The time necessary to evacuate today's high-rise buildings in a fire emergency is unsatisfactory from the standpoint of the development of untenable smoke conditions. The Division of Building Research has been working on the problem for several years and suggests several approaches to controlling smoke movement in buildings.

FIRE in high buildings presents several problems not normally encountered in buildings of lesser height. These and the basic requirements for their solution have been discussed in previous papers. Problems related to the safety of occupants arise mainly because the time for evacuation increases approximately in proportion to height, while smoke transfer into and out of stairwells (and other vertical shafts) occurs with ease and increases substantially when fire occurs on a lower floor of a heated building during winter. The time required for evacuation can thus be much greater than the time for development of untenable smoke conditions in stairwells and other parts of the building far removed from the fire.

High buildings also present special problems to fire fighters, including that of rapid and ready access to the fire floor. Elevators may be smoke-filled or unavailable, and if mass evacuation is attempted, stairwells may be filled with people.

APPROACH TO PROBLEMS

In the development of fire protection measures for high buildings, it should be assumed that occupants will be in the building for extended periods following the outbreak of fire, possibly for its duration. One of the principal objectives, therefore, must be to minimize the hazard to the occupants of upper stories when fire occurs in a lower story. At a minimum, such measures should reduce the possibility of a large number of casualties as a result of fire in a high building.

Over the years, effective fire protection measures have been developed
that play as important a role in high buildings as they do in buildings of lesser height. For example, the adequate compartmentation of a high building is a most important component. Much experience has been gained, and a great deal of information is available at present on the fire resistance of enclosing elements and structural building elements, which determine the effectiveness of compartmentation in restricting the spread of fire. Continuing study is required in this area, but building designers should have comparatively little difficulty in developing designs for high buildings that provide adequate compartmentation to resist the spread of fire in the vertical as well as the horizontal direction.

Adequate resistance to the spread of fire does not, however, ensure adequate resistance to the spread of smoke, which is the principal hazard to the occupants in the event of fire. At present there is a lack of information concerning measures for smoke control. Consequently, the Division of Building Research has, for the past two years, emphasized studies in this area. The results of these studies, including suggested approaches to smoke control, will be briefly discussed in this paper.

In considering fire protection measures for high buildings it has become evident that the problems of safety of occupants and of fire fighting are interrelated, that they involve smoke as well as fire, and that their solution depends on the design of the building as a whole. Thus a "systems" approach is required, incorporating measures that work in harmony to meet safety objectives. If the objectives and criteria can be adequately defined, it follows that a number of systems may be devised that provide an acceptable overall solution. Brief reference will be made in the following paragraphs to some of the measures that deserve consideration.

Attention should be given to limitations on the flame spread of lining materials in most areas of a high building. This measure is particularly important because it influences the early stages in the development of a fire. In addition, it is desirable to impose some limitation on smoke production from lining materials in order to minimize the smoke produced in the fire. Certain elevators should be under the control of fire fighters to provide ready and safe access to the fire area and a facility for emergency evacuation. Consideration should be given also to the installation of a communications system to provide voice communication to occupants on all floors from a central control point in order to keep them informed of what is happening and to direct their movements in the event of fire.

In all high buildings, consideration should be given to the provision of a system for smoke control. These systems should, in the first instance, maintain smoke concentrations at a low level in certain essential shafts. Smoke control systems involving electrical components as well as elevators consigned to fire fighters should incorporate a protected electrical power supply to forestall failure of these systems. In order to render such systems even more effective, consideration should be given to the extension of manual and automatic fire detection and alarm systems to activate their controls.