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JOINT FIRE RESEARCH ORGANIZATION

Fire Requirements for Curtain Walls and their Behaviour in Fires

by

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The note makes an appraisal of the fire problems relating to curtain walls and indicates the lines on which an experimental investigation might proceed.

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All buildings, other than houses of not more than two storeys, are required by British Byelaws⁽¹⁾ to have suitable provision made in their external walls to prevent the spread of fire vertically between windows in adjacent storeys. The requirements of the Byelaws are deemed to be satisfied if the bottom of the higher opening is not less than 3 ft above the top of the lower opening and not less than 2 ft above the upper surface of the floor separating the two openings, the relevant portion of wall having a fire resistance appropriate to the class of building. Alternatively a balcony or similar projection of solid non-combustible material may be used between the two openings projecting 2 ft from the wall.

In general, local authorities have taken the view that curtain walling does not give the standard of separation between window openings required by their Byelaws, and they have demanded that a back-up wall, which in itself has the appropriate fire resistance, shall be built on the floor below each opening except on the ground floor. Leaving aside the question of whether, in fact, the separation requirements of the Byelaws have any appreciable effect on preventing vertical spread of fire, it is desirable to examine whether or not curtain walls by themselves can comply with the Byelaws and at the same time to investigate any other hazards associated with this form of construction. The necessity of providing the back-up wall is an added cost on curtain walling which is an economic handicap, and therefore the Fire Research Station has been considering the effect on fire safety in buildings of dispensing with this addition.

Standard tests, although useful in evaluating the fire resistance of the panels used in curtain walls, cannot yield information on the behaviour of systems as a whole, nor demonstrate in particular the hazards that are peculiar to this form of construction. An investigation is therefore being made under actual fire conditions of typical curtain wallings, using the four-storey tower building at Boreham Wood. The purpose of the investigation is to test existing methods of construction, to determine if these are adequate from the fire protection aspect, and to devise means, if it is necessary, of overcoming their drawbacks. Experimental work has not yet started. The following appraisal of the problems is the results of thought and discussion, and the conclusions may need modifying after some tests have been made. There is at present no information available from actual fires in the United Kingdom of the behaviour of curtain walling. As far as can be ascertained, two large modern curtain wall buildings with back-up walls have been involved in fire, but in neither was the nature of the external wall a factor in fire spread. No evidence is therefore available from actual fires that a back-up wall is necessary.

The grounds for requiring the back-up wall are, apparently, that the curtain wall panels are not considered capable of giving the necessary fire resistance when exposed to fire internally or externally either on account of doubts of the integrity of the fixings or the effect on them of movements of the mullions. While, however, a back-up wall can readily be designed to provide the required fire resistance, it is suggested that protection against vertical fire spread will not necessarily be achieved with such a wall and its presence may not give an adequate standard of safety for the following reasons.

1. Since neither the panels nor the supporting members are required to have any resistance to fire, there is a possibility of failure of the panel fixings or the frame leading to collapse of part of the structure with consequent danger to the fire fighters.
2. Unless the gap between the back-up wall and the curtain wall is effectively sealed fire may spread up between them. Distortion of the curtain wall panels or frame could give rise to this flue effect.

It should be possible to design curtain walling to comply with the Byelaws without a back-up wall and be free from the possible drawbacks enumerated above. The essential features of such a system are: (a) panels securely tied to the structural floor slab and constructed to resist fire for the appropriate period; (b) framing members of suitable materials capable, with or without protection, of remaining in place when exposed to fire and free from movements or distortion which will affect the performance of the panels. These factors are being studied in the investigation which has been planned. In the first place a system having aluminium alloy mullions is being investigated since they are more susceptible to fire than other forms of construction.

Reference

- (1) Ministry of Housing and Local Government. Model Byelaws, Series IV. Buildings. 1953. Her Majesty's Stationery Office.