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FIRE PROTECTION HISTORY-PART 169: 1921 (DEPARTMENT STORE EGRESS DESIGN REQUIREMENTS)

By Richard Schulte

The fire at the Triangle Shirtwaist Factory in 1911 took the lives of 146 people. Given this, it was not surprising that one of the first topics tackled by the NFPA's Committee on Safety of Life was the egress design requirements for factories. Following the completion of this task, the Committee began work on the egress design requirements for department store occupancies. These requirements followed the pattern of the egress design requirements for factory occupancies.

The following is a transcript of the Report of Committee on Safety of Life presented at the twenty-fifth Annual Meeting of the National Fire Protection Association held in San Francisco in 1921 addressing the egress system design requirements for department stores:

> "*The President: The next order of business is the Report of the Committee on Safety to Life. In the absence of the Chairman, Mr. H. W. Forster, it will be presented by Mr. Clarence Heller of San Francisco.*
>
> ***Report of Committee on Safety of Life.***
>
> *H. W. Forster. Chairman.*
>
> *C. E. Beach, David S. Beyer, E. S. Chapin, Frank Irving Cooper, Henry B. Cross, C. Heller, Lloyd Marshall, R. S. Moulton, R. H. Newbern, William Newell, Lew R. Palmer, Frances Perkins, T. G. Toomey, C. T. Vilade, Sidney J. Williams, R. E. Wilson, J. R. Young.*
>
> *[This Committee consists of eighteen members of whom fifteen have voted affirmatively, two affirmatively with incidental reservations, and one has refrained from voting.]*

INTRODUCTION

Egress Requirements for Department Stores:

Following three years of work on the subject of egress requirements for department stores, your committee feels warranted in submitting the attached report for the consideration and approval of the National Fire Protection Association. The extensive study given life safety in factory buildings, which resulted in Association approval of a Factory Egress Code in 1918, has of course been the foundation of the work on department stores, and the general treatment of the subject, the engineering standards, and the credits for superior conditions are similar and identical where possible. The fundamental difference lies in the fact that in factory buildings it is possible to limit the number of persons with relation to available egress capacity, whereas in department stores, area more than any other factor controls the number of occupants. Hence, the Department Store Egress Code bases egress requirements on area.

For the past two years, your Committee has had the exceedingly valuable assistance of representative department store men, both as to advice and counts of numbers of persons in stores under rush conditions before Christmas and on the Saturday before Easter.

The regulations submitted herewith are believed to give both a very considerable degree of protection to life in department stores of all types of construction and protection, and at the same time to be reasonable and practical. These regulations follow the general principles set forth in the 1920 report of this Committee, but have been modified in detail and considerably amplified. A study of the table attached hereto will show that, as in the Factory Code, there are definite limits established for height, differing somewhat for existing and new buildings, and for different kinds of construction and protection. Certain existing buildings will not be permissible at all as department stores, or will need improvements to meet the requirements. Contemplated new buildings must be laid out with due regard to limitations established. Once it is established that a building may serve as a department store, the requirements permit ready calculation as to required stairs. See example at end of report.

Egress Requirements for Schools:

Your Committee had hoped to present a final report upon the subject of egress requirements for schools at this meeting, but because a number of prominent schoolhouse architects, with whom a sub-committee of your committee is consulting, have not been able to come to a definite conclusion upon a number of points particularly submitted to them, it is impossible to present a final report at this time. That will certainly be done at the next annual meeting.

National Egress Code:

The National Fire Protection Association was requested by the American Engineering Standards Committee to undertake the preparation of a National Egress Code covering the subject of egress in all of its ramifications. The Association accepted this invitation, and asked the Committee on Safety to Life to undertake the work. It is proposed to start this next fall.

Your Committee, under authority given it by the American Engineering Standards Committee, proposes to add to its present roster a number of persons representing national associations that can make valuable contributions to the work.

The tentative plan of the Committee is to provide standards for every means of egress, and to establish the egress requirements for all important classifications of buildings. It is expected that the work will take several years to complete, but it is hoped to complete one or more divisions each year.

EGRESS REQUIREMENTS FOR DEPARTMENT STORES

DEFINITIONS AND STANDARDS

Type of Building Construction:

1. Joisted or quick burning construction is any form of construction in which walls, columns, or floors are of lower fire-resisting power than mill construction.

2. Mill or slow-burning construction buildings are required to have masonry walls, heavy timber or fire-resistive columns, wide-spaced girders or floor timbers, with minimum dimensions of six inches, solid wooden floors not less than 4 inches (nominally) thick, and to be free from concealed spaces.

3. Incombustible construction is that in which walls, columns, girders, floors, enclosures of vertical openings, and principal partitions are incombustible.

4. Fire resistive construction is that in which walls, columns, girders, floors, enclosures of vertical openings, and partitions are incombustible, and in which all structural steel is protected against heat in accordance with the standards set forth in the regulations of the N. F. P. A.

Automatic Sprinkler Protection:

5. The rules of the N. F. P. A. governing the installation of automatic sprinkler equipment shall apply.

Protection of Vertical Openings:

6. Open stairs are those which are without enclosures of any kind or those which have enclosures sub-standard as to fire resistive power or method of arrangement.

7. Stairs adequately enclosed or protected are inside stairs with standard enclosures, or smokeproof towers of standard design.

8. Stairs that must be attractive from an architectural standpoint, leading from the street floor either to the second floor or to the basement, may be cut off respectively in the second story and in the basement and not necessarily in the street story, provided, however, that such stairs may not be included in the required stair capacity in those buildings in which enclosed stairs are a requirement.

9. Buildings in which all vertical openings are protected are those in which, in addition to the stairs, the light wells, elevator shafts, dumb waiter shafts, escalators, package chutes, cash carrier openings, and other vertical openings are protected in accordance with existing N. F. P. A. standards, or where no such standards exist, are protected in a manner adequate to safeguard occupants of the building from rapid vertical fire spread.

10. In every type of building construction (erected after date of enactment of rules), stairs and other vertical openings may be enclosed or protected as set forth in Sections 90, 91 and 92 in the 4th edition of the Building Code recommended by the National Board of Fire Underwriters.

11. In buildings of joisted or quick burning construction (erected after date of enactment of rules), stairs or other vertical openings may also be enclosed or protected as set forth in Section 93 of the above-mentioned Building Code.

12. In buildings of joisted or quick burning construction (erected prior to date of enactment of rules), stairs and other vertical openings may be enclosed as set forth in Section 94 of the above-mentioned Building Code.

Stairs:

13. All stairs, platforms, landings, balconies, and stair hallways (erected after date of enactment of rules) shall be of sufficient strength to sustain safely a live load of not less than 100 lbs. per sq. ft. with a factor of safety of four; and shall conform to all the requirements in Section 45 of the National Board Building Code as to hand rails, newels, landings, width, exit, and prohibition against winding treads. The space under any stairway built in whole or in part of combustible material shall be either left entirely open or be completely enclosed without door or other opening.

14. Stairs in buildings (erected after date of enactment of rules) used as required means of exit shall be at least 44 inches wide between faces of walls, or 40 inches between face of wall and an open balustrade, or between two open balustrades. All such widths shall be clear of all obstructions except that hand rails attached to walls may project not more than 3[-]1/2 inches within them. If newels project above tops of rails, a clear width of at least 44 inches shall be provided between the face of the newel and the face of the wall or newel opposite. All stairs shall have walls or well secured balustrades or guards on both sides. A stairway of 7 feet or more in width shall be provided with a continuous intermediate handrail substantially supported. All stairs shall have treads and risers of uniform width and height throughout each flight; the rise shall be not more than 7[-]3/4 inches, and the tread exclusive of the nosing not less than 9[-]½ inches. Stairways exceeding 12 feet in height shall have an intermediate landing at least 3 feet in length. (Section 45, Article 4, of National Board Building Code.)

Note. – A 7[-]3/4 inch rise and a 9½ inch tread produce a stair having an angle with the horizontal of approximately 40 degrees.

15. Stairs in buildings (erected prior to date of enactment of rules) shall not be used as required means of exit unless they conform to the foregoing section, except that the width may be not less than 36 inches clear of obstructions of any kind other than hand rails. The minimum clear space between walls, balustrades, newels, and hand rails shall in no case be less than 32 inches. The pitch of stairs shall not exceed 45 degrees, and the treads exclusive of nosings, shall be not less than 8 inches wide.

16. Stairways (erected after date of enactment of rules) used as required means of exit shall continue their full width for their entire length.

17. All stairways (erected after date of enactment of rules) that serve as required means of exit and are accessible from two or more stories and extend to one or more of the upper four stories shall be continued their full width to the roof.

Note.–This rule is made to prevent persons, thinking that they can escape to the roof, finding that the stairs lead only a portion of the way to that point.

18. All stairways shall lead by a direct line of travel to the street story, and lead in a direct line of travel to the street, or to an open-air or fire resistive passage leading to the street, or to a yard or court connected with the street. Such fire-resistive passage shall be not less than 7 feet in height.

19. The continuity of all stairs which may be used for exit purposes shall be interrupted at street level by partitions or doors or other means which will make clear the direction of egress to the street. (Section 45, Article 8, of National Board Building Code.)

20. Every enclosed stairway shall be provided with an adequate system of lighting. Inside of each story a sign shall be placed over the entrance to every stair and another shall be hung across the main aisle at right angles to such stairs designating their location. Such signs shall not be obstructed.

21. Stairs shall be located so that they are readily visible to occupants, particularly in connection with the design of new buildings.

22. In new buildings it is recommended that stairs be so located that they can discharge directly to the outside at the street level.

23. In every store building, unless sales basement or basements and also the street story are divided by one or more fire walls or fire partitions, affording standard horizontal egress to occupants, not less than 75% of the stair capacity required for sales basements shall discharge directly to the outside of the building, making it unnecessary for persons to enter the street story, and provided the arrangement is such that persons using these stairs will be protected against any serious fire in the street story or basement.

24. Such exits may be emergency ones, provided with panic locks, and desired additional operating stairs may be provided.

25. Where there is more than one sales basement, stairs shall be cut off in standard manner in each story below the street level.

26. All non-sales basements or portions of basements not used for sales shall be cut off in a standard manner as far as vertical and horizontal openings are concerned.

Smokeproof Towers:

27. The stairs, landings, and balconies or platforms of smokeproof towers, (erected after date of enactment of rules) shall be solid and completely enclosed, as required for interior stairways in Section 90, National Board Building Code, and shall extend from the sidewalk, court, or yard level to and above the roof to form a bulkhead. There shall be no openings in any wall separating the stairway from the building, but fixed or automatic fire windows sufficient for lighting purposes are not objectionable in the exterior walls, provided they are not subject to fire exposure hazard from the same or nearby buildings. Access shall be provided to the stairway from every story of the building by outside balconies of steel or masonry, or by vestibules within the walls of the building, but open at least on one side. Every such balcony or vestibule shall have an unobstructed width of at least 44 inches, and shall open upon an open space not less than 100 square feet in area. The balcony or vestibule shall be provided with a solid incombustible floor. Railings of steel or other approved incombus-

tible material shall be provided not less than 4 feet high. Access to the balcony or vestibule from the building and to the stairways from the balcony or vestibule shall be by approved self-closing fire doors not less than 40 inches wide and 7 feet high, which shall swing in the direction of exit travel. The doors shall be provided with locks or latches, with visible fastenings requiring no keys to open them. A wired glass panel not exceeding 720 square inches shall be provided in the door opening into the stair shaft. The level of the balcony or vestibule floor shall be not more than 7[-]3/4 inches below the door sill of the building. Landings in such stairways shall be of a width that the doors in opening into the stairway shall not reduce the free passageway of the landing to a width less than the width of the stairway. (Section 45, Article 10-B, of the National Board Building Code.)

28. Smokeproof towers (erected prior to date of enactment of rules), shall conform to the foregoing section except that the unobstructed width of vestibule may be 36 inches, and fire doors may be 36 inches wide and 78 inches wide.

Horizontal Exits:

29. In buildings (erected after date of enactment of rules) the term "horizontal exit" shall be understood to mean one or more openings through or around a fire wall, fire exit partition, or any wall separating two buildings; no such opening shall be less than 30 inches wide. Or such an exit may be an exterior bridge or balcony connecting two buildings or two floor areas of the same building. Where there is a difference in level between connected buildings or floor areas, gradients shall be provided of not more than 1 foot in 6 feet where practicable. The bridges or balconies shall be not less than 44 inches wide, and shall be constructed of incombustible material, and enclosed on the sides at least 4 feet high. All exterior exposed openings in connected buildings or floor areas within 10 feet of bridge or balcony shall be protected by fire doors or fire windows with fixed or automatic sash. The floor or a bridge or balcony shall be not more than 7[-]3/4 inches below the sill opening upon it; the connecting floor within the building shall be not more than 1 inch below the sill. Every such bridge or balcony when enclosed shall be provided with means for lighting. (Section 46, Article 2 © National Board Building Code.)

30. In buildings (erected prior to date of enactment of rules) horizontal exits shall conform to the above rules, except that bridges or balconies may be 36 inches wide, and provided that where the floors and enclosures are of solid material, no protection of exterior exposed openings shall be required.

31. Buildings over 10 stories in height must have on each floor from the second to the top story at least one standard horizontal exit.

Doors and Aisles:

32. No openings through which persons may be called upon to pass to reach an exit and no exit proper shall be less than 30 inches wide.

The width of one or more openings used as a means of egress through any wall, partition, or other enclosure, except on the street floor, shall not be less than the following:

a–Horizontal exits: 12 inches of unobstructed width for each 30 persons or fraction thereof.

b–For all other openings: 12 inches of unobstructed width for each 20 persons or fraction thereof.

33. Doors leading to means of egress must swing or revolve with the travel, or slide across the travel, and there shall be no obstructions to stairs, on stairs, on landings, in aisles, or elsewhere, provided that swinging doors when open shall not interfere with the full use of the stairs, and during their swing shall preferably not reduce the effective width of the stairs or landings.

34. The distance between adjoining groups of street floor doors shall not be greater than 150 feet. The minimum width of any street floor door group shall be 5 feet.

35. Revolving doors. Only the collapsible type of revolving door may be used as a means of egress.

36. Not to exceed 50% of the width of required street floor doors may be replaced by revolving doors, but there shall be no objection to providing such additional revolving doors as operating convenience may require. Any revolving door shall be considered to have 50% of the capacity of swinging door or doors of width equal to the diameter of the revolving door. For example, a 6 foot revolving door, from an exit standpoint, is considered the equivalent of 36 inches of swinging door.

37. At any location, the revolving door capacity shall not exceed the swinging door capacity immediately adjoining or within 20 feet. (See also Section 60, Street Floor Doors.)

38. The minimum width of any aisle leading to exterior doors shall be 5 feet, and the total width of aisles running parallel in either direction shall be as great as the required width of exit doors toward which the aisles lead.

Elevators :

39. Passenger elevators may constitute a required means of egress providing they are enclosed in standard shafts for their entire travel.

40. To determine the total number of persons accommodated in passenger elevators, divide the aggregate inside areas in square feet by two, reduce the capacity so ascertained by 33-1/3% to allow for elevators out of commission, cut off by fire or abandoned, and multiply by two, which shall be the average number of trips credited to each elevator. The total number of persons accommodated on this basis shall then be divided by the number of stories above the street floor, reached by the elevators in question, in order to establish the number of persons per floor for which the capacity is available.

41. The allowance for elevators in any story shall not exceed 10% of the required stair capacity for that story.

Escalators:

42. Escalators shall not constitute a required means of egress.

Fire Escapes:

43. Outside fire escapes or stairs shall not constitute a required means of egress.

LIMITATIONS IN USE OF BUILDINGS FOR DEPARTMENT STORE PURPOSES

Buildings Two Stories or Higher:

44. The tabulation herewith sets forth limiting conditions as to construction, automatic sprinkler protection, protection of vertical openings, height, and area, permitted for department stores of all types, both as regards existing buildings and those erected hereafter. The area limits for new buildings given in column 9 are those specified in the National Board Building Code, and take into account protection of property values, fire fighting by the public department, and other factors as well as safety to life of occupants.

45. These requirements pertain to each story of a building of any given class of construction and protection from the lowest up to and including the highest permitted, including basements, except as provided in the next section of these regulations.

46. In fire resistive buildings with standard automatic sprinkler protection, street floor areas may exceed areas of other floors, in accordance with the limitations established in the following section, provided that not less than the stair capacity required for floors above and below the street floor discharges directly to the outside of the building, making it unnecessary for persons to enter the street story, and provided that the arrangement is such that persons using the stairs will be protected against any serious fire in the street story or in basements.

47. In fire resistive buildings with standard automatic sprinkler protection, the maximum undivided area permitted on street floors shall be as follows:

Height	*Existing Buildings*	*New Buildings*
Up to 15 stories.	*50,000 sq. ft.*	*40,000 sq. ft.*
16 stories and higher..	*40,000 sq. ft.*	*30,000 sq. ft.*

48. In fire resistive buildings with standard automatic sprinkler protection, where egress from upper stories, discharging to the outside of the building, is provided in accordance with Section 46, and provided areas do not exceed the maximums specified in Section 47, the area of the street floor may be increased 100% if all the required stairs lead directly to the outside. Where only a portion of the required stairs lead directly to the outside, the increase in the area allowed for the street floor over and above the area limits for the other floors, shall be increased in proportion to the ratio which the capacity of the stairs which discharge to the outside bears to the total capacity, of the required stairs.

For example: In an existing building, under certain conditions of construction and protection, the permitted maximum area for stories above the street is 25,000 square feet. In such a building, if required stairs discharge outside the street floor, a maximum area of 50,000 square feet is permissible on the street floor, or an increase of 100%. If, however, only half the required stairs discharge outside, the increase may not exceed 50% and the maximum street floor area would become 37,500 square feet.

49. The foregoing permission, under certain conditions, to have street floor areas exceeding those above or below, means that some fire partitions in a building may not be continuous from the lowest level to the roof, but this fact shall not prevent a department store from being credited with horizontal exit facilities in upper or lower stories, provided other requirements herein pertaining to such horizontal exits are met.

One-Story Buildings:

50. In existing as well as in new buildings, the maximum area permitted for any building height in any one of the main divisions of the tabulation may be exceeded 50% where stores occupy only the street floor and have not more than one sales basement.

RATIO OF AREAS TO TOTAL STORE POPULATION

51. The population of store buildings, upon which egress requirements will be based, shall be determined by dividing the gross area in square feet of each story, including areas of mezzanines, except as provided in Sections 51 and 52, by the following factors, which are the number of square feet allowed per person on the floor specified:

a–Street floor 15
b–Floors above street floor 50
c–Sales Basements. 20
d–Basements not used for sales. 100

Note.– In view of the necessity of flexibility on the part of department store managements as to location of departments, an average occupancy of all floors above the street floor is established, and stairs and other means of egress are based upon that average figure.

52. Mezzanine areas. In existing buildings, all mezzanine areas shall be added to the areas of the floors immediately below, and the maximum permitted area shall be understood to be the sum of such areas, provided, however, that where adequate independent exits as required in Section 53 herein, are provided for mezzanines, these areas shall be charged for at 50% of the actual areas in calculating the maximum permitted area of a story.

53. In new buildings where means of egress are provided as specified in Sections 53 to 55 herein, no charge shall be made for area of mezzanine stories, provided no mezzanine exceeds 50% of the area of the floor immediately below. If, however, a light well pierces two or more stories, the combined area of all connected floor levels shall be used in establishing maximum areas.

NUMBER AND CHARACTER OF EXITS

54. Not less than two means of exit must be provided on every floor, including basements, of every building or section. Above or below the street floor one of these must be an inside stairway or a smokeproof tower, and the other or others may be inside stairways, or smokeproof towers or horizontal exits.

55. No portion of any building or section shall be more than 100 ft. airline from the nearest exit. Exits shall be as remote from each other as practicable.

56. Exits shall be so arranged with regard to floors that there are no pockets or dead ends of appreciable size in which occupants might be trapped.

57. The maximum stair capacity required for any story shall govern the required stair capacity for all stories between that story and the street level.

58. The required stair capacity for any retail store building may be reduced if there be provided one or more standard horizontal exits not to exceed the percentages set forth hereinafter, provided that no credits shall be given for horizontal exits required in Section 31, and provided that the horizontal exit is provided at least on all stories from the second to the top story, and in each sales basement where there are such basements.

a– For one standard horizontal exit. 25%
b– For two standard horizontal exits. 40%
c– For three or more standard horizontal exits. 50%

Number of Standard Horizontal Exits	*Permissible Reduction in Stair Capacity*
One..	*25%*
Two..	*40%*
Three or more..	*50%*

Note.–Two standard horizontal exits mean exits leading to two separate fire areas (not two doors to the same area).

Nothing in this section shall act to reduce the minimum number of exits required nor the minimum width of any required stair or exit.

59. To be entitled to such a reduction in required stair capacity, for the provision of horizontal exit or exits, the smaller or the smallest of the adjoining buildings or sections must be able to hold the total store population on that level on the basis of not less than 10 square feet of gross floor area per person. Where the capacity of the smaller or smallest adjoining building or section on the basis of 10 square feet of gross area per person does not meet this requirement, the credit allowed in reduced required stair capacity shall be in proportion to the ratio which the actual capacity of the smaller or smallest section bears to the required area for such sections.

Street Floor Doors:

60. The minimum clear unobstructed width of street floor doors shall equal the width of the required stairs leading down from upper floors, plus 50% of the width of required stairs leading up from the basement, if any, plus 12 inches of door width per each 1000 square feet or fraction thereof of gross area of the street floor, provided, that when there are no floors above the first, the minimum width of street floor doors shall equal the width of the required stairs leading up from the basement, plus 12 inches of door width per each 500 square feet or fraction thereof of gross area of the street floor; and provided that where stairs discharge directly to the outside, the minimum door width at such a point shall equal the width of the wider or widest stair plus 50% of any other stairs discharging through the same door. For stores having neither stories above nor below the street floor, the minimum width of street floor doors shall be 12 inches for each 250 square feet or fraction thereof of gross area. Sections 32 to 38 must also be complied with.

METHOD OF ESTABLISHING STAIR CAPACITY

Width of Stairs:

61. One person shall be allowed for each unit measure of unobstructed stair width, which shall be not less than one-half of the minimum width specified in Sections 14 and 15, provided, however, that in a credit of 50% of a full unit of stair width shall be allowed for an addition of 12 inches or more of clear stair width to two or more full units of stair width. The capacity of a stair is determined by its narrowest point, insofar as all persons above that point are concerned.

NOTE.– For example, a 48 inch stair in the case of an older building and a 56 inch one in the case of a new building will rate as 2[-]½ units of width.

Winders:

62. For each winding stair tread, reduce allowed capacity 5% for all persons in the building above that point who use that stair, except that the maximum reduction shall not exceed 75%. In buildings erected after date of enactment of rules, stairs having winders shall not be included in the required means of egress.

63. The capacity of a flight of stairs shall be considered to be the number of treads from floor to floor, divided by two, times the units of stair width.

Stair Enclosures:

64. Where stairs are enclosed in standard manner, there shall be allowed additional credit of one person for every 4 square feet of unobstructed area on landings or in halls, provided that the aggregate credit for such enclosure shall not exceed 100% of the aggregate capacity of the stairs themselves.

65. A reduction of 33-1/3% shall be made in the assumed capacity of all interior stairs whether open or enclosed, on account of the possibility of fire or smoke cutting off access in whole or in part. No such reduction shall be made in the case of smokeproof towers.

66. Where independent enclosed stairs are run from any floor to the street, in no way connected with any other floor, the capacity of the stairs so arranged shall be assumed to be 200% of the actual capacity of the stairs, landings, and halls, as established herein before.

67. For any given flight of stairs where the number of treads or the capacity of enclosures vary as between stories, the capacity of each story shall be assumed to be the average of the entire flight of stairs.

CREDITS FOR CONSTRUCTION, PROTECTION AND AREA

68. The population of department store buildings, as determined by Section 50, shall, on account of type of building construction, provision or lack of sprinkler protection, protection or lack of protection of vertical openings, and story height of building, be multiplied by the ratios appearing in Column 7 of attached tabulation, and the required stairs based upon the population so ascertained.

69. The basement immediately below the street floor shall, from an exit standpoint, be treated like the third floor, the first sub-basement like the fifth floor, etc.

70. Where a department store is not the sole occupant of a building, and where other occupants have access to the same stairs, the department store stair capacity shall be designed to take into account the entire structure upon the basis set forth in these regulations.

EXPLANATION OF TABULATION

71. A comparison with the Factory Egress Code will show a similarity in principle between the tabulation attached to the report on department stores and the one attached to the Factory Code. A third class of construction, namely, full fire resistive has been added.

The combinations of sprinkler protection, and stair conditions is the same.

The maximum height permitted in buildings of different degrees of construction and protection is generally a story lower than for the moderate hazard occupancy in factory buildings.

The element of area is introduced because in department stores control of occupants at time of fire is not so definite a possibility as with factory workers. The areas permitted in connection with new buildings are those of the National Board Building Code. With existing buildings, the general tendency has been to be more liberal as to areas.

The percentages appearing in Column 6 are those of the moderate hazard occupancy class from the Factory Code, and the ratios which appear in Column 7 are the reciprocals, which are necessary where area is the basis of population.

From a life safety standpoint, the degree of protection afforded by mill or incombustible construction is virtually the same as afforded by fire resistive, hence the percentages in lines 17 to 38 and those in lines 39 to 62 are the same.

72. The Factory Code stops at 12 stories for the very finest type of buildings. The department store table has been extended to 20 stories. The increase from a ratio of .60 at 10 stories to .50 at 11 stories is due to the fact that at 11 stories a store must have a horizontal exit for which no other credit is given.

73. The set of curves herewith shows graphically the extent to which the occupants are permitted to exceed the actual capacity of stairs and stair enclosures, in other words, the percentage of overload of the stair capacity. (Curves appear at end of this report.) In these curves no assumption of horizontal exits is made, except the one required at 11 stories or over. The provision of one or more horizontal exits permits, of course, of a certain increased percentage of overload.

Example of Method of Calculating Egress:

74. Assume an existing building; 50,000 sq. ft. per floor gross area; mill construction; 7 stories; one sales basement; automatic sprinklers; one standard horizontal exit; enclosed stairs with capacity per unit width per flight and hall, 15 persons; no smokeproof towers; elevator capacity equal to 10% of population.

Calculation of stair capacity for upper floors would proceed as follows:

a– Population of upper floor: $\frac{50{,}000}{50} = 1000.$

See Section 51.

b– Multiplying ratio Column 7, line 38 is .41. This reduces population for which stairs must be figured to 410 for upper floors.

c– Credit for one horizontal exit: 25%, reducing population to 308.

d– Credit for elevators, 10%, reducing population to 277.

e– Number of stair units required $\frac{277}{15}$ *= 18.47.*

f– Additional capacity required on account of blocking by fire or smoke, 50%, making required number of stairs 27.7 or 28.0.

g– This number of stair units grouped not less than 36 inches per stair would have to be distributed with due regard to maximum distance permitted between exits.

Calculation for stair capacity of sales basement of equal area:

h– Population: $\frac{50{,}000}{20}$ *= 2,500.*

I– Multiplying ratio: Column 7, line 34 is .27, making stairs required for population of 675. See Section 69.

j– Credit for horizontal egress; 25% reduces population to 506.

k– Number of stair units required 506/15 x 3/2 (on account of smoke) 15 = 50.6.

l– The street floor door capacity required would equal 28 units for upper stairs plus 25 units for basement stairs, equalling 53 units at not less than 18" each, or 79.5 ft. There would have to be added 50 ft. of door to take care of the 50,000 sq. ft. first floor area, making a total of 129.5 ft. of outside door. See Section 60.

Alarms and Drills:

75. While the Committee on Safety to Life does not feel that the provision of an alarm system and a drilled organization should affect the required egress capacity, the Committee does feel that alarm and drill provisions are highly desirable from a standpoint of safety to life, and makes the following general recommendations:

a– That department stores have closed circuit fire alarm systems extending to all portions of the store, both as regards sending stations and alarms, and preferably connected directly to the public fire alarm system, or through the medium of a central station supervisory alarm system.

b– That a code system of signals be employed, so that persons familiar with the signals will know the section and floor from which alarm has been sent.

c– That the system of signals be distinct from others used in the store, and preferably that they be of a character not to alarm the occupants.

d– That the store be equipped with an effective private fire brigade with representatives normally in all portions of the building.

e– That employees, and particularly the more responsible ones, be instructed in, and preferably drilled in the handling of customers at time of fire.

[Table Omitted]

Discussion.

Mr. Heller: I am sure it is a real disappointment to us all that Mr. Forster is not here to present this report in person. His ability and enthusiasm have always in previous years made the presentation of the report of this committee a pleasurable experience. I shall, however, do the best that I can to bring out the points I think he would like to have emphasized. Since last year, a paragraph has been added which requires horizontal exits in buildings over 10 stories in height. No credit in reduced stair capacity is allowed for this first horizontal exit. (See Section 31.)

In this report for the first time elevators are recognized as a means of egress, but they are limited in capacity as far as credit is concerned to ten per cent of the population on any floor. To receive any credit the elevators must be enclosed from top to bottom in a standard enclosure. (See Sections 3, 9, 40 and 41.)

In our Factory Code outside stairways are recognized as a means of egress; not the ordinary fire escape, but a stairway designed in accordance with the regulations of this Association. In department stores, because of lack of drill control, all approved stair capacity must be in the form of ordinary inside stairs or of smokeproof towers. The outside stairway is not recognized. (See Section 43.)

I would also like to call attention to Section 36. In the report of last year only 20% of the width of the street floor doors was permitted to be replaced with revolving doors; this year, that has been increased to 50%. That is a point which the Committee discussed at length and it is believed that this concession to the operating needs of department stores can be made without danger to life, especially as we call for generous street floor door capacity.

Chief McDonnell (Chicago): May I ask in Section 20 if "over the entrance to every stairway" means also on the outside of the building? It would be hard to maintain outside signs because small boys use them for targets.

Mr. Heller: Exit signs on each floor, not on the street, are intended.

The Secretary: Can that be made a little clearer, Mr. Heller?

Mr. Heller: I think that can be re-worded and the Committee will do so.

The President: Will former Vice-President Robertson please take the Chair?

(Mr. George M. Robertson of San Francisco presiding.)

Mr. Heller: I shall make a short explanation as to how this report was prepared. The report can be divided into three parts. The first is made up of specifications of what constitutes means of egress; in other words, how stairs, smoke-proof towers, and horizontal exits shall be designed. This part of the report is virtually identical with the Factory Code already approved and it will I believe require no discussion at this time. The second part deals with height and area limits, sprinkler protection and protection of vertical openings. In the table attached to the report the figures are based on the judgment of the Committee, and cannot be a matter of scientific calculation. The plan also follows closely the Factory Code. The third part is the determination of the population to be taken care of and the application of the entire set of rules to determine the number of stairways and exits required in any particular building. Here there is a decided deviation from the Factory Code. In that code we set certain minimum stair requirements, and thereafter limit the number of occupants to the available stairs. In a department store we cannot regulate the number of persons who may be in the building, and, as a consequence, we had to base population and hence stairs on floor areas. We found that the management of no store we approached had accurate data regarding the number of persons, other than employees, in their building at rush times, so the Committee arranged through the courtesy of store owners from coast to coast and with the help in New York City of the Department of Labor, to make actual counts of the people in the stores at times of the Christmas and Easter rushes. These resulted in the conclusions given in Section 51. These figures meet the most congested conditions found, and undoubtedly are drastic for many stores. Having applied this table, we get the approximate popula-

tion, and knowing the number of people that have to use exits we use the "moderate hazard" occupancy classification of the factory code and apply the rules which we already had in this code. The tabulation is the keynote of the report.

This whole subject, we all realize, is open to difference of opinion. The Committee does not make any claim for the rules being perfect; it simply asserts that they are the result of considerable painstaking effort and discussion, and that they are in fair shape, in their present form, for the Association to adopt. After we shall apply the rules for a few years we, no doubt, will find avenues for improvement in them. I move their adoption.

The Secretary: I second the motion. This report has been under consideration by the Committee for a period of three years. It imposes no mandatory obligation upon anybody. It is simply a very ingenious, yard-stick for measuring a very baffling and complicated problem. We have only to look at the report to discover the devoted labor of the Chairman and members of this Committee in blazing a trail where there has been previously nothing for anybody to go by.

The motion was adopted.

A detailed review of the fire safety regulations proposed for department stores by the Committee on Safety of Life in 1921 shows how remarkably similar these provisions are to the current regulations for mercantile occupancies contained both in the Life Safety Code and the model building codes utilized in the United States. Certainly, some of the details have changed over the years, such as the minimum required width of doors and stairs, and the method for determining the capacity of egress components, but still the similarities in today's code provisions and the 1921 provisions is quite noticeable.

Of particular interest is the methodology utilized to compute the capacity of exit stairs in this 1921 proposal. The capacity of exit stairs is based upon units of exit width, 22 inches, and the floor area available to stand within the stair enclosure.

Also of interest is that the capacity of the exit stairs is determined based upon the construction type classification of the building and whether or not floor openings are enclosed in fire resistive enclosures.

Given the similarities between the egress provisions proposed in 1921 and the egress provisions contained in codes some 50 years and later, it seems obvious that this original work on egress provisions for department stores forms the basis for the egress provisions included in our construction codes today. Given this, a study of the basis, or lack thereof, for the egress provisions proposed in 1921 is worthwhile.

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Source: "*Proceedings of the Twenty-fifth Annual* [NFPA] *Meeting*", San Francisco, California, 1921.