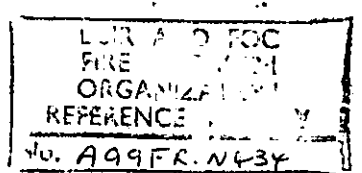


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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

MOVEMENT OF SMOKE AND TOXIC GASES IN FIRES IN BUILDINGS

by

L. A. Ashton

Summary

Some of the important factors governing the movement of smoke and toxic gases in buildings are considered as a preliminary to an investigation on the subject.

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Movement of Smoke and Toxic Gases in Fire in Buildings

by

L. A. Ashton

In any consideration of the hazards arising in building fires from smoke and toxic gases it is convenient to deal separately with single storey and multi-storey buildings, since the problems associated with the two types differ in their nature and their complexity.

The movement of the products of combustion in single storey buildings affects the firemen, who are impeded by them, rather than the occupants, who in general are not likely to be endangered as long as means of escape from the building are available. One method of reducing the spread of products of combustion in single storey buildings, by venting them through the roof, is the subject of an investigation now being made at Boreham Wood using models. The results of this investigation will be published in due course. This note is concerned with multi-storey buildings and its scope is limited to a discussion of some of the aspects affecting personal safety.

As buildings become higher precautions for personal safety assume increasing importance. The natural movement of products of combustion being upwards, all occupants of a building on the same floor as an outbreak of fire and above it will be threatened. Movement of the products of combustion in such buildings is restricted in present practice in the U.K. by using fire resisting walls and floors to form compartments of limited size, by enclosing stairs and lift shafts with fire resisting walls and by having corridors and escape routes separated from other parts of the building with similar walls. In addition, in the higher buildings the use of materials as linings which would assist and augment the spread of smoke and toxic gases is not allowed on escape routes. Provision for ventilating corridors and approach lobbies is required in certain multi-storey flats, and also for staircases and lift shafts in such buildings, but there appears to be no evidence that these provisions adequately fulfil their intended purpose under all conditions.

The movement of the products of combustion through openings in fire resisting walls is prevented in theory at least by fitting them with doors which may be termed "fire-resisting", "fire-check" or "smoke-stop". Such doors are commonly required to be self-closing. The vital importance of doors in restricting spread of fire, smoke and toxic gases will be appreciated when it is realized that if they are defective in any way, other fire precautions may be rendered of little use. Since in multi-storey buildings safety of life and property depend to such an extent on doors, a study of their capacity to stop the passage of smoke and flame under actual fire conditions is being made at Boreham Wood. At the same time an investigation of the contribution made by the ventilation of escape routes to the clearing of smoke and toxic gases is being carried out.

Doors which are intended to be smoke or fire barriers only fulfil their function if they are kept closed at all times except when being used. They therefore need an effective and reliable method of making them self-closing, and they must not be wedged open. At the start of the investigation it appears the following questions need answering.

1. Where self-closing doors are provided in buildings, is it the practice to wedge them open? A survey of normal conditions in existing buildings would be helpful.
2. How effective is a fire resisting door of timber as a barrier to smoke and hot gases and how critical is its fit in the frame? The answer here cannot be provided by the standard fire resistance test.

3. Given that a door opening on to a corridor may let smoke pass, how far is it reasonable to expect people to travel from other doors opening into the same corridor through smoke to reach a place of safety, e.g. a staircase? A distance of 15 ft, called the "short dash to safety" is proposed in the section on planning of a new Code on fire precautions in high flats which is being prepared by the British Standards Institution, but there is no evidence of its validity.

Doors are frequently specified in certain situations, such as in corridors for the purpose of providing a barrier to smoke and toxic gases.

Since these doors are unlikely to be subjected in a fire to such severe conditions as specifically fire resisting doors, they are termed "smoke-stop" doors. There is no performance standard for smoke-stop doors at present, and one item in the investigation is concerned with the development of a standard.