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FIRE PROTECTION HISTORY-PART 180: 1922 (LIFE SAFETY PROVISIONS-SCHOOL AND OFFICE BUILDINGS)

By Richard Schulte

The development of the egress requirements for buildings continued at the twenty-sixth Annual Meeting of the National Fire Protection Association in 1922. The following is a transcript of the Report of Committee on Safety to Life presented at this meeting:

"*The Chair: The next report is that of the Committee on Safety to Life, Mr. H. W. Forster, Philadelphia, Chairman.*

Report of Committee on Safety to Life.
H. W. FORSTER, Chairman.

C. E. Beach, David S. Beyer, E. S. Chapin, Frank Irving Cooper, Henry B. Cross, C. Heller, H. K. Hughes, R. S. Moulton, R. H. Newbern, William Newell, Lew R. Palmer, Frances Perkins, T. G. Toomey, C. T. Vilade, Stacey W. Wade, Sidney J. Williams.

[This report has been submitted to ballot of the committee, which consists of seventeen members, of whom fourteen have voted affirmatively, one affirmatively, with incidental reservations, and two have refrained from voting.]

As reported last year, the National Fire Protection Association has been requested by the American Engineering Standards Committee to act as sponsor and to undertake the preparation of a National Building Exits Code covering the subject of egress in all of its ramifications.

During the year this Building Exits Code Committee has been organized, having added to the Safety to Life Committee the following gentlemen representative of the interests specified.

Name	*Business*	*Designated by*
Connelley, Hon. Clifford B. Alternate: James Cronin	State Comm'r of Labor, Penna.	Assn. of Governmental Officials of U. S. and Canada
Cook, Peter G.	Operative Plasterers and Cement Finishers Union	U. S. Dept. of Labor
Davis, Ross B.	Chief Engineer, Phila. Fire Dept.	Int'nl. Assn. Fire Engineers
Gernon, James	N. Y. State Dept. of Labor	Int'nl. Assn. Industrial Accident Boards and Commissions
Hansen, Carl N.	Amer. Reinsurance Co.	Natl. Assn. of Manufacturers
Ingberg, S. H.	U. S. Bureau of Stds.	U.S. Bureau of Stantards
Ludlow, W. O.	Architect	American Institute of Architects
Maxon, Paul J.	Natl. City Realty Corp.	Natl. Assn. Bldg. Owners and Managers
McDermott, Charles	N. J. State Dept. of Public Instruction	Building Officials Conference
Riffel, B. C.	Natl. Bureau Casualty and Surety Underwriters	Natl. Bureau Casualty and Surety Underwriters
Whitty, R. P.		Associated General Contractors of America

Whatever work the Building Exits Code Committee does must receive the approval of the National Fire Protection Association before the American Engineering Standards Committee will give the report favorable consideration.

The Building Exits Code Committee held meetings in New York on January 17, February 9, February 23, March 9, and April 6, and in addition sub-committee meetings enabled a large amount of preliminary work to be done.

The analysis of the work before the committee and the order in which the subjects are to be taken up is as follows:

Section A. –Standards.

MEANS OF EXIT.

1. *Stairs (doors, enclosures, etc.).*
2. *Outside stairs.*
3. *Horizontal exits.*
4. *Ramps or inclines.*
5. *Aisles and corridors.*
6. *Spiral and straight chutes.*
7. *Elevators.*
8. *Escalators.*
9. *Wall openings (including windows).*
10. *Individual escapes.*

ALARMS AND DRILLS.

11. *Alarm systems of all types.*
12. *Fire drills to meet different occupancies.*

CONSTRUCTION AND PROTECTION.

13. *Standards for building construction.*
14. *Standards for fire protection.*

Section B.–Occupancies.

1. *Factories, warehouses, and other industrial buildings, including garages.*
2. *Retail stores.*
3. *Office buildings.*
4. *Schools.*
5. *Theatres of all types.*
6. *Other places of public assembly.*
7. *Exhibit halls and museums.*
8. *Hotels, clubs, apartment houses, lodging houses, tenements, and restaurants.*

9. *Hospitals, asylums, and prisons.*

10. *Public service properties, such as railroad stations, power houses, and telephone centrals.*

11. *Subway and elevated structures.*

12. *Docks and wharves.*

The Safety to Life Committee submits to the National Fire Protection Association at this meeting reports on items as follows:

1. *School Exits Code– tentative approval requested.*

2. *Progress report on the office building problem.*

SCHOOL EXITS CODE.

Introduction.

1. The general plan of this Code is to provide exits sufficient for reasonable safety of occupants of buildings in case of fire.

2. The fundamental principle of this code is to provide exits sufficient to empty school buildings in three minutes after alarm of fire has been given, and to provide for construction such that buildings may be emptied in this three minute period without danger to life by fire, smoke or resulting panic. Property damage from fire is not the concern of this code, although many of the requirements made for life safety will incidentally contribute towards fire safety of school building property.

3. It should be noted that while the requirements are drawn primarily for new buildings, they are intended to be also applicable to existing buildings, subject to the modifications given in the section on Existing Buildings. It should be noted that this Code gives minimum requirements in all cases.

Building Construction.

4. The following requirements shall govern construction and limit heights:

5. Two stories shall be the maximum height of buildings of non fire-resistive construction. Buildings of two stories or more shall have fire-resistive corridor floors and walls and all windows from rooms to corridors shall be wired glass in stationary metal frames.

6. Buildings of more than two but not more than four stories shall have fire-resistive floors, walls and partitions, but trim, finish floor, sash, doors and frames may be of wood, except where otherwise required.

7. Buildings of more than four stories shall be of fire-resistive construction throughout except that finish floor may be of wood.

8. In determining the number of stories and egress required, the basement (or "ground story") shall be considered a story if the ceiling is 7½ feet or more above the grade level at any point next to the building.

9. All basement walls and partitions shall be of fire-resistive construction.

10. It is recommended that first floor be of entirely fire-resistive construction.

11. Floor construction shall be fire-resistive immediately above basement rooms utilized for manual training, domestic science, kitchens, laboratories, shops, janitor's rooms, storerooms, boiler or heater rooms or fuel storage, or other similar occupancy.

12. Doors to basement rooms of occupancies listed in §11, leading to stairs, corridors or other lines of exit shall be self-closing, of metal or metal covered, and windows leading to corridors shall be approved wired glass windows with stationary metal frames.

13. All heating plants within school buildings, including fuel storage rooms, shall be completely surrounded by fire-resistive enclosures with self closing fire doors protecting all openings thereto, except those in exterior walls.

14. Auditoriums and gymnasiums shall not be located above the first floor (gymnasiums are included with auditoriums because they may be used for assembly purposes). (See also section on auditoriums and gymnasiums.)

Number and Location of Exits.

15. The same egress facilities shall be provided for school buildings irrespective of type of construction, whether ordinary or fire-resistive.

16. When the term "exit" is used, it is intended to describe egress secured through one or more openings leading out of doors either directly, through a stairway, or through a way of access to such an opening or stairway, which way is protected by a smoke stop.

17. Stairways and other exits shall be provided in sufficient number to comply with the three minute emptying time requirement, see Rules for Determining Required Exits (§33 to §42), and shall also comply with the following rules.

18. Not less than two inside stairs, or smokeproof towers, remote from each other, shall be provided from every floor, including basements.

19. Exits shall be so arranged with respect to corridors, passages and stair wells that there are no pockets or dead ends in which pupils might be trapped.

20. All required stairs shall be located adjoining outside walls and shall open directly outdoors.

21. Exits shall be so located that no corridor exit door of any room served by them shall be more than 100 feet distant along the line of travel from a stairway or other exit.

22. Every room above the first floor with capacity of over 20 pupils (400 sq. ft. as per rule for determining capacities) shall have at least two means of egress. In case these egresses finally open upon the same corridor, the openings into the corridor shall be on opposite sides of a smoke-resistive door, and shall give access to independent stairways.

Corridors.

23. Corridors shall be at least eight feet wide.

24. Lockers shall not be placed in main corridors.

Stairway Construction.

25. Stairs shall be Class A: except that all doors must swing (no sliding doors allowed), minimum stair width shall be 44", and intermediate handrails shall be provided where stairs are over 66" wide.

This reference to Class A stairs is to a section of this Code not yet ready for adoption but which when completed will be incorporated in the Code. Class A stairs are the best type specified, with maximum rise 7", minimum tread, exclusive of nosing 10 ½"*, intermediate landing where stairs are over* 10' *in height, etc.*

Stair and Other Enclosures.

26. All stairs shall be enclosed with enclosures Nos. 1, 2 or 3; except that for non fire-resistive buildings, No. 4 shall be permitted.

This reference to enclosures is to a section of this Code not yet ready for adoption but which will when completed be incorporated in the Code. The following summary is given for c

1. *Standard smokeproof tower.*
2. *8" brick, or equivalent.*
3. *Two cell cement plastered terra cotta, solid gypsum blocks not less than five inches in thickness, 4" reinforced concrete.*
4. *Cement plaster on metal lath and metal frame.*

27. All doors into stair enclosures shall be smoke resistive.

Note:– By a smoke-resistive door is meant a light door of metal or metal covered or other approved type with wired glass panels.

28. Smoke stops, the doors of which shall be double swing, should preferably be provided across each corridor between each two stairways, and shall be provided one in every corridor of 150 ft. or more in length, and in any case not over 150 ft. apart.

29. Doors in smoke stops and in stair enclosures, if kept normally open, shall be provided with fusible link holds or equivalent devices and also shall be provided with an electric release connected to the fire alarm system of the building, so arranged that doors will be released by either heat or by an alarm.

30. Exterior doors shall be operated by bars or other panic hardware device. Single leaf doors rather than double are recommended because hardware now available is more satisfactory for single than double doors. If glass is used in doors, it shall be wired glass.

31. Light wells are not recommended. If provided, they shall be open at the top. If less than 10 ft. in least dimension, they shall be enclosed by fire resistive walls in a manner similar to or better than that specified for stair enclosures and shall have wired glass windows in stationary metal frames.

32. Elevator and dumb waiter shafts shall be of fire-resistive material, similar to or better than that required for stair enclosures, and all openings provided with approved fire doors kept normally closed by means of proper hardware. Other openings such as dust, and package chutes shall be enclosed or protected in a standard manner. Incinerator chutes shall be so arranged and protected that fire cannot travel back through them.

Rules for Determining Required Exits.

33. Number of occupants shall be determined as follows, and exits provided suitable for occupants as so determined: Take gross floor area of building, exclusive of auditoriums and gymnasiums, in square feet, divide by 2, to get net area used for educational purposes, and divide by 20 to get number of occupants. Auditoriums and gymnasiums shall be separately treated figuring one person per six square feet of net floor area. (See §43.)

34. Stairways and doors shall be provided in sufficient number so that all buildings may be emptied in three minutes.

35. A unit of stair width shall be 22 inches for new buildings.

36. Rate of discharge of stairs and doors shall be computed at 45 persons per minute per unit of width.

37. In computing the number of stair units required under the rule, that all buildings shall be emptied in three minutes, one entire stairway (the largest) shall be disregarded on the assumption that it may be unavailable by reason of fire or smoke.

38. The number of stair units shall be computed on this basis, taking the aggregate population of the building above the second floor, and stairways provided accordingly. All stairways shall be continuous from the top floor to the ground level.

39. The basement (or "ground story") shall be treated the same as an upper story and exits provided accordingly, either stairs leading to the first story or doors leading directly outdoors.

40. First floor doors shall be provided sufficient to discharge in three minutes at the rate of 45 per minute per unit of width all the occupants of the stories above the first, plus occupants of the basement coming upstairs and using first floor exit doors, plus the occupants of the first floor.

41. Example: Assume a four story and basement building 60'x150 = 9,000 sq. ft. per floor. Assume that there are no independent exits from basement and that the occupants of the basement must use first floor exit doors.

Population of 3rd floor = 9,000 ÷ (2 X20) = 225
Population of 2nd floor = 9,000 ÷ (2 X20) = 225

Total to be accommodated by stairs from upper floors 450

At 45 per minute for 3 minutes, 135 can pass in one file. Providing one unit of stair width for each file, 450 ÷ 135 = 3.3 units of stair width. This means two stairways 2 units wide. Adding one stairway to provide for blocking by fire or smoke, this makes three 2-unit stairways:.

The basement population is similarly 225, which means 1.6 units, or one 2-unit stairway, plus one stairway to provide for blocking by fire or smoke requires two stairways from basement to first story.

First story doors shall be provided as follows:–

For occupants of upper floors	*3.3 units*
For occupants of basement .	*1.6 units*
For occupants of first floor	*1.6 units*
	6.5 units

This means four 2-unit doors plus one 2-unit door to allow for blocking by fire or smoke, making five 2-unit doors required from first story to outside. An alternative would be to provide two 2-unit doors and one 3-unit door, plus one 3-unit door to provide for blocking, making a total of two 2-unit doors and two 3-unit doors.

42. For buildings of over five stories, in lieu of the stairs required by §34, if stairs are of sufficient capacity to accommodate in the stair enclosure all the occupants above the first story they may be accepted. In determining capacities, one line of pupils shall be assumed for each unit of stair width with one person for every two steps and in addition one person for every three square feet of landing and other space within stair enclosures, except that the number on landings shall not exceed the number on stairs.

Auditoriums and Gymnasiums.

43. Exit facilities for the number of occupants determined by the rule of paragraph 33 shall be provided independent of those for the other parts of the building, all in general conformity with the exits hereinbefore specified for other parts of the building.

Auditoriums and gymnasiums will be further considered by the committee, and will be covered in detail in a subsequent section of this Code.

Fire Alarm.

44. Every building shall be equipped with an approved closed circuit fire alarm system. Signal gongs shall be placed on each floor, including basement, and shall be used for dismissal only, signals to be operated by signal stations placed on each floor and also in the principal's office.

Existing Buildings.

45. Existing buildings shall conform with the foregoing requirements, except that the following exceptions may be allowed.

46. Three story non-fire-resistive buildings may be accepted provided basements and rooms used for manual training, domestic science, kitchens, laboratories, shops, janitors' rooms, storerooms, boiler or heater rooms, fuel storage or other similar occupancy, are completely protected by automatic sprinkler systems installed in accordance with N. F. P. A. Regulations.

47. Non-fire-resistive buildings of more than three stories may be accepted if completely protected by automatic sprinklers.

48. Wherever fire-resistive construction is specified in paragraphs 9, 11, 12 and 13, ordinary construction protected by an approved automatic sprinkler system may be accepted.

49. Auditoriums and gymnasiums (see §14) if provided with proper exits as specified herein, and if the entire building below auditorium or gymnasium level is fire-resistive or protected by automatic sprinklers, may be allowed above first floor.

50. If existing stairs are insufficient according to rules herein, the required stair capacity may be obtained by adding exterior screened stairways leading continuously to the ground, or standard fire escapes may be accepted if already installed. Exterior stairs and fire escapes shall be in accordance with N. F. P. A. rules, Outside Stairs for Fire Exits. (This reference will be replaced by reference to section of this code on Outside Stairs when adopted.)

51. Stairs shall not be rejected if not located adjoining outside walls as per §20 if they comply with other requirements.

52. Rooms not provided with duplicate exits as per §22 may be accepted.

53. Stairs may be Class B instead of Class A specified in §25. *(This reference to Class B stairs is to a section of this Code not yet ready for adoption but which when ready will be incorporated in the Code. Class B stairs are 44" wide between faces of walls or* 40" *between face of wall and open balustrade; maximum rise 7*[-]*3/4"; minimum tread excluding nosing* 9[-]½".)

54. Stair enclosures grades 5 or 6 may be substituted for requirements of §26. (Reference to section of the Code not yet ready to be incorporated when adopted. No. 5 enclosure is wired glass with metal framing. No. 6 is wood covered with metal lath and cement plaster, or plaster board covered with sheet metal.)

55. A unit of stair width may be taken as 18" instead of 22" as specified in §35.

EXITS CODE FOR OFFICE BUILDINGS.

Your Committee has felt that the development of an exits code for office buildings followed logically after the factory and department store codes already approved in 1918 and 1921 respectively. No code is submitted for approval at this meeting, but we do present a brief statement of the problem as the committee sees it, and we ask the co-operation of the Association membership, especially along lines of constructive criticism.

The first problem that arose was the maximum population of a building at any one time especially from the second floor up, as persons in the second story and above would use the stair system. As with department stores, we found that there was very little data. Counts of persons in and out of buildings during a working day, or total elevator counts, did not give maximum population at one time. Hence the committee planned to count all persons in and out representative buildings, and by recording at frequent intervals the difference establish the actual occupancy at those periods. This was done with twelve office buildings in Philadelphia, including all the largest and several representative older and moderate sized structures. The fire department and the fire marshal loaned us men for this purpose.

In New York, the fire department made counts of the number of persons in several representative buildings during business hours, and certain other data regarding the number of employees of tenants is available through post office department registers which certain managements maintain.

While the committee has not yet sufficient data to justify any final conclusion, it believes tentatively that it will be wise to figure 100 sq. ft. of gross area per person as the basis upon which stair capacity shall be established. The gross area rather than rentable area has been selected as a basis, because rentable area may vary from time to time and, because, generally speaking, there is a fairly constant ratio between gross and rentable area.

***Congested Occupancies**.*

The committee realizes that certain occupancies, notably large aggregations of clerks of banks, insurance companies, railroads, and others, may materially increase the density of population and that certain provisions may have to be made to meet this situation. The 100 sq. ft. figure is for a miscellaneous tenancy office building.

As regards the hazard class, the committee feels that the office building belongs in the same class with the low hazard factory.

Height.

The 1918 factory code tabulation (which controls as regards factors of construction, sprinkler protection, vertical opening protection, and height) stops at 12 stories. For office buildings, greater heights are essential, and hence the tabulation will have to be increased for the best class of structures.

The committee proposes in connection with all structures to require protection of all vertical openings where height exceeds 10 stories.

Automatic Sprinklers.

The committee proposes to prohibit the use of any building for office purposes which is 12 stories or over in height unless the entire structure is under sprinkler protection. Our regulations are for existing as well as new structures, and this will mean if the regulation is adopted, that hundreds of existing buildings, in this country will have to be provided with automatic sprinklers if used above the 11th floor. This obviously is a radical step, but we believe it necessary, both because of the effect on life safety, and because of the admitted inability of a fire department to fight any important fire from the ground where a structure is of any material height.

It can be demonstrated that, because substantial credit is given to automatic sprinklers in that stairs need not be so ample in an office building under sprinkler protection, it may be actually cheaper to install sprinklers than provide additional stairs which take up valuable rentable areas.

Horizontal Exits.

It is proposed in connection with new buildings over 10 stories in height to require at least one standard horizontal exit, just as has been done with the department store, and in any building which has one or more horizontal exits to reduce required stairs 25%.

Mixed Occupancies.

The committee is devising carefully worked out regulations to take care of the conditions where, for example, stores or factory occupancies are found in office buildings, stores in factory buildings, etc. Miscellaneous occupancies are becoming exceedingly common, particularly in the large cities. It has been stated that it is virtually impossible to make an office building pay unless the first and second stories are rented out on a high rental basis to banks, stores, and similar occupancies.

By the 1923 meeting, it is expected to present a well rounded report on the exit requirements for office buildings.

Discussion.

Mr. Forster: There were two points with respect to which members of the Committee have taken exception, and if the convention has the time, I know that certain gentlemen here would be glad to present those points for your consideration. Of course we move the adoption of the report, subject to such modifications as this body and the committee subsequently and the Executive Committee finally, may approve.

Mr. Lew R. Palmer (New York): I think in justice to the absent members of the committee who have not been privileged to attend all the sessions of the committee, it might be well to bring out one thought. Regarding paragraph No. 5, under Building Construction, the question has been raised in the mind of one member of the Committee at least, whether we should go so far as to require that buildings of two stories shall have fire-resistive corridor floors. On my part, I think we should, but in justice to absent members I want to bring the point out before the Association.

The Chair: Will you discuss that part of the report?

Mr. Forster: Understand, please, that a one-story building can be of any construction; a new building, of two or more stories, is supposed to have the first and second floor corridors fire resistive. Do we inflict an undue burden on tax payers in return for greater life safety by having these corridors fire resistive? The committee has followed the National Education Association regulations in this respect; that is where the idea came from; we did not hatch it ourselves. The Chairman personally thinks the idea is a practicable one. The Committee has voted so by a large majority, but one of our very important and thoughtful members requested that that point be brought to your attention.

The Chair: You have the explanation of the Chairman.

Mr. Newell: I would like to ask if this Committee has considered that feature in connection with Prof. Woolson and his Department of Commerce Building Code Committee in Washington on standardization of and specification for small dwellings?

Mr. Forster: We have had no particular contact with Prof. Woolson except the occasional happy contact one has with our genial member when one goes to New York.

Mr. Newell: It struck me that his Committee would be interested in the matter just discussed; certainly in the question of cost.

Mr. Forster: I move that the part of the report covering the School Exits Code be adopted.

The Secretary: A tentative adoption?

The Chair: No, sir; final.

The motion was seconded and carried.

Mr. Forster: The Committee requested final adoption, subject to further review of certain points and approval by the Executive Committee. We have been at this some two or three years and there seems to be quite a desire to have a set of regulations. The question has arisen whether or not we are warranted in permitting an existing building three or four stories high to be used, if sprinklered, as that principle has been used in our exit codes for factories and stores, and while one intelligent member raised an objection, I personally feel that the Committee's opinion was warranted.

The Chair: The Chair understands that you are going to consider these minor points and present them to the Committee?

Mr. Forster: On the Exits Code for Office Buildings we are simply presenting an informational report; we have no specifications, and if there are objectionable features we will fight over those next year.

Professor Woolson: It strikes me that the introduction of sprinklers in the upper stories of these buildings would hardly accomplish the life-saving service that perhaps might be expected from them. My own opinion is that the sprinklers would not operate to protect the lives of the children in the upper stories if the exit facilities are such that the children may be delivered from that building in three minutes; because long before that time will have passed and before the sprinklers will have operated, the children would either be out of the building or partially or completely smothered by smoke or flame. I believe the children would be as safe without sprinklers on the upper floors. As regards the lower floors, I am in hearty accord. I question the advisability or necessity of sprinklering the upper floors.

Mr. Forster: We will be very glad to take that suggestion of Prof. Woolson under consideration at our meeting the latter part of this month.

The Chair: The next item is the report of the Committee Resolutions, Mr. Chas. A. Hexamer, chairman.

The Committee's report in 1922 included a flow rate through stairs and established three minutes as a time in which egress is to be accomplished in school buildings. The Committee's report also proposed that sprinkler protection and horizontal exits be provided for high rise office buildings.

The Committee's report clearly shows that egress requirements which we use today had their origins in the early work of the Committee on Life Safety. Similarly, the concept of providing sprinkler protection in high rise buildings advanced in the 1960's and early 1970's had its origins in the early work of the Committee on Life Safety.

In other words, the "new" concepts being proposed in the last 40 years are actually are not new, but date back to the earliest concepts being advocated by the experts in fire safety almost a century ago.

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Source: "*Proceedings of the Twenty-sixth Annual* [NFPA] *Meeting*", Atlantic City, New Jersey, 1922.