

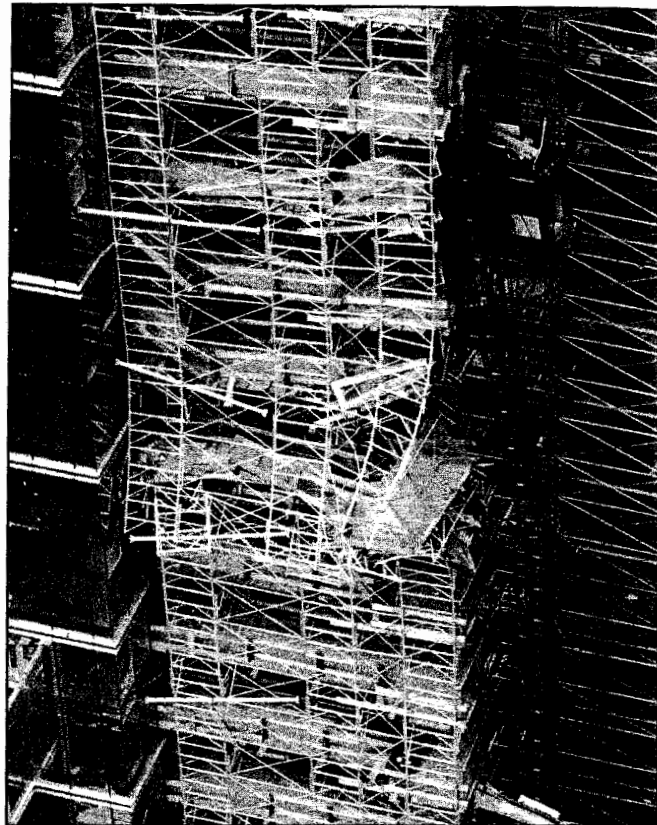
# TIMES SQUARE SCAFFOLD COLLAPSE

by Battalion Chief Raymond M. Downey

**T**here have been few incidents in the history of the FDNY where units were on the scene of an operation for 26 days. But that is exactly what happened this past summer when scaffolding used for transporting workers and equipment to the upper floors of a building under construction collapsed and initiated an FDNY operation that began on July 21, 1998, and involved 93 engine, ladder and rescue companies and 52 battalions and other units for a total of 145 Department units.

One woman was killed, a dozen people injured and thousands were evacuated from their buildings, leaving almost 500 homeless for an extended period of time. The area around Times Square was paralyzed for days and 43rd Street between Sixth Avenue and Broadway--where the scaffolding was located--did not re-open until August 18--29 days after the collapse. The economic impact was huge. Peter Kohlmann, vice president of marketing for the Times Square business improvement district, stated that 15 block-fronts and 150 businesses were shut down, affecting thousands of people. It was his belief that Times Square never had been shut down for so long a period.

The initial response came in at 0825 hours, when Manhattan dispatchers transmitted Box 795. Battalion 9 Chief Joseph A. Nardone arrived on the scene and, after quickly sizing up what had occurred, transmitted a 10-60 signal. (See "Transmit the 10-60 Signal," by Captain Terence S. Hatton, Special Operations Command (SOC), *WNYF* 2nd/98, page 11.) Upon arrival of Division 3, Deputy Chief Neil McBride assumed command. He was relieved by Citywide Tour Commander Steven DeRosa. Acting Chief of Department Peter J. Ganci, Jr., and Fire Commissioner Thomas Von Essen also responded to the scene and



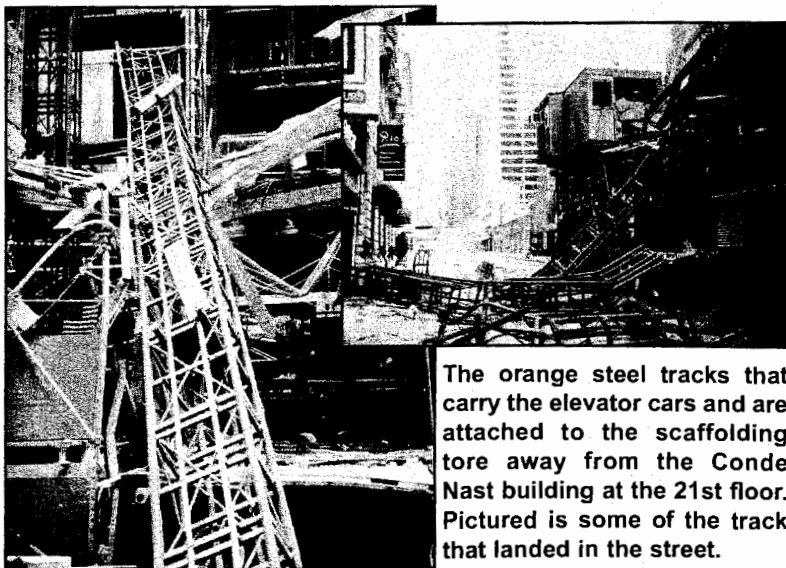
The scaffold collapse that tied up the Times Square area for 29 days and kept FDNY units on the scene for 26 days.

*all photos by Battalion Chief Raymond Downey*

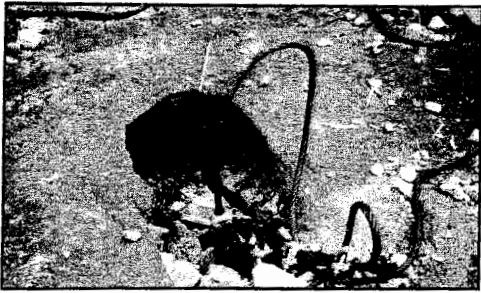
directed operations.

Construction on the Conde Nast building began in 1996, with completion scheduled for 1999. The building is listed as 48 stories, with two additional floors for machinery rooms above, bringing the height of the structure to 730 feet above street level. Erection of the upper-floor scaffolding at floors 49 and 50 was near completion when the accident occurred. Minutes before the collapse, construction workers noticed that the "tracks" that carry the elevator cars were beginning to buckle at the 19th floor. Using their radios, they notified workers on the street who were unloading a tractor-trailer at the base of the elevator that the scaffolding was about to collapse. The workers cleared the area around the scaffolding and warned pedestrians to run for cover. Ironically, this street--normally packed with morning traffic--was empty. A tractor-trailer in the process of backing into 43rd Street from Sixth Avenue caused the entire block to be free of vehicles, undoubtedly saving many lives.

Seven workers on one of the two elevator cars were able to scramble off at the 22nd floor. The oper-



The orange steel tracks that carry the elevator cars and are attached to the scaffolding tore away from the Conde Nast building at the 21st floor. Pictured is some of the track that landed in the street.



Counterweight for one of the elevators is imbedded deep into 43rd Street.

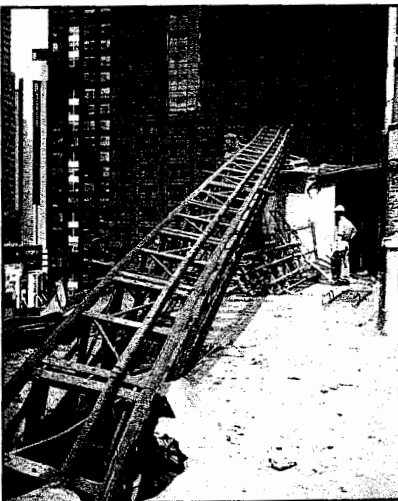
ator of the second elevator escaped from the car on the 16th floor. The orange steel tracks that carry the elevator cars and are attached to the scaffolding tore away from the building at the

21st floor. The track from the upper floors pulled away and sections of it landed on the street, in a parking garage directly across from the building and in the rear of a nine-story building on 44th Street. The largest section crashed through the roof of the 12-story Woodstock Hotel, located across the street from the scaffolded building. It was this section that penetrated the reinforced concrete roof of the hotel and killed the elderly occupant of room 1202 on the top floor. Damage to the cars on the roof of the garage and a section of the roof was significant. The counterweight for one of the cars was imbedded deep into 43rd Street.

Upon his arrival, Chief Nardone made a quick size-up of the situation. He assigned units to cover as many of the buildings as possible while awaiting arrival of the signal 10-60 units. Priority was given to the Woodstock Hotel, parking garage and building under construction. Information from units in the hotel gave a clearer picture of the extent of the damage and seriousness of the situation. A room-by-room search was undertaken and all occupants in the apartments were evacuated quickly. Evacuation commenced in all buildings on 43rd and 44th Streets, the latter of which also was in the collapse zone. Fortunately, the parking garage was free of occupants except for the workers who were able to clear out of the garage.

Rescue Company 1 was assigned to the building under construction and upon reaching the 19th floor, gave a preliminary report describing the extent of the damage at that

location. All of the aluminum scaffolding above the 19th floor had dropped down at least half the distance between floors. For example, the scaffolding marked "floor 39" actually was sitting about seven feet down from the 39th floor and seven feet up from the 38th floor. The same held true for all 30 floors above the initial area of collapse. If anyone had been on the walkways of the scaffold, a mid-air rescue would have been necessary.



The largest section of track penetrated the concrete roof of the Woodstock Hotel, killing an elderly resident within.

When Battalion Chief Raymond Downey, Commanding Officer of SOC, arrived, he was directed by Deputy Chief McBride to assess the scaffold and the potential for further collapse. Chief Downey climbed to the 19th floor by foot (all elevators had been stopped) and conferred with Lieutenant Pena of Rescue 1, who said that members of his unit had evaluated a few floors directly above the 19th floor and found the same conditions (as mentioned above). Chief Downey ordered Lieutenant Pena to begin lashing the vertical legs of the scaffolding to substantial structural members on each floor.

To get a complete assessment of the entire scaffold, Chief Downey began walking up to the top. He witnessed extensive damage. Additionally, there were building materials, oxygen and acetylene cylinders, a tool box and sections of the scaffolding hanging precariously over 43rd Street. Another scaffold and hoist--used for bringing materials up from lower floors--were located 20 feet to the west, in direct line with the collapsed scaffold. Evaluating the conditions and the potential for secondary collapse, Chief Downey recommended to Citywide Tour Commander DeRosa that the collapse zone be enlarged to include the distance that both these scaffolds could reach in the event that a secondary collapse occurred.

It was necessary to evacuate FDNY members from the Woodstock Hotel. Information received indicated an elderly resident still was missing. Members were forced to stop the search. (They returned later and found the victim under debris in her room.)

It was estimated that each floor of scaffolding weighed approximately 8000 pounds, including the scaffolding, planking for walkways, support members and the track for the elevators. Some levels of the scaffold also had building materials and debris on them. The condition of the collapsed scaffolding, the loose materials, the extreme weight supported by the lower section of scaffold and the uncertainty of what would happen if the remaining scaffolding collapsed dictated that the safest approach be followed.

The Office of Emergency Management (OEM) was on the scene and when everyone had been removed from the collapse zone, a meeting of all agencies was held. The Fire Department assumed the role of Incident Commander per the Mayor's document, "Direction and Control of Emergencies in the City of New York." The Incident Commander is responsible for the management of the City's response to the emergency. OEM is designated the "on-scene inter-agency coordinator." Representatives from Conde Nast and the other involved buildings were included in the meeting, too. These meetings were held every day until conclusion of the operation.

During the initial meeting, there were many issues that needed clarification and not every issue had an answer. The meeting began with a discussion of the status of the scaffolding and potential for further collapse. When conditions were described and explained, many attendees questioned the seriousness of the situation. This doubt changed quickly when they had the opportunity to view the extent of the damage.

Based on the available information, it was decided to

extend the collapse zone in all directions. A 700-foot-high scaffold can travel that distance and further, which dictated closing many streets in the immediate area. Three hundred of the 600 rooms in the Millennium Broadway Hotel had to be closed. These 300 rooms faced south and were in direct line of the scaffold. Although they were located on 44th Street, they were less than 700 feet from the scaffolding.

Many stores were closed and additional evacuations from residences were necessary. Permission was granted to go back into the Woodstock Hotel and search for the missing resident. Members of Rescue 3 accomplished this within a short period of time. All apparatus was removed from the collapse zone and the command post was established on Sixth Avenue, out of the direct line of the scaffold.

Construction personnel were as perplexed as everyone else regarding the cause and remedy for correcting the situation. Even the company that had erected the scaffolding never had experienced such an incident. Several theories were offered to explain why the scaffolding collapsed:

- One witness reported that he saw the crane located on the roof of the building strike the elevator track while lifting a load of material. This proved to be unfounded.
- Another theory was that the elevator hoisting system was missing some nuts and bolts.
- The scaffolding itself was suspected of being faulty, causing it to fail and put intense pressure on the elevator track.
- The theory receiving the most attention, however, focused on a report that some of the horizontal supports were removed to put the glass panels in place and that the supports were not replaced by the time the collapse occurred.

Additional units were assigned to work with Rescue 1 to help secure the remaining scaffolding. Every piece of available rope and cable was used in this effort. This operation continued until all floors were covered. There was no guarantee that the scaffolding would be held in place with this method. Most of the first day of the operation was spent evaluating the remaining scaffolding and elevator hoist, examining the horizontal supports to the scaffolding on each floor and developing a plan to stabilize and then remove the entire scaffold.

Further investigation revealed that damage was more severe than first believed. Developing a viable plan included bringing in outside construction consultants. During the nighttime hours, lighting was supplied by both Tactical Support Units and industrial "Hollywood" lights.



Horizontal supports to the scaffolding were examined and evaluated.

Transits were set up on the east and north sides of the incident to monitor movement of the scaffolding. These transits (carried by both Tactical

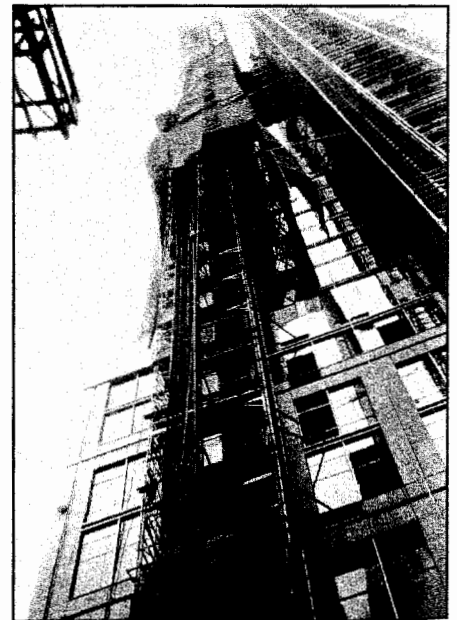
Support Units and the Collapse Unit) remained in place until the conclusion of the operation. A few days into the operation, the construction company provided another transit on the 21st floor to monitor the area where one of the elevator cars had collapsed into the scaffolding. This was considered to be one of the most unstable areas. Another transit was placed at the 30th floor where major damage had occurred. A firefighter with radio communications was stationed at these locations at all times. He was instructed to inform the command post any time movement was indicated. Pressurized air horns were placed at strategic locations in the event it was necessary to transmit an emergency evacuation signal.

The morning of the second day began with the daily meeting. A situation status report was given by all agencies. Reports of traffic problems, train station closings, bus rerouting, relocation of residents from hotels and apartment houses, business concerns, needs of the elderly who had been evacuated and were unable to take their medications, glasses, pets, etc., were addressed during the meeting. The construction company personnel revealed their plans, which were discussed at length. A new glossary of construction terms became common buzz words for the next month.

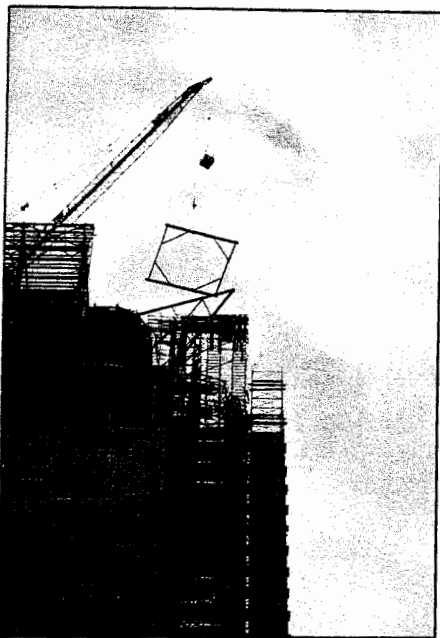
The plan developed by the construction company needed the approval of the Building Department, which had complete control over all plans for this operation. Likewise, the Fire Department was involved with all decisions made to rectify the situation. Safety was first in everyone's mind.

The first concern in developing the plan was to provide a means by which the entire scaffold (all 50 floors) could be secured in such a way to prevent loose debris, scaffolding, wood planks or piping to fall or scale away from the structure and become an airborne missile. Many ideas were considered, but the one selected was to completely encase the entire scaffolding in netting. This would produce a cocoon-type environment.

The first big question: How do you hold a netting that would be more than 730 feet high on four sides and secure it well enough so it wouldn't become a giant sail? Every detail of the design was taken into consideration--weight bearing, support cable size, methods of securing and putting it in place--and given serious thought. It was decided that a box 36 feet square would be needed to support the curtain. What would hold the



"Cocoon" encases the entire scaffolding in netting and prevents dislodged debris from falling to the street.



**Structural steel box and "A" frame are hoisted into position.**

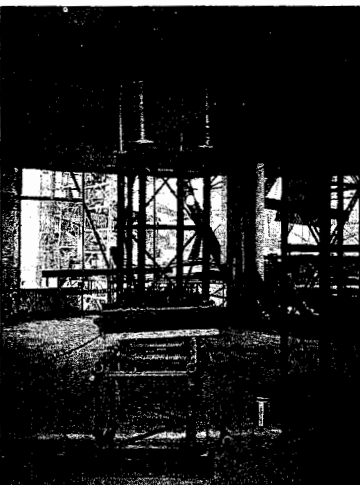
box? An "A" frame was designed and fabricated on the roof and set into place at a 28-degree angle over the scaffolding. Both the "A" frame and box were made of structural steel.

Calculations for these designs included a safety factor. The box was hung from the "A" frame with four steel cables attached to a ring on the "A" frame. The next step involved securing cables to the box from which the netting would be

attached. It was necessary to have 10 cables secured to the box to hold the netting. These cables had to be put in place in a "balancing" order, so stability of the system would not be upset. The number-one priority was not to disturb the scaffolding and cause debris or scaffolding to become dislodged.

Construction workers operated in man baskets secured to the crane's main line. FDNY members used handie-talkies to relay information to the workers in the baskets. Additionally, construction workers were directed by hand signals to ensure their safety as they attached these cables to the box.

While this operation was taking place, work inside the building included assembling "needle beams," to provide support to the scaffolding. These needle beams were



**Needle beams were used to support the scaffolding. For every foot of beam out from the floor, it was necessary to keep a foot and a half in on the floor.**

assembled by using the five-foot sections of what was used as tracks of the elevator hoist. Each section weighed 250 pounds and they were bolted together to form the beam. The needle beams then were placed out and under the collapsed scaffolding. For every foot of beam out from the floor, it was necessary to keep a foot and a half in on the floor. A 20-foot beam placed under the scaffold would have 30 feet back on the floor area. The section of beam back on the floor area had to be secured properly and shored to maintain its stability and

prevent it from tipping over. These needle beams were strategically placed on floor areas where they would provide the most support.

Additionally, because of the design of the building, it became necessary to provide additional shoring to the floor areas. The corner areas were provided with steel shoring to support the additional weight of the beams. Engineers also were concerned about the stress being placed on all floors from the collapsed scaffolding.

What many optimistic observers had hoped would be a quick resolution to the problem would find that the work needed to complete the primary mission of stabilization would not be accomplished as quickly as expected or hoped.

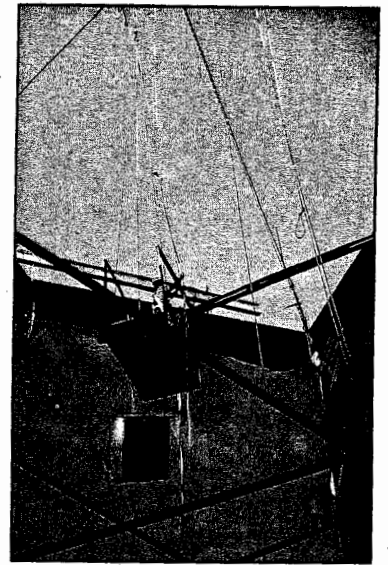
Fire Department personnel were stationed in each work area, providing both fire protection and lifesaving capabilities. Emergency Medical Service (EMS) paramedics were stationed alongside the Rescue and Squad Companies.

When the netting was in place, "curtain rods" (a term coined by Fire Commissioner Thomas Von Essen) were placed every 100 feet from the top down to secure the netting and prevent it from blowing in the wind. Before removing scaffolding, additional security of the netting was required. "Belly banding" was used to meet this objective and help secure the scaffolding. Cable was wrapped completely around sections of the scaffolding and secured to columns on the floors.

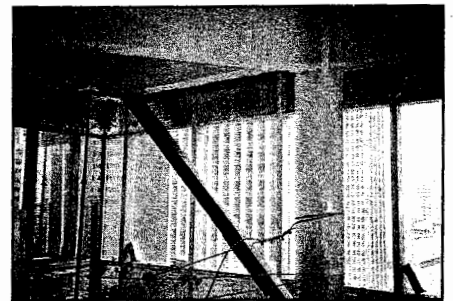
On the 46th floor, wood planking and a tool box were protruding out of the scaffolding, causing a serious concern. So, engineers designed a "diaper," which would assist in preventing any dislodged debris from falling to the street. The diaper was actually safety netting that was positioned under and around the debris and secured to the floor area without disturbing the load.

In the street, sidewalk sheds were built to deflect any falling debris and lessen damage. Additionally, they provided pedestrian protection when the streets were re-opened.

Once the scaffold was secure and enclosed, surrounding structures were evaluated. One of the supporting legs of a large water tank on the roof of the Woodstock Hotel had been damaged.



**Man baskets were secured to the crane's main line.**



**Corner bracing of steel shoring was necessary to support the additional weight of the needle beams.**

Inspection of the tank system indicated that it was in good condition and did not need any additional support.

To provide additional cable lines for the removal of the damaged scaffold and debris, two derrick cranes were assembled on the roof. These cranes come in sections and are assembled in place. They bolstered the presence of the one crane that had been used since the beginning of the incident.

During the round-the-clock operation, SOC provided portable lighting on all floors. (See "The Kelly Kart™," by Battalion Chief Ray M. Downey, *WNYF*, 3rd/98, page 5.)

### **Scaffold becomes secure, streets open, tenants move back in**

As more of the scaffolding became secure, more streets were opened and tenants allowed to move back in. Discussions continued on the best way to dismantle the scaffolding. The company that assembled the scaffolding would be the one to dismantle it. This was far from a typical disassembly job. On many floors, workers had to climb out on the sides of the scaffolding to reach areas that could be disassembled. Safety lines were placed on all workers working out on the scaffold, while Rescue Company members had rope systems in place in case an accident occurred and workers had to be reached. A written site safety plan was drawn up and issued to all agencies and workers. Only infrequently did work stop due to wind and/or rain conditions.

On day 14, all preliminary work was completed and the actual scaffolding dismantling began. The two derricks had been erected, a safety plan for scaffold removal was ready and the work schedule was changed to a 13-hour day to take advantage of the daylight. It would have been extremely dangerous for workers to be working from both the basket and on the scaffolding at night. Thus, daylight to dusk hours were deemed most effective for this operation. Debris was removed to a pier in Brooklyn and stored, pending completion of the investigation.

Investigators identified certain pieces and sections that they wanted marked and held. Laboratory tests would be conducted to determine if there was a failure of the material. Charting of each piece and section was implemented. The dismantling began the afternoon of day 14 and continued until dusk.

Fire Department members with radios were stationed at each derrick crane and the main crane. Rescue teams were in place with the work crew. A Squad Company stood by--acting as a firefighter assist (FAST) team--and a 2 1/2-inch hand-line was in place. Paramedics were stationed near the work area. (Most of these paramedics had attended the 40-hour collapse course given at the Bureau of Training in the Rescue School.) A chief officer supervised all operations and was on the scene 24 hours a day. When work on dismantling the scaffolding was finished for the day, work was started in other areas.

Daily meetings continued, but the number of personnel required to attend grew smaller, a sure sign of progress. Businesses were re-opening, streets were opening, trains

were moving, buses were back on their normal routes and residents were returning to their apartments.

From the start of the incident, the number-one logistical problem was elevators. The scaffolding that collapsed was equipped with the hoist and elevator that transported workers to all floors. The adjoining scaffold was used mainly for materials. Unable to use either one, workers, rescuers and material were transported via a small construction elevator. In the early stages of the operation, this created major problems. The passenger elevators were under construction and terminated at the 15th floor. It was not practical or sensible for members carrying tools and equipment to ride 15 floors and then walk 35 floors. Eventually, one passenger elevator was finished so that it did go to the upper floors.

As the scaffolding started to come down, more businesses and streets were opened. Nearing completion of the scaffold removal, only 43rd Street between Broadway and Sixth Avenue remained closed. Life was getting back to normal in the area.

Where possible, work continued on the surrounding buildings. The parapet of the hotel had to be removed. The fire escape on the rear of a building on 44th Street was damaged seriously and an alternative had to be provided for a secondary means of egress if the building was to be occupied. Residents of the Woodstock Hotel were allowed to enter and retrieve personal items after work had stopped for the day. Building inspectors made inspections of all the damaged structures.

### **FDNY commitment downsizes**

As the work progressed, the FDNY commitment was able to downsize. The field communications mobile command center was on the scene for the entire 26 days and played an integral role in assisting the incident commanders with day-to-day operations. The Mayor's Office of Emergency Management also had their command vehicle on-site. For an extremely difficult operation, it turned out to be a very safe and effective one that concluded without any injuries. The well-coordinated operation is a credit to all the agencies and construction companies that worked together to make it happen.

Those firefighters who worked with the construction workers learned many construction terms and techniques. Department members were able to incorporate valuable drill time with this operation. The construction workers appreciated the fact that FDNY members were standing by, ready to spring into action in the event of any problems. All FDNY members performed in an admirable way and are to be commended again for being the Bravest and upholding the highest traditions of the Department.

### **About the Author...**

*Battalion Chief Raymond M. Downey is a 36-year veteran with the FDNY and heads up the Special Operations Command. He is a Contributing Editor for Fire Engineering, the author of The Rescue Company, a regular contributor to WNYF and a frequently requested speaker and instructor throughout the country. He holds an AAS Degree in Fire Science.*

