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FIRE PROTECTION HISTORY-PART 245: 1919 (MERCANTILE OCCUPANCY)

By Richard Schulte

The twenty-third Annual Meeting of the National Fire Protection Association was held in Ottawa, Canada in May, 1919. Among the committee reports presented at this meeting was the Report of Committee on Safety to Life. The following is a portion of this report addressing fire safety in mercantile occupancies:

"***The Chair:*** *I can testify to that, because I am present at the Executive Committee meetings. We do go over these committees with the idea of accomplishing just what Mr. Fiske has in mind; and we shall certainly do so at the next meeting. The next report is that of the Committee on Safety to Life, Mr. H. W. Forster, Philadelphia, Chairman.*

Mr. Forster: *The Committee hoped to take a little more time on your program than it is going to be able to take, but because of your generosity to us in past years, notably at Washington, we are very happy to boil our presentation down to thirty minutes. (Laughter.) I hear cheers from the gentleman on my right. My friend Hexamer ought to know that I am not always as long winded as I am long legged.*

There are two sections to our report; retail stores and schools. I have asked Mr. Frank Irving Cooper, of Boston, to present the second section on Schools, therefore you will have to suffer me only about fifteen minutes.

The Committee at this time has finished, as regards the egress problem, only one important subject, namely, the factory building, and its program is to take step by step various other types of occupancy. For our next problems we have selected stores and schools. I will confine myself to stores.

Report of Committee on Safety to Life

H. W. Foster, Chairman,

David S. Beyer, Lewis T. Bryant, W. T. Colyer, Frank Irving Cooper, Henry Cross, F. W. Glading, J. O. Hammitt, C. Heller, L. H. Kunhardt, R. H. Newbern, William Newell, Robert Palm, Lew R. Palmer, Frances Perkins, E. B. Tolsted, Sidney J. Williams, J. R. Young.

PART I.

[This report has been submitted to ballot of the committee, which consists of eighteen members, of whom twelve have voted affirmatively, and six have refrained from voting.]

NUMBER OF OCCUPANTS ALLOWED IN A RETAIL STORE.

1. *As a portion of its 1919 report your Committee on Safety to Life submits herewith a preliminary report on, or study of, the egress problem presented by the retail store. The data, as presented, is based on a reasonable amount of specific information secured by the Committee on large department stores in particular, on existing building regulations, and on the experience and judgment the Committee has been able to develop in four years of study of the factory egress problem.*

2. *The Committee wishes it to be clearly understood that it may, in the light of additional data and further consideration, deem changes advisable both in the plan of procedure and in the values assigned. This report, it is hoped, will bring about constructive criticism on the part of our members and on that of the retail store interests.*

The Importance of the problem.

3. *There are tens of thousands of retail stores throughout the land, ranging from the humblest one-story shop, presenting little of an egress problem, to the mammoth department store which, under rush conditions, houses over 15,000 persons at one time. The largest department stores house more people simultaneously than any other form of structure, and these persons, to a large extent, are women and girls, both as regards employees and customers.*

4. *Great heights, enormous areas, often without a single division in wall, open elevators, stairs, and even light wells, large quantities of highly inflammable goods, special hazards scattered throughout the structure, and great number of undrilled persons combine to produce holocaust possibilities of serious proportions. The country fortunately has never suffered a department store holocaust. The reason unquestionably lies in the keen sense of responsibility of the more important retail store managements and especially in the general use of sprinklers. In spite of the acceptable record to date, your committee believes that retail stores, as well as factories, should be called upon to meet a reasonable standard of egress requirements, a standard that takes cognizance of all important features that will increase safety to life and will encourage the improvement of existing structures and the building of the best possible ones in the future.*

Difference Between the Store and the Factory Problems.

5. *The fundamental difference lies in the inability to control the number of persons who enter a retail store. In a factory the management, if it will, can meet the specific conditions laid down for a given building. In a retail store, however, the only limitations are the number of people that the building will hold with due regard to ability to move about and to be waited on, freedom from discomfort of very dense crowds, and, of course, the fact that under the worst conditions of crowding not all departments will be filled to maximum capacity. A main floor, a bargain basement, or a toy department at Christmas represent quite different conditions from a furniture, piano, or rug department. The customers pay no attention to matters of building construction, exits and fire protection, and the basis of procedure must therefore be on the basis of area, with due recognition that a given area in a first class building will need less in the way of egress than an equal area in a poor structure.*

6. *The fact that the best drilled group of employees cannot be relied upon to handle a large panic-stricken group of shoppers, points to another fundamental difference between the retail store and the factory.*

7. *The ignorance of the customers as to the exit stairs and the difficulty of insuring a sufficient distribution of customers to make more or less uniform use of the available stairs is another disadvantage of the retail store situation.*

8. *The reliance of customers and clerks on elevators and the generally ample provision of elevators makes it necessary to recognize the passenger elevator as a form of egress in retail stores, something which has so far not been done in connection with the factory egress problem.*

The Committee Proposal.

9. *As with factory buildings, the Committee in devising a plan of establishing the number of occupants that may use retail store buildings has in mind the following fundamental principles:*

a. To forbid the use of signally dangerous buildings for retail store purposes.

b. To encourage the improvement of existing buildings not up to a reasonable standard of safety.

c. To give due recognition to essential life safety factors such as superior construction, protection of vertical openings, provision of horizontal exits, moderate heights, and provision of automatic sprinklers.

d. To encourage the best possible construction and protection for new retail store buildings.

10. *The plan also is, insofar as possible, to make use of the principles and values established in the factory building egress code approved by the Association in 1918.*

11. *In due course the Committee expects to put its conclusions and recommendations in specific form, and its credits for various features listed above into a tabulation such as the one which is a part of the factory egress code. The following sections discuss principles and propose some preliminary figures and values.*

Construction, Heights, Areas, and Vertical Openings.

12. *Attached hereto is a tabulation in which are set forth suggested limitations of the inter-related factors of construction, height, area, and vertical openings, with due regard to provision of or lack of sprinkler protection. This tabular data will be merged into the final tabulation by which the relative life safety of various buildings is established.*

13. *It is to be noted that the permissible story heights selected for existing buildings are never, except in line 18, as liberal as the factory limits for moderate hazard occupancies, and that, except as regards open stair buildings and line 18, the story heights are as low or lower than those for high hazard occupancies, in factory buildings.*

14. *For new buildings, the heights and areas are those appearing in the 1915 edition of the National Board Building Code, which limits seem reasonable to your committee except that with maximum protection, as indicated in line 18, it is believed that buildings as high as twelve stories should be permitted. Such stores seem an economic necessity, and with proper safeguards should be reasonably safe to life.*

15. *In column 4, line 18, the figures "9-12" mean that regular sales operations may not be carried on higher than the ninth floor, but that other store operations may be carried on as high as twelve stories above the street.*

16. *The areas permitted in existing buildings have been made generous where vertical openings are protected and sprinklers installed. This will tend to encourage the protection of vertical openings, as being easier and less expensive than the building of fire walls. It must not be forgotten, however, that these are minimum requirements, and that the calculation of egress facilities needed as finally made may show that a store to avoid putting in any additional stairs may find it wiser to add another fire wall because of the liberal credit proposed for horizontal exits.*

Area the Basis of Number of Occupants.

17. *The introductory section of this report indicated the necessity for establishing the total probable number of occupants on the basis of area. From such data as your committee now has available regarding certain important department stores, it looks as though in those portions of the stores where the greatest crowds are to be found the part of the total building area available to customers approximates one-third. A moment's reflection will indicate that to handle many people there must be much counter space and many clerks, and a consequent reduction in the floor space available to customers. In those departments where there are relatively few customers there frequently are very large open areas as in cloaks and suits and floor coverings' departments.*

18. *Assuming that in spaces available to customers each customer requires ten square feet under maximum crowd conditions, there would then be approximately thirty square feet of total building area required per customer. Allowing one sales person for each four customers, a total of twenty-four square feet of floor space per occupant will follow.*

19. *The amount of stair and elevator capacity needed by a building must bear some relation to the time to get all people out of the structure, and if would obviously be unfair to require sufficient egress facilities to take care of all floors on the maximum occupancy basis which can probably be expected in basements, first stories, toy departments, restaurants, and possibly certain other sections. Your committee favors first class egress from basements, obviously sufficient exits from first floor to take care of all people who may be in the building, and then sufficient stair and elevator capacity to take care of persons above the first floor with due regard both to the aggregate number of persons and the fact that on certain floors above the first serious crowding is to be expected. In other words, there must ultimately be established an allowance of square feet per person for floors above the first, and a figure not nearly as great as that for the first floor and basement. This figure will be developed when much additional data of a specific character regarding existing stores has been secured.*

The Emptying Time Factor.

20. *When the likely number of persons in a building has been established on an area basis, it becomes necessary to provide sufficient stair and elevator capacity to get these persons out of the building in a reasonable time. It is proposed to vary this time greatly as regards the retail store, as was done with factory buildings, with due regard to construction, height, protection of vertical openings, provision of horizontal exits, and provision of automatic sprinklers. No variation is now contemplated on account of different occupancies, because of the great variety of materials found in retail stores. It is proposed to use an average occupancy hazard, perhaps about equal to the "moderate hazard" class in our factory building egress code.*

21. *Your committee believes that it should be possible to empty the poorest types of stores in two to three minutes, and the best stores (leaving out the horizontal exit factor for the moment) in from eight to ten minutes. Horizontal exits, especially where two or more are provided, are considered to have such unusual life safety value in a building where control of occupants is substantially possible, that very generous credit is proposed for horizontal exits, and emptying time via stairs and elevators as high as thirty minutes is being considered for the finest structures.*

Stair and Elevator Requirements.

22. *It is deemed essential to make an allowance for passenger elevators in getting persons out of retail stores, partly because customers and clerks use elevators so largely, and partly because the number of elevators is generally large and the capacity per trip considerable as a result.*

23. *It is proposed to develop an elevator capacity formula which may be expressed in an equivalent of stair capacity. It is proposed to make no capacity credit for unenclosed elevators where stairs may not be open, and to penalize open elevators in addition. Also the elevator capacity for which a credit is given must not be unduly large as compared to the required stairs.*

24. *In the following discussion the term "stairs" is intended to cover stairs and elevator capacity jointly.*

25. *Having established the number of persons on the basis of a unit such as one thousand square feet, and an emptying time relativity factor on account of structural and protection features, the problem of establishing the amount of stair capacity is a relatively simple one. For example:*

(a) Assumed building has an area of 20,000 square feet, height of six stories above the street, and a maximum emptying time of six minutes.

(b) Disregarding exits from first floor and basement, we are concerned with the second to sixth floors inclusive.

© Assuming that an area of fifty square feet per person were finally established for these floors, the average number of persons on each floor for whom provision would have to be made would he four hundred (400).

(d) Assuming twenty seconds required to travel down one story, the emptying time required to travel from the fourth floor (average distance above the street) to the outside would be three flights x [times] *twenty seconds, plus thirty seconds' allowance to reach stairs, and thirty seconds' allowance to get to street from end of flight in first story, or a total of two minutes.*

(e) The maximum time allowance is six minutes; therefore each unit of stair width is expected to take care of three sets of persons.

(f) One set of persons will equal those on one flight of stairs and the corresponding hall and landing spaces. With one person on every other step and with one person for each four square feet of landing and hall space, an average stair may be expected to have something like fifteen persons capacity per unit of stair width.

(g) Three sets per unit of stair width will give a capacity of forty-five persons per unit of stair width, and four hundred persons per floor would require substantially nine units or approximately eighteen feet of combined stair width.

26. *It is proposed to develop a final tabulation on the basis of number of feet (or fraction thereof) of required stair width per one thousand square feet of floor space, without consideration of the horizontal exit feature. For that additional credits are contemplated such as*

a. For one standard horizontal exit 50%.
b. For two horizontal exits 100%.
c. For three standard horizontal exits 150%.
d. For four standard horizontal exits 200%.

27. *Horizontal exits must of course meet the standard requirements as to the areas of sections to which persons could move, size and number of door openings, fire doors, and also the relative floor levels between sections.*

28. *With the committee plan as finally developed, if a person contemplated building a store, he could tell at once from the tabulations whether a structure such as he had in mind would be permitted, and if so, how much stair width would be required. If he felt the stair requirement to be excessive, he could build a better structure or provide one or more horizontal exits. As a matter of fact, the fire section area limits proposed, for new stores are such that any important structure will need at least one dividing wall.*

29. *If a person were considering an existing building, one glance at the tabulation will show him whether a building can be used as it then stands, and he can easily figure out what must be added in the way of division walls, stairs, protection of vertical openings, or sprinkler equipment to enable the building to be used for retail store purposes.*

Definitions and Standards.

30. *Proper definitions and standards for various features of construction and protection will of course ultimately be prepared by the committee. Due consideration will be given to our factory egress code and to other National Fire Protection Association and National Board of Fire Underwriters' Standards.*

SPECIFIC EGRESS FEATURES.

Aisles.

31. *Very important matters in retail stores are adequate aisles and unobstructed aisle space. Our investigations of existing stores indicate this latter feature, to be violated to a very dangerous extent. Aisle tables may sell more goods than any other, but probable serious interference with getting out of the structure in case of fire is, in our opinion, not warranted by this fact.*

32. *It is proposed to establish for main and for cross aisles a minimum percentage which the aggregate width of such aisles should bear to a building or section dimension and right angles to the aisles in question, and also to base the width of aisles, especially on the street floor, on the number of persons who may be called upon to use these aisles.*

33. *In a building where most of the occupants are not familiar with the location of stairs, it is particularly important that aisles be straight and that stairs be logically located and readily visible.*

Distances to Exits.

34. *The factory egress rule of not over one hundred feet airline from any point to an exit is suggested for retail stores also. Airline is recommended as easier of application and a little more generous than the plan where distance is measured along the shortest normal line of travel.*

Number of Exits.

35. *Permitted forms of egress shall be inside stairs (open in some instances), smoke-proof towers, and horizontal exits. The committee doubts very much whether outside stairs, commonly called fire escapes, should receive any credits whatever. The committee is agreed on this point as regards new buildings.*

36. *Every floor or important section shall have at least two separate exits as remote from each other as practical, and never less than forty feet apart. An opening to an inside stair, a smoke-proof tower, or horizontal exit shall be considered an exit under this rule. This rule shall not, however, make mandatory two exits from small workrooms, offices, or display rooms. For large areas, more than two exits will be needed, and the area basis is probably the best one that can be used.*

37. *Each fire section shall have at least one stair. This is not required in the factory egress code.*

38. *Elevators shall be distributed in moderate sized banks, and in new buildings a reasonable amount of elevator capacity must be provided in each fire section.*

39. *Special study will be given the basement and sub-basement egress problems.*

Stairs.

40. *The same units of measurement, penalties for sub-standard conditions, and methods of calculating capacities of stairs which have been established for factory buildings can, it is believed, be used for retail stores.*

41. *Stairs should, where possible, discharge directly to the outside and street level (and also to the inside), and stairs not so discharging should be penalized. To pour thousands of persons into the street level story; where fire might be raging is obviously less safe than to discharge those who use stairs directly to the outside.*

Horizontal Exits.

42. *Some special study of the horizontal exit feature as related to the retail store will undoubtedly be needed because of the great variation in departments in the amount of open floor space with a large crowd could occupy.*

Light Wells.

43. *Open light wells constitute so serious a menace that your committee contemplates severe penalties where such wells exist.*

Elevators.

44. *In establishing the value of elevators as a means of getting persons out of a building consideration must be given to the number of elevators, area of cages, height of building, speed of elevators, safety of elevator machinery, enclosure of shafts, emptying time allowed for the building, and possibly other factors. It is expected to develop a formula or a special tabulation to convert elevator capacity into stair capacity.*

Street Level Exits.

45. *There must be a definite relation between the aggregate width of the exits and all of the persons that may be accommodated by the building. This naturally carries with it a proper relation between the exits and the aisles leading specifically to them.*

46. *Minimum widths need to be established for such exits.*

47. *It is particularly important that street level exits bear a simple relation to stairs and elevators, and that these exits be not too far apart. A building with exits at two ends is not as safe as one with exits on four sides.*

The collapsible revolving door apparently is an operating necessity, but a retail store should have at least a reasonable proportion of its total door capacity in the form of ordinary doors swinging outward.

Signs.

48. *There is need of generous treatment as regards elevator, usual stair, and special fire exit stair signs. It is necessary that these signs be readily visible, preferably being well over head and across the normal line of travel and sight.*

49. *No obstruction of signs by decorations should be permitted at any time, and obviously no removal of signs tolerated.*

Occupancy.

50. *While it is undoubtedly desirable that retail stores be assumed have some average occupancy hazard, special treatment of the special hazards is undoubtedly warranted. Various minor manufacturing operations, kitchens and restaurants, and packing operations are the principal hazards found in the average store of considerable size. Treatment can take the form of placing of these hazards as near the top of the building as possible, of segregating them by special fire resistive partitions, and of installing sprinklers in those locations where the buildings are not generally protected.*

[**TABLE OMITTED**]

Mr. Forster: *The Committee has included in the above report a tabulation–you know the Safety to Life Committee is very fond of tabulations. In this tabulation we have suggested certain structural limits for old and new buildings. This is an important part of the treatment of the egress problem.*

While the Committee hopes to be able to accept without substantial changes the best stores now in use, I wish to point out that the life safety in a number of our prominent stores is anything but satisfactory, and it is likely that there may be serious objections from retail stores when the Committee gets further along in its studies. We plan to call into our councils the various organizations of retail store men and put our cards frankly on the table and ask their constructive help.

Mr. Banash: *Will Mr. Forster please take the tabulation and under say, unsprinklered buildings, elaborate for us how the Committee arrives at the maximum height of unprotected and semi-protected vertical openings, and also state how they dispose of the matter of the various stocks of different combustibility and density?*

Mr. Forster: *As regards the first point, these limitations of height under different conditions are purely arbitrary, they are based primarily upon the factory limitations of height, which you have already approved, except that we have stiffened up the requirements about one story as compared to factories.*

Mr. Banash: *The idea I had was that these were not stiff enough.*

Mr. Forster: *I am glad some people feel that way. The Committee has tried to be practical.*

Mr. Banash: *I do not wait to make an objection, but is egress so important, or could various other methods of solving the safety problem be attempted in some of these stores and still satisfy the Committee? It seems to be mostly a question of egress.*

Mr. Forster: *That is very true. Any of these buildings not of the best type can be improved by protection of stairs, if not protected; or the installation of sprinklers; or the provision of horizontal exits; or through the erection of fire wall. We have not attempted to differentiate between various kinds of stock as regards inflammability. We realize that we have everything from hardwood furniture and kitchen utensils to the flimsiest women's dresses, which burn with terrific speed, and since retail stores are subject to such a tremendous variety of occupancy, we have assumed simply that a store occupancy is a store occupancy, and we would safeguard the average conditions.*

Mr. Miller: *The subject covered by this report is so important that it is going to lead to a long discussion if we go into details. May I suggest that permission be given to members who want to discuss the details to send in their criticisms in writing by a certain time so that they may appear in the Proceedings as written communications, and others may get the benefit by reading the Proceedings.*

Mr. Forster: *The Committee wants criticism and constructive help very much.*

Mr. Miller: *I'm considering the point of getting the matter before the other members also; those who may have objections to make.*

The Chair: *I think that is quite in order.*

Prof. Woolson: *I will follow Mr. Miller's suggestion.*

The Secretary: *I assume that those communications as they come in will be turned over to the chairman, so that his reply may also appear in the Proceedings as if the questions had been asked and answered on the floor of the convention.*

Mr. Miller: *Will the Secretary please state by what time he should have those criticisms and suggestions?*

The Secretary: *They should be back in final form before the first of June in any event.*

Written Discussion by Mr. C. Heller.
(San Francisco.)

Part 1. Retail Stores.

Item 18. This section attempts to measure the probable total population in a mercantile establishment and provides for customers and clerks. It omits to mention other employees which in a large concern would number over 1000. Incomplete data at hand would indicate that the sales force constitutes about 47 per cent of the total number of employees. These other employees which are principally in the office, mail order and shipping departments might in a way be considered separately from the people on the sales floors, but no matter how considered they are in the building and are a part of its population for which exit facilities must be provided.

It should be understood by the members of the Association that the figures assigned in this paragraph for floor space occupied per person are only tentative, and will be revised as more data is gathered by the committee.

Item 21. Thirty minutes as an allowable time of egress seems excessive. It would also seem inconsistent with the time limits established for factories, which are much shorter. In two buildings, both of the same grade of construction, one occupied as a moderate hazard factory and the other as a department store, the safety to life hazard would appear to me less in the factory on account of the partial or total control of the occupants and their familiarity with the exits, as against a total absence of these factors in a store building, so that I can see no good reason for allowing a greater time for egress in such structures.

Chairman Forster's Reply.

Item 18. The Committee has in mind, of course, the fact that a large part of the employees in a retail store are not members of the direct sales force. The balance of the employees are likely to be scattered throughout the building, or, if they are concentrated upon certain office floors, the number of persons per hundred square feet is not large, and there is a corresponding reduction in the possible space for customers in exact proportion to the increasing number of employees on a given floor. This clerical staff problem will have to be given careful consideration when the final area plan is worked out.

Item 21. It is quite possible that the suggested maximum of thirty minutes' emptying time allowance is too high for even the best retail stores. We have to make many calculations as regards existing buildings before we can come to a final conclusion. Our preliminary studies indicated that some of the stores which today undoubtedly rank as the very finest in the country could certainly not be emptied in as little as ten minutes under crowded conditions. It has been the hope of the Committee that the very best buildings that now stand might be accepted as they are.

Mr. Forster: *If there is no other question of a fundamental character which needs to come up now, I will request that this part of the report be accepted by the Association as a progress report.*

The motion to accept the part of the report presented by Mr. Forster as a progress report was adopted.

Mr. Forster: *I will now ask that Mr. Frank Irving Cooper, of Boston, take the floor to present the section on schools.*

Of particular interest is the design occupant load factor developed for mercantile occupancies, 24 SF per person, by the Committee and also the egress capacity factor for egress stairs for mercantile occupancies, 45 persons per unit of egress width (22 inches), developed by the Committee.

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Source: "*Proceedings of the Twenty-Third Annual* [NFPA] *Meeting*", Ottawa, Canada, 1919.