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REPAIRABILITY OF BUILDINGS DAMAGED BY FIRE

by

L. A. Ashton

Summary

Present practice is to design the elements of a building so that they will give satisfactory performance during a fire. This note discusses briefly the problems associated with ensuring that structures will be repairable after a fire.

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In Great Britain the Standard (1) specifying the procedure for fire resistance tests takes no account of factors other than those aimed at providing for performance in a structural element of defined functions during a fire, and in addition, for loadbearing elements of stability after a fire. No methods are specified for enabling the fitness for service of a part of a building after a fire to be judged. Building Byelaws and Codes have hitherto confined their provisions for structural fire protection chiefly to those intended to ensure personal safety and preventing an outbreak of fire extending beyond the building in which it started. The suggestion that there should be mandatory requirements for buildings to provide that reinstatement would be possible needs examination.

Using the principles of fire grading, a building of a given class has assigned to it a level of fire resistance for the various parts, notably the loadbearing elements, external and division walls, so that they should be capable of resisting a burn-out of the contents. Such a "fully protected" building may, if suitably constructed, be of unlimited height and floor area (2). If the fire resistance required for an element of structure in a fully protected building is denoted by  $R_p$ , then the fire resistance  $R_L$  required for such an element when height and area are limited, is given by  $CR_p$ , where  $C$  is a factor less than unity. In British Byelaws (3)  $C$  has a value for storage buildings ranging from 0.125 to 0.5 depending on their size.

If provision is to be made in Byelaws for specifying a standard of fire resistance high enough to enable a building to be reinstated after a fire it would be logical to increase  $R_p$  by some factor  $K$ , where  $K > 1$ , to some new value  $R_p^1$ , and to leave  $C$  unchanged. The magnitude of  $K$  would be determined by the type of element under consideration and the nature of the construction, and would be independent of the class of building. Thus restrained floors and beams of protected structural steel or reinforced concrete would require a value of  $K$  which would be significantly smaller than that for similar elements of prestressed concrete. Before  $K$  can be determined, however, even for the common forms of construction, a great amount of research must be carried out, since relatively little is known of this aspect of fire protection. Limited investigations have been made at Boreham Wood on the repairability of reinforced concrete columns (4) and prestressed concrete beams (5) but much has still to be done if this factor is to be taken into account in grading buildings.

One aspect should not be overlooked in consideration of making repairability mandatory - that of cost. Building to a higher standard entails increased expenditure for all buildings with the prospect of some problematical saving a reconstruction of the relatively small number which might at some time be involved in a fire. On the face of it, provision for repairability on the scale envisaged is unlikely to be an economic proposition, but it would be difficult to show this by calculation with any degree of accuracy.

There is undoubtedly room for a great increase in knowledge of the properties of structures after fires of various severities and of the conditions under which repair is feasible. This knowledge could be best utilised, however, in ensuring that where buildings have been subjected to fires of less severity than those which they are capable of withstanding, a sound appraisal of the possibilities of repair may be made and guidance given on suitable methods, rather than adding to building costs by requiring construction to be of a much higher standard than it is now.

## References

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