

HIGH-RISE APARTMENT FIRE

Manhattan, NY
January 11, 1988



FIRE INVESTIGATIONS

NATIONAL FIRE PROTECTION ASSOCIATION

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Investigation Report
Apartment High-Rise Fire
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ABSTRACT

On January 11, 1988 at 8:19 p.m., the New York City Fire Department was notified of a building fire at East 50th Street, Manhattan. Arriving fire fighters found a fire involving several first floor rooms with trapped occupants on the floors above. Before the fire was under control, the fire department had sounded five alarms bringing over 200 fire fighters to the scene; four civilians died, 13 fire fighters were injured, and another nine civilians were also injured. Approximately 70 people were rescued by fire fighters.

The mixed-use building was a fire-resistive, 115 ft x 100 ft, 10-story high-rise structure. The first two floors had commercial areas, and floors three through ten contained apartments. A single-station, battery operated, smoke detector was provided in each apartment. Other fire protection equipment included a standpipe system in one of two enclosed stairways, fire extinguishers, and a partial wet-pipe automatic sprinkler system protecting a storage room in the basement.

The fire originated in a first floor office and, before the fire department arrived, spread to other areas on that floor. Combustion products spread to floors above because the first floor access doors for the two enclosed stairways were held open with wedges.

Coordinated suppression and rescue operations restricted the number of fatalities and injuries and limited the extent of damage to the building.

The following factors appear to have contributed significantly to the severity of this fire and to the loss of life:

1. Building modifications that increased the fuel load;
2. The absence of automatic detection or suppression systems;
3. Stairway doors at the level of fire origin that had been blocked open, allowing heat and smoke to spread throughout the building.

INTRODUCTION

The National Fire Protection Association (NFPA) investigated the fire at 135 East 50th Street, Manhattan, New York in order to document and analyze significant factors that resulted in the loss of life. Soon after learning of the incident, Michael S. Isner, Fire Protection Specialist, Fire Investigations Division, traveled to the scene to conduct a study of the incident, in cooperation with the New York City Fire Department.

This report is another of NFPA's studies of fires having important educational or technical interest. The information presented is based on the best data available immediately after the fire and that obtained during subsequent follow-up.

This report describes firesafety conditions at the apartment building and, based on the NFPA analysis of collected data and observations during the investigation, presents findings on factors that contributed to the loss of life. The objective of this report is to document and analyze a significant multiple fatality incident in order to prevent a recurrence of such an incident in the future. It is not NFPA's intention that this report pass judgment on, or fix liability for, the loss of life at the apartment building.

The cooperation and assistance of Fire Commissioner Joseph Bruno, Fire Chief Robert Butler, Assistant Chief Anthony Fusco, and others of the New York City Fire Department are greatly appreciated.

BACKGROUND

The Building

General Description:

Records indicate that the original certificate of occupancy issued in 1924 classified the building as a tenement house and apparently this classification had not changed through the years. At the time of the fire, however, the building had both commercial and residential occupancy uses. The front half of the first floor (see Figure 1) had two restaurants, a travel agency and lobby area; the rear half of this floor contained several offices. The second-floor rooms contained business offices, a massage parlor and barber shop. Floors three through ten contained the residential apartments. The basement had small rooms and at least one 1200 sq ft room, of which all were used for storage.

Except for a small one-story addition, the construction of the 115 ft X 100 ft building was fire resistive. The floor/ceiling assemblies were poured-in-place concrete and the exterior bearing walls were masonry. Interior load and nonload bearing partitions also were masonry. Plaster-covered masonry surfaces, the original noncombustible interior finish, was maintained in the interior stairways, corridors, and rooms on floors two through ten. This was not the case on the first floor where the majority of building alterations were made.

A 40 ft X 20 ft one-story addition was constructed at the first floor level in the rear of the building. The exterior walls of this single-room addition were built with concrete blocks, and a composite roof covered concrete panels that were two inches thick, 14 inches wide and four feet long. These panels were supported by unprotected steel wide-flange beams.

Significant renovations of the building's first floor had also occurred. The original masonry load bearing walls were retained to ensure structural integrity but many new nonload bearing interior partitions were added. The new walls establishing separate tenant spaces were constructed with gypsum board; some walls had wood studs and others had metal studs. Most of the original masonry walls on the first floor were also covered with gypsum board. The gypsum board-faced walls for the offices and reception area in the rear of the first floor were then covered with plywood paneling. A set of lockable glass doors with aluminum frames separated the rear office area from the front lobby.

Most walls in the front lobby were painted gypsum board and those that were not painted had noncombustible imitation brick glued to the gypsum board. A corridor that connected the lobby and Stairway B (see Figure 1) was also painted gypsum board. The small foyer between the lobby and exit discharge also had glass doors and painted gypsum board walls.

All ceilings on the first floor were constructed with noncombustible materials. The ceiling in the lobby and foyer was constructed of noncombustible ceiling tile glued to gypsum board supported by a metal support system. In the rear office area, ceilings were plaster that had been applied directly to the concrete slab for the second floor.

The fuel loading provided by contents on the first floor varied significantly between areas. In the lobby, the fuel consisted of trim work, couches and other furnishings. In addition to the combustible wall finishes, many offices had upholstered chairs and other furnishings, shelves containing books, and paper goods that contributed to the fuel load.

Means of Egress:

The original egress system included five enclosed stairways and three exterior fire escapes. This arrangement provided most apartment occupants with at least two remote means of egress, each with a separate access. Occupants of Apartments 1 and 2 could use Stairways C and D (see Figure 2) and occupants of Apartments 5 and 6 could use Stairways B and E. The entrance doors to Apartments 7 and 8 opened onto Stairway B and those to Apartments 11 and 12 opened onto Stairway A. Each of these four apartments was also equipped with an exterior fire escape to provide a remote means of egress with separate discharge. Apartments 3, 4, 9 and 10 had two entrance doors per apartment and all of these doors opened onto the building's center corridor. Several doors had been installed in the corridor to provide each apartment with separate access to at least two enclosed stairways, i.e. Stairway A, B or C.

The construction of Stairways A and B indicated that, according to the original building design, these stairways likely discharged at the first floor level. It was not possible to determine if the stairways had originally led to a common discharge or separate discharges from the building. It was also not possible to determine where and at what level the discharge for Stairway C was located. Stairways D and E had separate discharges located at basement level.

During building alterations, many changes were made to the means of egress. Doors that divided the corridors on floors two through ten were removed and new doors were installed closer to Stairways A and B. The change of exit door locations resulted in most apartments opening onto a common corridor and eliminated the separation between the access to the enclosed stairways from Apartments 3 and 4 on all floors. Stairway C had been sealed with masonry and covered with plaster to match the finish of other interior

walls. To increase the usable space on the first floor, sections of Stairways D and E were removed and concrete panels were installed in line with the concrete slabs for the first and second floors. The modified stairways terminated at the second floor without an exit discharge and eliminated stairways from being part of the building's egress system.

Although no longer a part of the building's means of egress, Stairs D and E still provided access to the roof. Therefore, during an emergency it might have been possible for occupants who were aware of the roof access to reach the roof and, once on the roof, use fire escapes to reach grade. A post-incident inspection of these stairs revealed that some occupants stored boxes, sofas, and other materials in these unlighted stairs. The stored materials were of sufficient size and quantity to have prevented many occupants from reaching the roof access door at the top of both stairways.

As a result of the building modifications, Stairways A and B were the only means of egress for occupants of apartments not equipped with fire escapes. Both interior stairways had an access door to the roof and self-closing metal doors separating each stairway from the occupied area on every floor. Stairway B discharged into a small corridor that led into the first floor lobby and Stairway A discharged into the same lobby. A small foyer was the only exit discharge from this lobby.

Fire Protection:

The building was nonsprinklered except for a partial wet-pipe automatic sprinkler system that had been installed in a 1200 sq ft storage room in the basement. The building's domestic water supply was the primary water supply for the sprinkler system and a street level fire department connection was also provided.

A wet, Class I standpipe system equipped with 2-1/2-inch connections, hose, and nozzles was installed in Stairway A. A roof-mounted 2500-gallon

water storage tank supplied water to the standpipe and separate street level fire department connections were also provided for the standpipe system.

Apartments were equipped with battery operated, single-station smoke detectors. Reportedly, many of these detectors were missing or the detectors were without batteries. There was no central alarm system or manual pull stations.

Self-closing metal doors protected the openings to the apartments, Stairways A and B, and miscellaneous rooms, such as the janitor's closet and access areas for trash chutes.

Ventilation and Utilities:

There was no central air handling system for the building, so natural air currents moving through the building provided ventilation for all areas. Two elevator shafts, one trash chute, a ventilation duct for the trash rooms, and a mail chute in the center corridor created several vertical openings between all floors. Each of these vertical shafts had access doors or other openings on every floor.

Electrical wiring, communication wires, domestic plumbing, and heating plumbing appeared to have been run vertically through cavities in the walls. No pipe chases or means for running piping and wires were observed.

Occupant Activity Before Fire

Floors three through ten contained a total of 92 apartments. Some apartments had not been rented and were vacant and others were unoccupied because the residents were not at home at the time of the fire. Approximately 70 people were in their respective apartments at the time of the fire.

The first floor and second floor offices were closed for business at the time of the fire. However, both restaurants were open and had some patrons. There was a building maintenance man on duty and in the building that evening.

Exposures

Portions of the west, north, and east sides of the fire building abutted other fire-resistive buildings. All three of the exposed buildings were residential occupancies, had windows that faced the fire building, and were taller than the fire building. The building's south side faced East 50th Street.

The Fire Department

The New York City Fire Department protects over seven million people spread throughout its five boroughs. The department has 12,101 personnel, 225 fire stations, and 352 engines and ladders. Of these resources, 2,549 personnel, 55 stations, and 78 engines and ladders are assigned to the Manhattan borough.¹

Manhattan has a high concentration of high-rise buildings that have large populations. Recognizing the demands that a fire in these buildings can place on fire service resources, the New York City Fire Department has put in place many policies and procedures that help personnel meet those demands. For example, the department's manning policy allocates five fire fighters plus an officer for all ladder companies in the city, and four or five fire fighters plus an officer for engine companies in Manhattan. Department procedures assign the first engine and ladder companies the responsibility for finding and locating the fire during a high-rise incident. The second-due engine and ladder companies are responsible for protecting the floor above the fire. Additional units are used for search, rescue, and other tasks.

Fire department procedures also outline the duties of each fire fighter.

¹ Based on 1986 data.

For example, on a ladder company one fire fighter is assigned to carry a fire extinguisher and another is assigned to carry an axe and halligan tool. These personnel are considered the forcible entry team and go with the officer to the area of fire origin. The fourth fire fighter on the ladder checks for exterior fire extension and possible jumpers, and performs other duties. Another fire fighter is assigned to go to the roof and gain access to the building. This fire fighter will search for victims at the top of the building, ventilate as required, and perform other tasks as necessary.

Weather Conditions

The night of January 11, 1988 was clear with a 5 mph wind to the NNE (25°). The relative humidity was 48 percent and the temperature at 8 p.m. was 27°F.

The Fire

Initial Response

At 8:19:43 p.m., the New York City Fire Department received the first telephone report of this fire. Engines 8 and 21, Ladders 2 and 16 and a battalion chief were assigned. When Ladder 2 arrived, the crew found a man and woman at street side waiting their arrival. Neither of these people appeared anxious or overly concerned. The man told the officer on Ladder 2 that a cigarette was burning in an office couch and that everyone was out. The battalion chief radioed the dispatch center at 8:22:46 p.m. and indicated that he had arrived on-scene.

According to procedures, the driver remained at the ladder truck and two fire fighters assigned with the forcible entry responsibilities went with the lieutenant to the front entrance of the building. The last two fire fighters from Ladder 2 went to the rear of the building.

Operations Inside Building

As the officer and fire fighters from Ladder 2 entered the foyer, they found that the inside doors to the foyer were black with smoke. Looking through the doors, they saw that the smoke was nearly to the floor, leaving only a one-foot clear air space. These men could see as far back as the entrance to the offices in this ground level air space. Smoke conditions appeared uniform throughout the lobby.

The lieutenant opened the door and air rushed into the room. Despite flames that erupted overhead, the lieutenant crawled about five feet into the fire area. Fearing a back draft, he returned to the foyer. By this time fire fighters from Engine 8 had brought a 2-1/2-inch hose with a straight-tip playpipe nozzle to the front entrance. The line was charged from the pumper's tank water. Recognizing that the fire was extremely severe, the officer from Ladder 2 did not allow the attack line to be advanced until he was sure that the engine had been connected to a hydrant.

Once the fire fighters were ready, they entered the lobby and attacked fire in couches to the right of the lobby entrance. Flames from rooms in the back of the building roared passed at ceiling level. After knocking down the fire in the couches, the engine crew advanced toward the rear offices. The men from the ladder followed them and separated to search the area.

Even though they did not know where the seat of the fire was or what was fueling it, the engine crew continued to move into the building, knocking down fire as they found it. A second flame front passed over the fire fighters, but they continued to move further into the building.

The engine crew reached the rear of the lobby and found the mailboxes and other combustibles burning. The door to Stairway A was blocked open, so heat and smoke were going up the stairway. After knocking down the fire involving

the mailboxes, the fire fighters moved toward the apparent source of heaviest flame, the rear office area. As they approached the entrance to the rear offices, flames from the office area again roared toward the entrance foyer at ceiling level.

The office reception area was heavily involved with fire and the nozzleman knocked down what he could as he advanced. As before, the fire fighters advanced further into the building and found deteriorating conditions but they still did not know the location of the heaviest fire.

Fire fighters from Engine 21 brought a 1-3/4-inch hoseline into the building and met the first attack crew in the office reception area. One crew advanced into a psychologist's office and the other crew moved down the corridor to the right of the reception area.

The crew in the doctor's office controlled the majority of the fire in that room, saw through an opening in the east wall that there was fire in the single-room addition, and began to attack the fire. During this attack, steel I-beams supporting the roof distorted sufficiently to allow some of the concrete roof panels to fall. No fire fighters were injured by the collapse.

Three other hoselines were brought into the building. One hoseline was a 2-1/2-inch hose that was advanced into the lobby area and used to extinguish hot spots. The next hoseline, a 2-1/2-inch hose, was connected to the standpipe in Stairway A and extended a line onto the second floor. The last hoseline was a 1-3/4-inch hoseline and it too was extended to the second floor for the protection of the apartments.

Operations Outside the Building

One of the fire fighters from Ladder 2 went to the rear of the fire building and climbed a fire escape to the roof of the building. He found

heavy smoke coming from the building and radioed his officer to report conditions and to ask for assistance. The fire fighter opened the roof door to Stairway B and found one victim on the landing for this stairway.

The second fire fighter from Ladder 2 who went to the rear of the building found flames coming from the windows of the small first-floor addition. He radioed the lieutenant and reported the location of the fire and that flames were extending nearly five stories above the addition. This fire fighter then climbed a fire escape to the roof to assist the fire fighter already at the roof.

Almost immediately upon his arrival, the battalion chief made a special request for a rescue vehicle. Moments later he made a second special request and asked for a second battalion chief and a division chief. Rescue 1 and two battalion chiefs were assigned to meet these requests. The battalion chief at the scene also requested a second alarm about two minutes after his arrival; five engines, two trucks, and other units were assigned. As the additional units began to arrive, some crews were assigned to assist and eventually to relieve the fire fighters already in the building.

Search and Rescue

Early in the fire, the interior stairways were impassable so fire fighters climbed exterior fire escapes and entered the building through windows opening onto the fire escape. Since exposed buildings were adjacent to and taller than the fire building, one fire fighter entered the west exposure, took an elevator to the tenth floor, gained access to an apartment with windows facing the fire building and went through a window to the roof of the fire building. Fire fighters broke into a penthouse apartment and worked their way down through the building.

As they found the apartment residents, the fire fighters did what they could to protect them. Some of the residents were led down two of the three fire escapes while other building occupants were kept in their apartments until the stairways and corridors became passable. Fire fighters used ground ladders to evacuate the second floor, which was the floor directly above the fire. Aerial and tower ladders were not used at any time during this incident.

Before the incident was over, five alarms and nine special calls were made bringing 24 engine companies, 16 ladder companies, two rescue units, three other units, nearly 200 fire fighters and twelve chief officers to the scene. As more units and officers were assigned, command responsibilities were continually adjusted to ensure that fire ground operations were orderly and efficient. The New York Fire Department Chief, Chief Butler, assumed command of the operations at 9:01 p.m.

The fire on the first floor was considered under control at 10:16 p.m. and the last New York Fire Department unit left the scene at 2:08 a.m. the next morning.

Casualties and Damage

Two of the four residents who died in this fire were found in Stairway B near the 10th floor access to the roof. One of these victims was a 30-year-old male, and the other was a 30-year-old female. It appears that both people were overcome by smoke before they could reach the roof access door. A third victim was found in Apartment 11 on the 9th floor and, like the previous two people, this 60-year-old female appears to have died of smoke inhalation. The last victim, a 30-year-old male, was found in Stairway B between floors one and two. This man had severe burns and evidence of smoke inhalation, but the cause of his death was not determined. In addition to those who died, nine civilians were injured.

Thirteen fire fighters were injured, with exhaustion being the most common injury. A fire fighter from Truck 2 was the only fire fighter admitted to the hospital. He was suffering from exhaustion, minor burns, and exposure to smoke.

Extensive fire damage occurred on the first floor (see Figure 3). Two offices, the reception area, and front lobby were gutted by fire. Nine other offices at the rear of the first floor received varying degrees of flame, heat, and smoke damage. The two restaurants were not damaged during this incident and were able to resume business the next day.

Heavy smoke stains coated all of the interior surfaces of Stairway A. In addition, peeling paint and other evidence indicates that flames impinged on walls enclosing the first floor landing and on the stairway walls between the first and second floors.

Like Stairway A, Stairway B had heavy smoke stains coating its interior surfaces. Floors two through ten had smoke damage in the central corridor and the most severe smoke damage occurred on floors nine and ten.

ANALYSIS

Fire Growth and Spread

Investigators from the New York City Fire Marshal's office have determined that this fire was accidental in nature with the probable cause involving electrical extension cords and a three-way plug connected to a wall receptacle in the east wall of the psychologist's office. A couch positioned against this wall appears to have been the first item ignited. Information regarding the couch frame construction, padding material and finish fabric was not available.

Flames from the couch impinged on the combustible wood paneling covering the east wall, spreading the fire to this surface. Reportedly, there were many shelves, books, furnishings and other combustible materials also available to fuel the fire. Considering the available fuel, the geometric arrangement of the room, and physical evidence after the fire, it appears likely that flashover occurred in the room.

One of the windows between the psychologist's office and the addition had been sealed off with plywood and other combustible materials. Fire in the room of origin burned through this material and spread to the single-room addition. As the fire grew in this area, it broke exterior windows and a skylight, allowing air to enter the room intensifying the fire. The flames venting from this room were the flames that fire fighters saw at the rear of the building and estimated to be extending up five stories.

Before the fire department arrived, the fire spread from the room of origin into the office reception area and adjacent offices. The fire also broke through the reception area glass doors and filled the front lobby with hot smoke. The concentration of smoke in the lobby quickly blocked the exit stairs and trapped the apartment occupants.

Conditions in the lobby had become so severe by the time the fire fighters arrived that the first attack crew became concerned about a possible backdraft. Although a backdraft never occurred, three flame fronts did pass over the heads of the fire fighters after the fire fighters introduced outside air by opening the entrance door to the front lobby.

The first floor access door to Stairway A was blocked open and was approximately ten feet from the double glass doors to the rear office area. When the fire reached these doors and began to fill the lobby with smoke, smoke also began to fill the stairway. Heat damage and scorch marks in Stairway A reveal that fire entered the lower part of this stairway.

The access door to Stairway B was also blocked open, allowing smoke and flames to enter this stairway too. There was less exposure to this stairway because Stairway B was farther from the office area doors. Still, this stairway was not usable early in the incident because of the severe fire in the lobby.

Smoke in both stairways rose to the top of the building and seeped onto the floors through cracks around doors and any other available openings. Smoke also entered hallways as occupants opened doors while attempting to investigate and leave. The two elevator shafts, the trash room ventilation duct and the mail chute allowed smoke to spread to the upper floors. However, it appears that most smoke spread vertically through the two stairways. When smoke filled the corridors on the upper floors, many occupants were trapped in their apartments.

The prevailing winds were moving from the front of the building toward the rear and appeared to have affected smoke spread. Many occupants on the front side opened their windows and waited by the windows for rescue. Apparently, little smoke entered these apartments and the occupants were in little danger. However, several occupants of apartments at the rear of the building reported that smoke entered their apartments and caused them much concern.

Protection of Occupants

Stairways A and B were the primary and secondary exits for most apartments and discharged through the same lobby. When heat, smoke, and flames filled the lobby, the stairways became impassable and occupants could not leave the upper floors. The alterations to Stairways C, D, and E prevented occupants from using these stairways as egress alternatives.

The fire escapes at the rear of the building were used by both occupants and fire fighters. A few occupants exited the building over the fire escapes

without assistance while others had to be escorted by fire fighters. In addition to serving as a means of egress, the fire escapes allowed fire fighters to access all floors and the roof.

Many people did not use the fire escapes, however. Reports indicate that one of the fire escapes was exposed to fire and smoke from the addition, preventing both occupants and fire fighters from using the escape. In some instances, occupants chose not to use the fire escapes until fire fighters escorted them down. Apartment 11 on the ninth floor was one of the apartments equipped with a fire escape but an elderly woman was found dead in that apartment. The reason the woman did not use the escape is not known. Occupants of apartments without fire escapes were only able to leave the building via this means of egress if the entrance doors to the apartments with fire escapes were left unlocked or if the apartment was forcibly entered.

Compartmentation within the building helped to protect the occupants. Three of the four fatalities occurred when occupants attempted to move through the smoke-filled corridors and stairways. Though some smoke entered apartments, the metal apartment doors and unpenetrated masonry walls minimized smoke migration into apartments, allowing occupants to remain in their rooms until rescued.

Fire Suppression

The engine companies and ladder companies composed of five fire fighters were an asset during fire suppression and rescue. Size-up upon arrival revealed that a severe fire had many people trapped on the upper floors of the building. Because of the available personnel, fire fighters from the first-due companies were able to concentrate on search and rescue of occupants on the floor of fire origin, fire suppression, and building ventilation. Fire fighters from subsequent arriving companies began search and rescue in the remaining areas of the building and performed other fire ground tasks.

The experience of the New York fire fighters allowed them to make many decisions under adverse conditions, enhancing the effectiveness of their operation and limiting the risk to occupants and fire fighters. For example, aerial ladders were not raised due to the large number of people at many windows who were not in any danger. The wind was blowing from the front of the building to the rear. It was felt that raising aerial ladders could cause anxiety among those waiting to be rescued and increase the potential for jumping. Instead, ground ladders were used to remove people from the second floor and fire fighters entered the building via the fire escapes and other means. Once they reached occupants, fire fighters stayed with them until safe evacuation was possible.

Similar to the efficient and effective actions by fire fighters, the fire department has in place an emergency communication system and a well-defined incident command system; both contributed to the successful fire ground operations. This incident quickly escalated from a one-alarm fire to a five-alarm fire involving over 40 apparatus, nearly 200 fire fighters and twelve chief officers. Despite this large commitment of equipment, personnel and other resources, the use of a command channel and a communications coordinator permitted effective control and flow of command level communications. Most importantly, the incident command system allowed the adjustment of responsibilities between officers to occur without detracting from suppression, rescue and other operations.

The original design and construction of the apartment building at 135 East 50th Street included many recognized firesafety provisions to protect occupants. Noncombustible construction divided the entire building into many small compartments providing protection against fire spread; additionally, the interior finish was noncombustible. The original building design also included five enclosed interior stairways, of which at least two had remote exit discharges. In addition to the interior stairways, three exterior fire escapes were installed. This system of interior enclosed stairways and fire escapes provided most occupants with at least two remote means of egress with separate discharges.

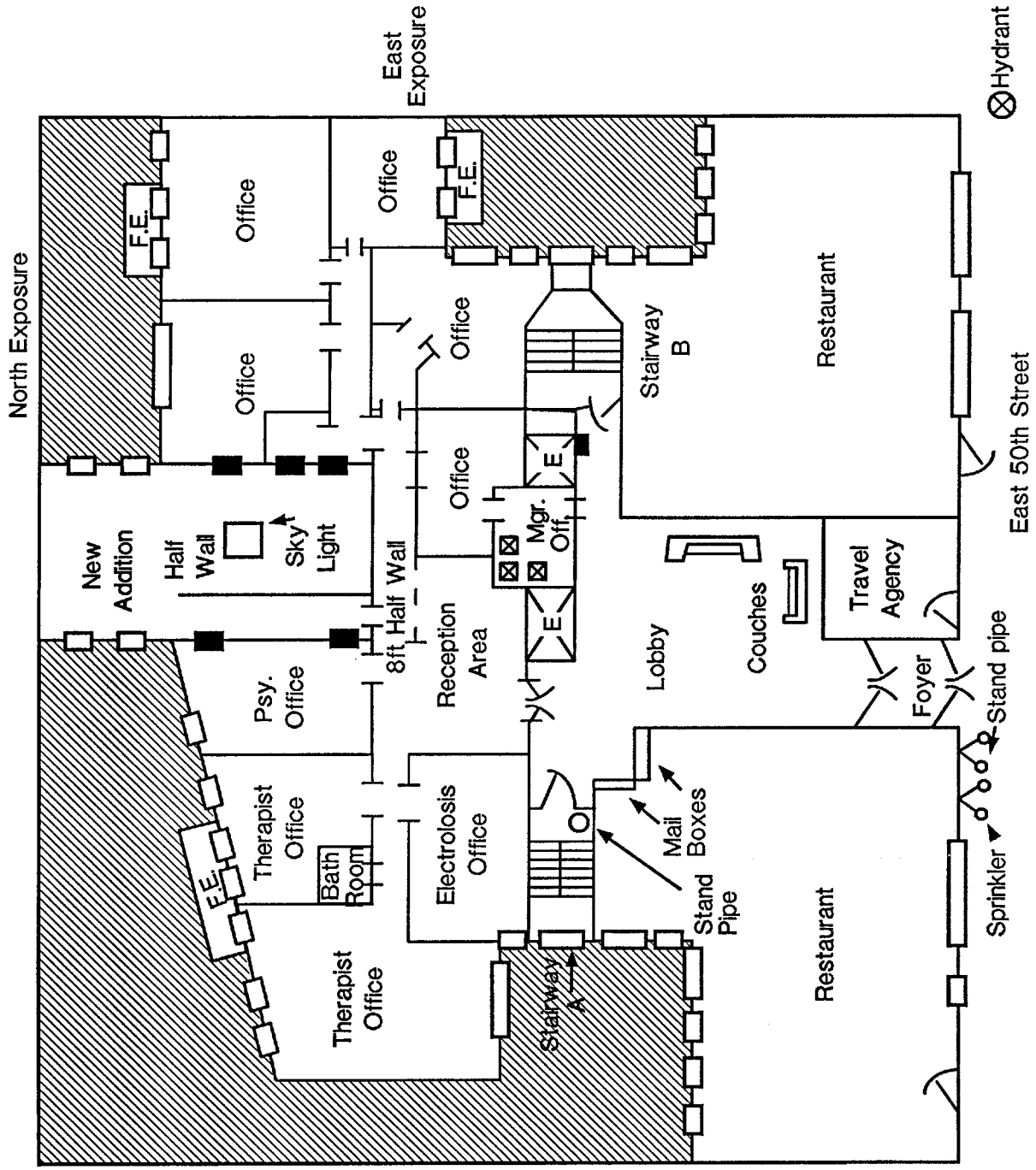
Through the years, conditions within the building changed. Most of the interior exits were sealed off and doors in exitways were removed. Alterations on the first floor made the two remaining interior stairways discharge through the same lobby and resulted in both stairways being vulnerable to blockage by a single fire. The alterations on the first floor also increased the combustibility of the interior finish in some areas. These changes contributed to the fire hazard and decreased the level of occupant protection. Neither automatic sprinkler systems nor detection systems were installed to improve protection provided for all areas of the building.

Arriving fire fighters found an extremely large fire posing a threat to the many occupants of the building. The New York Fire Department had the manpower, equipment, procedures and command structure that allowed simultaneous fire suppression and rescue operations. Without the rapid commitment of many fire fighters and equipment, fire control would likely have been delayed, increasing the fire and smoke exposure to occupants.

Conditions in the building permitted extensive fire spread through the first floor office area and allowed heat and smoke spread to upper floors, trapping many occupants. The following factors appear to have contributed significantly to the severity of the fire and to the loss of life:

1. Building modifications that increased the fuel load;
2. The absence of automatic detection or suppression systems in the building;
3. Stairway doors at the level of fire origin that had been blocked open, allowing heat and smoke to spread throughout the building.

Figure 1: First Floor Plan at Time of Fire



West Exposure

- Window opening
- Sealed window opening
- F.E. = Fire Escape
- ⊠ Vertical shafts penetrating all floors
- Mail Chute

Figure 2: Door Placement Floors 2-9

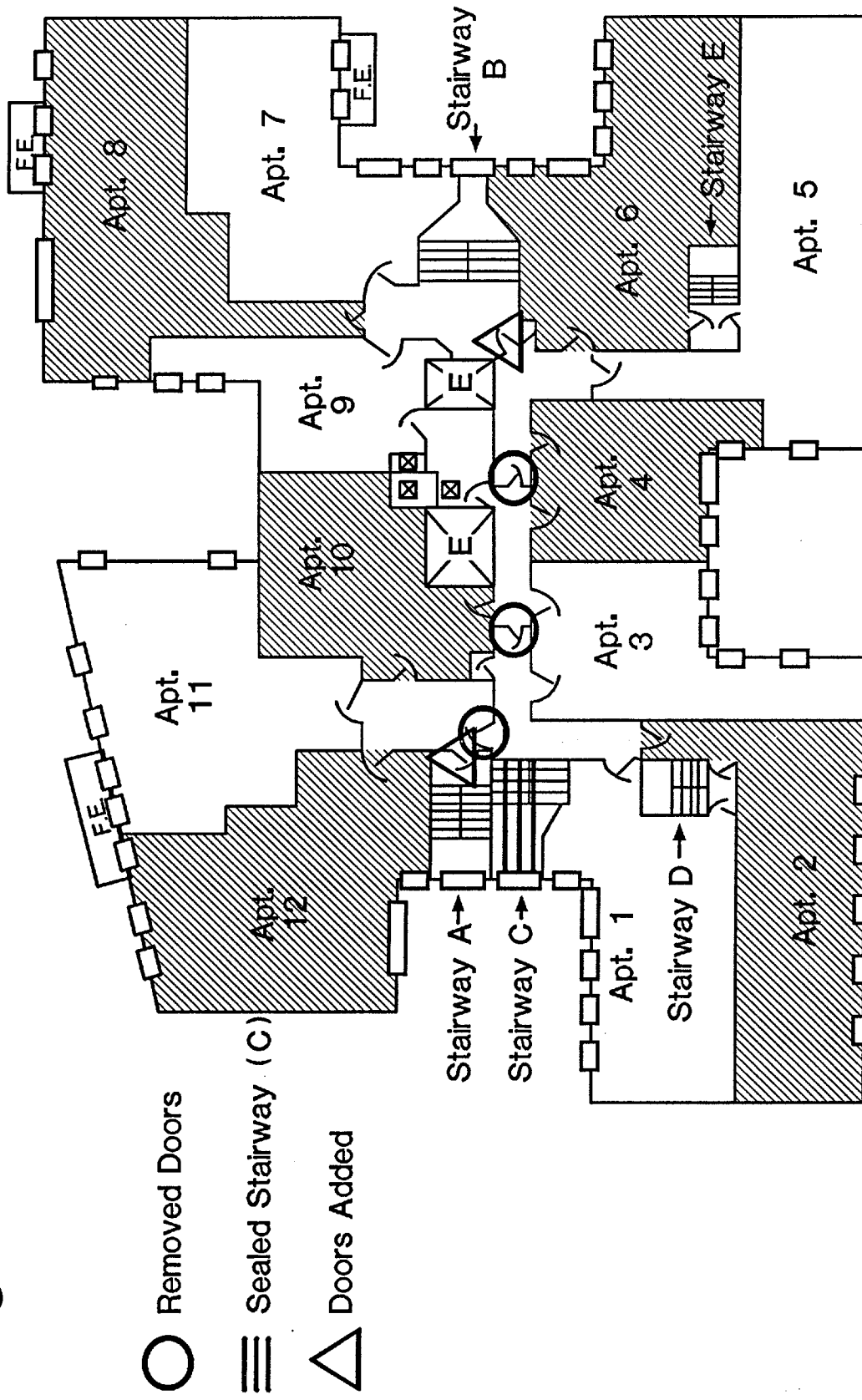
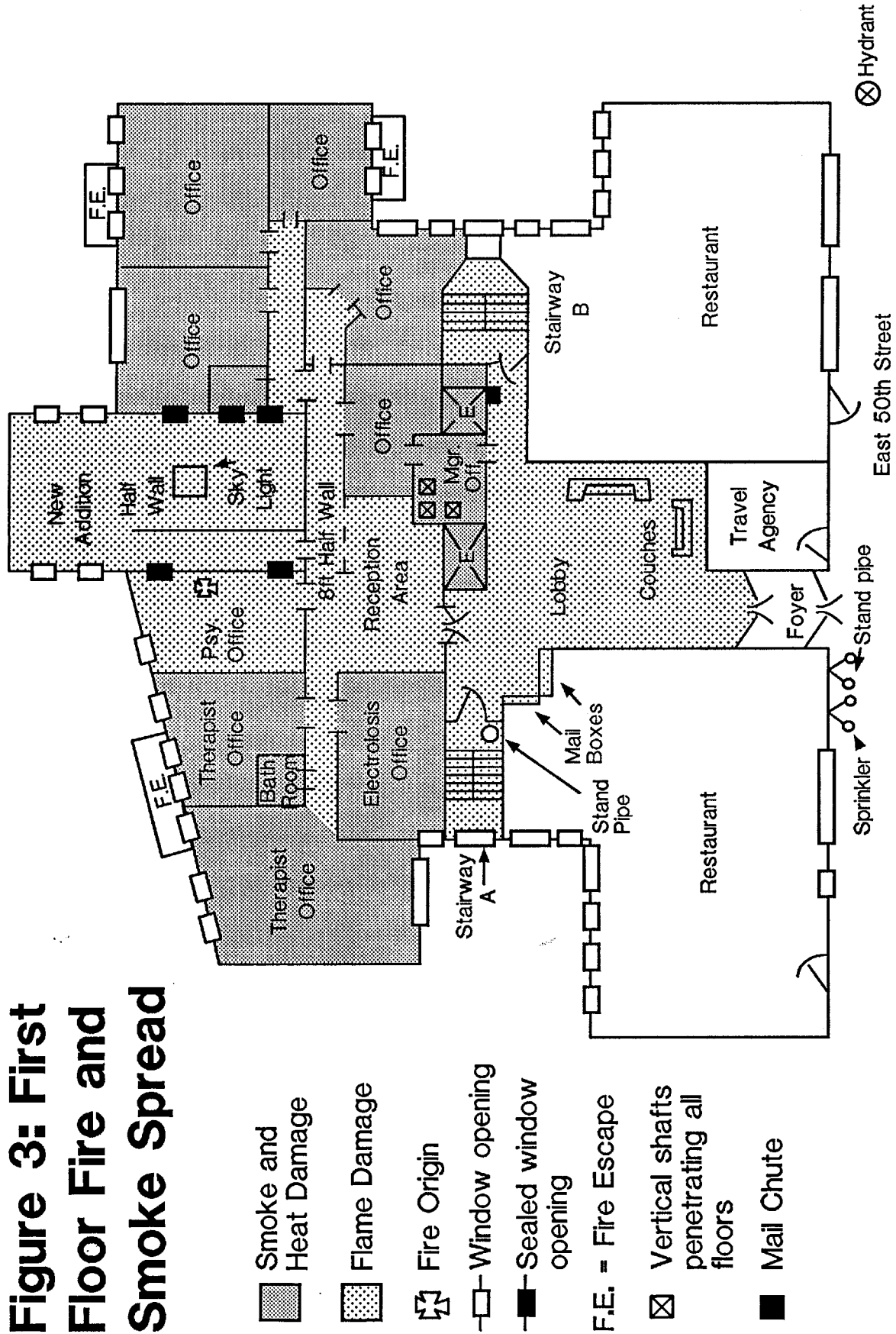


Figure 3: First Floor Fire and Smoke Spread



Smoke and Heat Damage

Flame Damage

Fire Origin

Window opening

Sealed window opening

F.E. = Fire Escape

Vertical shafts penetrating all floors

Mail Chute