

**GUIDELINES FOR DETERMINATION OF OCCUPANT LOAD**

The method and means of calculating occupant loads can vary from municipality to municipality. This variance often leads to widely differing occupant load figures being assigned to the same type and size of building in different municipalities.

This Bulletin has been developed to clarify the requirements of Alberta Building Code 1997 (ABC) and the Alberta Fire Code 1997 (AFC) for occupant loads. By recommending a method of calculation it is the intent of this Bulletin to make the application of both Codes more consistent and uniform throughout the Province. This Bulletin will discuss:

- I. The purpose of occupant load calculations
- II. Determining occupant loads, and
- III. The posting of occupant loads.

**I. The Purpose of Occupant Load Calculations**

**(1) Determining Occupant Loads During the Design Phase (The Alberta Building Code)**

The ABC defines 'occupant load' as meaning the number of people for which a building or part thereof is designed. When an occupant load is determined for the purposes of design it is referred to in this Bulletin as the *design occupant load*.

The determination of the *design occupant load* for purposes of the ABC allows the designer to determine further Code requirements that may be applicable, such as:

- (a) the minimum number and width of exit and access to exit facilities
- (b) the number of sanitary fixtures required
- (c) if a fire alarm system is required

ISSUE OF THIS INFORMATION  
BULLETIN IS AUTHORIZED  
BY THE DIRECTOR/ADMINISTRATOR.

C. M. TYE




SAFETY CODES COUNCIL



- (d) if emergency lighting is required
- (e) if exit signs are required
- (f) if additional requirements apply for high buildings
- (g) the type of hardware required on exit and access to exit doors
- (h) the required direction of door swing.

The calculation of a *design occupant load* using Table 3.1.16.1. of the ABC is not intended to specify how many square metres one must provide for each occupant. Its primary function is to indicate to the designer the approximate number of people which can be expected to occupy the space and, therefore, indicating which other safety features need to be incorporated into the design.

The calculation of a *design occupant load* using Table 3.1.16.1. of the ABC is not intended to limit the number of people who can safely occupy a room or building based on an area allotment per person only.

## **(2) Determining Occupant Loads for the Operation of a Building (The Alberta Fire Code)**

The AFC uses a different definition for occupant load as the ABC: the maximum number of persons that may occupy a building or an area of a building at one time. When an occupant load is determined for the purposes of applying the Fire Code it is referred to by this Bulletin as the *operational occupant load*.

The calculation of an *operational occupant load* for AFC purposes is to determine the maximum number of people that the authority having jurisdiction considers may safely occupy a space. This number is based on either,

- (a) a specified amount of area per person, (this also includes a specific number of people that the building was designed for),
- (b) the capacity of the means of egress, or
- (c) the occupant load as calculated and posted in accordance with the ABC.

The lowest figure (fewest people) calculated by (a), (b) or (c) is used to establish the maximum occupant load (*operational occupant load*).

## **II. Determining Occupant Loads**

The same table from the ABC is referred to for calculating both the *operational occupant load* and the *design occupant load*. However, the **purpose** for calculating the *operational occupant load* differs from the purpose for calculating the *design occupant load*. Therefore the ratio chosen to determine one may not be the appropriate ratio to determine the other. This may sometimes result in a different occupant load figure calculated by the designer than the one calculated by the authority having jurisdiction.

## (1) Calculating the *Design Occupant Load*

The ABC requires us to consider the following when determining the *design occupant load*.

### (a) Exceptions to Using Table 3.1.16.1.

- i) In an assembly occupancy such as a theatre or an arena, the number of fixed seats determines the *design occupant load*.
- ii) In buildings with sleeping facilities such as hotels, motels, dwelling units etc. a figure of 2 persons per bedroom is used to determine the *design occupant load*.
- iii) A designer may choose to design a building or a space to accommodate more people or fewer people than the figures arrived at using Table 3.1.16.1. would provide. If a figure other than one derived from Table 3.1.16.1. is used, the *design occupant load* must be posted as discussed in Part III of this Bulletin.

### (b) Using Table 3.1.16.1.

- i) As a general rule, the area per person used to determine the *design occupant load* is the area indicated in Table 3.1.16.1. However, spaces may fall within more than one category in the Table. In such cases the category having the most specific description should be used. For example, an industrial arts shop in a school would fall under the category school shops and vocational rooms rather than classrooms even though students are present.
- ii) The figures in Table 3.1.16.1. include the space occupied by fixtures, products, displays, etc. It is not the intent of the Table to have the designer calculate the gross area and then subtract the areas of tables, chairs, bar stools and so on. Although it is not appropriate to use 0.4 m<sup>2</sup> per person when determining the *operational occupant load*, (as discussed further on in this Bulletin), 0.4 m<sup>2</sup> may be appropriate for use during the design phase. For example, a designer may wish to determine the number of people who may be using a concourse when exiting an arena and 0.4 m<sup>2</sup> per person would assist him in doing so.
- iii) For the determination of *design occupant load*, mezzanines, tiers and balconies are to be considered as part of the floor area.

### (c) Rooms and Spaces Not to be Included in Calculations

- i) Service spaces that are provided to facilitate or conceal the installation of building services, such as chutes, ducts, pipes and shafts.
- ii) Service rooms such as boiler, furnace, incinerator, garbage, elevator machinery, electrical and compressor rooms are not to be considered as contributing to the *design occupant load*.
- iii) Access to exit corridors would not normally be considered in the calculation of the *design occupant load*. However, where a corridor contains an occupancy, that occupancy must be included in the calculation.
- iv) Exits and vertical service shafts need not be included in the calculations.

(d) Multi-use Spaces

A building or part of a floor area may have two or more uses. For example, the ice surface in an arena may occasionally be used for trade shows, concerts, banquets, etc. To determine the correct *design occupant load* in these situations each use must be considered separately and the largest *design occupant load* figure calculated is to be used. Please note that this is a *design occupant load* calculation for buildings that are intended to have more than one use. Instances where an *operational occupant load* is required for unique or infrequent changes in occupancy type, such as concerts being held in arenas, are discussed under (2) calculation of the *operational occupant load*.

(e) Associated Use Spaces

Many buildings have separate rooms or spaces which will be used only periodically. The occupants may have already been included in the *design occupant load* of other spaces. For example, the *design occupant load* of a school is usually calculated by determining the area of the classrooms and dividing by 1.85 m<sup>2</sup> (Table 3.1.16.1.). The students who use these classrooms also use the washrooms, corridors, cafeteria, auditorium etc.

The area of these auxiliary spaces is not to be included in calculating the total *design occupant load* of the building. However, *design occupant loads* of these individual areas must be calculated to determine the exiting requirements, etc. for the times when they are occupied.

(f) Special Circumstances

There are activities and uses that are not covered in Table 3.1.16.1. Combining the good judgement of the owner/designer and the authority having jurisdiction is the best way to determine *design occupant loads* in these types of situations.

**(2) Calculating the Operational Occupant Load**

The AFC requires us to consider the following when determining the *operational occupant load*.

(a) *Operational occupant loads* derived from Table 3.1.16.1.

Not all figures in Table 3.1.16.1. are appropriate to calculate an *operational occupant load* for a building or part thereof. The following excerpt from the Life Safety Code Handbook states:

It has been shown in research by the National Research Council of Canada and by the London Transport Board that, if people are crowded into a space so that each person occupies less than 7 sq ft (0.65 sq m), movement approaches a "shuffle"; when each person occupies less than 3 sq ft (0.28 sq m), "jam point" is approached, and thus all movement by occupants comes to a virtual stop.

Although the standing space factor in Table 3.1.16.1., may be used by a designer to determine fire alarm requirements, washroom requirements and exit requirements from an area where a large number of people may congregate prior to entry into a facility or prior to boarding a train etc., it is not appropriate to use this as a determining factor for standing space in a licensed premises since "shuffling" to an exit is not a preferred pace for exiting. Therefore the ratio of 0.4 m<sup>2</sup> per person is not considered appropriate for the calculation of an *operational occupant load*.

(b) Table 3.1.16.1., ABC 1997.

The following assembly use section taken from the table in the ABC has been expanded to provide clarification and examples to enable a more uniform method of determining *operational occupant loads*.

Type of use of <i>Floor Area</i> or Part Thereof	Area per person m <sup>2</sup>
<b>ASSEMBLY USES</b>	
<p><b>space with fixed seats</b> Fixed seating includes any seating which is permanently secured to the floor and is not intended for rearrangement. This category would be used when calculating an <i>operational occupant load</i> for buildings such as movie houses, live entertainment theatres, sports arenas (when used for viewing sporting events), auction houses, lecture theatres, etc.</p>	See Clause 3.1.16.1.(1)(a) ABC
<p><b>space with nonfixed seats</b> Nonfixed seating refers to those seats which are not permanently attached to the floor and are intended to be re-arranged, and the use of other furniture is limited. Examples of functions where nonfixed seating is generally used include, school concerts, public information meetings, etc. Not to be used for licensed premises.</p>	0.75
<p><b>stages for theatrical performances</b> This category applies only to those stages that are intended for live performances. Areas included with the actual stage are those areas associated with the activity taking place on the stage and can include dressing rooms, green rooms, scenery storage rooms, etc. Areas intended for use by the viewing public are not to be included.</p>	0.75
<p><b>space with nonfixed seats and tables</b> This category is intended to include those areas used for assembly purposes where the function includes the use of seats and tables but neither are secured to the floor and are intended to be re-arranged from time to time. Examples of buildings where the figure for this type of category would be appropriate include bingo halls, banquet halls, similar spaces where all areas contain non fixed seats and tables. <b>Licensed Premises</b> (see also dining, beverage and cafeteria space) <b>Single Room</b> (utilizing non-fixed seats and tables) When an <i>operational occupant load</i> is being determined for a <u>single room</u> licensed premises which is only intended to accommodate one function using non-fixed seats and tables such as a hotel reception room, banquet room, lounge, etc., a ratio of 0.95 m<sup>2</sup> per person is considered the appropriate figure after the deduction of the area occupied by non fixed seats and tables only. <b>Single Room</b> (standing space) When a standing space <i>operational occupant load</i> is being determined for a single room that does not use any non-fixed seats and tables such as a hotel reception room a ratio of 0.95 m<sup>2</sup> per person of the gross designated area is considered appropriate.</p>	0.95

<b>standing space</b> This area per person ratio is not appropriate for the determination of an <i>operational occupant load</i> . <b>Licensed Premises</b> See space with non-fixed seats and tables	0.40
<b>stadia and grandstands</b> This figure would only be used if the stadia or grandstand had dedicated areas for the public to view an event but did not provide seating for those people.	0.60
<b>bowling alleys, pool and billiard rooms</b>	9.30
<b>classrooms</b>	1.85
<b>school shops and vocational rooms</b>	9.30
<b>reading or writing rooms or lounges*</b>	1.85
<b>dining, beverage and cafeteria space</b>  <b>Licensed Premises</b> (see also space with nonfixed seats and tables) When the <i>operational occupant load</i> of licensed premises is being calculated all spaces are to be included except those rooms into which the public is not expected to go. The public is not expected to enter mechanical rooms, kitchens, or separated storage rooms. All other areas, including dance floors, "stand-up" bar space, service bars and washrooms, are to be included in the calculation.  When an <i>operational occupant load</i> is being determined for licensed premises and the premises are intended to allow for more than one function such as dance floors, stand-up bars, games areas, etc., the ratio of 1.20 m <sup>2</sup> per person of the gross designated area is considered appropriate.	1.20
<b>laboratories in schools</b>	4.60

\* The term "lounges" does not apply to those spaces which are considered to be lounges intended for the consumption of alcoholic beverages.

### (3) Calculation of Exit and Access to Exit Capacity

- (a) Whereas the ABC uses the occupant load to determine the number and size of required exits and access to exits, the AFC also uses the exits and access to exits to determine the allowable occupant load.
- (b) Means of Egress is defined by the AFC and the ABC as being a continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare. Means of egress includes exits and access to exits.
- (c) The AFC refers to the ABC method of calculating the capacity of access to exits and exits. The Building Code assigns a ratio expressed in mm per person to determine the capacity of an exit or an access to exit. This ratio varies in accordance with the type of exit facility and with the type of building it is located in.

In buildings that are classified as Group A, C, D, E, or F, the capacity of an exit or an access to exit may be calculated by dividing the width of:

- i) Ramps with a gradient of not more than 1 in 8, doorways, corridors, or passageways by 6.1 mm per person, and
  - ii) For ramps with a gradient of 1 in 8 or more, and for stairs by 9.2 mm per person.
- (d) For buildings classified as Group B, the width of the exit or access to exit may be divided by 18.4 mm per person and for buildings classified as Group A Division 4 by dividing aisles, stairs other than exit stairs, ramps, and passageways in vomitories by 1.8 mm per person and by 2.4 mm per person in exit stairs.
- (e) There are minimum widths which must be considered as well. The minimum widths are:
- i) 1100 mm for
    - (A) corridors and passageways, and
    - (B) stairs and ramps that serve more than 3 storeys above grade or more than 1 storey below grade,
  - ii) 900 mm for stairs and ramps that serve not more than 3 storeys above grade or more than 1 storey below grade,
  - iii) 1650 mm for stairs and ramps serving patients' sleeping rooms,
  - iv) 1050 mm for doorways serving patients' sleeping rooms, and
  - v) 790 mm for doorways not serving patients' sleeping rooms.

### **III. Posting of Occupant Loads**

#### **(1) Alberta Building Code**

Sentence 3.1.16.1.(2) of the ABC states that where the occupant load of a room or floor area is determined with an "area per person" not in conformance with the Table 3.1.16.1. then the room or floor area must be posted with a permanent sign indicating the occupant load for which the room or floor area was designed. The sign with the design occupant load must be posted at or near the principle entrance to the room or floor area.

#### **(2) Alberta Fire Code**

Article 2.7.1.4. of the AFC requires that those areas in a building that are classified as assembly occupancies and have a maximum occupant load exceeding 60 people are to show the maximum occupant load on an acceptable sign in a conspicuous location near the principle entrance. Where an owner has been required to provide a sign under the ABC the figure shown on the sign should be the same.

The fire authority can accept an owners commitment to an occupant load that is less than is provided for in Table 3.1.16.1. In both cases an infraction would occur should the posted occupant load be exceeded.