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Sprinklers and Tradeoffs

The Prestressed Concrete Institute is concerned with the growing tendency in this country to permit tradeoffs in the construction of buildings with automatic sprinkler systems. The concept of tradeoffs is to permit changes in certain life safety features, such as increasing the distance to exits, reducing the number of exits, and reducing the fire rating requirements of materials. In the economics of modern building construction, tradeoffs are often considered necessary to offset the cost of automatic sprinkler installations.

The concept of tradeoffs is not in the interest of building owners, firefighters, or the general public. The basic premise behind the so-called validity of tradeoffs is that the installation of an automatic sprinkler system provides essentially all of the life safey protection required in a building and, therefore, other life safety features in buildings can be minimized or eliminated. Experience with actual fires, however, clearly refutes this premise. Sprinklers do play a role in total life safety, but they must be used in conjunction with proven fire-resistant construction.

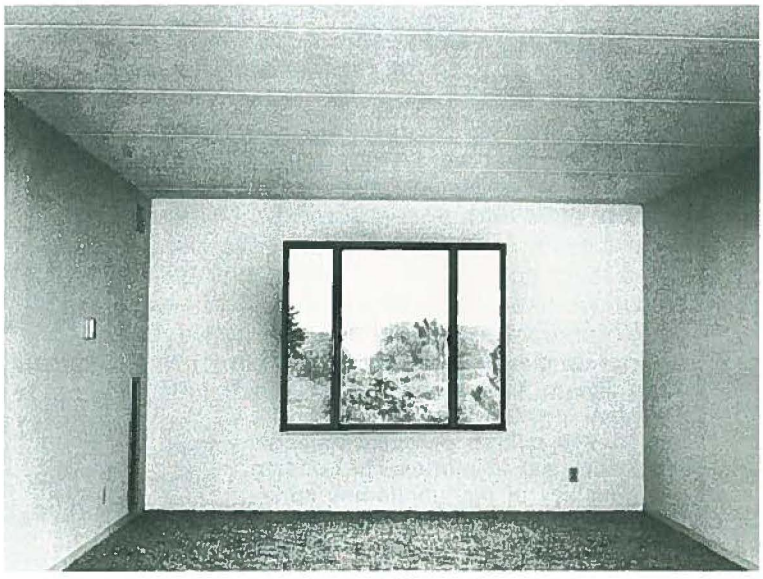
Although the contents of this apartment were destroyed by fire, the concrete walls and ceiling prevented the fire from spreading.

Sprinkler Effectiveness

Fire safety is an emotional issue. A few years ago, 99 persons died in a department store fire in Tokyo, Japan, because the sprinkler system had been turned off for maintenance.

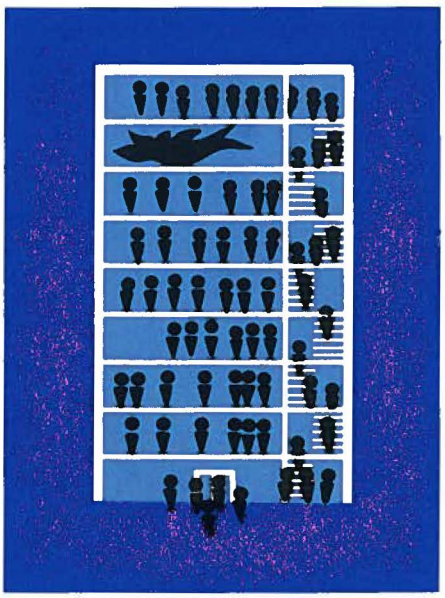
Proponents of sprinklers have given the public an erroneous concept of the value of sprinklers. Therefore, the following general observations are offered:

1. Sprinkler proponents claim that many fire deaths could have been prevented if sprinklers had existed. However, many other systems, such as smoke detectors, might have been equally or more effective.*
2. Tests conducted by Factory Mutual Research Corporation show that ceiling sprinklers will generally operate only when flames impinge on the ceiling. The fire must reach considerable inten-



Restoration of the burnt-out apartment required only minor cosmetic repairs.

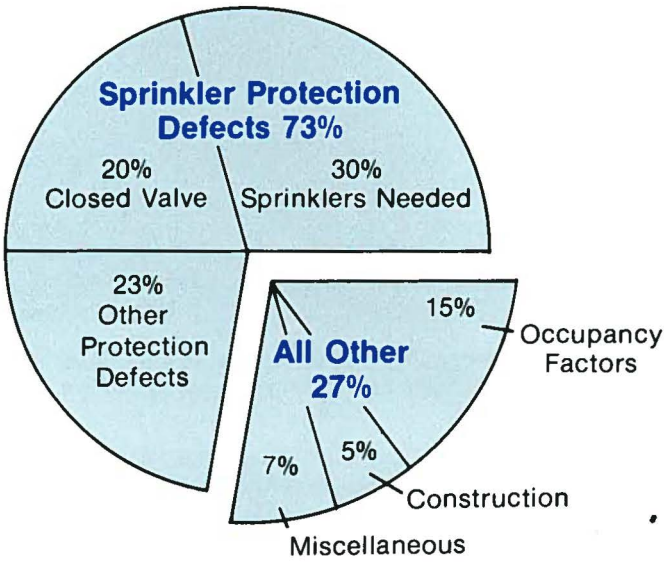
*Sprinklers are not effective in controlling the spread of gases and smoke generated by materials which become combustible at low temperatures.



Time is needed during a fire to evacuate the occupants. Concrete compartments contain the fire.

sity before the sprinkler system is activated. Unfortunately, many plastics that give off toxic gases burn at temperatures considerably below those required to activate sprinklers. This is a major threat to life safety in residential structures.

3. One of the problems in fighting the 1967 fire that destroyed Chicago's McCormick Place was the closed valves in water mains and hydrants. Even if sprinklers had existed, they could not have worked without water.
4. In earthquake zones, statistics show that when structures perform well, sprinkler *systems* remain intact. Unfortunately, earthquakes often destroy the water mains that supply sprinklers. Again, sprinklers without water are just an assembly of useless pipes.
5. Statistics published by the Oregon State Fire Marshal for the four-year period 1969-1972 show that sprinklers controlled fires in only about 50% of the situations where they had been installed. This is considerably below the 81% effectiveness claimed by the National Fire Protection Agency (NFPA). Statistics from foreign countries indicate similarly poor and questionable performance.
6. Many building inspectors are concerned with leaky, plugged, and otherwise defective sprinklers. Half of the sprinkler systems checked by building inspectors in Milwaukee, Wisconsin were defective. Sprinklers would not have functioned properly in these cases.



This analysis of 666 fires in sprinklered factory buildings valued at over $50,000 each shows that 73% of the $182 million loss was due to defects in sprinkler protection. *Source: Factory Mutual System.*

Work crew clears debris from devastating fire in fully-sprinklered, heavy-timbered, metal-clad building. This fire caused $10 million property damage, five deaths, and 16 injuries. The building had a history of malfunctioning sprinklers and, unfortunately, sprinklers were turned off by employees who thought the alarm was false.

7. Another study by Factory Mutual indicated that in their evaluation of 666 fires, 75% of the dollar losses were related to defects in the sprinkler system.
8. Arson is the fastest growing crime in the United States. Arsonists, spurred by motives of revenge, vandalism, and insurance fraud, will prevent sprinklers from working.
9. Many building fires are accompanied by or result from explosions that break waterlines, rendering sprinklers inoperative. Also, if property losses are less than 20% of total value, sprinklers are classified as having been effective.

Clearly, sprinklers are not 100% effective. There are countless reasons why sprinklers do not always work. Conversely, there have been many instances when sprinklers have saved both lives and property. The mistake is to make sprinklers the only weapon in the life safety arsenal. It is not logical to reduce other life safety features simply because sprinklers are used. The public needs more protection, and they can be provided with more.

Position Statements

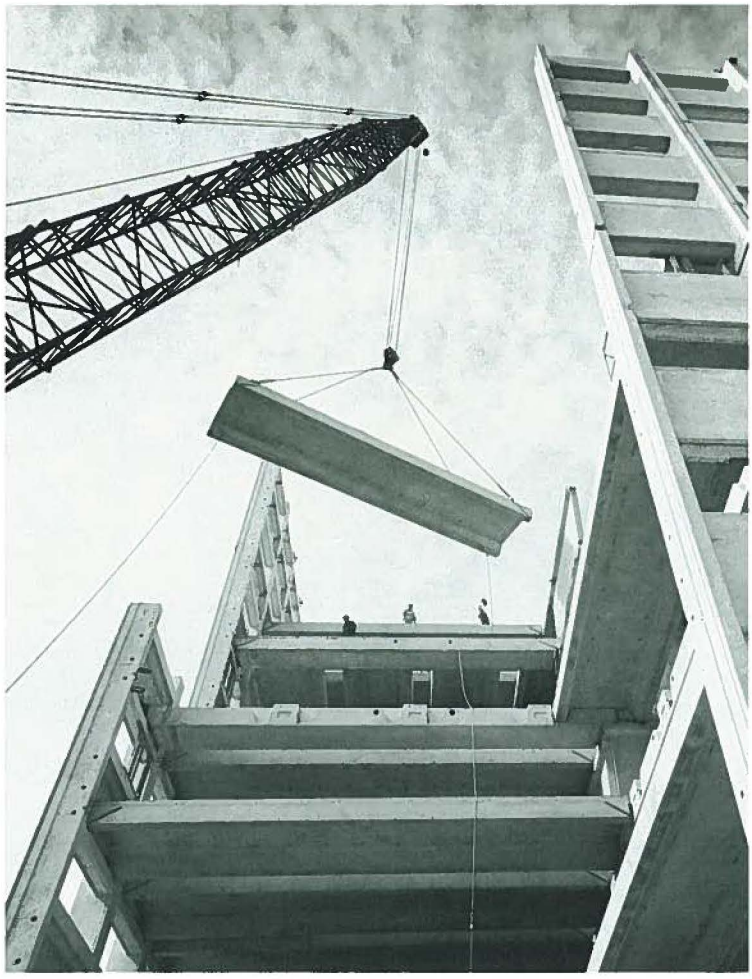
The Prestressed Concrete Institute offers the following position statements regarding life safety as it relates to fire and building construction:

1. Building structures should be highly resistive to fire and should be designed to minimize the possibility of structural failure during a fire. This is essential not only for occupants but also for firefighters.

2. Codes and building regulations should be reoriented toward reducing fire hazards; that is, they must include restrictions on use of hazardous materials, smoke-generating plastics, combustible finishes, etc.

3. Compartmentation is a proven method of providing life safety for building occupants. Compartmentation (in other than small buildings) should include enclosing each story, stairwell, elevator, and utility shaft, and should provide at least two compartments separated by self-closing doors or dampers.

4. Automatic sprinkler systems must be required in hazardous areas, particularly where combustible contents exist. However, the structural integrity or life safety aspects of a structure (for example, distance to exits and fire ratings) must not be impaired. Sprinklers simply are not effective enough to justify using them alone in a life safety system. If sprinklers fail to perform or to control a fire, the building is no better off than if the sprinklers were not present. All it takes for failure is one closed valve.

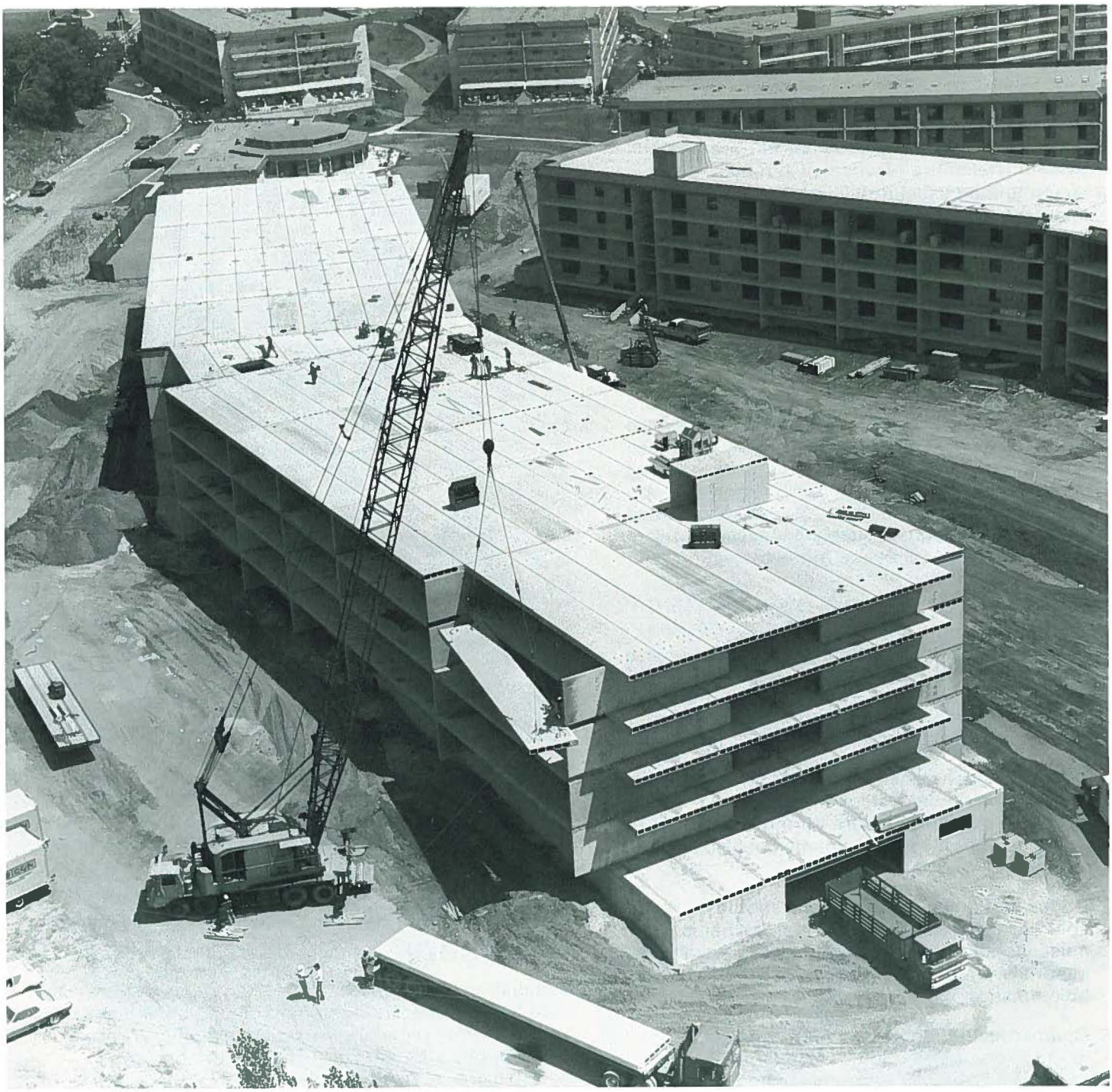


Occupants and property should have the benefit of proven fire-resistant construction.

Summary

Installation of automatic sprinkler systems that are paid for by tradeoffs in the form of reduced fire ratings and other reductions in building quality are not in the public interest. Sprinklers have not proven to be totally reliable in controlling fires. Hence, if they are the only life safety features in a structure and do not perform, the results can be devastating. Safe designs should take into account the possibility of sprinkler failure.

Use of proven noncombustible materials should be incorporated into designs in conjunction with other life safety systems to develop maximum protection for life and property. Restrictions must be placed on use of materials which emit toxic smoke and gases. Further, because complete evacuation of occupants in medium-rise and high-rise buildings is not realistic, the compartmentation concept is extremely logical. Prestressed concrete construction lends itself to providing life-protecting compartments while at the same time providing a noncombustible, stable, concrete building.



Precast prestressed concrete hollow-core slabs with precast walls provide a stable building structure that automatically offers life-saving compartments.

Smoke detection with an early warning system is the most effective life safety system that can be provided. Occupants can die from smoke and gas produced at temperatures that are too low to activate sprinklers. To do anything less for the safety of people cannot be justified.

Life safety cannot be achieved through a single method. An overall systems approach is required to safeguard life and property effectively during a fire.

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Sprinklers and Tradeoffs

A POSITION PAPER

Automatic sprinkler systems are becoming increasingly common as a component of life safety systems in buildings. Building codes across the country routinely require their installation. It is also common practice to offset some or all of the cost of sprinkler systems by permitting tradeoffs. Tradeoffs permit changes in certain life safety features in buildings, such as increasing the distance to exits, reducing the number of exits, and reducing the fire-rating requirements of materials when sprinklers are used.

A few years ago, 99 persons died in a department store fire in Tokyo, Japan, because the sprinkler system had been turned off for maintenance. The Prestressed Concrete Institute believes that this tragedy and others like it should be a clear warning that the concept of tradeoffs is not in the interest of building owners, firefighters, or the general public.

The concept of valid tradeoffs implies that sprinklers are completely reliable. However, statistics on past performance of sprinklers indicate otherwise. While sprinklers do play a role in a total life safety system, their use should be in conjunction with proven fire-resistant construction, compartmentation, and other features to provide a total life safety system.

There are numerous cases where sprinkler effectiveness has been substantially less than 100%. Some examples are as follows:

1. Tests conducted by Factory Mutual Research Corporation show that ceiling sprinklers will generally operate only when flames impinge on the ceiling. The fire must reach considerable intensity before such a sprinkler system is activated. Many plastics that give off toxic gases burn at temperatures considerably below those required to activate sprinklers.
2. Earthquakes often destroy water mains that supply sprinklers.
3. Statistics published by the Oregon State Fire Marshal for the period 1969-1972 show that sprinklers controlled fires in only about 50% of the locations at which they had been installed.
4. Half the sprinkler systems inspected recently in Milwaukee, Wisconsin were defective. These included standpipe problems and defective valves. Sprinklers would *not* have performed properly if required.
5. Another Factory Mutual study shows that 75% of the dollar losses in fires were due to sprinkler defects.
6. Arson is the fastest growing crime in the United States. Arsonists know how to prevent sprinklers from working.
7. Fires often follow explosions that could break water pipes and render sprinklers useless.

Clearly, sprinklers are not 100% effective. There are many reasons why sprinklers do not always work. Conversely, there have been many instances when they have saved lives and property. The mistake is to make sprinklers the only weapon in the life safety arsenal. The public needs more protection, and they can be provided with more.

The Prestressed Concrete Institute strongly objects to the concept of tradeoffs and endorses the following positive recommendations:

1. Building structures must be designed to minimize the possibility of failure when subject to fire.
2. Codes should be reoriented toward reducing fire hazards, smoke-generating materials, and combustible finishes.
3. Compartmentation is a proven method of providing life safety for building occupants and should be provided to contain a fire within a limited area.
4. Sprinklers should be required in hazardous areas, particularly where combustible contents exist. However, the structural integrity or life safety aspects of a building must not be impaired.

In summary, sprinklers are not totally reliable. Safe designs should take into account the possibility of sprinkler failure rather than the hope of sprinkler performance. Use of proven noncombustible materials, compartmentation, smoke detection, and selective use of sprinkler systems offers the best life safety system.