fire floor within all stair enclosures

### **Stair types**

There are different kinds of stairs in a building. Firefighters must be able to identify the kind of stair and know how to use it correctly during a fire. In high-rise buildings for example, there are smoke-proof stairs, enclosed stairs, and scissor stairs and access stairs. Some stairs should not be designated attack stairs. Some stairs should not be designated evacuation stairs.

### **Smoke proof stairs**

A smoke-proof stair sometimes is called a fire tower. The term used by fire protection engineers is smoke-proof stair. This is a more precise A smoke-proof stair is an enclosed stair that requires people fleeing a fire to first pass through an open-air balcony or through an

interior vestibule containing a smoke vent shaft or through an interior vestibule containing a vent shaft opening with a mechanical fan.

The purpose of the open-air balcony or interior vestibule vent shaft in a smoke proof tower is to dissipate smoke, heat or flame, so it does not follow the person entering the stair enclosure. For example, when a person leaving an office floor opens a self-closing exit door and enters the open-air balcony or interior vestibule, any smoke or heat following the occupant will dissipate into the atmosphere or up the vent shaft. The occupant inside the vestibule must open another self-closing door to enter the smoke-free stair enclosure.

At a serious high-rise fire when a fire officer decides what stair to use for evacuating people above a fire and what stair to use for attack and hose stretching, the smoke proof stair should be designated for evacuation-not for attacking the fire. This is because smoke-proof stairs, containing interior vestibules with vent smoke shafts, have created problems when used as attack stairs. At several fires, when the door from the vestibule to the occupancy was opened to stretch the hose-line and attack the fire, heat and smoke swept into the vestibule, up the vent. Smoke overflow from the vent, spread up the stair enclosure. Firefighters temporarily trapped above the fire, were forced to retreat back into the enclosed tower and to the floor below

At another fire where this super-heated chimney effect swept up the interior vestibule vent, it melted an aluminum stair guardrail enclosing a vent shaft. Firefighters crawling from the stair enclosure, through the vestibule in smoke could have fallen 20 stories down the unprotected smoke proof stairway vent shaft. Experience has taught firefighters to use a smoke proof stairs, (Fire tower) which has an interior vestibule vent shaft-as an evacuation stair, to bring people down from above the fire and not to use a smoke proof tower as an attack stair.

## **Enclosed stairs**

An enclosed stair has walls rated to resist fire for two hours and self-closing doors (rated at one- fire resistance); an enclosed stair does not have an intermediate vestibule. When you open the door from the occupancy, you enter the stair enclosure. Heat, smoke and flame follow people entering an enclosed stair when the door is open. Doors leading to enclosed stairs have spring hinges. These hinges automatically close the doors after opening. This so-called self-closing door is designed to limit the amount of smoke and heat that enter a hallway or stairway when the door is opened, however, when firefighters use an enclosed stair- to attack a fire, they must hold the self-closing door open. This allows tremendous amounts of smoke, heat and flame to enter the stair and trap any occupant or firefighters above the fire.

Generally, there are two enclosed stairs in a high rise building. An enclosed stair may be used as either an attack stair or an evacuation stair. When used as an attack stair and a hose is stretched from it to the fire, the stair enclosure above will fill up with smoke and heat. Before stretching the hose insure, as much as possible, no occupants are coming down the stair before you open the stair door to advance the hose line. If people are descending the stair does not open the door to attack the fire or you will trap them in the stair above the fire. Immediately notify the officer in command of the fire of this action taken.

## **Scissors stairs**

Some enclosed stairs are constructed as scissor stairs. This is two stairs built inside of one stair enclosure. The stairs crisscross inside the single stair enclosure. The integrity of each scissor stair depends on the partition walls that enclose the two stairs. If there are unauthorized openings in the enclosure partition and if there is no partition between stairs two stairs may become contaminated with smoke.

Scissor stairs may be used as an attack stair or an evacuation stair. Some scissor stairs open on alternate floors. One stair inside the enclosure opens on odd floors. The other stair opens on even numbered floors. A scissor stair containing two stairs, which open on, alternate odd and even floor complicate fire attack and evacuation of people at a high rise fire. Exit doors leading to scissor stairs are close proximity to each other. Exit doors are supposed to be remote from each other. If one exit door is blocked by fire the other remote stair can be used. This is not always possible with a scissor stair. One fire may block both exit doors leading to a scissor stair. A scissors stair design lives up the “letter” of the law-not the “spirit” of the law.

### **Access stairs**

Access stairs are open stairs. There is no enclosure around this stair. Access stairs spread fire, heat and smoke from floor to floor. Access stairs are decorative stairs, usually found in commercial buildings near executive offices or in duplex apartments. These unprotected open stairs allow people to go, floor to floor without going out to the public hall and using the elevator or public stairs. Access stairs should not be used to attack a fire during the initial stages of a blaze however. If the initial attack hose-line cannot extinguish the fire, an alternate hose-line may be stretched up an access stair from the floor below the fire. When a firefighter discovers an access stair on the floor above a fire or on the floor below a fire, this information should be relayed immediately to the officer in command of the high-rise fire. This may affect his strategy. If an access leads from the fire floor to the floor above this stair will spread fire to that floor. A hose line must be stretched to stop the fire spread

### **Stair Designations**

Stairs in high-rise office buildings in New York City must be labeled by identifying letters; for example, "stair A" or "stair B" or stair C." Also, the floor number must be marked next to

the identifying stair letter. The ground floor of a building may be labeled "stair A" floor # 1". The label identifying the stair enclosure and the floor number must "posted on every exit door, inside and outside. Obviously, it would be desirable if all high-rise residential buildings in New York City were so labeled.

This seemingly simple stair identification system is very important for high-rise firefighting and occupant evacuation. Firefighters searching an upper floor, discovering a fire must be able to identify the floor numbers and relay that information back to the command post. Also, when recommending to the officer in command what stair enclosure to use as the attack stair and what stair to use for evacuating people, again, the identifying stair letter readily must be determined

If letters does not identify stairs, and the floors are not numbered correctly, there can be no effective high-rise firefighting or safe evacuation of occupants from the floor above the fire.

### **Flamover fires in stairs of high rise residence buildings**



New York City high-rise housing projects have experienced several so-called 'high-intensity' arson fires in stairways. These fires could also be classified as flameover fires. A flameover fire is described as a fire that spreads along the surface of a wall, ceiling or floor. Flameover fire was first reported at the Wynncoff hotel in Atlanta Georgia in 1946 where 119 people died on the upper floor rooms. They were trapped because the stairs in the high rise hotel were engulfed in flameover fires. In New York City high rise projects small fires, in stuffed chairs and rubbish, in stair enclosures created blowtorch-like flameover fires racing up 10 or 20 floors. This was caused by the build-up of many coats of oil based paint on the stairs, ceiling and walls. This paint build up occurred because of frequent painting to remove graffiti. This combustible paint build-up allowed the flames to rapidly spread up the stairs, and in some instances-blow the roof door open and off the hinges.

To prevent this, once a rubbish fire is discovered in a stair, the officer must warn occupants and firefighters to stay out of the burning stair. Unfortunately many high rise residential buildings are not required to have stair labeling. Without stair labeling, the officer cannot designate a specific stair to be used by the occupants to leave the burning building. Also, without a public address system for all the apartments and halls, the fire chief cannot direct a safe evacuation of occupants. And in some instances firefighters radios do not work due to concrete and steel of the structure.

The fire service should attempt to have stairs identified by letter and floor number on every exit door and insist that public address systems be installed to warn occupants in all high-rise residence buildings , and firefighter radios work properly in all high rise buildings.

## **Dead-end Hallways**

A dead--end hallway is a corridor extension that goes beyond the exit door. It is a pocket in which a firefighter may be trapped during a smoky fire. Smoke filling up a hallway can disorient firefighters and cause them to be trapped during a fire. If disoriented in a smoke filled hall, and crawling past an exit door, firefighters will be trapped in a dead-end portion of the hallway. Firefighters are increasingly being trapped and killed in dead-end hallways of high rise fire resistive (fireproof) apartment houses.

### **Hallway Safety actions**



Before forcing open a door to an apartment in a high rise residence, first size-up the hall. Observe where the exit doors are located. And note the dead end portions of the hall. After the

door to the burning apartment is opened the hall may fill up with smoke and visibility will prevent a size-up. It is important to control the door leading from the public hall to the burning apartment. You do not want the door to fully open after the lock is forced allowing heat and smoke to fill up the public hall. If the fire blows out entire doorway after force entry, shut the apartment door and wait for the hose line before searching apartment. Leave a firefighter at the apartment door when entering smoke filled apartment to warn of fire buildup. If the fire increases and blows out the hallway and there is no hose line ready, after all occupants and firefighters are out, close the door to the apartment and retreat back to the enclosed stairway. Re-enter with the attack hose line.

### **Lessons learned**

To use stairs and halls effectively to fight a fire and rescue people, the following fire protection features must be in place:

1. There must be a public address system in the lobby with connecting speakers in each apartment and in the stairs, so the fire commander can make announcements and give life saving directions to occupants. They must be instructed when to leave the building and when to stay in the apartment. The stair to use for evacuation must be announced over public address system.

Unfortunately--thanks to the media especially television-many people erroneously believe the way to escape a fire in a high-rise building is to go to the roof and wait for the helicopters to rescue them. What actually happens is that they die in the stairway above the fire on their way up to the roof? Stairs, from fire floor to roof, must be searched after a fire.

2. Stair enclosures must be marked with designating letters, such as A, B, C, etc., depending upon how many stairs in the building.
3. . Each stair level should be marked with the proper floor number--1, 2, 3, etc. The ground-floor level should be marked "floor number 1," not "ground floor."
4. The stair letter and number should be marked on the inside and outside of every door leading to every exit.
5. Apartment doors must be equipped with self- closing devices (spring hinges) to close the door automatically when the person leaves to escape a fire. This confines a fire to the apartment and reduces the smoke build up in the public hallway.
6. Firefighters must size-up the hallway and determine a path for retreat in case the fire and smoke suddenly spread out into the hallway.

**Questions for Newsletter:**

1. Which one of the following is not a proper use of a stair during a fire?
  - A. To attack a fire
  - B. To evacuate people
  - C. To send people up to the roof
  - D. To vent smoke

Answer \_\_\_\_\_

2. True or False

At a serious fire high rise fire in a standpipe building firefighters should connect hose to the standpipe outlet on the fire floor.

Answer \_\_\_\_\_

3. Which one is an inaccurate statement when a fire occurs in a building with two stair enclosures?
- A. Divide stairs for attack and evacuation
  - B. There should be no smoke permitted in the evacuation stair.
  - C. The door to the fire from the attack stair may be opened to attack the fire
  - D. The door to the fire from the evacuation stair may be opened for search

Answer \_\_\_\_\_

4. Which stair type is the preferred stairway for people to be evacuated from a burning high rise building?
- A. The smoke proof stair
  - B. The enclosed stair
  - C. The access stair
  - D. The scissor stair

Answer \_\_\_\_\_

4. Which one is not a recommended firefighter safety action when forcing a door to an apartment containing a serious fire in a high rise building?
- A. Size up the hallway look for the dead end hallway and the exit
  - B. Control the door about to be force so it does not swing fully open after lock forcing
  - C. When fire and smoke prevent entry and search close door to prevent smoke buildup in the public hall

D. Always enter and search before the hose line even at a serious fire

Answer\_\_\_\_\_

**Answers for question: 1. C; 2. F; 3. D; 4. A; 5. D**