



CLASS SIZE

ISSUE: Several aspects of health and safety can determine maximum class size.

BACKGROUND

School boards must comply with the Ontario Building Code (including any municipal supplements) and the Ontario Fire Code. Both of these stipulate maximum occupancy loads, for different reasons. If the two provide different maximums for a room, the more stringent value always is applied. In some parts of the province, there is confusion about who has jurisdiction - municipal building officials or fire prevention services; however, the Ministry of Labour (MOL) will order compliance with the appropriate version of the Building Code, and the Fire Marshal enforces the Fire Code which applies the current Building Code, where applicable.

Ventilation standards are set by ASHRAE (an industry association in United States) and applied in Canada. The MOL relies on ASHRAE standards and expects employers to comply with them for general and local ventilation, and for basic air quality (i.e. temperature and humidity comfort levels).

Some details of how each of these applies to school boards are provided below.

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BUILDING CODE

Introduction

The Ontario Building Code (O.Reg. 158/94) regulates the construction and renovation of buildings in the province. It is periodically updated to reflect new construction materials, processes, and engineering and safety standards. Buildings must comply with the version of the Building Code in force at the time of construction or major renovation; i.e. a school built in 1959 must have complied with the version of the Building Code in force in 1959 to pass inspection and, during *major* renovations in 1995, the building should have been “brought up to code” to comply with the version in force in 1995.

Many large municipalities have supplemented the Ontario Building Code with specific



by-laws, but the unaffected sections of the Ontario Building Code will still apply. As well, many counties have adopted their major municipality's rules. To determine if your municipality or county applies *Section 3.1.16. Occupant Load* of the Ontario Building Code or what they use in its place, ask your local Building Inspector.

Relevant Parts of Building Code O.Reg. 158/94

Section 3.1.16. Occupant Load

3.1.16.1. Occupant Load Determination

- (1) The *occupant load* of a *floor area* or part of a *floor area*, or of a *building* or part of a *building* not having a *floor area*, shall be based on
- (a) the number of seats in *assembly occupancies* having fixed seats,¹
 - (b) [residential]
 - (c) the number of persons
 - (i) for which the area is designated, or
 - (ii) determined from Table 3.1.16.A. for *occupancies* other than those described in Clauses (a) and (b).

Table 3.1.16.A.
 Forming Part of Article 3.1.16.1.

Type of Use of <i>Building</i> or <i>Floor Area</i> or Part Thereof	Area per Person, m ²
Assembly uses	
space with fixed seats	See Clause (1)(a)
space with non-fixed seats	0.75
stages for theatrical performances	0.75
space with non-fixed seats and tables	0.95

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Number of fixed seats in assembly areas (e.g. auditoriums) is determined by the Fire Marshall to comply with the Ontario Fire Code, and is explained below.



Type of Use of <i>Building or Floor Area</i> or Part Thereof	Area per Person, m ²
standing space	0.40
stadia and grandstands	0.60
classrooms	1.85
school shops and vocational rooms	9.30
reading or writing rooms or lounges	1.85
dining, alcoholic beverage and cafeteria space	1.20
laboratories in schools	4.60
Institutional uses	
treatment and sleeping room areas	10.00
detention quarters	11.60
Residential uses	
dormitories	4.60
Other uses	
kitchens	9.30
storage	46.00
<i>public corridors</i> intended for <i>occupancies</i> in addition to pedestrian travel	3.70

- (2) Where a *floor area* or part thereof has been designated for an *occupant load* other than that determined from Table 3.1.16.A., a permanent sign indicating that *occupant load* shall be posted in a conspicuous location. ²
- (3) For the purposes of this Article, *mezzanines*, tiers and balconies shall be

² When applying the Ontario Fire Code, its occupant requirement may be more stringent and therefore applies. (See below)



regarded as part of the *floor area*.

- (4) Where a room or group of rooms is intended for 2 or more *occupancies* at different times, the value to be used from Table 3.1.16.A. shall be the value which gives the greatest number of persons for the *occupancies* concerned.

Interpretation

The Building Code in force when the building was built or underwent **major** renovation applies. Fixed or permanently installed cabinets, closets, work benches, machinery/equipment, etc. are not included in calculations of the *floor area*. Moveable furniture, desks, filing cabinets, etc. are included.

Sub-section (4) may cause confusion if one assumes that use and intention are the same. If a room was intended to be a classroom then it was designed and built to comply with the value for classrooms at the time (e.g. 1.85 m² per person, since 1994). If it was intended as a laboratory, it was designed and built to comply with the laboratory value (e.g. 4.60 m² per person). One can not argue that both apply, or that the classroom value applies to a science lab simply because one wishes to use the classroom as a science lab or to assign a history class to use a science lab.

ONTARIO FIRE CODE

Introduction

All buildings must comply with the most recent version of the Ontario Fire Code (O. Reg. 388/97). When the Fire Code is changed, the school board must comply with, or exceed, the changes. The current Fire Code, rather than referring to the Building Code as in the past, now contains a modified version of its occupant load section.

Calculating occupant load using the Fire Code generally concerns *assembly occupancy* in large rooms, and it stipulates the size, number and location of aisles and exits, and the arrangement of seats relative to exit locations. However, in Table 2.7.1.A., the new Fire Code does state occupant loads for classrooms, cafeterias, school labs, tech shops and vocational rooms, auditoriums, etc.

Relevant Sections of the Ontario Fire Code

Schools are considered *assembly occupancy* as defined in the Fire Code:

“Assembly occupancy (Group ‘A’) means the occupancy or the use of a building, or part thereof, by a gathering of persons for civic, political, travel, religious,



social, educational, recreational or like purposes or for the consumption of food or drink.” (p.12, O. Reg. 388/97)

Section 2.7 SAFETY TO LIFE applies to assembly occupancy and nonfixed seating.

SECTION 2.7 SAFETY TO LIFE

Subsection 2.7.1. Means of Egress

Occupant Load

- 2.7.1.4.(1) The number of persons occupying a room or floor space in an assembly occupancy shall not exceed the occupant load for the intended use as determined in Sentence (2).
- (2) The occupant load for any room or floor space shall be the lower of
- (a) the occupant load as calculated in accordance with Sentences (3) to (7), or
 - (b) the occupant load for which means of egress are provided as determined by the Building Code.
- (3) The occupant load of a floor area or part of a floor area in an assembly occupancy shall be based on
- (a) the number of fixed seats, or
 - (b) the number of persons
 - (i) for which the area is designed, or
 - (ii) determined from Table 2.7.1.A. for occupancies other than those described in Clause (a).
- (4) For the purposes of this Article, mezzanines, tiers and balconies shall be regarded as part of the floor area.
- (5) Where fixed bench-type seats without arms are provided, the occupant load shall be based on a seat width of 450 mm per person.
- (6) The occupant load of a room in which a dance floor is situated shall be based on that portion of the room that is not occupied by the dance floor except where the occupant load is determined using Subclause (3)(b)(i).
- (7) At no time shall the maximum occupant load determined in Sentences (2) to (6) exceed the occupant load calculated on the



- basis of
- (a) 0.60 m² of floor space per person in dining, alcoholic beverage and cafeteria space, and
 - (b) 0.40 m² of floor space per person in all other uses.

Table 2.7.1.A.
Forming Part of Article 2.7.1.4.

Type of Use of Building or Floor Area or Part Thereof	Area per Person, m²
ASSEMBLY USES	
Space with fixed seats	Clause (3)(a)
Space with nonfixed seats	0.75
Stages for theatrical performances	0.75
Space with nonfixed seats and tables	0.95
Standing space	0.40
Stadia and grandstands	0.60
Bowling alleys, pool and billiards rooms	9.30
Classrooms	1.85
School shops and vocational rooms	9.30
Reading and writing rooms or lounges	1.85
Dining, alcoholic beverage and cafeteria space	1.10
Laboratories in schools	4.60
Exhibition halls other than those classified in Group E	2.80

Posting Occupant Load

- 2.7.1.5.(1) When the occupant load as determined in Article 2.7.1.4. is more than 60 persons, the occupant load shall be posted in a



conspicuous location.

- (2) When the occupant load has been determined using Subclause 2.7.1.4.(3)(b)(i), a permanent sign indicating the occupant load shall be posted in a conspicuous location.

Non-Fixed Seating

- 2.7.1.6.(1) Nonfixed row seating in an assembly occupancy shall be arranged as described in Sentences (2) to (6).
 - (2) Aisles leading to exits shall be provided so that there are not more than 7 seats between any seat and the nearest aisle.
 - (3) The minimum clear width of aisles shall be at least 1100 mm, except as permitted by Sentence (4).
 - (4) Aisles required in Sentence (3) may be reduced in width to 750 mm when serving 60 seats or less, or 900 mm when serving seats on one side only.
 - (5) Aisles shall terminate in a cross aisle, foyer or exit and the width of such cross aisle, foyer or exit shall be at least the required width of the widest aisle plus 50 per cent of the total required width of the remaining aisles that it serves.
 - (6) The distance of travel to an exit door by an aisle shall not be greater than 30 m.
 - (7) Where the occupant load exceeds 200 persons in an assembly occupancy containing nonfixed seating, the seats shall be fastened in units of not less than 4 nor more than 12 seats, or each end seat abutting an aisle shall be securely fastened to the floor.
 - (8) Seats may be arranged in a manner that does not meet the requirements of Sentence (7) where the aisle widths are increased by 50 per cent above the requirements set out in Sentences (2) to (6), and where the maximum occupant load is based on one person per 1.2 m² of total floor area.

Obstructions

- 2.7.1.7.(1) Access to exits, including corridors used by the public and exits, including outside areas, shall be maintained free of obstructions.



Lighting

- (2) Lighting provided for illumination in exits and access to exits, including corridors used by the public, shall be maintained.

The Fire Code also uses the number and size of exits to modify the **current** Building Code occupant load value (m² per person). The following excerpt is taken from instructions used for Fire Department personnel, edited for clarity.

ASSESSING EXIT FACILITIES

1. Introduction

When carrying out inspections, especially in places of public assembly, the fire prevention officer should pay particular attention to the exits (i.e. number, location, width, etc.) in a building. Since exits are designed according to the requirements of the Ontario Building Code, it is wise to consult this Code when evaluating the adequacy of various facilities. The purpose of this note is to describe some of the principles and steps involved in effectively assessing exit designs.

2. Principles of Exits

For areas of public assembly, particularly those where there is a “high occupant load” (area requirement per person 1.1m² or less), the following principles can be used as a guideline:

- (a) There should be at least two exits from the area.
- (b) They should be as remote as possible from one another.
- (c) They must be wide enough to pass the maximum possible number of occupants.
- (d) They shall not narrow down as they near the outside.
- (e) They should be clearly marked.
- (f) They should be kept free of obstructions.

3. Assessing Existing Exits

To determine if exit facilities are adequate, follow the steps below:

- (a) Determine the floor area in m².
- (b) Determine its use. Ask the owner/manager how the area will be used and refer to Table 2.7.1.A. in the Fire Code for the appropriate area per person requirement.
- (c) Determine the occupant load based on floor area. Divide the floor area by the area per person requirement.
- (d) Calculate occupant load based on exit size. Measure in millimetres the clear width of each existing exit at its narrowest point. Divide the width of each by 6.1 if there are no stairs (ground floor) or 9.2 if there are stairs involved. Add the values. This is occupant load based on exit size.

The lower of the two occupant loads (i.e. based on floor area, or based on exit size) applies.

Note that in recently constructed schools, many large exits are usually built to speed the movement of students so the occupant load based on exit size is frequently much higher than the occupant load based on floor area. This is not the case in many older



schools.

VENTILATION STANDARDS

Legal Requirements

Under Section 25.(2)(h) of the Occupational Health and Safety Act, “... *the employer shall ... take every precaution reasonable in the circumstances for the protection of a worker*”; and under Section 26.(1)(g), “*the employer shall ... comply with a standard limiting the exposure of a worker to biological, chemical or physical agents as prescribed*”. Not only is it considered ‘reasonable’ within established practice to provide adequate ventilation and good air quality, but it is also ‘prescribed’ in the Industrial Regulations which are applied to school boards.

The Industrial Establishments Regulations (O.Reg. 851), which applies to schools, prescribes that “*an industrial establishment shall be adequately ventilated by either natural or mechanical means such that the atmosphere does not endanger the health and safety of workers. R.R.O. 1980, Reg. 851, s. 131*”. In Ontario, and most of North America, determination of ‘adequately ventilated’ is adopted from the ASHRAE Standards. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) establishes the specifications for heating, ventilation and air-conditioning (HVAC) systems which are accepted by engineers, architects, contractors, and the Ontario Ministry of Labour.

The ASHRAE Standards are very precise. On-site calculations to determine whether an HVAC system meets the standards can be complicated. Below is a list from ASHRAE Standard 62 for air volume measured in CFM’s (i.e. cubic feet per minute per person) for certain work locations. Also included are the basic formulae for on-site calculations which can be performed with an accurate thermometer to roughly determine what the CFM rate is for a room. More accurate instruments are available but this method can give fairly accurate results without requiring an understanding of the complexities of ventilation systems.

ASHRAE STANDARDS for General Ventilation

LOCATION	Est. Max. Occupants (persons/1000 ft ²)	Outdoor Air CFM (per person)
auditorium	150	15
office space	70	20



classroom	30	15
meeting room	50	20
cafeteria	100	20

If these ventilation standards are not being met for the occupant load of an area, the employer must either upgrade or increase the efficiency of the ventilation system, or decrease the occupant load in order to comply with O.Reg. 851, s. 131.

[NOTE: These ventilation standards do not indicate air quality values, only the volume of air being supplied and the per cent outside or “fresh” air. However, in most locations, providing **approximately 30% outside air** results in good air quality. As the amount of outside air decreases, so does the quality of the air regardless of the volume being supplied. Testing air quality is a complex issue, seldom done correctly by school boards, and usually unnecessary if these ASHRAE ventilation standards are met.]

Calculations to Estimate Outside Air CFM’s (and % Outside “Fresh” Air) in Building

Minimum Outside Air (%)

$$OA\% = \frac{RAT - MAT \times 100}{RAT - OAT}$$

OA% = Outside Air %
RAT = Return Air Temp.

MAT = Mix Air Temp.

OAT = Outside Air Temp.

Outside Air CFM (cubic feet/minute)

$$CFM = \frac{OA\%}{100} \times \text{supply fan volume (CFM)}$$

NOTE: the supply fan volume (CFM) is stamped on the specification plate of the fan (usually on the side of the fan motor) or obtainable from the manufacturer.

Conversion to Metric (if required)

CFM converts to LPS (litres/second) with this calculation:

$$LPS = \frac{CFM \times 28.316847}{60}$$

Once the outside air CFM is calculated, divide this value by the number of occupants (or the occupant load) to determine if the ventilation system meets the ASHRAE minimum standard (e.g. 150 CFM divided by 15 occupants = 10 CFM/person which is below standard).



NOTE:

Many Boards' maintenance departments use instruments which will accurately measure volumetric air flow from or through a duct. While this is useful to know, it alone does not indicate how much of that air is fresh outside air or what percentage is recirculated air.

CONCLUSION

Any or all of these (Building Code, Fire Code, and ASHRAE ventilation standards) can easily be used to limit class size.

Your Joint Health and Safety Committee is **legally empowered** in section 9 (18) of the Occupational Health and Safety Act to *"identify situations that may be a source of danger or hazard to a worker"* and to *"make recommendations to the ... employer and the workers for the improvement of the health and safety of the workers"*.

The Board (employer) is **legally obligated** to comply with the Building Code and Fire Code. The Ministry of Labour will advise the Board to comply with ASHRAE standards, if consulted on a ventilation issue.

It is often less costly to reduce class size than to alter the building or upgrade the ventilation system.

Careful consideration must be made of possible impacts on programs and staffing since it can also be less costly for the Board to eliminate or reduce programs.

For further information, contact 60 Mobile.
Health and Safety Sub-Committee,
Collective Bargaining Committee