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FIRE PROTECTION HISTORY-PART 72: 1942 (BMS92)

By Richard Schulte

A report titled "***Building Materials and Structures -Fire-Resistance Classifications of Building Constructions***" developed by the Subcommittee on Fire-Resistance Classifications of the Central Housing Committee on Research, Design and Construction was issued on October 7, 1942. This report, also known as **BMS92**, includes the following excerpts:

> "*The object of this report is to present a classification of building construction based on essential features having a bearing on the restricting and retarding effect on fire offered by the different types. The classes within each type are differentiated by the degree of fire resistance of structural members. As an assistance in applying these classifications, data are included from surveys of combustible contents of buildings and from fire tests of building constructions and materials conducted at this Bureau and other laboratories. The report should be of value in presenting building classifications and pertinent related data on the basis of which restrictions on the size, location, and structural components of buildings can be applied to give a required degree of safety with the economical use of a wide range of acceptable materials.*"

> "*A classification of building construction from the standpoint of fire safety is presented by a committee of representatives of Federal agencies concerned with the design, construction, and operation of buildings. By considering only the basic properties having a bearing on fire hazard and fire resistance, four types were found sufficient to cover the whole range of building construction. Within each type are two or more classes which are defined by the fire resistance required for their structural members. In chapter I this classification is outlined and information given on how it can be applied with reference to the fire severity obtaining for given structural and occupancy conditions. Chapter II contains a discussion of the types of restrictions and limitations generally incorporated in building codes, with particular reference to their application to the classification of building types herein presented. Chapter III gives results of surveys of combustible contents of buildings housing typical occupancies as a basis for estimation of fire severity. In chapter IV are given available fire-resistive ratings of building construction and fire-resistance classifications of roofing materials.*"

"*The purpose of this report is to present to architects, engineers, and public officials responsible for fire safety in buildings, a classification of building construction which represents the recommendations of the Subcommittee, a discussion thereof, and certain factual data which have been assembled by the Subcommittee. The report is not proposed as a fire-protection section of a building code, but it is intended to indicate some of the changes from current practice that should be considered in writing or revising building codes and to supply some of the factual data necessary to a proper consideration of the changes indicated.*"

"*The Subcommittee believes that the idea of designing some buildings for the full severity corresponding to the occupancy and others for a given established fire resistance, is a logical advance in fire protection engineering. It offers no more complications as regards possible occupancy changes and code requirements than does the idea of designing buildings for predetermined live loads. For example, buildings designed for residential use with live loads of 40 lb/ft^2 cannot be used for heavy mercantile occupancy, and it is illogical to require them to be designed for the same fire severity.*"

"*Chapter III summarizes the findings of actual surveys of combustible contents of buildings for a number of typical occupancies. This material is considered to be a reliable guide in making an estimate of the probable combustible contents of projected occupancies similar to those surveyed.*"

"*The Fireproof type includes all buildings of incombustible structure which will either withstand complete combustion of their contents without collapse or which will have a general fire-resistance rating of 4 hr and in addition other safeguards designed to prevent a more severe fire. Within this type, the classification is such that a building may be designed to have a fire resistance corresponding to the fire severity that may be created by the occupancy. This eliminates the common practice of requiring a uniform fire resistance for all Fireproof-type buildings, which results in excessive resistance for occupancies having light combustible contents and insufficient resistance where the combustible contents are very heavy. Economies are thus made possible in the former case and increased protection is required in the latter for buildings classed as Fireproof.*"

"*That type of construction* [referring to Fireproof construction] *in which the structural elements are of incombustible materials with fire-resistance ratings sufficient to withstand the fire severity resulting from complete combustion of the contents and finish involved in the intended occupancy . . .*"

"*It has been found from burn-out tests performed in fireproof structures with various concentrations of combustibles having a calorific value in the range of wood and paper (7,000 to 8,000 Btu/lb) and assembled to represent building occupancies, that the relation between the amount of combustibles present and the fire severity is approximately as given in table 5.*"

"*Table 5. – Relation of amount of combustibles to fire severity*

Average Weight of combustibles, lb/ft² of floor area	***Fire Severity***
5	*½*
7[-]*½*	*3/4*
10	*1*
15	*1*[-]*½*
20	*2*
30	*3*
40	*4*[-]*½*
50	*6*
60	*7[-]½*"

Note: The Fire Severity referred to in Table 5 is denoted in terms of equivalent hourly exposure to the ASTM E119 time-temperature curve.

"*In apartments and residences, even with combustible floors and other woodwork, the amount of combustible contents was found to be relatively light, with the average below 10 lb/ft² of floor area. In areas containing concentrated furniture storage, the combustible contents were found to be no more than 14 or 15 lb/ft², which includes allowance for a wood finish floor and wood trim.*"

"*Assuming that Fireproof buildings are designed to withstand a complete burning-out of contents and combustible trim without collapse, there should in effect be no limitations imposed on the score of degree of fire resistance other than its relation to the expected fire severity for the given building.*"

"*For buildings generally associated with the lower range in combustible contents, such as residential and office buildings, it does not appear justifiable even from this standpoint to apply an unduly large factor of safety. Where the expected fire severity is in the range* [of] *½ to 1*[-]*½ hr, a 2-hr requirement for high buildings should give good assurance of stability under fire conditions. It is noted that fire resistance ratings are based on the performance of members near the lower range in size. For the larger size members used in all but the upper stories of such high buildings, there would be considerable increase in fire resistance above the nominal ratings for the same kind and thickness of protecting materials. Also, the structural continuity inherent in the type of construction increases the margin of safety on stability above that indicated in test furnaces for comparable fire exposure and loading of segregated columns, beams, and floor and wall assemblies.*"

BMS92 is quite a pioneering document in that it clearly lays out the relationship between fire loading and the severity of fires, measured in terms of the ASTM E119 time-temperature curve. While the relationship between fire load and fire severity is not as precise as implied in BMS92, this relationship is still a good "rule of thumb".

BMS92 is also a pioneering document from another standpoint-the recommendation that it is acceptable for structural members of “Fireproof” construction to have a fire resistance rating (per ASTM E119) equal to the fire severity as determined by the fire loading. BMS92 specifically states that a 2 hour fire resistance rating is more than adequate for the structural elements of high rise buildings which contain either residential or office occupancies.

The recommendation that a 2 hour fire resistance rating is adequate for the structural elements of high rise office and residential buildings is at odds with the recommendations developed by the National Institute of Standards and Technology (NIST) in NIST’s investigation of the collapse of the World Trade Center towers.

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