HOTEL FIRE
Las Vegas, NV
February 10, 1981

(All Non-NFPA credited photographs have been removed from this document)

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FIRE INVESTIGATIONS

NATIONAL FIRE PROTECTION ASSOCIATION

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Fire Investigation Report

Hotel Fire
Las Vegas, Nevada
Eight Fatalities
February 10, 1981

Prepared by

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Consultant to
NFPA Fire Investigations Department

In Cooperation with

Federal Emergency Management Agency
United States Fire Administration
and
National Bureau of Standards

(Revised 11/20/81)

This investigation was conducted by the National Fire Protection Association (NFPA) under an agreement with the Federal Emergency Management Agency, U.S. Fire Administration and the National Bureau of Standards. It was jointly funded by these agencies and the NFPA.

ABSTRACT

At approximately 8:00 p.m. on Tuesday, February 10, 1981, eight people died and 350 were injured as a result of a fire at the largest hotel in the United States, the Las Vegas Hilton. This fire has a great deal of technical significance because of exterior, vertical fire spread that involved 22 floors of the 30-story building. This was the second multiple fatality fire in a Las Vegas area hotel in a 2 1/2-month period; the first occurred November 21, 1980 at the MGM Grand Hotel and resulted in 85 deaths and almost 700 injuries.

The fire at the Las Vegas Hilton was incendiary in origin. The fire quickly developed in an elevator lobby on the eighth floor that had carpeting as its wall and ceiling finish. A flame front that formed on the exterior of the building exposed each elevator lobby on the floors above primarily by radiation. The fire progressed vertically from floor to floor to the top of the building via the building's exterior.

The most significant factors that contributed to the fire spread and subsequent fatalities, injuries, and damage in the fire incident were failure to extinguish the fire in its incipient stage and the presence of highly combustible carpeting on the walls and ceilings of the involved elevator lobbies contributing to the exterior fire spread. The resulting fire spread exposed a large number of building occupants on multiple floors.

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I. INTRODUCTION

At approximately 8:00 p.m. on Tuesday, February 10, 1981, eight people died and 350 were injured as a result of a fire at the largest hotel in the United States, the Las Vegas Hilton. This fire has a great deal of technical significance because of exterior, vertical fire spread that involved 22 floors of the 30-story building.

On Wednesday, February 11, 1981 David P. Demers, P.E., consultant to the NFPA Fire Investigations Department, traveled to Las Vegas to conduct a fire loss study of the incident. Mr. Demers was assisted by Mr. Bruce Teele, NFPA Fire Service Specialist; Mr. Robert E. Carter, NFPA Chief Fire and Arson Investigation Specialist; and Mr. Tom Klem of the U.S. Fire Administration.

This report is based on data gathered during the three-day field investigative effort and related follow-up. The cooperation and assistance of Clark County Fire Chief Roy Parrish; Assistant Chief James Barrett; Captain Mike Patterson; Captain Wayne Burns; Investigator Robert James; and the other members of the Clark County Fire Investigations Unit are greatly appreciated. The assistance of A. Elwood Willey, NFPA Assistant Vice President, Research and Fire Information Services is acknowledged.

II. BACKGROUND

The Building

The Las Vegas Hilton is a large hotel complex adjacent to the Las Vegas Convention Center. The hotel is the largest in the United States, having 2,783 guest rooms. Construction had recently been started for a 400-room addition.

The 30-story building was constructed in three stages. The original Central Tower was started in 1967 and opened in July of 1969. The East Tower opened in 1975 and the North Tower opened in 1979. This resulted in different provisions for fire safety in each of the three towers due to differences in building code requirements, technology, and construction techniques (see Figures 1 and 2).

The building consisted of large ground and second floor areas that contained a casino, restaurants, showrooms, a large number of assembly rooms, offices, service and mechanical spaces, and other function areas. Guest rooms were on the 3rd through 29th floors with additional assembly and function areas on the 30th floor. This report primarily addresses the guest room floors of the building; the lower floors were not directly affected by this fire incident.

The building's structural system was constructed of reinforced concrete. When classified according to NFPA 220-1979, Standard on Types of Building Construction, the building would be at least Type I-332 and more likely Type I-443. These designations would indicate fire-resistive construction with the Arabic numbers indicating the fire-resistive rating of exterior bearing walls, supporting elements (frame or columns and girders), and floor construction.*

*See Table 3, NFPA 220-1979, p.9.

Interior, non-bearing partitions were constructed of gypsum wallboard on steel studs. Exit access corridor walls consisted of 5/8-inch fire-rated gypsum wallboard on both sides of steel studs. This assembly, assuming proper construction techniques, would provide a nominal, 1-hour fire resistance rating.

Guest room doors were of 1 3/4-inch solid wood composite construction. Decorative trim was applied to these doors. There were no self-closing devices on these doors in either the Central or East Towers. Self-closers were provided in the North Tower.

At the point where the original Central Tower ended and the new North Tower began, glass doors (not wired glass) were installed within the corridors on each level. These doors were arranged to be held open with electro-magnetic devices that released the doors upon activation of the North Tower's fire alarm system. Additional compartmentation was provided by automatic closing fire doors that protected the opening into the North Tower elevator lobby, creating a fire-rated elevator vestibule. These doors were arranged to close on activation of smoke detectors or manual pull stations. The elevator lobbies in the Central and East Towers were not arranged in this manner and did not have elevator vestibules.

The interior finish of the guest room corridors consisted of plastered ceilings, with heavy vinyl wall covering and carpeting on the floor. Sections of the East Tower ceiling were also covered with vinyl. The elevator lobbies in the Central and North Towers had wall coverings of vinyl.

The interior finishes of the walls and ceiling of the East Tower elevator lobbies were all similar. These lobbies were significantly different from the other common areas on guest room floors. Both the walls and ceiling in this area were covered with carpeting. This carpeting was glued directly to the noncombustible surfaces of the ceiling which were plaster and gypsum wallboard

and stretched and stapled along the walls; there was no pad. There was an approximate total of 455 square feet of this carpet in each lobby; the ceiling area of each lobby was 220 square feet with the balance of the carpet on the walls. The carpeting on the floor was the same as that provided in the corridors, and did not appear to be the same as carpeting applied to elevator lobby walls and ceilings.

The East Tower elevator lobbies had four elevators; there were two on each side. Each pair was in an individual hoistway. On the exterior wall, there were three 3-foot by 6-foot double strength plate glass windows, creating a large glass area 6 feet by 9 feet (see Figure 3). The lights of glass were recessed 18 inches and were separated vertically by a 3 1/2-foot spandrel (see Figure 1).

The spandrel was a prefabricated masonry, plaster and gypsum wallboard on steel stud assembly. There was no apparent evidence of any combustible material, such as foam plastic insulation, associated with the assembly. This spandrel unit was attached to the reinforced concrete building structure. The type of caulking used was undetermined.

The furnishings of the elevator lobbies consisted of a small wooden bench with a polyurethane foam plastic cushion approximately 18 inches wide, 54 inches long, and 2 inches thick in front of the window. Draperies were hung on both sides of the window (see photo 3). There was a piece of furniture at the north end of the elevator lobbies (opposite the glass). Most were small tables, although on some of the more luxuriously furnished floors, there were larger wooden cabinets and hutches of various designs.

The furnishings on the 28th floor along with the exterior construction were unlike the furnishings on other floors. Instead of the bench in front of the window, there was an inner spring couch with foam plastic padding and the ceiling had large recessed, mirrored light fixtures. There was also carpeting on the walls and ceiling. Due to a balcony that extended out from the 29th

floor, there was a 9-foot concrete overhang above the window opening of the 28th floor.

The means of egress from the guest room floors included three smokeproof towers and two enclosed interior stairs. The smokeproof towers were located at the ends of each of the three wings of the original Central Tower (see Figure 2). The vestibules for the smokeproof towers were the mechanical ventilation type rather than the natural ventilation type. The equipment was reportedly arranged with exhaust capacity at least 150 percent of the supply, with more than one air change per minute in the vestibules. In addition, these stairways were reported to be pressurized. This could not be verified in the field. The vestibules were constructed with smoke traps, i.e., the ceilings were several inches higher than the door openings, which would allow smoke and heat to collect in this area and not spread to the stairs. The exhaust grill was located within these smoke trap areas.

There were enclosed interior stairs with fire-rated door assemblies provided at the east end of the East Tower and the north end of the North Tower. The interior stair at the end of the North Tower was reportedly pressurized. The enclosures of these interior stairs did not appear to be impaired.

The detection devices and evacuation alarms provided varied from tower to tower. The original Central Tower was provided with manual pull stations as initiating devices and bells as alarm sounding devices; and two smoke detectors, one in the service elevator lobby and one in the corridor adjacent to the North Tower. In the East Tower an ionization-type smoke detector was located on each side of the East Tower elevator lobby. Alarm sounding devices were speakers. All elevators were provided with manual fire department control.

The North Tower was equipped with 110 volt AC powered single station smoke detectors in guest rooms and smoke detectors on 30-foot spacing in the

corridor. This tower had combination "slow whoop" and voice communication sounding devices.

Due to the different construction dates, the fire alarm systems in each tower were essentially independent. Each of the systems had remote annunciators in both the Security Room and the PBX Room. With the exception of the North Tower system, the systems were presignal systems; without automatically sounding evacuation alarms or notifying the fire department. The North Tower system was arranged to automatically sound evacuation alarms on three floors (the fire floor, one floor above and one floor below the fire).

Automatic sprinklers were provided in some portions of the first and second floors of the hotel complex. A detailed review of coverage was not conducted. There were no sprinklers provided in the guest rooms or corridors of guest room floors.

Manual suppression equipment included fire hose cabinets with 1 1/2-inch occupant use hose and standpipes with 2 1/2-inch fire department connections in the stairways. The hotel had a fire brigade consisting of security personnel. Although not provided with protective clothing, the brigade was equipped with self-contained breathing apparatus, and a cart supplied with various types of portable fire extinguishers.

The mechanical systems for the guest room towers supplied conditioned air to the corridors from a mechanical equipment penthouse. There was no return air from the corridors. Large air handling units that supplied conditioned air to tower floors reportedly were equipped with duct-type smoke detectors arranged to indicate an alarm condition and automatically shut down the fans in the units.

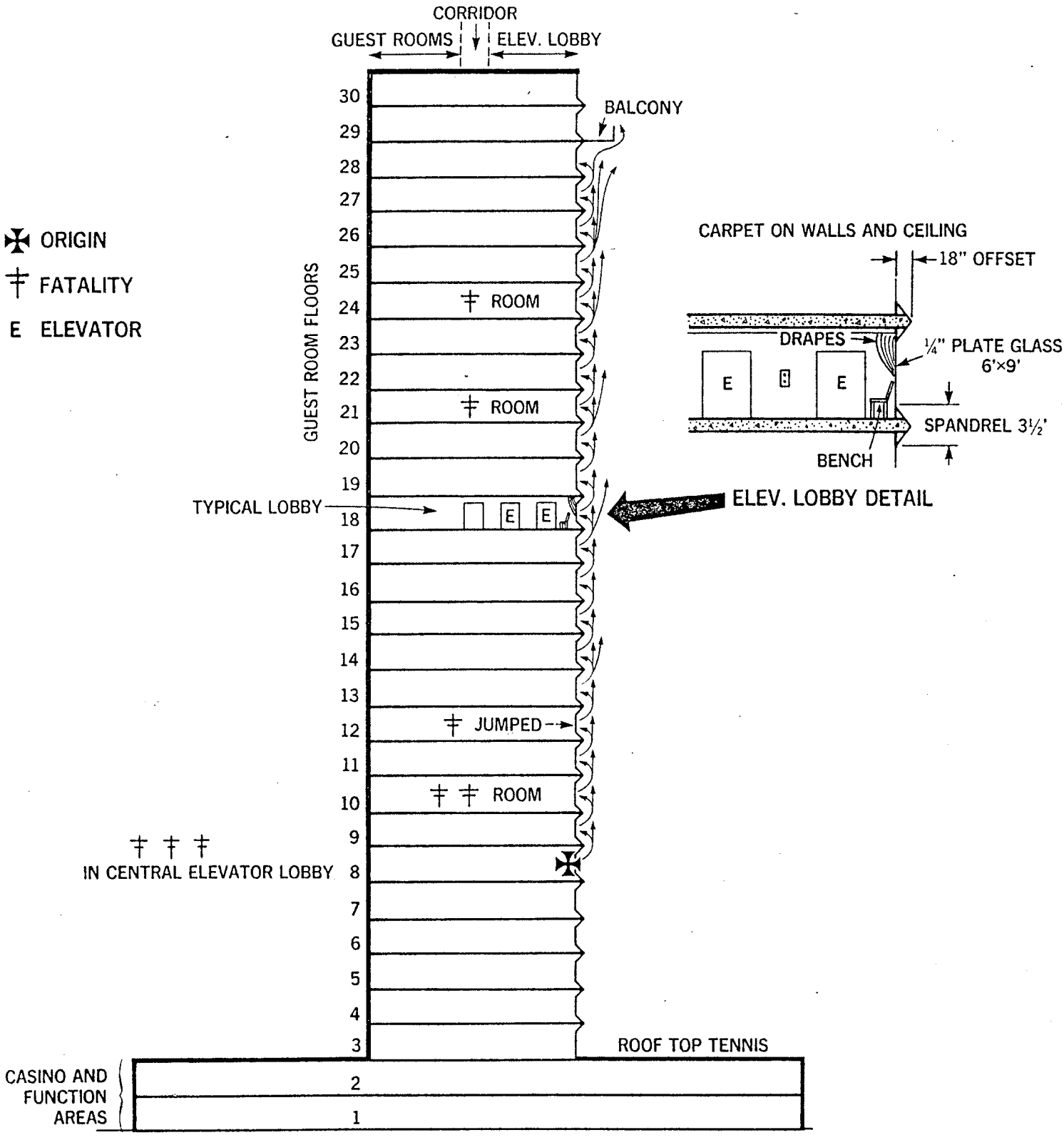
Make-up air for guest rooms was provided from the corridors through a grill-fire damper assembly in the corridor wall, through a duct, to individual

fan-coil units. The fan-coil units were equipped with chilled water piping and an electric heating coil and, while in operation, recycled a portion of the guest room air. Toilet exhaust through ducts and shafts from each guest room was provided.

The number of people in the building at the time of the fire was undetermined; however, approximately 80 percent of the 2,783 guest rooms were rented.

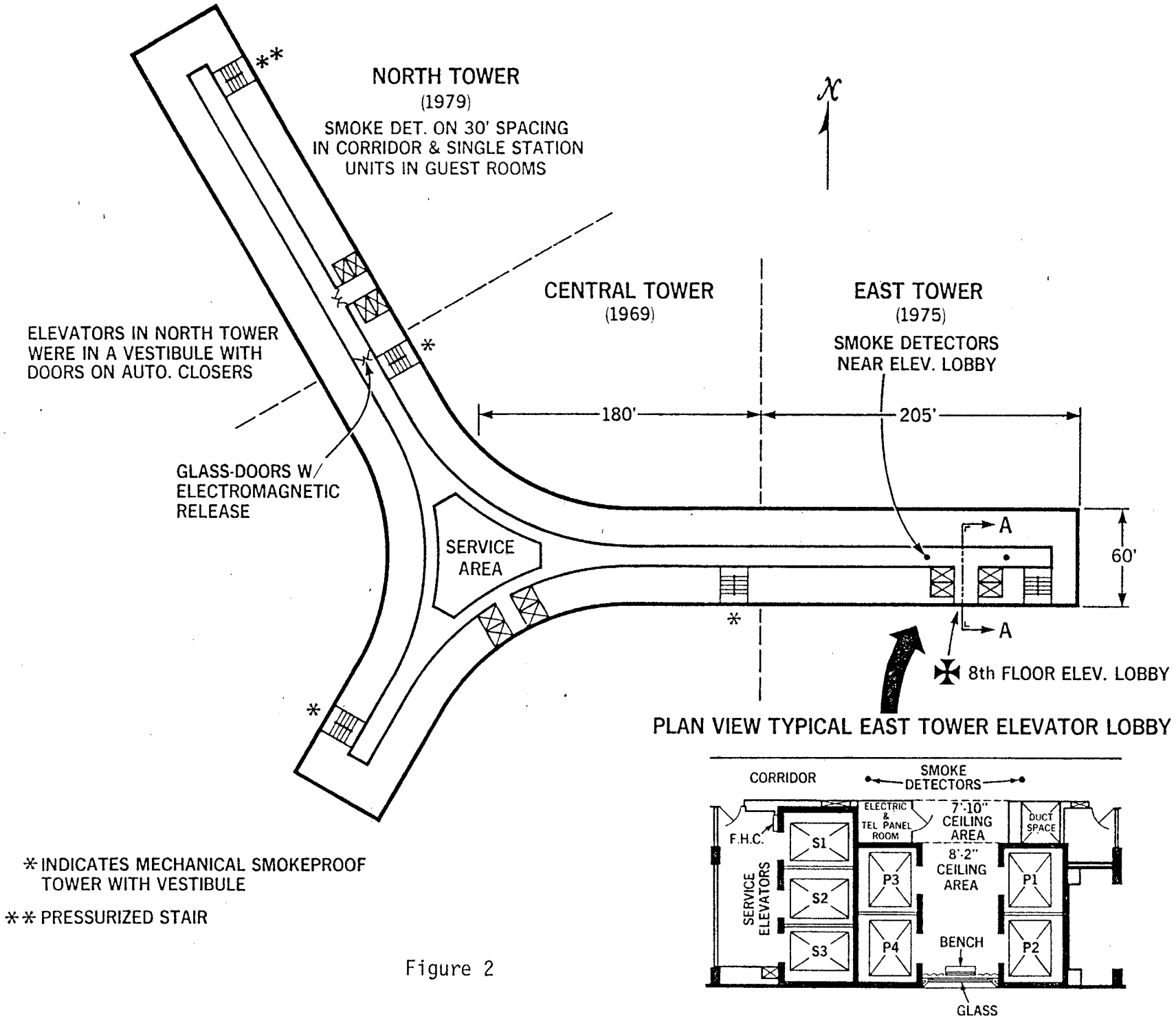
The weather on the evening of February 10, 1981 at nearby McClarran Airport was as follows:

Time	Conditions	Temperature (°F)	Humidity	Wind (mph)
7:00 PM	Partly Cloudy	53°	54%	ENE 4
8:00 PM	Cloudy	51°	63%	WSW 7
9:00 PM	Cloudy	51°	61%	NW 4



SECTION A-A OF EAST TOWER

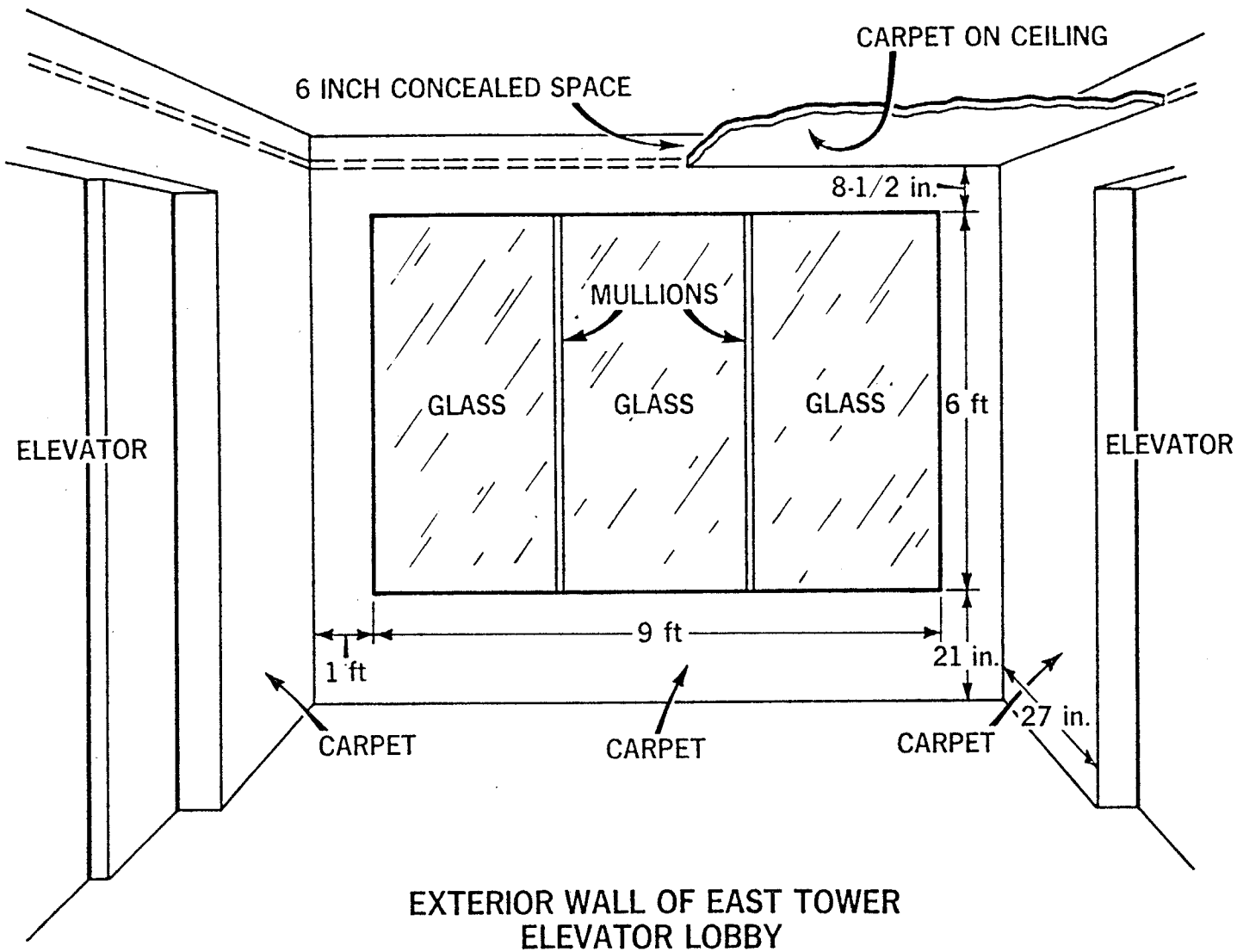
Figure 1



* INDICATES MECHANICAL SMOKEPROOF TOWER WITH VESTIBULE

** PRESSURIZED STAIR

Figure 2



EXTERIOR WALL OF EAST TOWER
ELEVATOR LOBBY
LAS VEGAS HILTON

Figure 3

III. FIRE INCIDENT

Fire Discovery

At 8:05 p.m. on February 10, 1981 the dispatcher in the Hotel's Security Office received a telephone call from an employee that there was a fire on the 8th floor in the vicinity of the East Tower elevator lobby. Two security officers were dispatched from the Security Room to the 8th floor via the service elevators in the Central Tower. Immediately after the officers left, an alarm was indicated for the East Tower 8th floor on a remote annunciator panel in the Security Room. At some point, the hotel's fire brigade was alerted, but exactly when has not been verified.

Upon arrival at the 8th floor, the security officers, who were equipped with portable radios, directed the dispatcher to call the fire department as they did have a fire.

The Clark County Fire Department received the alarm at 8:07 p.m. Clark County Station 18 is adjacent to the hotel complex and, upon leaving the station, fire fighters could see fire on the exterior of the building coming from two floors. On their arrival, the fire had extended to a third and fourth floor.

Fire Fighting and Rescue

First arriving engine companies set up to supply standpipes in the building as fire fighters proceeded inside with breathing apparatus and standpipe packs. Additional alarms were sounded and incoming fire fighters were directed to rescue efforts, emergency medical services, and fire suppression.

A ladder pipe was set up and used from the exterior of the building to knock down a portion of the fire. The ladder pipe was also directed into some

of the East Tower elevator lobbies up to the 16th or 17th floors. This ladder was used to knock down a very dramatic exterior fire spread rapidly advancing up the building before fire fighters in the interior could get above and ahead of it. Fire fighters on the outside observed hundreds of people at their room windows because they were trapped and watched one individual jump or fall from the 12th floor. They did not know if the interior fire fighting effort taking place on multiple floors was gaining any headway.

A command post was established by the Chief of Department east of the East Tower in the parking lot. An interior command post and initial casualty triage center was established on the 7th floor. Additional interior sector commands were set up on the 14th and 20th floors and on the roof.

Fire fighters that were involved in the interior fire fighting effort used the closest smokeproof tower and the interior stairway at the east end of the East Tower for staging areas. It became very difficult to go up or down the stairs due to the hose lines and large numbers of fire fighters and their equipment necessary in the stairs for the multi-floor interior attack. Guests were also using the smokeproof tower for evacuation early in the fire.

The interior stair on the east end of the East Tower became completely smoke-logged from the 8th floor to the top during the interior fire fighting efforts. The proximity to the heavy fire in the East Tower elevator lobby and the necessity of keeping the stairway door open because of hose lines connected to the standpipe on several floors allowed a great deal of smoke and heat to enter the stair and travel upward. This diminished the value of the stair as a staging area and made the suppression efforts extremely difficult.

East Tower public and service elevators and Main Tower public and service elevators were all brought to the 1st floor and placed on manual control. Three groups of fire fighters were transported via an East Tower service

elevator to the 7th floor on manual service by hotel security. Due to smoke conditions, fire fighters who climbed the East stairway had to utilize their breathing apparatus. Many fire fighters suffered smoke inhalation injuries when they ran out of air in this stair.

During the fire fighting and rescue efforts, two and possibly three additional separate fire ignitions were found. These ignitions apparently occurred well after the initial arrival of fire fighters -- sometime during the evacuation of guests and employees. These separate fires occurred in a 2nd floor linen and storage room and within a 3rd-floor service elevator lobby. There was a possible third ignition within an East Tower hose cabinet on the 9th floor. However, it is also possible that this was an extension or rekindle of the original fire. All three relatively minor fires were easily controlled by fire fighters.

A total of 23 engine companies, 6 ladders, 2 snorkels, 9 rescues, 2 air cascade units, and 12 aircraft were utilized during the fire fighting and rescue effort.

Evacuation

At some point after notification of the fire department, evacuation alarms were manually and automatically activated in the building although many occupants reported not hearing any alarms. It is likely that the alarm system in the East Tower failed early due to fire exposure. Voice communications capabilities were utilized by the fire department. Fire fighters advised the occupants of their presence and what actions to take.

Occupants either evacuated via stairways, were trapped in their rooms by the fire, or waited the fire out in their rooms. Many people encountered smoke in the stairs, especially in the East Tower east interior stair. Some people in stairways were able to get to the roof where they were rescued by helicopters.

Occupants who were trapped or who remained in their rooms and telephoned the hotel operators were told to put wet towels and sheets around the doors and wait for the fire department. Most of the smoke inhalation injuries occurred when guests opened their room doors or tried to evacuate the building.

One guest reported using an elevator in the Central Tower to evacuate after finding out about the fire. The elevator (not tied into smoke detectors) opened on the 8th floor, the floor of origin, which was charged with smoke. The guest was able to crawl down the corridor and bang on guest room doors. One door was opened and the guest waited out the fire there. Three other people on the same elevator were later found dead in the elevator lobby.

One guest who was trapped in his room reported smoke coming in through the fan coil unit for several minutes. A sound like a door closing was heard and the smoke stopped. This sound was probably the fire damper in the grill in the corridor wall closing due to the melting of the fusible link.

Fifteen hundred people in a first-floor showroom evacuated orderly and without incident after dancer Juliet Prowse had started her show when the people were told of a "problem" in the hotel. The word "fire" was specifically left out of the announcement.

Casualties and Damage

There were eight fatalities and approximately 350 injuries as a result of this fire. Forty-eight of the injured were fire fighters. One fire fighter suffered a severe heart attack in the hospital as a direct result of smoke inhalation.

The fatalities were all hotel guests. Three victims were found in the Central Tower elevator lobby of the 8th floor. One of these victims was

halfway in and halfway out of an open elevator. One victim jumped or fell from a 12th-floor room that was very close to the East Tower elevator lobby (Room 1263). There was evidence that the door to the corridor had been left open.

The other four victims were found in guest rooms in the East Tower. All the rooms had open doors to the corridor or evidence that corridor doors had been opened. Two victims were found in a room on the 10th floor at the easternmost end of the East Tower (Room 1069). One fatality was found in the corridor of the 21st floor and dragged into Room 2178, which was halfway between the East Tower elevator lobby and the smokeproof tower. One victim was found on the 24th floor in Room 2464, which was separated from the East Tower elevator lobby by a room containing an ice machine.

There were no fatalities in rooms in which occupants kept the doors closed and waited out the fire or waited for rescue. Partitions between the corridor and guest rooms along with the doors did resist the fire, even though some had severe fire exposure. Fire dampers in the grills in the corridor walls that were exposed to heat in the East Tower appeared to have closed and helped to limit the fire spread.

Some guest rooms had doors that were left open by evacuating guests. These rooms either received extensive smoke (see photograph 9) or heat damage or in some cases the fire spread from the corridor into them, causing room burnout.

The fire spread varying distances down the corridors, consuming the vinyl wall covering and carpeting on the floor. The following table indicates the approximate distances that received actual fire exposure. These variations were most likely dependent on interior fire fighting effectiveness, the time from ignition to water application, and the impact of ladder pipe stream penetration into the East Tower elevator lobbies. The 9-foot overhanging

balcony of the 29th floor created a large heat collector that forced a great deal of the fire from the building's exterior into the elevator lobby on the 28th floor.

Floor	Length (feet) in Corridor of Flame Exposure
30	Limited
29	Limited
28	302
27	38
26	169
25	65
24	63
23	68
22	75
21	83
20	131
19	90
18	126
17	104
16	143
15	147
14	88
13	174
12	161
11	162
10	181
9	247
8	299

Smoke spread was throughout the East Tower and Central Tower. The North Tower received little damage, if any, due to the glass doors on electromagnetic releases at the end of the original Central Tower.

IV. ANALYSIS

Discussion

The fire ignitions relative to this incident have been determined to be of incendiary origin by Clark County fire and Metropolitan Las Vegas police officials. The individual who initially called in the alarm to the security dispatcher was arrested, charged, and indicted for eight counts of homicide and arson. The individual was a hotel room service bus boy, and had been employed there only a few weeks.

At the time of preparation of this report, the most probable ignition scenario had not been released. However, initial reports do not indicate any large amounts of accelerant present or any other evidence which indicates anything other than a small, open flame ignition source.

Once ignition occurred in the East Tower 8th-floor elevator lobby, the fire most likely rapidly involved the furnishings and carpeting on the walls and ceiling. After flashover took place, the exterior plate glass window failed, allowing a flame front to extend vertically on the exterior of the building. The fire continued to spread horizontally within the East Tower corridor with the vinyl covering on the walls and some ceiling areas contributing to the fuel load.

The fire progressed vertically up the exterior of the building floor by floor. It is likely that the process accelerated as more floors became involved and the fire was reaching toward the upper portion of the building. Once the 8th floor became involved, based on eyewitness accounts of fire fighters, it is estimated that the vertical exterior spread took 20 to 25 minutes to reach the top of the building.*

*This exterior flame spread phenomenon has been described in an earlier fire loss study. See A. Elwood Willey, "High-Rise Building Fire, Sao Paulo, Brazil," Fire Journal (Boston: NFPA), July 1972.

The vertically extending flame on the building's exterior probably involved two mechanisms of heat transfer to the glass and elevator lobby on the next level. There would have been a great deal of radiant thermal energy transfer through the glass, possibly igniting the draperies, wooden bench and foam plastic cushion. These would have acted as kindling fuels that soon ignited the carpeting on the walls and ceiling.

In addition to the radiant heat transfer, with the recessed plate glass and the shape of the spandrels (triangular cross section), the flow of flame and heated gases most likely would have created turbulence and a rolling effect, causing direct flame contact with the glass. This would have contributed to the heat transfer into the elevator lobby along with early failure of the glass.

The combustible carpeting material applied to the East Tower elevator lobbies appears to be a major factor in the formation of a flame front on the exterior and the subsequent floor-to-floor spread. Interior finish as a factor contributing to flame emission from windows has been documented in the research literature.*

The Center for Fire Research, National Bureau of Standards tested samples of carpet material from an undamaged East Tower lobby in order to determine an estimated flame spread classification. Two samples were tested by the Radiant Panel Test Method, ASTM E-162 (an appropriate test method for wall or ceiling interior finish materials). Results indicated flame spread indexes of 244 and 234, for an average of 239. The carpet tested would be classified as Class C (flame spread 76 to 200) or Class D (greater than 200). These results were indeterminant, i.e., a specific flame spread classification was not

*See G. W. Shorter et al., "The St. Laurence Burns," NFPA Quarterly, Vol. 53, No. 4 (April 1960), pp. 300-316 (also available as Reprint Q53-17). M. Law, Radiation from Fires in a Compartment, Fire Research Technical Paper No. 20 (London: Ministry of Technology and Fire Officers' Committee, Joint Fire Research Organisation, Her Majesty's Stationery Office, 1968).

determined, as the ASTM E-162 Test Method does not correlate well with NFPA 255 (ASTM E-84) Method of Test of Surface Burning Characteristics of Building Materials. Materials analysis indicated that the carpet was of mixed wool and nylon fibers; the percentage of each fiber was not determined. NFPA 101®, Life Safety Code® 1981, references the NFPA 255 (ASTM E-84) Test Method, and requires that carpeting applied to walls and ceiling have a Class A flame spread rating (0-25). See Code Review Section for details regarding flame spread classification requirements.

The only vertical spread of fire during this incident was via the exterior of the building. There was some evidence of smoke and heat travel in the elevator hoistways of the East Tower but this would be considered very minor relative to the exterior vertical spread.

Code Review

In the interest of comparing life safety problems exemplified in this incident to current national consensus standards, the 1981 edition of NFPA 101, Life Safety Code (the Code) was utilized for analysis purposes.

The following summary of requirements from the Code has particular relevance to this fire incident. The requirements cited in this section are for existing hotels unless otherwise indicated. In the Code, requirements for new hotels are contained in Section 16-3.4 and for existing in Section 17-3.4. This section is not intended to be a complete description of all parts of the Code that pertain to this hotel, nor is it to imply that the 1981 Code had been adopted in Clark County.

Interior Finish

17-3.3.1 This section establishes requirements for interior finish on walls and ceilings for various areas within existing hotels subject to the limitations and modifications specified in

Section 6-5. These requirements are:

a. Vertical exits - Class A or B

b. Exit access - Class A or B

c. Lobbies, corridors that are not exit access - Class A, B, C

d. Places of assembly (sec. 9-3.3)

e. Individual guest rooms and other rooms - Class A, B, C

6-5.6.2 "Materials such as carpeting having a napped, tufted, looped, or similar surface, when applied on walls or ceilings, shall meet the requirements of Class A interior finish."

Alarm and Communications Systems

Manual alarm systems are required for both new and existing hotels accommodating 15 or more guests. Unless sprinklered, new hotels are required to have a corridor smoke detection system connected to the alarm initiation system. Unless prohibited by the authority having jurisdiction, presignal systems are allowed.

Compartmentation of Corridors

17-3.6.2 Guest room doors that open onto an interior corridor shall have at least a 20-minute rating or 1 3/4-inch solid bonded wood core doors.

17-3.6.3 Doors between guest rooms and corridors are required to be self-closing and meet the requirements of 17-3.6.2.

17-3.6.4 "Unprotected openings shall be prohibited in partitions of interior corridors serving as exit access from guest rooms."

17-3.6.6 "Transfer grills, whether protected by fusible link operated dampers or not, shall not be used in these walls or doors."

There are two exceptions: one, if there is a corridor smoke detection system and, two, if automatic sprinklers are provided. In either case, the grills must be located in the lower 1/3 of the wall or door height.

The 1981 Life Safety Code has no requirement for the subdivision of exit access corridors.

Building Services

Section 17-5.2 of NFPA 101-81 requires heating, ventilating and air conditioning (HVAC) equipment to comply with Section 7-2, except as otherwise required in the chapter on existing hotels.

Section 7-2 of 101 requires equipment to be installed in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA 90A, or Standard for the Installation of Warm Air Heating and Air Conditioning Systems, NFPA 90B, as applicable.

A significant exception is that existing installations may be continued in service, subject to approval by the authority having jurisdiction.

The 1978 edition of NFPA 90A contains the following section:

2-2.2 "Public corridors in health care, penal, and residential occupancies shall not be used as a portion of a supply, return, or exhaust air system serving adjoining areas other than toilet rooms, bathrooms, shower rooms, sink closets and similar auxiliary spaces opening directly on the corridor. Air transfer because of pressure differential in health care occupancies and infiltration into residential occupancies from corridors is acceptable, provided door clearances shall not exceed those specified for fire doors in the Standard for Fire Doors and Windows, NFPA 80. Further, doors and/or wall grills shall not be used."

Sec. 17-5.3 of 101 requires elevators to comply with the provisions of Section 7-4. Section 7-4 references the Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks, ANSI A17.1. Existing installations may be continued in service subject to approval by the authority having jurisdiction.

Summary

The extensive fire spread exhibited during this incident rapidly exposed a large number of guest rooms on many floors along with a large number of building occupants. This multi-level fire also presented an extremely difficult fire fighting and rescue operation. This situation was not unlike the conditions present with unprotected vertical openings.

If water had been applied to the fire very early in its development (before flashover of the 8th floor elevator lobby), the probability of having

a major fire incident would have been greatly diminished.

The two most significant factors that led to the rapid vertical fire spread were the failure to extinguish the fire in its incipient stage and the presence of combustible interior finish in the form of carpeting on the walls and ceiling of the East Tower elevator lobby.

V. APPENDICES

A. Test Results

B. Photographs

A. Test Results

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

AUG 31 1981

August 18, 1981

MEMORANDUM FOR Merritt Birky, Head
Combustion Toxicology Research

From: Sanford Davis, Head S. Davis
Fire Test Methods Research

Subject: Carpet from Las Vegas Hilton

Because the carpet specimen obtained from the Las Vegas Hilton was wall-mounted, it was appropriate to measure its flame spread according to ASTM E 162. Whereas the codes usually specify ASTM E 84 for classifying interior finish materials, E 162 may be expected to provide an estimate of the flame spread classification.

The carpet specimens were conditioned at 73 F and 50 percent relative humidity for several weeks prior to testing. There was only sufficient material to run two specimens: flame spread index 244 and 234, for an average of 239.

Not knowing what the code requirements were at the time of the fire, it is not possible to state whether the carpet was in compliance. This carpet would be classified as Class D (>200 FSI) or Class C (76 to 200 FSI); this is indeterminate because of the poor correlation between ASTM E 84 and E 162.