Comparison of requirements for exits: a preliminary study

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SUBJECT COMPARISON OF REQUIREMENTS FOR EXITS - A PRELIMINARY STUDY

This study is a comparison of the NFPA Building Exits Code and the exit requirements of the National Building Code of Canada (1953). It was prepared originally at the suggestion of the Advisory Fire Group of the Associate Committee on the National Building Code and is issued in this form for the information of the NFPA Safety to Life Committee at their meeting in Los Angeles, November 1959.

Information is factual and contains no recommendations or suggestions. As is noted below, an exact comparison is difficult. The authors would be grateful to know of any errors of interpretation or omissions in their statements concerning the NFPA Code.

Requirements for exits in the NFPA Building Exits Code are distributed throughout the document under various occupancy sections, and for this reason are difficult to assemble for comparison. Table I has been prepared, therefore, to show the general exit requirements, where these vary with occupancy, and how they compare with the National Building Code regulations. It is impossible to show in such a condensed form of table the detailed requirements which apply in each case, but these may readily be found by referring to the Code.

Comparison of NFPA and NBC Codes is not always exact as there is a basic difference in set-up. The NFPA Code deals with each building as a whole and the major occupancy in most cases governs in applying the regulation. The NBC considers each room separately, according to its intended occupancy, and exit facilities are provided for each room according to its intended occupancy.

The following notes refer to the vertical columns in Table I:

Estimated Population (Column 1)

The method of arriving at an estimate of the number of people for whom exit facilities must be provided is different in each Code. In the NFPA Code the total area of each floor is used

as the basis of calculation, while in the NBC each room is calculated separately for exit requirements. In Table I the area per person is noted as gross area to indicate that it applies to the building as a whole, and as net area where it applies to individual rooms.

Exits from Ground and Upper Floors (Columns 2 and 3)

The capacity of exits is calculated in units of exit width and is based on a rate of travel of 60 persons per unit exit width per minute through doorways or corridors, and of 45 persons per unit exit width per minute on stairs, with an additional factor introduced in some occupancies to provide standing space in the stairwell. This is discussed in more detail in DBR Technical Note No. 295.

The time calculated from the Code requirements within which every person in a building can escape either to the outside or into an enclosed stairway is as follows:

		NFPA Code		NBC	
		Min.	Sec.	Min.	Sec.
Assembly Buildings	Ground Floor	1	40	1	30
	Upper Floors	1	40	1	20
Educational Buildings	Ground Floor	1	40	1	0
	Upper Floors	1	20	1	20
Institutional Buildings	Ground Floor		30		30
	Upper Floors		40		40
Residential	Ground Floor		50		30
	Upper Floors		40		40
Mercantile	Ground Floor	1	0	1	0
	Upper Floors	1	20	1	20
Offices	Ground Floor	1	40	1	0
	Upper Floors	1	20	1	20
Industrial	Ground Floor	1	40	1	0
	Upper Floors	1	20	1	20
Storage	Ground Floor		-	5	
	Upper Floors		-	1	20

Number of Exits (Columns 4 and 16)

The number of exits required for each occupancy is the same in both Codes, except for the circumstances under which a single exit is permitted. These vary considerably.

The NFPA conditions for a single exit vary with occupancy. The NBC requirements do not, except for assembly buildings in which at least two exits are required. NBC requirements for one exit are not more than 60 persons in a room of not more than 1,000 sq ft area and a travel distance of not more than 75 ft (or 100 ft where sprinklers are installed). The NFPA bases the same concession on a specified maximum number of people in a building, travel distance, and a street level door (street level is defined as being not more than 4 ft above grade and not more than 1 ft below grade).

Exit Travel (Columns 5 and 6)

The distances permitted for travel from any part of a building or from a room door to an enclosed exit vary with occupancy in the NFPA Code, and greater distances are permitted in some instances when automatic sprinklers are installed. Where part of the exit travel is from an enclosed stair through a public lobby, the distance of travel through the lobby must be added to the travel distance to reach the stair in order to comply with the regulations.

The NBC has the same travel distance in all occupancies, 75 ft or 100 ft where the building is non-combustible, though this requirement is waived in a one-story building with doors not more than 100 ft apart around the perimeter.

Dead End Corridors (Column 7)

Dead end corridors of varying length are permitted in many occupancies by the NFPA Code but not at all by the NBC.

Smoke Barrier (Column 8)

Smoke barriers with self-closing doors are required by the NFPA Code in educational and institutional buildings and in hotels.

Interior Finish (Column 9)

Flame spread properties of interior finish materials are restricted, using the Underwriters Laboratories Tunnel Test Index as the unit of measurement.

Emergency Exit Lighting (Column 10)

The NFPA Code specifies three types of emergency exit lighting for use in different situations:

> Type 1 is a form of emergency lighting which will come on automatically in the event of any failure of the electrical supply, either within the building or in the public supply system.

Type 2 emergency lighting comes on if there is any failure of the public supply.

Type 3 emergency lighting comes on if failure is within the building.

The NBC requires emergency lighting in some occupancies that is roughly equivalent to the NFPA Type 1 emergency lighting.

Exits Signs (Column 11)

Exit signs are generally required by both Codes.

Fire Alarm (Column 12)

The NFPA Code requires a manual form of alarm in some occupancies, except where there is an automatic system. Special precautions are recommended to avoid creating panic in such buildings as hospitals: for example, the use of a flashing light at the nurses' station instead of an audible alarm.

Corridor Width (Column 13)

Width of corridors is regulated in the NFPA for different occupancies. In the NBC the requirements for width of exit govern.

Exits Discharging through Public Area (Column 14)

In both Codes a proportion of the required exits may pass through a public lobby. NBC requires sprinklers. NFPA requires sprinklers or low flame spread on wall surfaces, and all communicating rooms protected with wired glass fire resisting partitions and self-closing fire doors.

Open Stairways Connecting Floors (Column 15)

NFPA permits open stairways between two or three floors in certain occupancies.

Where the open stair is a required exit, travel on the stair is included in the permitted distance to an exit.

Stairs (Column 17)

The NFPA Code has three types of stairs, Classes A, B, and C. The Class A stair has a minimum width of 44 in., the Class B stair a minimum width of 44 in., (or 36 in. where the occupancy served is less than 50 persons), and the Class C stair is intended for use in existing buildings only and may be 30 in. wide. Height between landings, dimension of treads and risers, etc., for each class of stair is specified in detail.

A class C stair is permitted in schools and lodging and rooming houses by the NFPA Code.

Smoke Proof Tower (Column 18)

The NFPA Code specifies a smoke proof tower as the safest type of exit from upper floors of buildings, except where balconies are subject to exposure by fire in an adjoining hazardous occupation.

A smoke proof tower is defined as a continuous fire resistive enclosure protecting a stairway from fire or smoke in the building served; communication between the building and the tower is provided by means of balconies directly open to the outer air so that under no conditions will fire or smoke from the building enter the tower, even though doors are blocked open.

Outside Stairs (Column 19)

The NFPA Code requirements for outside stairs are as follows:

Outside stairs may be not more than one story in height, or arranged "to give the psychological impression of height not in excess of one story...."

Where the equivalent inside stair is required to be enclosed, "the outside stairs shall be separated from the interior of the building by fire-resistive walls ... with fire doors or fixed wired glass windows ... or in lieu of such separation ... the stairs shall be 15 ft, horizontally, from any opening in the building below the level of the top landing of the stairs".

"Outside stairs ... shall be protected by roofs or canopies to prevent accumulation of snow or ice, except in the case of main entrance stairs ... where it may be assumed that normal use of the building will require removal of snow and ice ...."

Illumination may be by street lights which provide the specified degree of lighting intensity.

Outside stairs leading to roofs may be approved by the enforcing authority where there is a continuous and safe means of exit from the roof, and all other reasonable requirements for life safety are maintained.

The NBC does not mention outside stairs.

Ramps (Column 20)

The NFPA Code has three grades of ramps: A, with a slope of 1 in 12; B, with a slope of 1 in 10; and C, with a slope of 1 in 6. Corridors with a slope of 1 in 16 ($\frac{3}{4}$ in. per ft) are not classed as ramps.

The NBC permits ramps with a slope not greater than 1 in 8.

Escalators (Column 21)

Escalators are permitted as part of the required number of exits by the NFPA Code provided that all the requirements for exit stairs are met. Travel must be in the direction of the exit unless provision is made for stopping or reversing the escalator.

The NBC permits escalators as exits if they are moving in the direction of exit travel, are fully enclosed, and meet the requirements for stairs.

NFPA Code conditions for protecting escalator openings where the escalator is <u>not</u> a required exit:

(1) An automatic fire and smoke detection system.
An automatic exhaust system.
An automatic water curtain.

(2) An automatic fire and smoke detection system.
Automatic spray nozzles.
A non-combustible draught curtain.

(3) Automatic self-closing rolling shutters above street floor only.

Fire Escapes (Column 22)

In general, fire escapes are permitted by both Codes only as a means of improving exit facilities in existing buildings. The NFPA Code does, however, permit a fire escape as one of two required means of egress from lodging or rooming houses.

Horizontal Exits (Column 23)

The NFPA Code permits horizontal exits in some occupancies, while the NBC permits them for not more than half the required exits. The NBC does not allow horizontal exits where there is a high occupant load (this applies primarily to assembly rooms). It does require horizontal exits in hospitals.

Doors to Grade (Column 24)

The NFPA requirements for exterior doors to grade are as follows:

(1) Street floor is defined as not more than 4 ft above grade and not more than 1 ft below grade.

(2) In assembly buildings, doors to grade may be not more than 21 in. above or below grade.

(3) In educational buildings, outside stairs are permitted, but must have one-third more units of exit width than doors served.

(4) In hospitals, doors to grade should be without stairs. (Ramps are recommended where outside doors are not more than one-half story above grade.)

(5) In nursing homes, the door to grade may be five risers above or below grade. (Ramps are recommended as being more desirable than stairs.)

(6) In other occupancies outside stairs are permitted. In cases where the floor cannot be defined as a street floor, requirements for upper floor exits will be met.

Slide Escapes (Column 25)

Slide escapes are not permitted by NBC except in hazardous occupancies, and in existing schools and hospitals.

NFPA permits slide escapes in educational buildings and in high hazard industrial buildings.

Revolving Doors (Column 26)

NFPA Code permits revolving doors between street floor and street but not at foot of stairs. All revolving doors are rated at one-half unit of exit width. Collapsible revolving doors are not given additional rating because of the possibility that the device will not function in emergency.

The NBC does not permit revolving doors in factories where there is a high occupant load or where there are infirm persons. In other cases, although not at the foot of stairs, collapsible type revolving doors are permitted.

References

1. Building Exits Code. NFPA No. 101, Sixteenth Edition, 1959, National Fire Protection Association, Boston, Mass.

2. National Building Code of Canada (1953). Issued by Assoc. Committee on the National Building Code, NRC, Canada.

TABLE I

N.F.P.A. Exits Code Requirement (15 / 6) — N.B.C. of Canada Requirement.	1. Estimated Population Area ft² / Person	2. Exit from Gd. Floor Persons/Unit Exit Width	3. Exit from Other Floors Persons/Unit Exit Width	4. Number of Exits	5. Exit Travel: Gd. Floor Feet (Max.)	6. Exit Travel: Other Flrs Feet (Max)	7. Dead End Corridors Feet (Max)	8. Smoke Barriers Feet (Min.)	9. Interior Finish Tunnel Test Index	10. Emergency Exit Lighting	11. Exit Signs	12. Fire Alarm	13. Corridor Width Inches	14. Exits Discharging Thro Public Area.	15. Open Stairs Between Floors No. of Floors	16. Single Exit Permitted	17. Type of Exit Permitted: Stair	18. Smoke Proof Tower	19. Outside Stair	20. Ramp	21. Escalator	22. Fire Escape	23. Horizontal Exit	24. Door to Grade	25. Slide Escape	26. Revolving Door
Assembly for > 1000p. N.B.C. Group A.	15gr. / 6n / 6n	100 / 90	75 / 60	4 / 4	150 / 75 / 100NC	150S / 100 / 75 / 100NC	N.P. / N.P.	- / -	20 / -	1 / 1	R / R	M. / -	- / -	2/3 / 1/2 S.	open floor to balcony / N.P.	N.P. / N.P.	A 44° / 36°	P / -	P / -	A 1:12 / 1:8	P / P	N.P / NP	P / N.P.	P / P	NP / N.P	N.P / N.P.
Assembly for 600-1000p. N.B.C. Group A.	15gr. / 6n / 6n	100 / 90	75 / 60	3 / 3	150 / 75 / 100NC	150S / 100 / 75 / 100NC	N.P. / N.P.	- / -	20 / -	2 or 3 / 1	R / R	N.R. / -	- / -	2/3 / 1/2 S	open to balcony / N.P.	N.P / NP	B 36° / 36°	P / -	P / -	B 1:10 / 1:8	P / P	N.P. / N.P.	P. / N.P.	P / P	N.P. / N.P.	N.P. / N.P.
Assembly for < 600 N.B.C. Group A.	15gr. / 6n / 6n	100 / 90	75 / 60	2 / 2	150 / 75 / 100NC	150S / 100 / 75 / 100NC	N.P. / N.P.	- / -	75 / -	- / 1	R / R	N.R. / -	- / -	- / 1/2 S	open to balcony / N.P.	>100p >50ft s.l. >50p >1000ft²	B 36° / 36°	P / -	P / -	B 1:10 / 1:8	P / P	N.P. / N.P.	P / N.P.	P / P	N.P. / N.P.	N.P. / N.P.
Educational N.B.C. Group A2.	40gr. / 20n / 20n	100 / 60	60 / 60	2 / 2	150S / 100 / 75 / 100NC	150S / 100 / 75 / 100NC	40 / N.P.	300 / -	75 / -	1 or 2 / N.R.	R / R	M / -	72 / -	N.P. / 1/2 S	N.P. / N.P.	>100p >2000 ft² >60p >1000 ft²	C / 36°	P / -	- / -	C 1:6 / 1:8	- / P	N.P. / N.P.	P / N.P.	P / P	P / N.P.	- / P
Hospitals N.B.C. Group B 2.	150gr. / 50n	30 / 30	30 / 30	2 / 2	150S / 100 / 75 / 100NC	150S / 100 / 75 / 100NC	30 / N.P.	150 ft 3,000 sq ft -	20 / -	1 / 1	R / R	M / -	96 / -	N.P. / 1/2 S	N.P. / N.P.	N.P. >60p >1000 ft²	A 44° / 46°	- / -	- / -	C 1:6 / 1:8	- / P	N.P. / N.P.	P R / >1/2	P / P	- / NP	- / N.P.
Nursing & Old Age Homes N.B.C. Group B 2.	150gr / 50n	30 / 30	30 / 30	2 / 2	100 / 75 / 100NC	100 / 75 / 100NC	30 / N.P.	150 ft 30p -	20 / -	1 or 2 / 1	R / R	M / -	72 / -	N.P. / 1/2 S	N.P. / N.P.	N.P. >60p >1000 ft²	B 44° / 46°	- / -	- / -	B 1:10 / 1:8	- / P	N.P. / N.P.	P 44° R / >1/2	P / P	- / NP	- / N.P.
Hotels N.B.C. Group C.1.	125gr / 100n	50 / 30	30 / 30	2 / 2	150S / 100 / 75 / 100NC	150S / 100 / 75 / 100NC	36 / N.P.	150 / -	75 / -	1 >500p 2 >25 p / 1	R / R	M >15p / -	30 / -	1/2 / 1/2 S	F.R or S 3 / N.P.	>50 ft. s.l. >60p >1000 ft²	B 36° / 36°	P / -	P / -	B 1:10 / 1:8	P / P	N.P. / N.P.	P / >1/2	P / P	N.P. / N.P.	P / P
Apartment Houses N.B.C. Group C.1.	125gr. / 100n	50 / 30	30 / 30	2 / 2	150S / 100 / 75 / 100NC	150S / 100 / 75 / 100NC	20 / N.P.	- / -	75 / -	1 or 2 >25 Aph / NR	R >8 Aph / R	M >3 flrs / -	30 / -	1/2 / 1/2 S	F.R or S 3 / N.P.	Varies >60p >1000 ft²	B 36 / 36	P / -	P / -	B 1:10 / 1:8	P / P	N.P. / N.P.	P / >1/2	P / P	- / N.P.	P / P
Dormitories N.B.C. Group C.1.	125gr / 50n	50 / 30	30 / 30	2 / 2	150S / 100 / 75 / 100NC	150S / 100 / 75 / 100NC	P >10p. / N.P.	- / -	75 / -	1 or 2 >100p / NR	R >100p / R	M / -	30 / -	- / 1/2 S	F.R. 2 / N.P.	>10p s.l. >60p >1000 ft²	B 36 / 36	P / -	P / -	- / 1:8	- / P	N.P / N.P.	P / >1/2	P / P	- / N.P.	- / P
Lodging or Rooming Houses for > 15 persons N.B.C Group C.1.	125gr. / 100n	50 / 30	30 / 30	2 / 2	- / 75 / 100NC	- / 75 / 100NC	- / N.P.	- / -	- / -	NR / NR	R / R	M / -	36 / -	- / 1/2 S	F.R or S 3 / N.P.	single storey >60p >1000 ft²	C / 36	- / -	P / -	- / 1:8	- / P	P / N.P.	P / >1/2	P 24° / P	- / N.P.	- / P
Mercantile > 30,000 sq. ft. or > 3 stories N.B.C. Group E	30 G.F. 60 U.F. gr. 30 G 60 U.F. n.	60 / 60	60 / 60	2 / 2	150S 100 75HH / 75 / 100NC	150S 100 75HH / 75 / 100NC	50 / N.P	- / -	75 / -	1 or 2 / 1	R / R	- / -	60 / -	1/2 S / 1/2 S	2 or 3s / N.P.	N.P. >60p >1000 ft²	B 36 / 36	P / -	P / -	C 1:6 / 1:8	P / P	N.P. / N.P.	P / >1/2	P / P	- / N.P.	P / P
Mercantile : 3,000-30,000 sq. ft or > 1 storey N.B.C. Group E	30 G.F. 60 U.F. n gr 30 G.F. 60 U.F.	60 / 60	60 / 60	2 / 2	150S 100 75HH / 75 / 100 N.C.	150S 100 75HH / 75 / 100 NC	50 / N.P.	- / -	75 / -	1, 2 or 3 / 1	R / R	- / -	60 / -	1/2 S / 1/2 S	2 or 3s / N.P.	N.P. >60p >1000 ft²	B 36 / 36	P / -	P / -	C 1:6 / 1:8	P / P	- / N.P.	P / >1/2	P / P	N.P. / N.P.	P / P
Mercantile < 3,000 sq ft or 1 storey N.B.C. Group E.	30 G.F. 60 U.F. n gr 30 G.F. 60 U.F.	60 / 60	60 / 60	2 / 2	150S 100 75HH / 75 / 100 NC.	150S 100 75HH / 75 / 100 NC	50 / N.P.	- / -	75 / -	N.R. / N.R.	R / R	- / -	60 / -	1/2 S / 1/2 S	P 1/2 / N.P.	>50 ft s.l. >60p >1000 ft²	B 36 / 36	P / -	P / -	C 1:6 / 1:8	P / P	- / N.P.	P / >1/2	P / P	N.P. / N.P.	P / P
Offices N.B.C. Group D.	100 gr / 100n	100 / 60	60 / 60	2 / 2	225S 150 / 75 / 100 N.C.	225S 150 / 75 / 100 NC	100 60 / N.P	- / -	75 / -	1, 2, 3 >1000 p / N.R.	R / R	M / -	44 / -	1/2 S / 1/2 S	F.R or S 3 / N.P.	>100p >100ft s.l. >60p >1000 ft²	B 36 / 36	P / -	P / -	B 1:10 / 1:8	P / P	- / N.P.	P / >1/2	P / P	N.P. / N.P.	P / P
General Industrial N.B.C. Group G	100gr / 50n	100 / 60	60 / 60	2 / 2	150S 100 / 75 / 100 NC	150S 100 / 75 / 100 NC	50 / N.P	- / -	200 / -	- / N.R.	R / R	M >500p / -	44 / -	1/2 S / 1/2 S	F.R or S 3 / N.P.	>25 p >50 ft s.l. >60p >1000 ft²	B 36 / 36	P / -	P / -	B 1:10 / 1:8	P / P	- / N.P.	P / >1/2	P / P	N.P. / N.P.	P / N.P.
High Hazard Industrial N.B.C. Group F	100gr / 50n	100 / 60	60 / 60	2 / 2	75 / 75 / 100 NC	75 / 75 / 100 NC	NP. / N.P	- / -	200 / -	- / N.R.	R / R	M / -	44 / -	1/2 S / 1/2 S	NP / N.P.	N.P. >60p >1000 ft²	B 36 / 36	P / -	P / -	B 1:10 / 1:8	P / P	- / N.P.	P / >1/2	P / P	P / P	P / N.P.
Storage N.B.C. Group G	/ 300n	/ 60	/ 60	2 / 2	100S 75 / 75 / 100 NC.	100S 75 / 75 / 100 NC	- / N.P	- / -	- / -	- / N.R.	R / R	- / -	- / -	- / 1/2 S	- / N.P.	>10p >1500 ft² >60p >1000 ft²	- / 36	- / -	- / -	- / 1:8	- / P	- / N.P.	- / >1/2	P / P	P HH / P	- / P