

FIRE AT THE MGM GRAND

A Preliminary Report

The NFPA has completed a preliminary report of its investigation of the MGM Grand Hotel fire that killed 84 people and injured 679 others in Las Vegas, Nevada, on November 21, 1980.

The NFPA's preliminary conclusions are that lack of fire-resistant barriers, highly combustible interior furnishings and finishes, and failure to extinguish the fire in the incipient stages were major factors that accounted for the rapid fire spread and the deaths.

The MGM Grand Hotel was located on the southeast corner of the intersection of East Flamingo and Las Vegas Boulevards. The 26-story building was constructed during 1972 and 1973 and opened in December 1973. Like most of the large hotels on the "Strip," it was under the jurisdiction of Clark County.

The building consisted of a very large ground floor area that contained the Casino, restaurants, showrooms, a convention center, and the upper level of a jai alai fronton. (See Figures 1 and 2.) The below-grade level (Arcade level), which had approximate outside dimensions the same as the Casino level, contained the lower level of the jai alai fronton, a movie theatre, a large number of shops and boutiques, service areas, and underground parking. The Casino and Arcade levels were directly connected by an open stairway. The gross dimensions of the Casino and Arcade levels were 380 feet by 1,200 feet; the huge Casino itself measured approximately 150 feet by 400 feet. The Hotel, which consisted of three wings, was built on top of the Casino and Arcade levels. Each wing was approximately 320 feet long and 70 feet wide.

The I-shaped tower of the Hotel contained 2,076 guest rooms. An additional 780 guest rooms were under construction on the west side of the existing building. On the morning of November 21, 1980, the building contained 5,000 guests, staff members, and other people.

The building was of mixed construction. The construction types included fire-resistive, protected noncombustible, and unprotected noncombustible. The interior finish varied considerably and included both combustible and noncombustible materials.

The building complex was partially sprinklered. Protected areas included the Arcade level, major portions of the Casino level, and part of the 26th floor. Convention areas, showrooms, and some restaurants were protected



on the Casino level. The large gambling Casino and the high-rise tower were not sprinklered.

Means of egress from the Casino level was either through doors directly to grade level or down a stairway to grade level. The means of egress from the high-rise tower consisted of one interior stairway and one smokeproof tower for each of the three wings, or a total of six stairways. All of the stairways discharged to the outside of the building. At the bottom of most of the stairways, horizontal passages were used to reach the outside. All three of the interior stairways and one of the smokeproof

Studying The Fire

In conjunction with the Clark County Fire Department, a cooperative investigative effort is now being conducted by the NFPA, the US Fire Administration (USFA), and the National Bureau of Standards (NBS), under the NFPA/USFA/NBS Major Fires Investigation Agreement. This agreement, funded by all three organizations, provides for the investigation of technically significant fires by the NFPA Fire Investigations Department to document and analyze incident details and report lessons learned for loss prevention purposes. Due to the extensive nature of the MGM fire, all three groups sent their personnel to the site; the NFPA is responsible for compilation of the data, analysis, and preparation of the final report.

In addition, the NFPA is conducting a human behavior study of the hotel's occupants in cooperation with the Clark County Fire Department, the US Fire Administration, and the National Institute for Occupational Safety and Health. The results of both studies are expected to be available by June 1981.

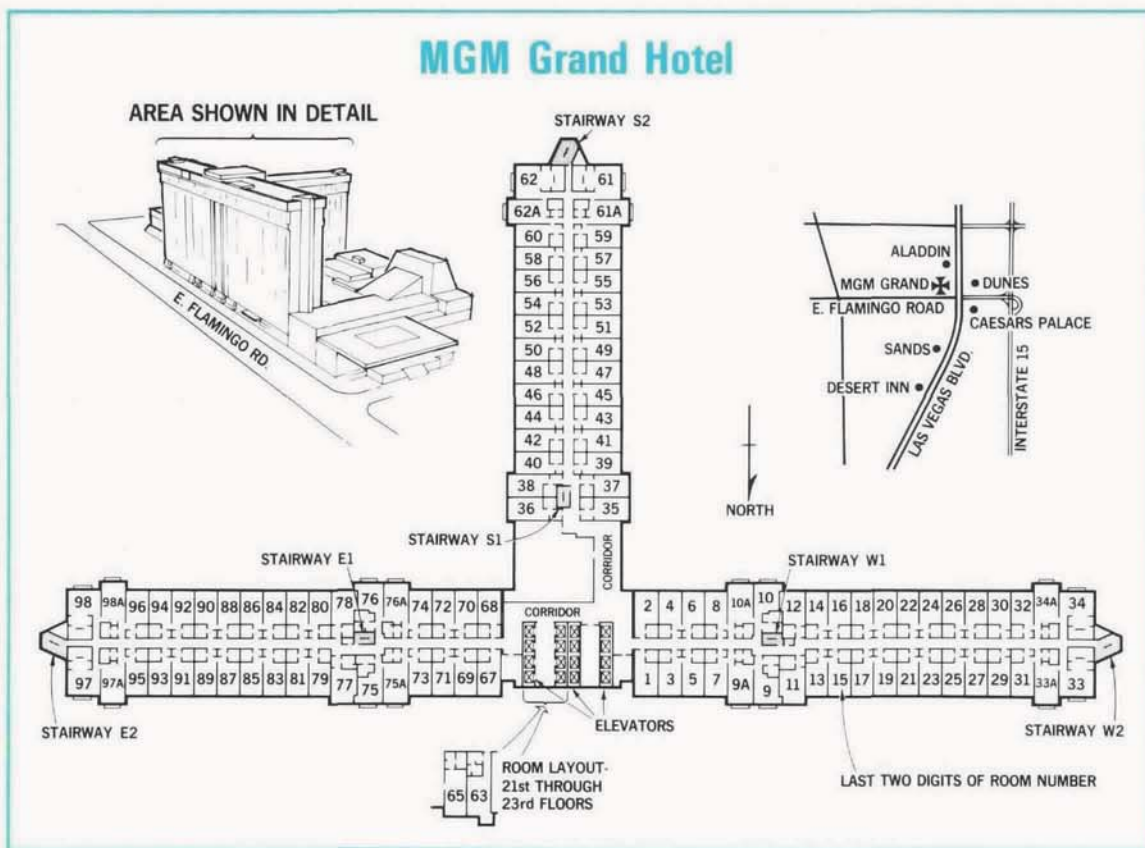


Figure 1.

towers were not enclosed with two-hour fire-rated construction. The doors in the stair enclosures were locked from the inside; once people entered the stair enclosures, they could not gain access to other floors until they reached the ground floor.

A manual fire alarm system with bells and public address capability was provided. There apparently were no manual pull stations on the Arcade and Casino levels; however, the alarm system could be activated from the security office on the Casino level. Manual pull stations were located throughout the guest-room floors. The alarm system was arranged to sound a pre-signal, and then a general alarm five minutes after activation of a manual pull station. The system was a local-signaling system only. Other than automatic sprinklers, the building contained no automatic detection devices.

The heating, ventilation, and air-conditioning (HVAC) system had four major subsystems. Heated or cooled air was supplied through ducts for the Arcade and Casino levels. Return was provided through air transfer grills and the lighting system to a large return-air plenum above the ceiling. The return-air plenum for almost the entire Casino level was through one undivided area.

The second subsystem provided conditioned air from a mechanical penthouse on the roof to the central core and three wings of the high-rise. This penthouse also contained the elevator machinery for one bank of elevators.

There was no return air from the guest-room corridors. The third subsystem included guest rooms equipped with individual fan coil units; these had chilled water piped to them, and make-up air was provided from the corridor. The fourth subsystem was provided for toilet exhaust. The toilet-exhaust system serviced the Casino level and guest-room toilets in the tower.

In the high-rise portion of the building, two "seismic joints" went from the area above the ceiling of the Casino to the return-air plenum above the 26th floor. These were shafts, approximately one foot wide, that isolated the east and west wings of the building from the south wing. The bottoms of these seismic joints were not enclosed and communicated directly with the return-air plenum above the Casino ceiling. Where the corridors crossed these seismic joints on each level, there were flexible, non-fire-rated, "accordion-fold" stainless panels in the corridor walls that went from floor to ceiling level.

The Fire

At approximately 7:10 am on November 21, an employee discovered a fire in a "bus" station in a restaurant called The Deli at the east end of the Casino. The bus station was a waitress and bus-boy service area. The Deli was not open for business, but the Casino and adjacent Orleans Coffee House were in full operation. The Security

Department was contacted, and an employee attempted to extinguish the fire using an occupant-use hose; the attempt was unsuccessful, however, due to the magnitude of the fire. The Clark County Fire Department was notified at about 7:15 am. There is no evidence that the building fire alarm system sounded.

The Clark County Fire Department has determined that the most probable source of ignition of this fire was electrical in nature and the area of fire origin was within a combustible concealed space adjacent to a pie case along the south wall of The Deli.

The first materials ignited included plywood that was used to enclose the pie case. The fire probably smoldered for a period of time before it broke out of the concealed space and into The Deli bus station, at approximately 7:10 am.

Initially, smoke probably moved directly from The Deli bus station to the return-air plenum above the ceiling through an air-transfer grill. Once open flaming took place in the bus station, the fire apparently began to spread on lightweight fuels such as plastic and paper products and the combustible interior finish. It then spread to the remainder of The Deli, consuming other available combustible materials, such as wooden decorations and the foam plastic padding of chairs and booths.

Flashover of the bus station and then The Deli, plus the lack of fire-resistant barriers, allowed the thermal energy to be transferred out of The Deli and into the Casino. Large amounts of air flowing through the adja-

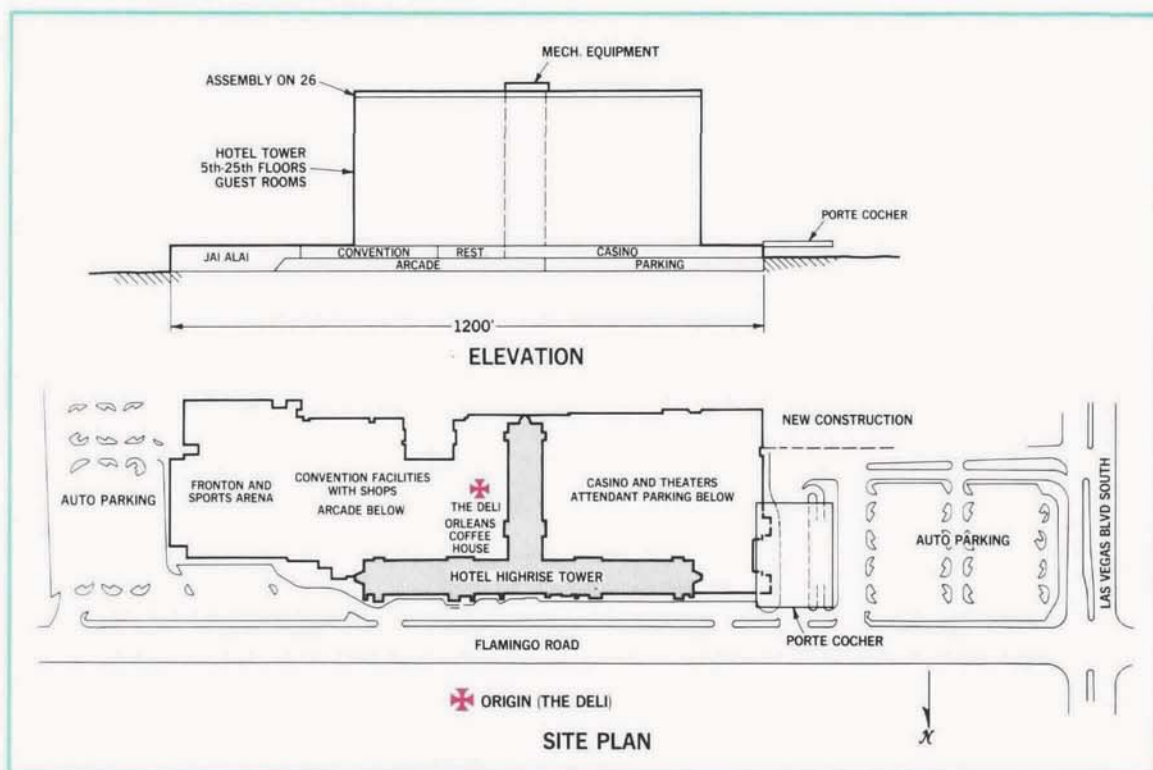
cent Orleans Coffee House and the Arcade provided a fresh-air supply for the fire. The Casino contained highly combustible furnishings and contents and combustible interior finish. Large amounts of plastic materials such as foam padding and mouldings were included in the fuels. The presence of fuel, air supply, and the very large undivided area of the Casino allowed for extremely rapid fire spread and heavy smoke production. The entire Casino and porte cochere¹ on the west end of the building were fully involved with fire by 7:25 am. The fire spread to upper floors by elevators, stairways, and shafts located at seismic joints in the high-rise tower.

Tower occupants slowly became aware of the fire when they smelled or saw smoke, heard people yelling, or eventually noticed helicopters flying around the building. Some occupants were able to leave the building without assistance. Many were rescued by fire fighters, construction workers, and passersby. Many others made their way to the roof, where they were removed by helicopters. A large number of guests were trapped in their rooms, where they awaited rescue. The total evacuation of the building's occupants and staff took nearly four hours.

Preliminary information on the locations of victims in the hotel accounted for approximately 78 of the total 84

¹ A roofed structure extending from the entrance of the building over an adjacent driveway, used to shelter persons getting in and out of vehicles.

Figure 2.



fatalities. Some casualties were removed from the upper levels of the building before their locations were documented. Fourteen victims were on the Casino level, and approximately 64 victims were found on the upper floors of the hotel. Of the 64 victims above the Casino level, 29 were located in guest rooms, 21 were in corridors and elevator lobbies, 5 were in elevators, and 9 were in stair enclosures. Most of the victims were on the 20th through the 25th floors.

Three of the interior stairways were not enclosed with two-hour fire-rated construction. There were direct openings from the return-air plenum above the Casino to these stairways. In addition, non-rated access panels allowed fire and products of combustion to spread into these stairways. The spread of smoke into the stairways directly contributed to several fatalities. At least one of the smokeproof towers was not enclosed on the bottom with adequate fire-resistant materials, which allowed di-

rect transmission of smoke from the Casino area into the smokeproof tower. As far as can be determined, the air-handling equipment was not equipped with smoke detectors arranged to shut down the systems upon sensing products of combustion. In addition, some fire dampers were disabled, so that they could not close when the fusible links melted, and others did not close completely. As a result, products of combustion were distributed through the tower by the heating, ventilating and air-conditioning equipment.

The fan coil units in the guest rooms most likely contributed to the movement of products of combustion from the corridors to the guest rooms. These fan units were not directly connected to any vertical air shaft; make-up air was provided from the corridor, through a duct with a fire damper. The fan units provided a method for smoke spread that may also have contributed to several fatalities. △

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