MASONRY COVERED FLOOR COLLAPSE

by Captain John Norman

Any masonry flooring must be detected and reported to the Incident Commander immediately if a fire is suspected below it.
photo by Capt. John Norman

On December 31, 1995, New York firefighters suffered a cruel blow ending a year that had been one of the worst in recent times. Another tragedy had befallen the FDNY with the death of Lieutenant John Clancy of Battalion 50. Lt. Clancy died while battling an arson caused cellar fire in a vacant Queens dwelling. The loss of firefighters at building collapses has plagued the department for decades. The worst tragedy in the department's history, the 23rd Street Fire in 1966, was a result of some of the same factors found at the fire that claimed Lt. Clancy. One factor being the sudden failure of a masonry floor supported by wooden joists.

There have been many other building collapses since the 23rd Street Fire that have injured and killed members of the FDNY as well as firefighters across the nation, including: FF Alfred Ronaldson of Rescue Co. 3 in 1991, four firefighters in Seattle Washington in 1995 and four firefighters in Brackenridge Pennsylvania in 1993. In addition, fires in Brooklyn in 1992 and Manhattan in 1995, narrowly missed causing greater casualties than the 23rd. St. fire. These serve to point out the deadly swiftness with which collapses occur, as well as the unpredictable timing of their occurrence. It is critical to the safety and survival of all firefighters that they be able to recognize the factors that cause collapses, and to know what actions to take to avoid becoming a victim of one.

Masonry Floor Construction

Firefighters have become accustomed to thinking of concrete and masonry as "fire resistive" construction, which in the literal sense it is. Concrete does not burn. High rise buildings built of poured concrete have an excellent record of fire and collapse resistance, and

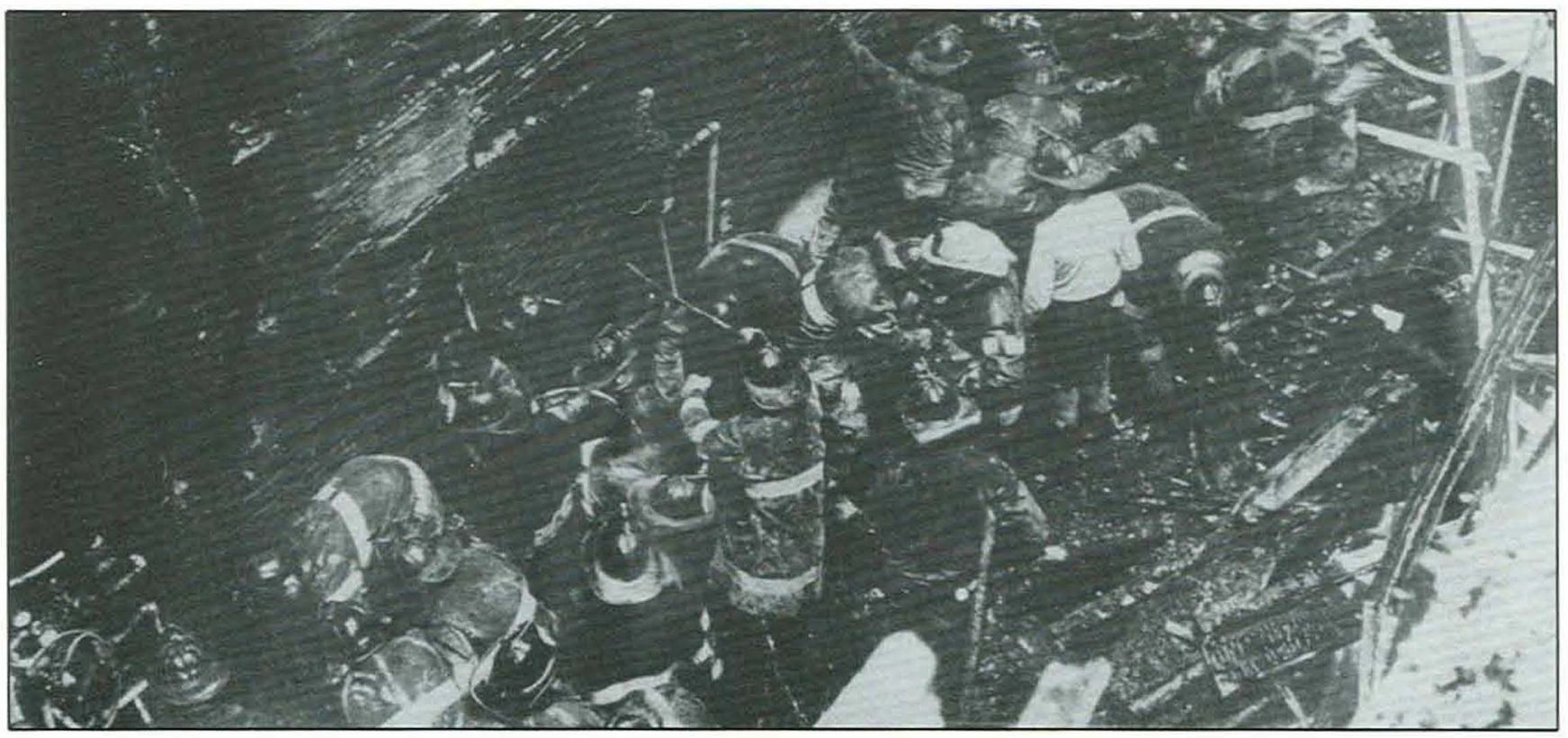
it is that record that firefighters think of when they encounter concrete. That record is based on one type of masonry—steel reinforced poured concrete, which behaves very differently under fire exposure than other types of concrete and masonry construction. Firefighters need an understanding of the various types of masonry in order to predict its behavior under fire conditions.

Concrete is a mixture of Portland Cement, aggregate (sand, gravel, or stone that is mixed with the cement), and water. When concrete is allowed to harden it forms a very dense material that is very strong in resisting compressive or crushing loads. However, concrete has very little strength in resisting loads that are applied pulling in opposite directions (called tensile loads), or loads that force one part to slide past the other (called shear loads).

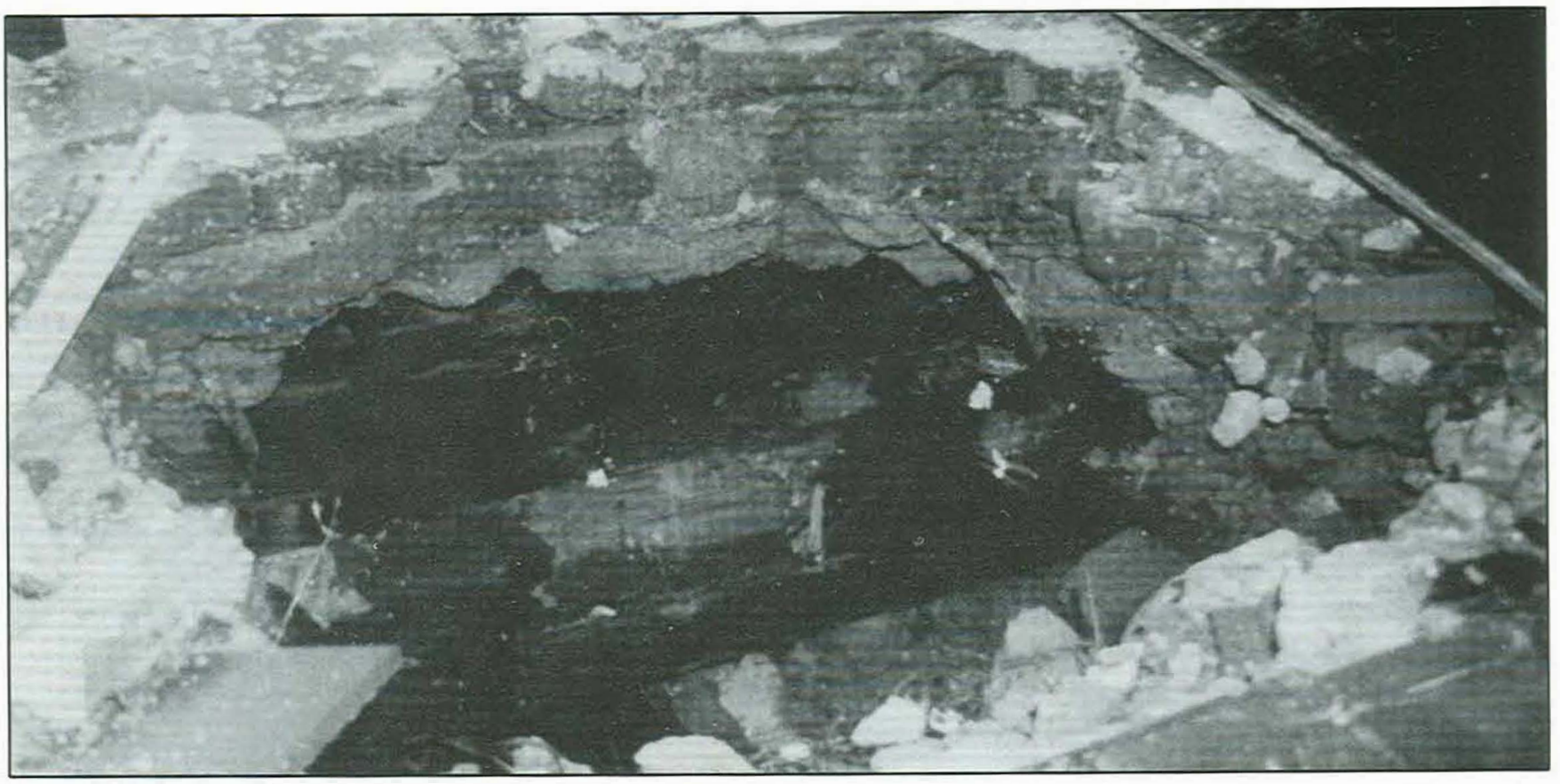
Terrazzo and tile are two other types of masonry floors commonly encountered. Terrazzo is a type of decorative concrete that uses polished marble chips as the aggregate. Tile floors use a bed of concrete (known as "mud") as a base for setting the ceramic tiles. Both types of floors behave the same as other unreinforced masonry floors.

To make concrete and masonry useful for applications like floors, some method of resisting the effects of tensile loads must be used. In modern construction, steel rods, cables or beams are stretched within the form and wet concrete is poured around them. The steel acts to resist the pulling tensile load, holding the concrete together once it hardens. In turn, the concrete acts as a shield to the steel in the event of fire, for steel exposed to high temperatures rapidly loses strength. This is known as "reinforced concrete."

Older construction methods, still commonly encountered in wood frame (Class 4) and wood joist (Class 3-Non-Fire Proof) buildings, utilize wood to support the tensile loads. Concrete, terrazzo, or "mud" tile floors are poured on top of wooden floor joists for a variety of reasons. These reasons include providing a low maintenance floor surface, sound and/or temperature deadening, or simplifying the leveling of an uneven or sagging floor. The obvious problem is that if the floor joists are attacked by fire, the concrete has nothing to help it resist collapse. The concrete compounds the problem. Its insulating properties may prevent firefighters from realizing they are operating directly over a raging fire, and the weight of the masonry adds to the early collapse potential. Concrete, terrazzo, and tile, each weighs about 150 pounds per cubic foot. A four inch thick slab of concrete resting on wood joists adds nearly 50 pounds per square foot to the load the beams are carrying. A room 10 feet long and 10 feet wide will have 5,000 pounds of dead load added to its support before a single piece of furniture is added or more importantly, before a single firefighter sets foot on it. This situation is often compounded by a desire to maintain an even floor surface, and avoid a step up at the entrance to the room with the masonry floor. One deadly practice that was common in the past saw the depth of the floor joist reduced or cut down in the area where the "mud" floor was to be poured. If the



Masonry floor collapse caused the death of 12 firefighters and officers at the 23rd Street fire. *Official FDNY Photo, FDNY Forensics Unit.*



Firefighters breaching this 11 1/2 inch thick masonry floor (quarry tile, concrete, tile & terrazzo) found the floor supported by wood joists with heavy fire involvement. *photo by Capt. John Norman*

rest of the floor was supported by 2" x 8" joists, some contractors would use 2" x 4" under the masonry. This practice allowed four inches for the concrete and tile while still fitting flush with the adjoining floor surface. These floor "joists" are dangerously undersized in an area that is now supporting an even greater floor load! Catastrophic floor collapse should be **expected** if fire attacks these joists. Unfortunately for firefighters, this condition is not visible to the members on the floor above who unknowingly set foot on this "firefighter trap."

History has repeatedly shown us that these conditions are likely to be found in specific places in various occupancies. In tenements, for example, the bathrooms often have tile floors. This is one area to observe carefully for signs of collapse, and to avoid if collapse appears imminent. Tile is commonly found in private dwellings in bathrooms as well as kitchens and rear or side entrance foyers. In taxpayers, the front sales areas often feature terrazzo or tile, while this relatively expensive feature is omitted in stock areas. One particular occupancy where large concentrations of concrete will ***always*** be found is in laundromats. The commercial washing machines produce such high torque while operating that they must always be bolted down to at least a 12-inch concrete slab. At times this slab is properly supported on reinforced concrete pillars (see *WNYF* 4/89), but at other times it has been found entirely dependent on the wood joists for support!

Actions to Take

The single most important action to take is to identify the masonry floor that is supported by wood joists, or by unprotected steel beams. The best time to discover this condition is while on Apparatus Field Inspection Duty (AFID). Discovery of masonry flooring supported by either wood joists or unprotected steel should prompt submission of a Critical Information Dispatch System (CIDS) card clearly stating the location of such conditions, i.e.: "eight-inch terrazzo floor on wood joists throughout first floor," or "Tile/mud floor on wood joists in second floor bath, NE corner." If examination indicates this was an alteration to the building, also forward an A-8 form to the Buildings Department for evaluation of the condition.

Units arriving at the scene of a fire should carefully evaluate the floor decking directly over the fire. If visibility permits, tile and terrazzo are readily observed. When smoke reduces visibility we must resort to the sense of touch. Take a heavy metal tool, such as a halligan or an axe, and forcefully strike the floor surface. Wood floors will produce a hollow sound and significant bounce of the tool. Masonry floors will produce a pronounced metallic "clank" sound with little bounce of the tool, but significant vibration if an all metal tool such as a halligan is used. Discovery of a

masonry floor above the suspected fire location must immediately be relayed to the incident commander for evaluation and possible adjustment of tactics. If conditions indicate a serious fire exists below a masonry floor supported by either wood or unprotected steel, all personnel must be removed from the area directly over the fire until the fire is knocked down and an evaluation of the structural stability of the floor has been made. A lack of CIDS information causes the incident commander to operate blindly. Discovery of masonry flooring does not automatically mean a collapse is imminent. Knowledge of the support system below is needed. If size-up of the building indicates the structure is of fire resistive construction, (for example buildings over 75-feet high), the masonry floor is likely reinforced concrete and safe to operate on or below. If the size-up indicates nonfireproof construction (Class 3) or frame (Class 4) construction, then unreinforced masonry is most likely. An old two-story taxpayer was *not* built with reinforced concrete. Operations must proceed with caution based on the assumption that early collapse is likely. An examination opening can be created at a safe area (remote from the seat of the fire, or from an entrance doorway) utilizing the hydraulic or gasoline driven jackhammers carried by rescue companies and the tactical support units.

Defensive tactics are called for if CIDS, size-up or examination indicate heavy fire attacking wood or unprotected steel joists supporting a masonry floor. For cellar fires, high expansion foam applied through as many areas as possible may control the fire. Cellar pipes or distributors may also prove useful, applied through holes breached from safe areas. Adjoining cellar walls may also be breached to permit stream access.

Once the fire has been knocked down, keep personnel off the suspect surface, as well as out from under the area until sufficient lighting and ventilation permits an examination of the area. Several of the recent collapses, including at least one firefighter death, have occurred after the fire was knocked down, during secondary searches and overhauling. If it is essential to operate on or under a slab that has had major damage to its support system, utilize the rescue company to shore up the suspect area. Consider the need for special calling the Collapse Rescue Unit.

Very rarely are collapses entirely unpredictable. In most cases, the causes have been known for years. This knowledge was bought and paid for with the lives of our comrades throughout the years. Buildings outlast the careers of even our most senior members. The factors that cause collapse such as masonry covered wood floor joists, or bowstring truss roofs, existed for dozens of years, even hundreds of years, in our older ar-

Moments after the last members left the store, the entire width of the store for the rear 40 feet fell into the cellar, with no prior warning--**other than** the presence of masonry!
photo by Capt. John Norman

eas. There is little excuse for our being unaware of a condition that is likely to kill firefighters if the building has been available for our inspection for any time. In the past one of the highest compliments that could be given to firefighters or officers was that they really knew their district and its buildings. Unfortunately, when such members retired or otherwise left an area, the information that these members had compiled often left with them. With the advent of the CIDS system over ten years ago there is no excuse for this information being unavailable to everyone. It provides the information for members regularly assigned to an area and to probies, details, or covering officers. Go into the buildings in your district and evaluate them for "firefighters' traps." Be sure that the information is forwarded up the chain of command for further action. We may or may not be able to get some of the conditions corrected, but we can at least inform every firefighter who steps foot into that building what the dangers are. The first step, identifying the hazards, is up to **you.**

About the author...

Captain John Norman is a 17-year veteran of the FDNY and is the commanding officer of Rescue Company 1. He attended Oklahoma State University majoring in Fire Protection and worked as a Fire Protection Engineer for seven year prior to joining the FDNY. Captain Norman received the Lifesaving Benevolent Association Award in 1982, the Mayor LaGuardia Medal in 1988, and the Uniformed Fire Officers Association Medal in 1992.

THE SURE CHOCK

By Capt. Richard Alles &
FF Mike Capasso

The Back to Basics article in *WNYF 2/96* described the various door chocks in use by NYC firefighters. The purpose of this article is to provide some additional information on the metal angle iron chock. This chock is beginning to be recognized as the superior chock in use today.

Members of Ladder 106 had been using a similar chock that was larger, heavier and bulkier than the one now in use. FF Mike Capasso, in conjunction with a local metal shop, formatted a metal door hinge retainer into a smaller chock, now known as *Sure Chock.*

FF Capasso and Capt. Richard Alles the commander of Ladder 106 arranged to havea local metal shop to manufacture the chocks for each member of L-106, purchasing them with the company Petty Cash Fund.

Capt. Alles presented the chock at a Division 11 Safety Committee Meeting where it was received with overwhelming approval by the officers and firefighters in attendance. Deputy Chief Philip Burns, Commander of Division 11 gave his approval for the chocks to be made available to units in Division 11 as an informal Pilot Program. A majority of Ladder companies and several Engine companies then purchased the chocks. The subsequent use of this chock by these additional units has been very successful.

The *Sure Chock* can be put on the upper hinge on entrance doors ensuring the door will not close or lock. When used on the fire door it should be placed on the lowest hinge. Units that do not yet have this new chock should be aware that if the fire door will not close they should check the hinge for its presence.