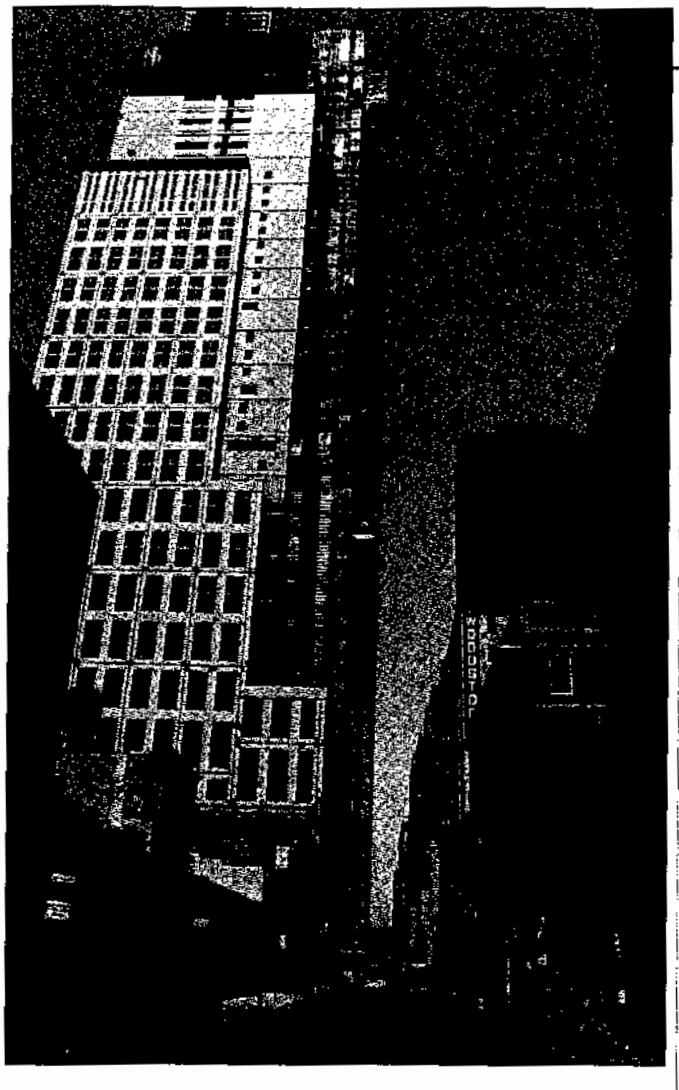
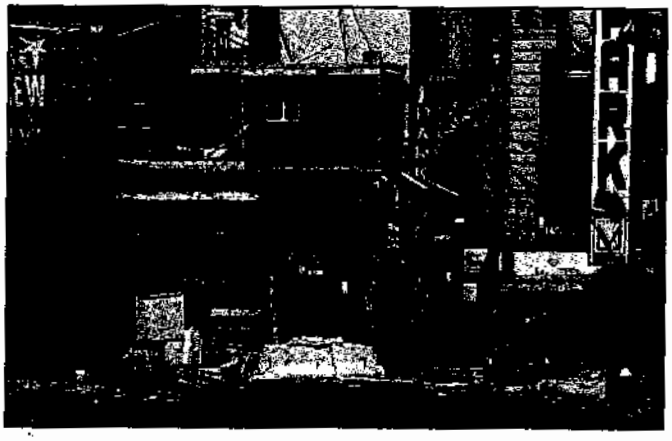
TIMES SQUARE SCAFFOLDING COLLAPSE



BY RAY DOWNEY



(Top left) A 50-story scaffolding collapsed at the 19th floor of the Conde Nast building, under construction, at 4 Times Square in New York City. Another scaffolding is directly behind the collapsed scaffolding; it looks like part of the collapsed scaffolding. (Top right) Collapsed track used to carry elevator cars at street level. (Bottom right) Note the missing track on which the hoist car rode. Those sections landed on the street and a hotel across the street. (Photos courtesy of Fire Department of New York.)

THE FIRE DEPARTMENT OF NEW YORK (FDNY) responded to more than 450,000 alarms in 1997. These incidents usually lasted from five minutes to a few hours; some lasted a day or longer. Imagine an operation that lasted for 26 days. It happened in the summer of 1998 when scaffolding used for transporting workers and equipment to the upper floors of the Conde Nast building, which was under construction, collapsed. Construction on the building began in 1996 and is scheduled to be finished sometime this year. The building is listed as 48 stories, with two additional floors that are to be used as machinery rooms, 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.

One woman was killed; a dozen people were injured. Thousands were evacuated from their buildings, leaving almost 500 homeless for an extended period of time. The area around Times Square was

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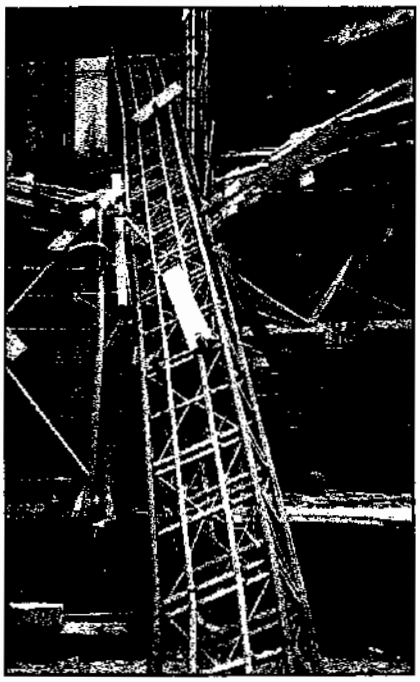

(Top left) This section of track crashed through the roof of the Hotel Woodstock, dropping ceiling and roof material. The elderly occupant of the top-floor apartment directly below was killed. (Top right) Part of the collapsed track landed in the street directly below the collapsed scaffolding. (Bottom left) Debris and parts of the hoistway car landed on the roof of a hotel across the street from the collapsed scaffolding. (Bottom right) This section of track dropped from floors above the 20th floor to the street. (Photos by author.)

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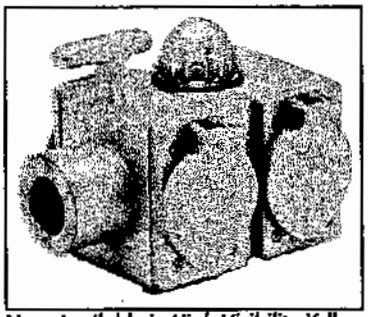

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paralyzed for days, and 43rd Street between Sixth and Broadway, where the scaffolding was located, didn't open until August 18—29 days after the collapse. The economic impact was significant. Peter Kohlmann, vice president of marketing for the Times Square Business Improvement District, stated that 15 blockfronts and 150 businesses had been shut down, affecting thousands of people.

INITIAL RESPONSE

The scaffolding collapse started an operation that ultimately involved 145 FDNY units. The initial report came in at 0825 hours on July 21, 1998, when Manhattan dispatchers transmitted Box 795. Battalion Chief Joseph Nardone of the 9th Battalion arrived on the scene. After a quick size-up, he transmitted a 10-60 signal.[1] The 3rd Division arrived; Deputy Chief Neil McBride assumed command. He was relieved by Citywide Tour Commander Steven DeRosa. Acting Chief of Department Peter Ganci and Fire Commissioner Thomas Von Essen responded to the scene and directed operations.

THE INCIDENT

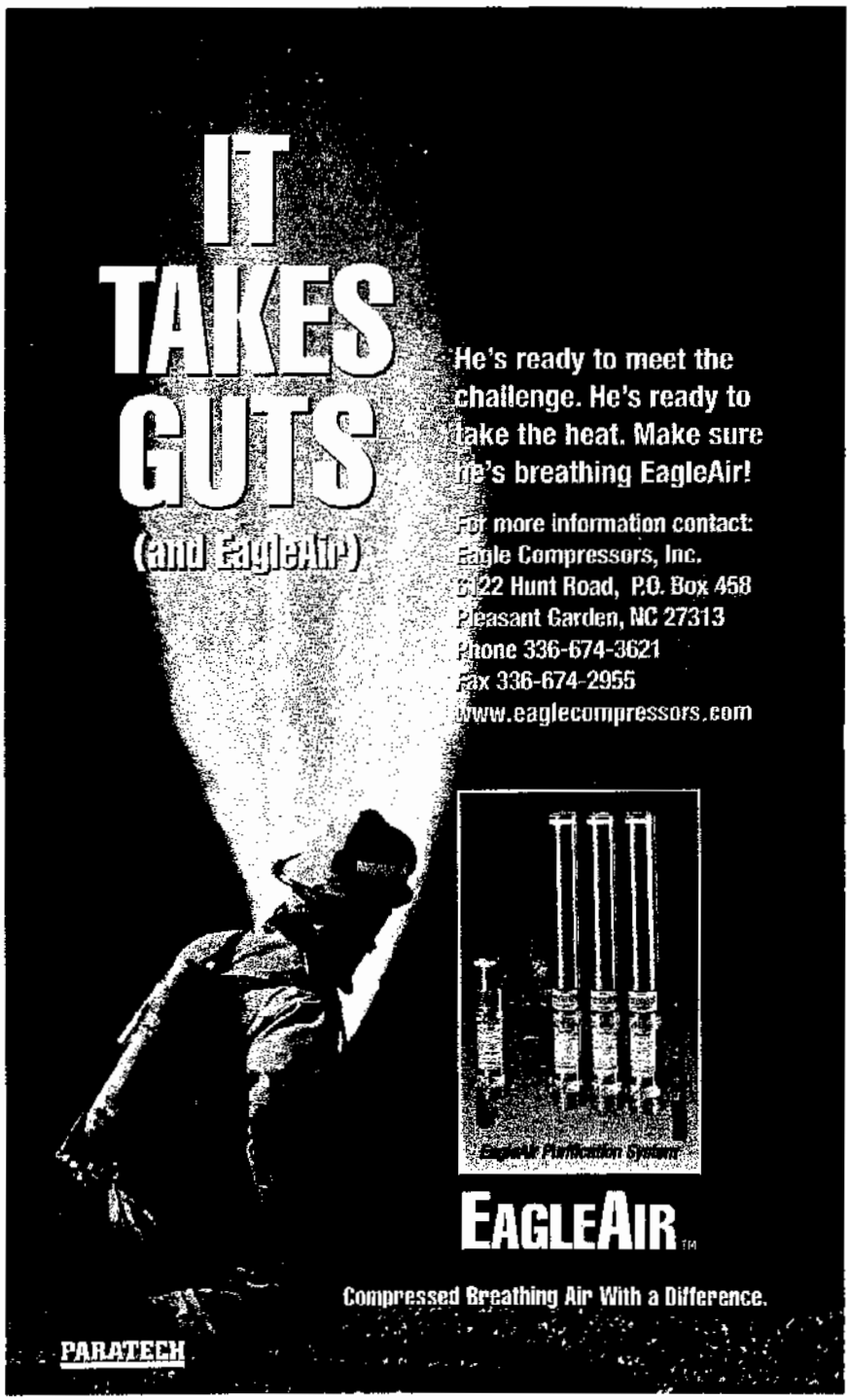
According to construction workers, they noticed, minutes before the collapse, that the "tracks" carrying the elevator cars were beginning to buckle at the 19th floor. Using their radios, they notified

workers on the street, who were unloading a tractor-trailer at the base of the elevator, warning them that the scaffolding was about to collapse. Quickly, the workers cleared the area around the scaffolding, warning pedestrians to run for cover.

Ironically, a 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 operator of the second elevator escaped from the car on the 16th floor. The orange steel tracks carrying the elevator cars, and 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 Hotel Woodstock, located across the street from the scaffolding. This section penetrated the reinforced concrete roof of the hotel, killing the elderly occupant of Room 1202 on the top floor. Damage to the cars on the garage roof and a section of the roof was significant. The counterweight for one of the cars was imbedded deep into 43rd Street.



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EXPOSURES SEARCHED

While awaiting the arrival of the 10-60 units, Nardone began assigning units to cover as many of the exposure buildings as possible. Priority was given to the Woodstock Hotel, the parking garage, and a building under construction. Occupants of the hotel were evacuated. Units inside the hotel assessed the extent of the damage and conducted a room-by-room search.

Occupants of all buildings on 43rd and 44th Streets—in the collapse zone—also were quickly evacuated. Fortunately, the only occupants of the parking garage were workers, who exited the garage.

Despite reports that an elderly resident of Hotel Woodstock was still missing, department members had to stop their search for the victim and vacate the building. (They returned later and found the victim under debris in her room.) Each floor of scaffolding was estimated to weigh about 8,000 pounds (including scaffolding, planking for walkways, support members, and the elevator track). Some floors also had building materials and debris on them. Taking into account the condition of the collapsed scaffolding, the loose materials present, the heavy weight being held basically by the lower section of the scaffolding, and the uncertainty about what would happen if the remaining scaffolding collapsed, these safety measures had to be taken. The members of Rescue Co. 3 located the victim shortly after they had received permission to reenter the building and resume the search.

THE ACCIDENT SITE

Rescue Company 1 was assigned to the Conde Nast building and gave a preliminary report of the extent of the damage at the 19th floor. They reported that 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" was actually sitting about seven feet down from Floor 39 and seven feet up from Floor 38. This was the

case with all 30 floors above the initial area of collapse. Anyone on the walkways of the scaffolding would have had to be rescued from midair.

On my arrival, I was directed by Deputy Chief McBride to assess the scaffolding and the potential for further collapse. When I reached the 19th floor by foot (all elevators had been stopped), I conferred with Lieutenant Michael Pena of Rescue 1, who informed me that members of his unit had evaluated a few floors directly above the 19th floor and found the same conditions. I requested that he begin lashing the vertical legs of the scaffolding to substantial members on each floor and get a complete assessment of the entire scaffolding.

I began walking up to the top floor by floor. I could see that the damage was extensive. In addition, building materials, oxygen and acetylene cylinders, a tool box, and sections of the scaffolding were hanging precariously over 43rd Street. Twenty feet to the west of the collapsed scaffolding were another scaffold and the hoist used for bringing materials up from the lower floors. The hoist was in direct line with the collapsed scaffolding. Evaluating the conditions and the potential for secondary collapse, I recommended that the collapse zone be enlarged to include the distance both of these scaffolds could reach if a secondary collapse were to occur.

PRELIMINARY MEETING

When everyone had been removed from the collapse zone, a preliminary meeting was held. Representatives of all involved agencies and of the Conde Nast and other buildings involved attended. A daily meeting was held thereafter until the conclusion of the incident.

The mayor's Office of Emergency Management (OEM), designated the "on-scene interagency coordinator," arrived on the scene. The fire department assumed the role of incident commander, in accordance with the Mayor's document "Direction and Control of Emergencies in the City of New York." The incident commander is responsible for managing the city's response to the emergency. During the initial meeting, many issues needed to be clarified. Not every issue had an answer.

THE STATUS OF THE SCAFFOLDING

The first issue discussed was the current status of the scaffolding and the potential for further collapse. At first, many of the attendees doubted whether conditions were as serious as reported. This attitude quickly changed after the extent of the damage had been assessed close up.

Based on the available information, the collapse zone was expanded in all directions. A 700-foot-high scaffold can travel that distance and further. This necessitated closing many streets in the immediate area. Three hundred rooms out of the 600 in the Millennium Broadway Hotel had to be closed. These rooms, which faced south, were in the direct line of the scaffolding. Although they were on 44th Street, they were less than 700 feet from the scaffolding. Many stores had to be closed and additional residences evacuated.

After the recovery of the victim in the Hotel Woodstock, all apparatus were removed from the collapse zone. A command post was established on Sixth Avenue, out of the direct line of the scaffolding.

CAUSE OF THE COLLAPSE

No one, not even the construction company that erected the scaf-

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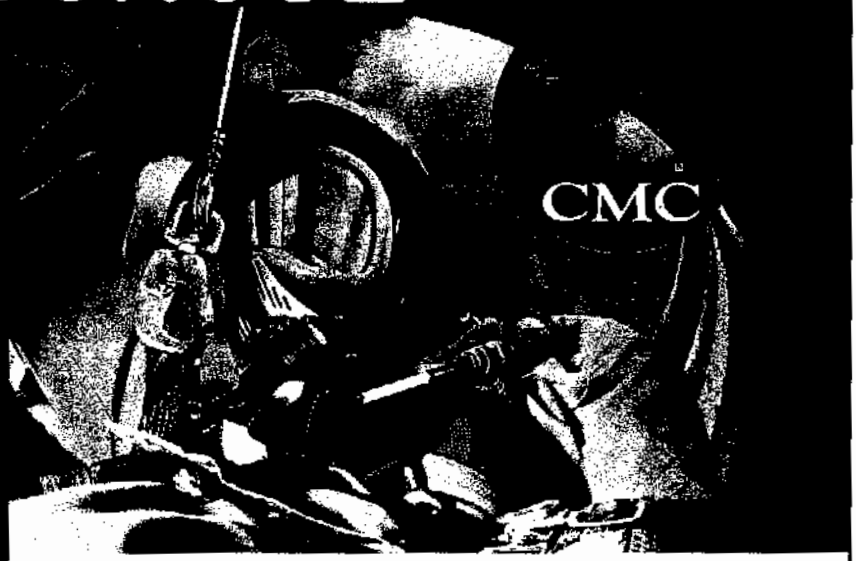

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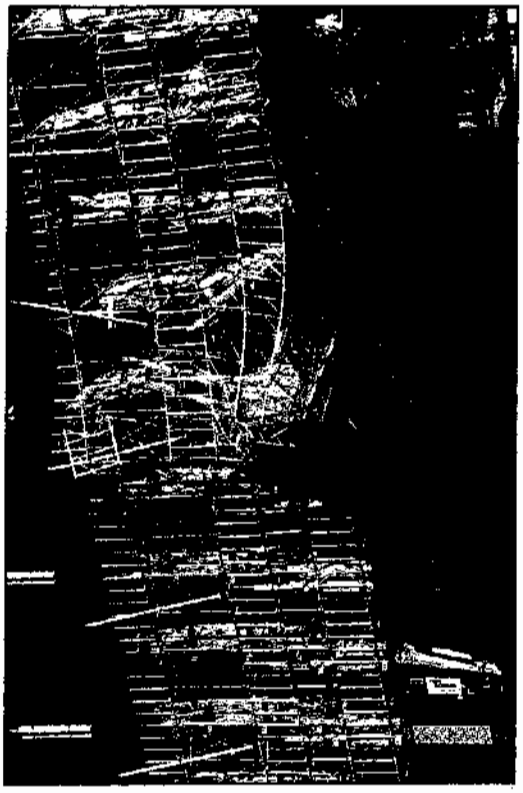
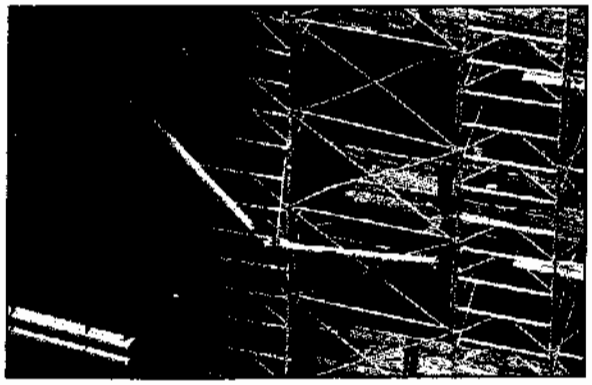
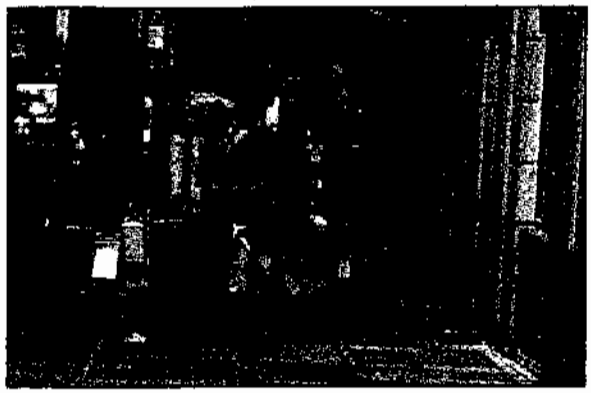






(Left) Close-up of the damaged scaffolding and broken horizontal supports. (Top right) This horizontal support was broken in half. These supports provided stability to the scaffolding at each floor. (Bottom right) Transits were set up to monitor the movement of the scaffolding. Firefighters with radios stationed at the transit sites were instructed to notify the command post if any movement was observed. (Photos courtesy of Fire Department of New York.)

folding, knew why the collapse had occurred. A number of reasons were offered. One witness reported that he saw the crane on the building's roof strike the elevator track while lifting a load of material. This report was discounted. Another possible explanation was that some nuts and bolts were missing from the elevator hoisting system and the scaffolding was faulty, thereby causing it to fail and put intense pressure on the elevator track. The explanation getting the most attention was that some of the horizontal supports had been removed to put glass panels in place and had not been replaced by the time of the collapse. The report was still being investigated at the time this article was prepared.

SECURING THE SCAFFOLDING

Most of the first day was spent evaluating the remaining scaffolding and elevator hoist, examining the scaffolding's horizontal supports on each floor, and developing a plan to stabilize and then remove all scaffolding. Additional units were assigned to assist Rescue Company 1 in securing the remaining scaffolding. Every piece of rope and cable available was used in this effort. Orders were given to continue this operation until all the floors were covered. It was not known whether this approach would be successful in holding the scaffolding in place.

Further investigation revealed that the damage was more severe than originally had been thought. Outside construction consultants were called in to help develop an operational plan.

Transits to monitor the movement of the scaffolding were set up on the east and north sides of the incident; they remained in place until the operation was concluded. The transits were provided by the FDNY tactical support and collapse units, which carry them. A few days into the operation, a transit, provided by the construction company, was installed on the 21st floor to monitor the area where one of the elevator cars had collapsed into the scaffolding—the area considered to be one of the most unstable on the site.

Another transit was placed at the 30th floor, where major damage had been sustained. Firefighters with radios were stationed at these locations at all times and were instructed to notify the command post if any movements were observed in these areas.

Pressurized air horns were placed at strategic locations in case it became necessary to transmit an emergency evacuation signal.

During the night hours, lighting was supplied by FDNY tactical support units and industrial "Hollywood" lights. During the around-the-clock operation, FDNY Special Operations Command provided portable lighting on all floors.[2]

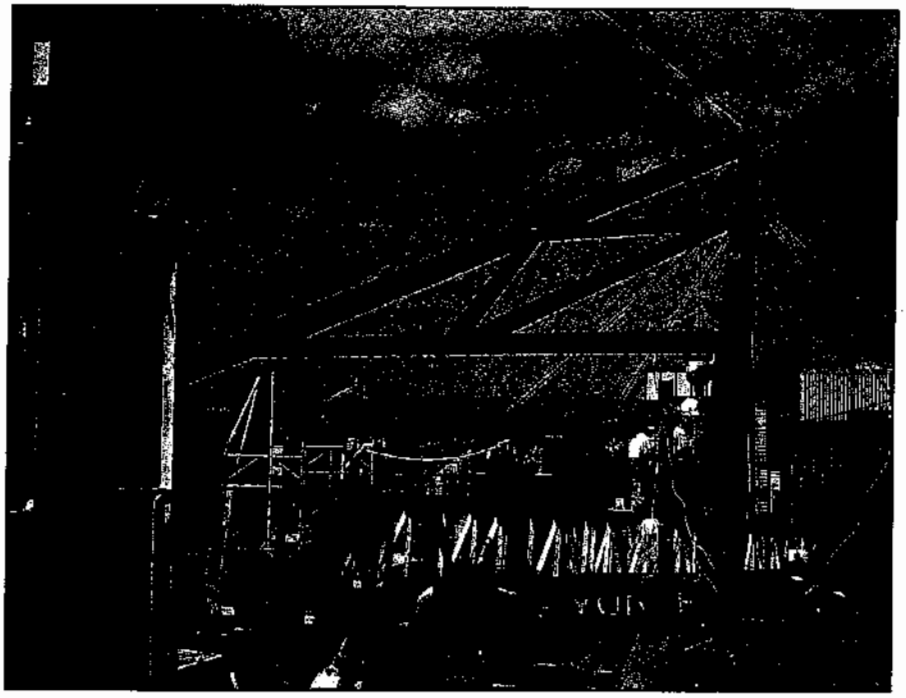
The second day began with the morning meeting at which all agencies gave a situation status report. These reports covered traffic problems; train station closings; bus reroutings; the relocation of residents from hotels and apartment houses; the concerns of businesses; the needs of the elderly who had been evacuated and were unable to take their medications, retrieve their glasses, and rescue their pets; and so on.

THE OPERATION PLANS

The construction company revealed its plans, which were discussed at length and had to be approved by the Building Department, which had complete control over all operating plans. The fire department also had to approve all operational plans. Safety was the primary concern of all.

The first concern in developing the plan was to secure all scaffolding (all 50 floors) so that loose debris such as wood planks and piping would not fall or scale away from the structure. A number of ideas were considered. The option selected was to encase all the scaffolding in netting to achieve a cocoon effect. The first big question to be resolved was, How do you hold a netting that would be more than 730 feet high on four sides and secure it so that it wouldn't become a giant sail?

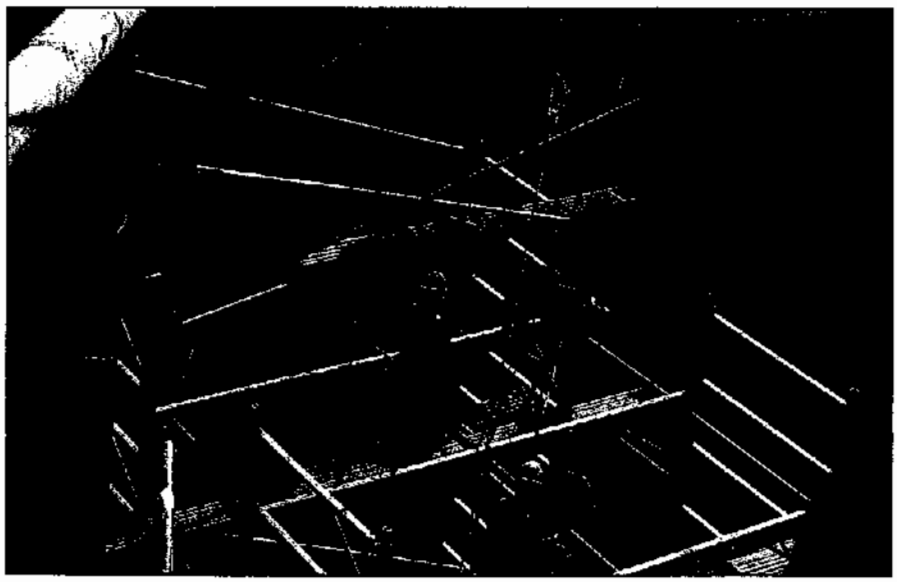
Note: Every detail of the design was taken into consideration, including weight-bearing, the sizes of the support cables, and methods of securing and putting the netting in place.



(Above) The structural steel, 36-square-foot box that would support the curtain (the netting enclosure around the scaffolding to prevent additional debris from falling from the upper floors) is set on the A-frame. Four steel cables supported the box, which was suspended from a ring in the A-frame. The netting was attached to 10 cables and then secured to the box. (Right) Close-up of the A-frame being set in place at roof level. (Photos by author.)

The plan adopted involved constructing a 36-square-foot box of structural steel to support the curtain, which would be held by an A-frame, also constructed of structural steel. The unit would be fabricated on the roof and set in place at a 28-degree angle over the scaffolding. The box was suspended from a ring on the A-frame by four steel cables. Ten cables to which the netting would be attached were then secured to the box. The cables were put in place in a "balanced" sequence to maintain the system's stability. The primary objective was to prevent the scaffolding and debris from becoming dislodged. Construction workers operated in baskets secured to the crane's main line. Radios and hand signals were used to ensure workers' safety while they attached the cables to the box.

While this operation was taking place, "needle beams" that would be used to support the scaffolding were being assembled inside the building. The beams were assembled with the five-foot sections of the material used for the tracks of the elevator hoist. The sections, each of which weighed 250 pounds, were bolted together to form the beam. The needle beams were then set out and under the collapsed scaffolding. For every foot of beam out from the floor, a foot and a half of beam had to be kept in on the floor—if 20 feet of beam were placed under the scaffolding, for example, 30 feet would be back on the floor area. The section of beam back on the floor was properly secured and shored to maintain its stability and prevent it from tipping over.



(Top left) The floor was supported with interior shoring. Angle iron was used at the corner of the building to support the upper floor. For every foot of supporting beams placed outside under the collapsed scaffolding, a foot and a half of supporting beam was kept on the floor inside. (Bottom left) Close-up of floor bracing (made from sections of the track on which the hoist car rode). (Right) Workers dismantling the scaffolding were secured with safety lines. (Photos by author.)

(Top) Workers in basket on the outside of scaffolding remove hanging debris. (Bottom) Rescue teams, positioned near the work crew, were rotated during the work day. (Photos by author.)

These needle beams were strategically placed on the areas of the floor from which they would provide the greatest support. Also, the building's design made it necessary to provide additional shoring for the floor areas. The corner areas were shored with steel to support the additional weight of the beams.

Engineers also were concerned about the stress the collapsed scaffolding was placing on all floors. It became clear that the problem would not be resolved quickly. Stabilizing the scaffolding took longer than was anticipated.

During these operations, fire department personnel were stationed in each work area, providing fire protection and life-saving capability. EMS paramedics were stationed alongside the rescue and squad companies.

When the netting was in place, "curtain rods" were placed every 100 feet, from the top down, to secure the netting and prevent it from blowing in the wind. Before removing the scaffolding, the netting had to be secured by "belly banding": The cable was wrapped completely around sections of the scaffolding and secured to columns inside on the floors.

On the 46th floor, wood planking and a tool box were protruding out of the scaffolding, causing serious concern that debris could be dislodged and fall to the street. Engineers designed a "diaper" out of safety netting and positioned it under and around the debris and secured it to the floor area without disturbing the load.

Sheds were built on the sidewalk to deflect falling debris, lessen damage, and provide pedestrian protection when the streets were opened.

Exposures

Once the scaffolding was secured and enclosed, the surrounding structures were evaluated. A supporting leg of a large water tank on the roof of the Woodstock Hotel was damaged. However, an inspection of the tank system revealed that the tank did not need additional support. Two derrick cranes were assembled on the roof to provide additional cable lines for removing the damaged scaffolding and debris. These cranes come in sections and are assembled in place. These additional cranes were a welcomed relief for the one crane that had been in operation since the beginning of the incident.

As more of the scaffolding became secure, more of the streets were opened, and tenants were allowed to move back into their apartments.

Wherever possible, work on the surrounding buildings was continued. The parapet of the hotel had to be removed. The fire escape on the rear of a building on 44th Street was seriously damaged, and other means 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 go back into the hotel to retrieve personal items after work had stopped for the day. Building inspectors had to inspect all the damaged structures.

Dismantling the Scaffolding

Discussions on how to dismantle the scaffolding continued. The scaffolding would be dismantled by the company that had assembled it. The disassembling process was far from routine. At many floors, workers had to climb out on the sides of the scaffolding to reach areas that could be disassembled. Workers on the scaffolding were secured with safety lines. Rescue company members had rope systems in place in case an accident should occur and workers had to be reached.

A written site safety plan for dismantling the scaffolding was drawn up and issued to all agencies and workers. Preliminary work was completed on Day 14. The two derricks were erected. A day-

light-to-dusk, 13-hour work schedule was adopted to take the greatest advantage of the daylight and to avoid having workers exposed to the extreme dangers inherent in working from the basket and on the scaffolding at nighttime.

The plan called for removing the debris to a pier in Brooklyn, where it would be stored pending completion of the investigation. Investigators identified the pieces and sections they wanted marked and held for laboratory testing to determine if the material had failed. Each piece and section was charted. Dismantling began that afternoon and continued until dusk. Fire department members equipped with radios were stationed at each derrick crane and the main crane. Rescue teams were in place with the work crew. A squad stood by as a FAST, or rapid intervention, team. A 2½-inch handline was in place. Paramedics were stationed near the work area. (Most of these paramedics had attended the 40-hour collapse course given at the FDNY Division of Training Rescue School.) A chief officer supervised all operations and was on the scene 24 hours a day.

Many hills and valleys were encountered during the dismantling operation. Daily meetings continued, but fewer personnel attended. This was a sure sign of progress. As the scaffolding started to come down, more and more businesses and streets were opened. Businesses were opening up. Streets were opened. Trains were moving. Buses were back on their normal routes, and residents were returning to their apartments. As the operation was approaching completion, only 43rd Street between Broadway and Sixth remained closed. Things were getting back to normal.

From the start of the incident, elevators posed the primary logistical problem. The scaffolding that collapsed was equipped with the hoist and elevator that transported workers to all floors. The adjoining scaffolding was used mainly for materials. Unable to use either one, workers, rescuers, and materials had to be brought to the upper floors in a small construction elevator, which created major logistical problems during the operation's early stages. The passenger elevators were under construction and terminated at the 15th floor. It wasn't practical or sensible for members carrying tools and equipment to go to the 15th floor and then walk up 35 floors. Eventually, one passenger elevator that could go to the upper floors was finished.

As the work progressed, FDNY downsized its field communications mobile command center, which was on the scene for the entire 26 days. The OEM also had its command vehicle on-site.

Although it was an extremely difficult operation, there were no injuries, attributable in large part to the well-coordinated manner in which the agencies and construction companies worked together. Firefighters learned many construction terms and were able to incorporate valuable drill time during this incident. FDNY firefighters were not used to full capacity in every single aspect of this operation; they certainly would have preferred more action. But the workers appreciated their participation, knowing that the FDNY members were standing by and ready to spring into action if a problem arose. ■

Endnotes

1. The 10-60 is transmitted for a collapse, an airplane crash (except Airport Crash Boxes 37—Laguardia Airport and 269—Kennedy Airport), a train derailment, or similar emergencies with the potential for multiple casualties. The following units will respond: one deputy chief, four additional battalion chiefs, three rescue companies (including Rescue 3 with collapse utility truck), one tactical support unit, one "FAST" unit, Hazardous Materials Company 1, Squad 1 and a second piece, one additional squad company, a Safety Operating Battalion, a Special Operations Battalion, a field communications unit, and a public information officer. On the transmission of a second alarm and a 10-60 signal, an additional deputy chief responds.

2. The Kelly Kart™, named after Lieutenant Tim Kelly of the Fire Department of New York Special Operations Command, provides portable lighting in locations that are not the norm for the routine response. Its modular construction enables it to fit into a Chevy Suburban. It can be maneuvered by one firefighter at the scene and is easily assembled/disassembled. It has a 3,500-watt Coleman Powermate generator and a Honda 5.5-hp engine. The generator can be used remote from the Kart (125 feet maximum) by way of a four-wire cable that feeds a branch 1900-type box on the Kart. Four outlets in the branch box can be used for lights or power hand tools.

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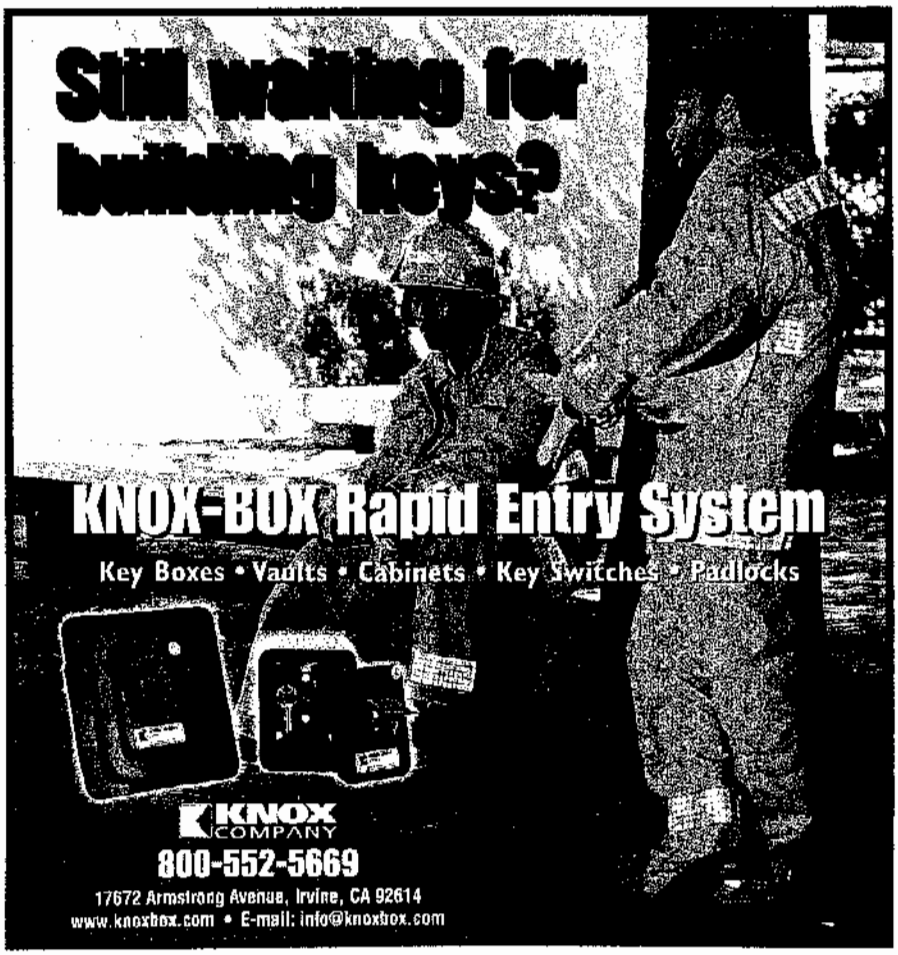

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