

**DORMITORY**  
Williamsburg, VA  
January 20, 1983



# **FIRE INVESTIGATIONS**

**NATIONAL FIRE PROTECTION ASSOCIATION**

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Summary Investigation Report

Jefferson Dormitory Fire  
College of William and Mary  
Williamsburg, Virginia  
January 20, 1983

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In Cooperation With

Federal Emergency Management Agency/  
United States Fire Administration

and

National Bureau of Standards  
Center for Fire Research

This investigation was conducted by the National Fire Protection Association (NFPA) under an agreement with the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) and the National Bureau of Standards/Center for Fire Research (NBS/CFR). It was jointly funded by these agencies and the NFPA.

The substance of this investigation report is dedicated to the public. It may be freely reprinted with the customary crediting of the source. The authors and publisher are solely responsible for the accuracy of statements or interpretations contained herein.

## INTRODUCTION

The National Fire Protection Association (NFPA) investigated the Jefferson Dormitory fire on the campus of the College of William and Mary, Williamsburg, Virginia, in order to document and analyze significant factors that resulted in the loss of the dormitory and its contents due to fire. This study was conducted under a Major Fires Investigation Agreement with the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) and the National Bureau of Standards/Center for Fire Research (NBS/CFR).

The agreement, funded by all three organizations, provides for the investigation of technically significant fires by the NFPA Fire Investigations and Applied Research Division to document and analyze incident details and report lessons learned for loss prevention purposes.

The NFPA became aware of the Jefferson Dormitory fire on January 20, 1983. James R. Bell, Legislative Technical Specialist in the NFPA Washington, D. C. office, traveled to Williamsburg, Virginia, to document the facts related to this fire. A three day on-site study and subsequent NFPA analysis of the event were the basis for this report. Entry to the fire scene and data collection activities were made possible through the cooperation of the Virginia State Fire Marshal's Office and the Williamsburg Fire Department. This report presents the findings of the NFPA data collection and analysis efforts.

This report is another of NFPA's studies of fires having particularly important educational or technical interest. The information presented is based on the best data available immediately after the fire incident and that obtained during subsequent follow-up. It is not NFPA's intention that this report pass judgment on, or fix liability for, the loss of property at the Jefferson Dormitory.

The cooperation of Howard H. Summers, Jr., Virginia State Fire Marshal, and Robert J. Baily, Fire Marshal, City of Williamsburg Fire Department, is acknowledged. The cooperation and assistance of Mr. Robert Goff, P.E., Chief Engineer, Mr. Frank F. Duffee, Quinn M. Harris, Jr., Deputy State Fire Marshals, Virginia State Fire Marshal's Office and Assistant Fire Marshals Bert Geddy, Robert Howard and T. K. Weiler, of the Williamsburg Fire Department, are greatly appreciated.

The assistance of Mr. W. Samuel Sadler, Dean of Students, and Mr. Michael Kershner, Planning Engineer and Safety Analyst, of the College of William and Mary, is acknowledged.

## Abstract

An early morning fire in the Jefferson Dormitory, on the campus of the College of William and Mary, Williamsburg, Virginia, January 20, 1983, required the evacuation of 184 occupants and led to an estimated \$4 million loss to the structure and contents. Prompt sounding of the manual fire alarm system and evacuation of the dormitory resulted in no injuries to any of the occupants. The fire was reported to the Williamsburg Fire Department at 1:13 a.m. The fire spread through the sprinklered building in non-fire stopped combustibile concealed spaces, not protected by sprinklers. Efforts of fire fighters to locate and extinguish fire in concealed spaces above ceilings and behind wall surfaces were unsuccessful. After approximately 1-1/2 hours of interior fire fighting efforts, fire fighters were forced to withdraw from the building when the corridor floor on the first floor collapsed and cracks formed in the exterior bearing walls. The developing fire caused the loss of the entire West Wing of the building and all of the attic and roof, with extensive damage to the remaining East Wing of the structure.

Factors contributing to property loss in this fire include:

- Development of the fire within combustibile concealed spaces beyond the reach of automatic sprinklers.
- Lack of automatic sprinkler protection in combustibile concealed spaces above suspended ceilings.
- Lack of fire stopping in horizontal and vertical concealed spaces.
- Openings in walls and partitions above suspended ceilings allowing fire spread above the ceiling through those openings.

Factors contributing to the successful evacuation of the dormitory were:

- Immediate sounding of the general evacuation alarm upon discovery of smoke conditions in the building.
- Prior practice of evacuation procedures by occupants during required fire drills.
- Resident Assistants on each floor had received training in evacuation procedures.
- Individual initiative of Resident Assistants to exercise the responsibilities of their positions in ensuring evacuation of occupants.

### BACKGROUND

#### Building Occupancy

Jefferson Dormitory was one of the oldest dormitories on the campus of the College of William and Mary, the second oldest American college after Harvard University. The dimensions of the building were 44 feet by 213 feet. The three story with basement and attic dormitory structure (see Figure 1) was built in 1921 and occupied at that time as the first dormitory for women. (See Photo 1.) The original building also contained the women's gymnasium and swimming pool. The building was converted solely to dormitory use in 1965 and underwent extensive renovations in 1975. The renovations included new plumbing, heating, and electrical systems and extension of the automatic sprinkler system to parts of the building not previously sprinklered except for concealed spaces.

At the time of the fire, the coed dormitory structure housed 184 residents; 176 freshmen students and 8 Resident Assistants (upperclassmen and graduate students). Not all of the residents were in the dorm at the time of the fire.

## Construction

The 62-year old Georgian style dormitory was of ordinary construction with wood frame members and 14-inch thick brick bearing walls. The roof was slate on wood sheathing on wood trusses, rafters and beams. Included in the original construction were steel beams and columns which provided support over the spaces that had contained the gymnasium, swimming pool, and centrally located lobby areas. Wood framing around the unprotected steel created unstopped concealed spaces that were continuous throughout the building. Heating pipes, electrical conduit, and ventilation ducts were enclosed in combustible chases open between floor levels and communicating to other concealed spaces.

Floor assemblies in most areas of the building consisted of 2 cross layers of tongue and groove sub-flooring and flooring on 2 inch by 8 inch and 2 inch by 10 inch floor joists. Floor joists ran both transversely and longitudinally in the building.

The floor assembly of the first floor of the east wing consisted of concrete slab on steel deck and bar-joists. This floor assembly had been added when the gymnasium area located in the East Wing was converted to dormitory room use. The addition of the floor separated the original 2-story area into two separate dormitory floors.

The attic was divided into five compartments by four 1-hour partitions. The partitions, consisting of plaster on gypsum button-board and 2 inch by 4 inch studs, were equipped with fire doors and fire dampers in openings between compartments.

## Interior Finish

Interior finish throughout most of the building consisted of plaster on heavy metal lath applied to wood studs. On exterior walls, plaster and lath



was applied to furring strips, creating a small concealed space between the brick bearing wall and the plaster and lath.

On the ground and first floors of the East Wing and the ground floor of the West Wing, the interior finish of the corridors consisted of paint on concrete block walls installed during the 1975 renovations.

### Concealed Spaces

The original ceiling interior finish had consisted of plaster on heavy metal lath applied directly to the underside of the 2 inch by 8 inch and 2 inch by 10 inch floor joists. During the renovation of the dormitory in 1975, a suspended mineral tile ceiling had been added in corridors and other public areas. The ceiling tile in corridors and other public areas was suspended in a metal grid-work supported by hanger wire at a height of approximately 8 feet. A concealed space approximately 18 inches in height existed between the original plaster and lath ceiling which was attached to the floor joists and the suspended mineral tile ceiling.

In most areas, the original plaster and lath ceiling was left in place during the renovation. However, much of the remaining plaster and lath had multiple holes made to allow for the penetration, attachment, or support of electrical conduits, anchoring of suspended ceiling tile hanger wires, and attachment of hangers for sprinkler piping. (See Photo 3.) On the ground floor of the West Wing, the plaster and lath ceiling had reportedly been removed from the underside of the floor joists leaving the floor joists and subflooring totally exposed.

In corridor areas, plaster and lath had been removed from the top of corridor walls exposing top plates and stud caps of the corridor separation walls. Concealed spaces above the central lobby, corridors and above some student rooms were open and continuous.

### Means of Egress

Dormitory rooms were located on either side of a central 5-foot wide corridor. A typical floor contained 12 to 16 dormitory rooms in each wing. (See Figure 1.) In addition, each floor contained bathrooms, lounges, or kitchenettes. The ground floor also contained mechanical, electrical and game rooms as well as a laundry room. In the center of the building was a lobby area which divided the structure into two wings, designated as the East and the West wings. Corridors were arranged with two means of escape including a central stairway and stairways at the end of each wing. The central stairway was enclosed with a non-fire rated, combustibile enclosure and 1 1/2-hour B labeled fire doors. The stairs at the ends of the corridors had 2-hour fire rated enclosures and 1 1/2-hour B labeled fire doors. The stairways discharged to the exterior at grade.

### Mechanical Systems and Utilities

The dormitory was heated by steam from the campus central heating system. Fresh air was supplied by a 3,575 CFM air handling unit located in the attic. The fresh air was supplied to each floor corridor through ducts located in four shafts. Each duct penetrated the corridor at each floor with a 6 inch by 30 inch grille and fire damper. Two grilles were located in the corridor of each floor in each wing. There was one additional duct shaft which provided exhaust ventilation for the kitchen ovens through the roof.

### Fire Protection Systems

Jefferson Dormitory was provided with a full automatic sprinkler system except for the concealed spaces above the suspended ceilings. Sprinkler protection covered all dormitory rooms, corridors, public areas, and utility service rooms within the building. Two pendant sprinkler heads provided coverage in each student room beneath the suspended mineral tile ceiling. In corridors and other public areas, pendant sprinkler heads provided protection

beneath the suspended ceiling. Sprinkler heads on branch lines in each corridor were spaced at a distance of approximately 14 feet 6 1/2 inches.

Automatic sprinkler system protection was not extended above the suspended ceiling tile or above the original plaster and lath ceiling finish to protect combustible concealed spaces. Multiple penetrations through the original plaster and lath ceiling and wall surfaces exposed floor joists, floor sheathing, and other wood structural members.

The sprinkler system was provided with an electric water flow alarm at the riser in addition to a water motor alarm located at the northeast corner of the building.

The sprinkler system was inspected and tested quarterly by outside contractors in conjunction with Buildings and Grounds personnel of the College. Information contained on the inspection tag indicated that the last inspection and test had been conducted on January 13, 1983, one week before the fire. At the last test, the following information was recorded:

- Static Pressure 60 PSI
- Residual Pressure 55 PSI
- Did Alarms Operate? Yes
- Water Supply Valve Open and Sealed? Yes

Information on the available water supply for the sprinkler system was not available for review by NFPA.

The building was also provided with a wet standpipe system. Two risers for the system were located at opposite ends of the building near the exit stairway door from each corridor. The hose cabinets contained 1 1/2-inch occupant hose and a separate valve for fire department use as well as a ten pound dry chemical fire extinguisher.

The building was provided with a manual evacuation alarm system. Manual pull stations were located at either end of the corridor in each wing, the

lobby area on each floor, the attic, and some of the building's utility areas. Activation of the pull stations sounded alarm bells throughout the building.

The building was not provided with an automatic smoke detection system. A single heat detector was installed in the building mechanical room located on the first floor.

Activation of the sprinkler water flow alarm, heat detector, or manual pull stations would sound the general evacuation alarms and transmit an alarm signal to the proprietary alarm console in the communications center of the Campus Police. The Campus Police communications center was connected to the Williamsburg Fire Department by means of a direct telephone line.

#### Public Protection

Williamsburg is a small city with a population of 10,000 located in the southeastern part of Virginia. The city has an area of five square miles. Located within the city limits, however, is the historic restoration of Colonial Williamsburg, one of Virginia's early capitals and site of many historic events connected with America's colonial period and the Revolutionary and Civil Wars. This attraction draws 1.5 million visitors each year to the city.

The College of William and Mary, the second oldest university in the country after Harvard University, is a small Virginia state operated school having 4500 undergraduate and 1500 graduate students.

The Williamsburg Fire Department is comprised of 23 paid personnel and 37 volunteers. The Department provides both fire protection and emergency medical services to the city, the college, and Colonial Williamsburg. Water for public fire protection is provided through the water system of the city. The college is responsible for water distribution within the confines of the college property.

### Pre-Emergency Training

According to the regulations of the college, each resident hall is required to have a minimum of two fire drills per semester. The state law requires that the residence halls be evacuated during a drill. It is a function of the Area Coordinator (a college employee who supervises student housing) and Resident Assistants (upperclassman and graduate students assigned to each building area) to ensure that all persons have evacuated in accordance with the Fire/Emergency Evacuation Plan for the building. In this dormitory, a Residence Assistant was assigned to each separate floor and wing of the building.

The regulations require that room doors be closed by occupants when the building is evacuated. The evacuation plan further requires that residents report to a designated outside assembly area.

### General Weather Conditions

At the time of the fire, the temperature was approximately 14 degrees Fahrenheit, the weather clear, and there was no measurable wind.

## THE FIRE INCIDENT

### Discovery and Evacuation

At approximately 1:10 a.m., two residents of the third floor, one of whom was the Resident Assistant for the West Wing, noticed the smell of smoke in their room. As they entered the corridor to investigate the source of the smoke, a single station battery powered smoke detector located in a room across the corridor began sounding an alarm.\* The occupant of the second room, awakened by the detector alarm, also stepped out into the hall to investigate. Smoke was coming from a ventilation duct opening located near the east end of the corridor.

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\* The single station battery operated detector had been given to the student as a Christmas present.

The Resident Assistant told the occupant in the second room to pull the manual fire alarm station located at the end of the corridor activating the general evacuation alarm and sending an alarm signal to the Campus Police office. The Resident Assistant also went to a phone in the corridor to call the Campus Police. He reported that the alarm that they were receiving was not a false or accidental alarm and that there was smoke in the building. The alarm was received by the Campus Police at 1:11 a.m. The Campus Police immediately reported the receipt of the alarm signal to the Williamsburg Fire Department over the direct line.

Occupants of the third floor attempted to cover the opening to the air conditioning duct (the grille was missing) with a piece of cardboard to prevent the smoke from entering the corridor. Their attempts were without success.

Many residents of the dormitory, thinking the alarm was a fire drill or a false alarm, threw on robes, coats, and shoes, and casually began to exit from the building into the very cold weather.

Using a pass key and beating on doors, the Resident Assistant from the third floor checked each room to see that it had been evacuated. The Resident Assistant used a towel over his face due to the heavy smoke beginning to build up in the corridor. Other Resident Assistants in the building directed the evacuation of the students from each floor. Once outside, residents quickly scattered to find shelter from the bitter cold weather, preventing Resident Assistants from obtaining an accurate head-count.

Upon hearing the alarm, the Head Resident went to the electrical room on the ground floor to check the alarm panel. Upon entering the room she saw fire around the light fixture in the the concealed space above the ceiling. She called the Fire Department to advise them of the fire.

Occupants entering the basement corridor of the West Wing found smoke and fire issuing from within the air conditioning duct located at the east end of the corridor. Students attempted to extinguish the fire using a fire extinguisher. Although the attempt apparently knocked down the flames, smoke continued to pour into the corridor.

On the third floor, two residents who had not yet evacuated the building attempted to use the hose from the standpipe hose cabinet located in the West Wing. Their efforts were limited to stretching the hose since heavy smoke forced them evacuate to a lower floor. The hose was not charged.

When the Fire Department arrived at 1:14 a.m., the senior fire officer reported that most of the students had already evacuated. All of the residents except one evacuated from the dorm following the fire evacuation procedures. One student was removed from a second floor balcony over a ground ladder after being overlooked during the evacuation and becoming aware of the fire after Fire Department arrival.

Dormitory Resident Assistants, campus police, college officials, along with the Fire Department, made repeated efforts in the early hours of the fire to obtain an accurate head count. This effort was made more difficult since the students who had evacuated from the building quickly sought refuge from the bitter cold in nearby dorms and other student residences.

Since it was not known whether all occupants had definitely evacuated the building, Fire Department search and rescue teams began a search of the building. Two teams of two firefighters each conducted a room by room search of the dormitory using master keys which had been turned over to them by Resident Assistants.

Fire fighters searching student rooms reported that search procedures carried out in heavy smoke conditions were complicated due to the presence of

loft beds. Many of the beds had the mattress platform located near the ceilings of the rooms which made the search of the beds by firefighters, with breathing apparatus, harder due to the cramped space between the platform and the ceiling.

#### Fire Department Response and Actions

Responding from the station located 7 blocks from the dorm, the first fire apparatus arrived at 1:14 AM. The initial response consisted of the duty Assistant Chief and two engines with a Captain and three fire fighters. The first fire officer to enter the building was met by a student who stated there was smoke in the building but did not give the location. The officer reported that there was a light smell of smoke in the corridors and that the smoke "had the smell of a trash fire." The first floor was free of any visible smoke. A search of the upper floors was begun; smoke was found rising around an oven in a kitchenette located on the second floor of the building. As fire fighters worked on removing the oven to investigate the source of the smoke, the heat and smoke in the kitchenette intensified. Fire fighters recognized that the source of the smoke was below them.

On the first floor, fire fighters noticed that the baseboards located on the east end of the corridor of the West Wing were beginning to discolor. Removing the baseboard molding, fire fighters found fire in the combustible concealed spaces under the floor and behind the wall of the corridor. As more molding was removed and attempts made to extinguish the fire, it was apparent that the fire was already well advanced. It was determined that the fire was spreading in the non-fire stopped concealed spaces beneath them. The floor was opened for access to the fire causing heat and smoke conditions to build rapidly.



Additional 1 3/4-inch handlines were brought in on the ground and first floors. Fire fighters on the first floor pulled baseboards, cut into flooring, and pulled at the suspended ceiling tile. Wherever entry was made, fire was found. Efforts to "get ahead" of the fire were unsuccessful.

Fire fighters on the ground floor, pulling suspended ceiling tile and light fixtures, found the area above filled with fire. Locating the fire was made difficult as the amount of smoke reduced visibility. With eventual exposure to the fire, sprinkler heads in the corridors began to activate. Fire fighters also reported to the command post that the sprinklers were having no affect on the fire in the non-sprinklered concealed spaces above the suspended ceiling.

Although the sprinkler system had activated while fire fighters were in the building the Fire Department siamese connection was not used. It was recognized by the fire department at this time that the fire was confined to concealed spaces and that sprinklers would be ineffective in controlling the fire in those confined locations.\*.

Because of low water pressure the college called their plumber out of bed to shut off water to the other college buildings. The low water pressure was a result of the demand put on the water supply in city mains for fire fighting purposes. At the height of the exterior fire fighting operations 4,650 GPM were being applied by master streams and ladder pipe operations. Major streams were in use for 5 hours and the water pressure in the city mains dropped to 5 PSI.\*\*

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\*It was Fire Department policy to connect to the sprinkler system Siamese connections when smoke or fire were visible.

\*\*F.F. Duffee, "Fire Loss Report", File No. 1864-38, a post fire investigation report prepared by the Norfolk District Fire Protection Engineer, for H. H. Summers, Jr., Chief Fire Marshal, Commonwealth of Virginia.

Approximately one hour into the fire, the floor on the first floor of the West Wing was reported to be getting "spongy." In rooms and the corridor on the ground floor, the plaster and lath ceiling began to collapse. Fire officers in charge of the handlines stated that they could not determine whether just the ceiling or the ceiling and structural members were coming down. They did not advance the handlines into the collapsing area. During these collapses, the automatic sprinkler branch lines on the ground floor were broken.

At approximately one and a half hours into the fire, the floor in the first floor corridor of the West Wing collapsed. At the same time, cracks were noted in the exterior bearing wall at the center of the building.

Expecting further structural collapse, all firefighters and handlines were ordered from the building. Firefighting activities were reorganized for exterior firefighting. Firefighting efforts were concentrated on the center of the building to prevent the fire from spreading into the East Wing of the building. Ladderpipe and deck guns were used to prevent further involvement of the East Wing.

Several times during later fire fighting operations, handlines were advanced into the East Wing from the east end of the building to cut off fire spreading in concealed spaces of the first and second floors. These efforts were successful.

During the height of the fire, patrols of near-by residential neighborhoods were conducted by the police department to prevent additional fire from embers issuing from the fire. One small fire started on the roof of a garage but was quickly extinguished by the occupant of the dwelling.

Additional mutual aid companies were called in from James City County, York County, Camp Peary Army Experimental Station, the City of Newport News,

and the Newport News Shipbuilding and Drydock Company, located in Newport News. An engine company from James City County stood by at the Williamsburg station. A total of 114 firefighters fought the fire or assisted by providing standby aid.

### Fire Damage

As a result of the fire, the entire West Wing of the building collapsed within the brick exterior bearing walls which remained intact and standing. Most of the roof and the entire length of the attic burned away or was heavily damaged by the fire.

The fire was able to extend throughout the attic even though the attic was divided into compartments. Although the fire doors and fire dampers appeared to function well, the fire penetrated the compartments at the peak of the roof as the roof sheathing, rafters, and trusses burned from west to east past each fire barrier.

## ANALYSIS

### Fire Origin and Development

The exact point of origin was not determined by state or local fire investigators; however, as documented in this report, by the time of Fire Department arrival, an extensive fire was already in progress in the combustible concealed space between the ground and first floor of the West Wing. The fire spread in non-fire stopped combustible concealed spaces beyond the reach of sprinklers and non-sprinklered spaces above the suspended ceilings.

The area of origin was initially determined by investigators from the State Fire Marshal's Office and the Virginia State Police to be in a kitchen

near the center of the building, located on the first floor of the West Wing. The investigators concluded that the fire may have started in the vicinity of the floor behind a refrigerator, and may have burned through the floor or baseboard behind the refrigerator entering the concealed space above the ground floor ceiling.

A follow-up investigation conducted by the State Fire Marshal's Office and insurance investigators indicated that the fire may have originated in the concealed spaces above the ceiling of either the ground floor mechanical or electrical rooms.

#### Concealed Space Protection

Jefferson Dormitory was provided with automatic sprinkler protection in all living spaces below the ceilings. The combustible concealed spaces above the suspended ceilings were not protected, and water from the pendant sprinklers located below the ceilings could not reach fire spreading above the ceilings.

The original plaster and lath ceiling and wall coverings, if continuous and unbroken, would have allowed the space between the original plaster and lath ceiling and the suspended ceiling to be considered as a non-combustible concealed space for purposes of NFPA standard 13-1983, Standard for the Installation of Sprinkler Systems. However, the plaster and lath in the East Wing was penetrated to provide for the installation of electrical conduit, the attachment of suspended ceiling metal grid support wires, and sprinkler system pipe hangers (see Photo 3). The holes in the plaster and lath varied from a few inches to several feet in diameter. Similar conditions most likely existed on all floors of the West Wing. The openings exposed joists and subflooring within the concealed spaces. The exposure of these wood components within the concealed spaces would constitute "exposed combustible

contruction" according to the intent of Section 4-4.4, Concealed Spaces, of NFPA Standard 13, Installation of Sprinkler Systems.\*

Penetrations in the original plaster and lath ceiling allowed fire to extend into and out of the channels formed by the 2 inch by 8 inch and 2 inch by 10 inch joists and the tongue and groove subflooring of the original flooring system. The penetrations allowed air to enter the joist channel providing oxygen and draft conditions which allowed continued development and propagation of the fire in those spaces. Once fire had entered the concealed spaces on each floor, it was apparently able to spread the length of the West Wing due to non-fire stopped joist channels which ran the full length of the building.

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\* 4-4.4 Concealed Spaces

4-4.4.1 Sprinklers shall be installed in all concealed spaces enclosed wholly or partly by exposed combustible construction, as in walls, floors and ceilings, except as modified by 4-4.4.3. In spaces formed by studs or joists, sprinklers shall be provided where there is 6 in. (152 mm) or more clearance between the inside or near edges of the studs or joists which form the opposite sides of th space; the distance from the first sprinkler to the wall, however, need not be less than specified in 4-2.1.4. In partly or wholly combustible bar joist construction, sprinklers shall be installed wherever the total depth of the space exceeds 6 in. (152 mm) between roof or floor deck and ceiling; the spacing of sprinklers in that case may be on the basis of light hazard classification provided the space is not accessible for storage or other use.

4-4.4.2 Sprinklers may be omitted from combustible concealed spaces when any of the following conditions prevail:

(a) When the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck.

(b) When concealed space is entirely filled with a noncombustible insulation. In solid joisted construction the insulation need fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck.

(c) When there are small concealed spaces over rooms that do not exceed 50 sq. ft. (4.6 m<sup>2</sup>) in area.

Removal of the plaster and lath from the underside of the floor joists above the rooms located near the center of the building near the lobby allowed the fire to extend along floor joists from the south to the north side of the building.

The plaster and lath ceiling construction prevented the effective application of water from the hand lines used by the firefighters. Hose streams applied to spaces above the suspended ceiling were reported ineffective in reaching fire in the joist channels concealed by the plaster and lath still in place. Application of hose streams reportedly caused fire in concealed spaces to flash back and intensify. This condition was due to the introduction of oxygen contained within the fog fire streams being used and air turbulence created by the streams.

Fire fighters observing the spread of fire in the West Wing from the north side of the building described the involvement of student rooms on all floors as random and not in sequence. Fire involved individual rooms after penetrating the rooms from concealed spaces in the walls or above the suspended ceilings.

#### Corridor Wall Modifications

On some of the floors of the Jefferson Dormitory, corridor and student room partitions, and partitions surrounding the central lobby area did not extend from the floor to the underside of the floor assemblies above due to wall modifications made when the suspended ceilings were installed. This created an 18-inch deep space above the suspended ceilings that was open and continuous. In some cases, the original plaster and lath finish on corridor walls providing compartmentation between the corridors and other areas in the building had been removed above the suspended ceilings during renovation work and not replaced (see Photo 5). The absence of plaster and lath exposed stud

caps and top plates of wall partitions as well as joist channels. Without continuous partitions to provide compartmentation, fire was able to travel unchecked from the west to the east side of the building in the concealed spaces above the suspended ceilings.

### Dormitory Evacuation

The fire in the Jefferson Dormitory demonstrates the combined value of fire emergency planning, provision of training and conducting of fire drills, and the importance of assigning responsibility for evacuation procedures. At the time of the fire, most of the 184 occupants in the dormitory were sleeping. However, within four minutes of the sounding of the general evacuation alarm, the fire officer entering the building reported that most of the students had evacuated the building "in spite of the 14<sup>0</sup>F weather conditions". The remainder of the occupants were making their way from the building.

As part of their training, Resident Assistants are acquainted with fire drill requirements, fire evacuation procedures, and their duties and responsibilities in assuring that occupants are aware of the fire alarm and leaving the building. In this incident, Resident Assistants were effective in the exercise of their individual and joint responsibilities in a fire emergency.

The actions of the Resident Assistant on the third floor of the West Wing were instrumental in initiating the evacuation of occupants while conditions were still safe in the corridors. Upon discovery of smoke entering the third floor corridor, he immediately directed that the evacuation alarm be activated, notified the campus police by phone of the smoke conditions, and then initiated room checks using a master key. Similar actions of the six other Resident Assistants and the Head Resident, who occupied a room on the first floor, provided for the timely and safe evacuation of other areas in the dormitory.

## Summary

With proper design, installation, and maintenance, automatic sprinkler protection can provide a high level of protection of a building, its contents and the life safety of its occupants from the threat of fire. However, automatic sprinkler protection can not be expected to effectively provide protection in a building if sprinkler protection is not extended to protect combustible concealed spaces and if non-fire stopped concealed spaces will allow extensive fire spread through those spaces.

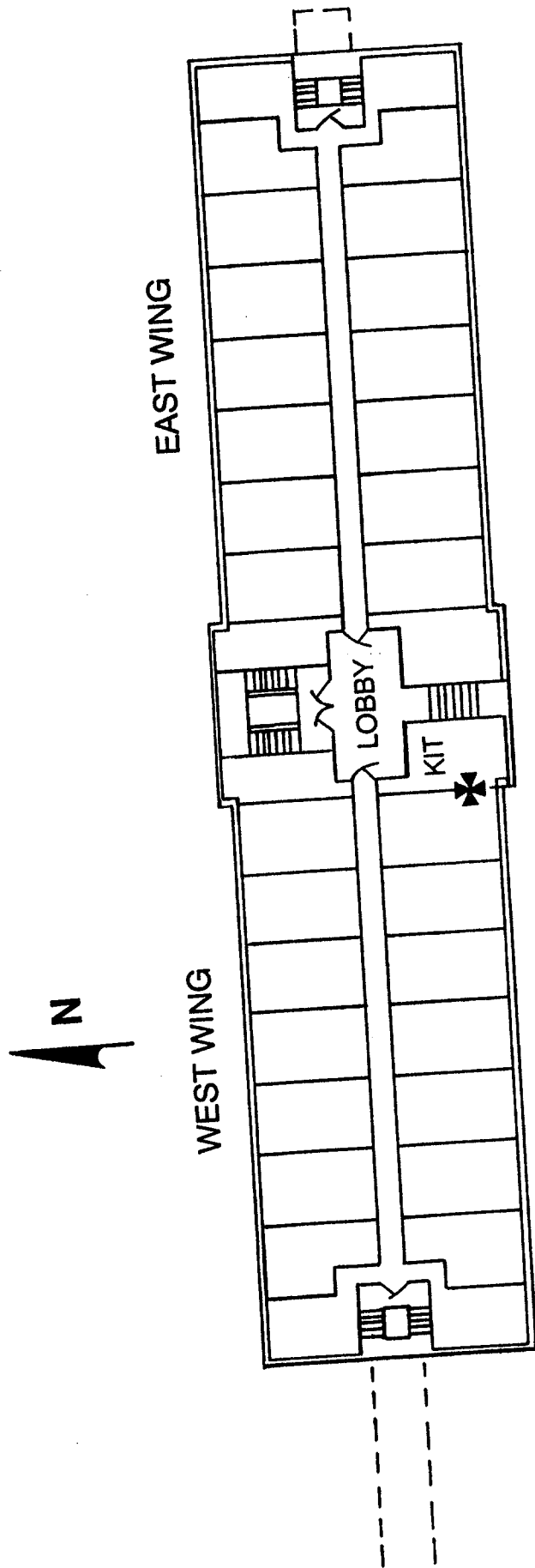
It is considered good practice for first arriving fire apparatus to connect hose lines to sprinkler fire department connections to ensure adequate water supply to sprinkler systems.\* In this fire, the decision of the Fire Department not to support the automatic sprinkler system, and subsequent drop in the water pressures and available water supply for the sprinkler system appear to have little affect on the final outcome of this incident. The significant factors responsible for the extensive loss in this building were: the development of the fire within combustible concealed spaces beyond the reach of automatic sprinklers, lack of automatic sprinkler protection in combustible concealed spaces above suspended ceilings, lack of fire stopping in horizontal and vertical concealed spaces, and openings in walls and partitions above suspended ceilings allowing fire spread above the ceiling through those openings.

Factors contributing to the successful evacuation of dormitory occupants included: the immediate sounding of the general evacuation alarm upon discovery of smoke conditions in the building, prior practice of evacuation procedures by occupants during required fire drills, the training of Resident Assistants in evacuation procedures, and the individual initiative of Resident Assistants to exercise the responsibilities of their positions ensuring evacuation of occupants.

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\*See NFPA 13E, Recommendations for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems.





**FIGURE 1. FLOOR PLAN (FIRST FLOOR)**

**✦ AREA OF ORIGIN**  
**(NOT TO SCALE)**