CALCULATING OCCUPANT LOADS IN ASSEMBLY OCCUPANCIES

e method of calculating occupant loads can vary greatly between jurisdictions and even tween published Codes. This variance often leads to widely differing occupant load figures ing assigned to the same type and size of building or premises in different municipalities.

is Bulletin is intended to clarify the requirements of Alberta Building Code (ABC) and the berta Fire Code (AFC) for calculating occupant loads in assembly buildings or floor spaces. recommending a method of calculation it is the intent of this Bulletin to make the application both Codes more consistent and uniform throughout the Province. This Bulletin will discuss:

I. **Purpose** of occupant load calculations
II. **Determining** occupant loads, and
III. **Posting** of occupant loads.

The Purpose of Occupant Load Calculations

cupant load calculations are made under both the ABC and AFC for two different purposes.

Occupant Loads During the Design Phase: Alberta Building Code

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

e *design occupant load* allows the designer to calculate the approximate number of persons ticipated to use a building or space and to determine Code requirements that may be plicable, 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
(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.

e calculation of a *design occupant load* using Table 3.1.17.1.* of the ABC is not intended to it the number of people who can safely occupy a room or building based on an area allotment r person only.

*** Note: All Code references are to Division B of the ABC and AFC.**

Occupant Loads for the Operation of a Building: Alberta Fire Code

e AFC has a different definition for occupant load and means the maximum number of rsons that may occupy a building or an area of a building at one time. When an occupant load determined for the purposes of applying the AFC it is referred to in this Bulletin as the *erational occupant load*.

e calculation of an *operational occupant load* for AFC purposes is to determine the maximum rmissible occupant load that the fire authority having jurisdiction considers may safely occupy space. There are three factors that influence how the *operational occupant load* is determined:

(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.

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

Determining Occupant Loads

ble 3.1.17.1. of the ABC is referred to for calculating both the *design occupant load* under the BC and the *operational occupant load* under the AFC. However, the purpose of calculating the *sign occupant load* differs from the purpose for calculating the *operational occupant load*.

Calculating the Design Occupant Load

the design stage of a building, Table 3.1.17.1., is used to plan out the area needed to commodate an expected number of people. A designer wanting to build a restaurant that lds 175 persons would use the coefficient of 1.2 m²/person to estimate approximately the size floor space that would be needed. In this case, approximately 210 m² would form the base of e design. The Table coefficients are not used to establish the maximum number of persons at will occupy the floor space. In applying Article 3.1.17.1., the designer must consider the use d function of a space or floor area and from there apply the appropriate Table coefficients. e Article also addresses the purpose of a *design occupant load* in that it can either exceed or less than the values obtained from the Table. This gives the designer latitude in determining at other building features are needed to satisfy other requirements of the Code. It also gives e designer the ability to post the building *design occupant load* to inform any users that there ay be special conditions that apply to the overall Code compliance of the facility.

L.17.1. Occupant Load Determination

1) The occupant load of a floor area or part of a floor area shall be based on
   a) the number of seats in an assembly occupancy having fixed seats,
   b) 2 persons per sleeping room in a dwelling unit, or
   c) the number of persons for which the area is designed, but not less than that determined from Table 3.1.17.1. for occupancies other than those described in Clauses (a) and (b), unless it can be shown that the area will be occupied by fewer persons.

2) If a floor area or part thereof has been designed for an occupant load other than that determined from Table 3.1.17.1. a permanent sign indicating that occupant load shall be posted in a conspicuous location.

3) For the purposes of this Article, mezzanines, tiers and balconies shall be regarded as part of the floor area.

4) If a room or group of rooms is intended for different occupancies at different times, the value to be used from Table 3.1.17.1. shall be the value which gives the greatest number of persons for the occupancies concerned.

using Table 3.1.17.1. the designer can perform the calculation and exempt certain parts of or areas where occupancy is not expected:

ooms and Spaces Not to be Included in Design Calculations

i) Service spaces that are provided to facilitate or conceal the installation of building services, such as chutes, ducts, pipes, vertical service shafts and other shafts.
ii) Service rooms such as boiler, furnace, incinerator, garbage, elevator machinery, electrical and compressor rooms and storage rooms.
iii) 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) Stairways including landings on stairways.
v) Kitchens and coat check rooms.

ezzanines

mezzanine is treated as part of the main floor area if any of the exiting from the mezzanine ects persons down and through the main floor level. In this case, the occupant load lculated for a mezzanine is included as part of the main floor area. The main floor exit pacity must support both loads. For example, a mezzanine is calculated to hold 50 persons d the main floor level has an exit capacity for 500 persons. The maximum occupant load for e building is 500. By deduction, the main floor can safely only hold 450 persons and must cilitate the 50 persons on the mezzanine as if they were on the main floor level. If the exiting m the main floor will not support the combined loads, then the authority having jurisdiction, in nsultation with the owner, will determine where the occupant load will be reduced, either on e mezzanine or the main floor and will post the reduced load.

mezzanine that has separate exiting from it should be considered as a separate floor area. e exiting must handle the full mezzanine occupant load.

either case, the main floor and the mezzanine must have a separate maximum permissible cupant load posted on each level.

ılti use Spaces

ɔuilding or part of a floor area may have two or more uses. It is necessary to determine the rrect *design occupant load* for each use situation. Please note that this is a *design occupant ad* calculation for buildings that are intended to have more than one use. Instances where an *erational occupant load* is required for unique or infrequent changes in occupancy use are scussed under calculation of the *operational occupant load*.

ɔecial Circumstances

ere are activities and uses that are not covered in Table 3.1.17.1. Combining the good lgement of the owner/designer and the authority having jurisdiction is the best way to termine *design occupant load*s in these types of situations.

Calculating the Operational Occupant Load

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

(a) Operational occupant loads derived from Table 3.1.17.1.

ɔt all figures in Table 3.1.17.1. are appropriate to calculate an *operational occupant load* for an sembly space.

e categories and numbers from the ABC table are intentionally being used for a different rpose under the AFC. The AFC applies the m^2 per person factor to situations where rooms d spaces are being occupied and that may contain a variety of furniture and fixtures that can mpromise the safety requirements for the overall egress system. Therefore the number of rsons that a building is designed for may be substantially different than what the maximum rmissible occupant load is calculated for.

ɔoms and Spaces Included in Gross Area Calculation

e AFC directs individuals to use Table 3.1.17.1. of the ABC for the calculation of the ɑximum permissible occupant load of a room and then applies a factor to take into nsideration the overall general intended functions for the floor space use.

RST: Determine the gross area available for assembly use within the occupancy. This will :lude: the floor area to be occupied, interior line up areas, seating areas, stand up areas, ɑge areas, dance floor areas, and areas for service staff behind bar counters.

ɔoms and Spaces Not to be Included in Operational Calculations

i) Service spaces that are provided to facilitate or conceal the installation of building services, such as chutes, ducts, pipes, vertical service shafts and other shafts.
ii) Service rooms such as boiler, furnace, incinerator, garbage, elevator machinery, electrical and compressor rooms and storage rooms.

iii) Exit corridors would not normally be considered in the calculation of the *operational occupant load*. However, where a corridor contains an occupancy, that occupancy must be included in the calculation.
iv) Stairways including landings on stairways.
v) Kitchens, washrooms, and coat check rooms.

ECOND: Determine the net floor area by deducting all substantial architectural, decor and rvice items within the occupied space. Deduct pillars and planters, bar counters, free standing olers and ice machines, pool tables, games tables, VLT's, and video games. The deduction of ese or other areas that will not be occupied by a person from the gross area will result in the et useable floor space."

ıce the net usable floor space is determined then a decision as to what factor number from e following Table is to be selected for the typical floor use. For example any licensed premises ch as a restaurant, nightclub, lounge, pub or bar would have the floor space factor of 1.2 m^2 r person applied throughout the entire "net useable floor space area".

(b) Table 3.1.17.1., of the ABC

e following have been extracted from the Table in the ABC and expanded to provide ırification and examples to enable a more uniform method of determining *operational cupant load*s.

Type of use of Floor Area or Part Thereof	Area per person m^2
ASSEMBLY USES	
pace with fixed seats ixed seating includes any seating which is permanently secured to the floor nd is not intended for rearrangement. This category would be used when alculating an *operational occupant load* for buildings such as movie houses, ve entertainment theatres, sports arenas (when used for viewing sporting vents), auction houses, lecture theatres, etc.	See Clause 3.1.17.1.(1)(a) of the ABC
pace with non-fixed seats lon-fixed seating refers to those seats which are not permanently attached to ne floor and are intended to be re-arranged, and the use of other furniture is mited. Examples of functions where non-fixed seating is generally used nclude, school concerts, public information meetings, etc. This category is ot to be used for licensed premises.	**0.75** See Article 2.7.1.5. of the AFC for seating and aisle arrangements

pace with non-fixed seats and tables This category is intended to include hose areas used for assembly purposes where the function includes the use f seats and tables but neither are secured to the floor and are intended to be e-arranged from time to time. Examples of buildings where the figure for this ype of category would be appropriate include bingo halls and meeting rooms. hese occupancies may include incidental service of food and beverages. his category is not to be used for licensed premises.	**0.95** See Sentence 2.7.1.5.(4) of the AFC for seating, table, and aisle arrangements
lining, beverage and cafeteria space **icensed Premises** When the *operational occupant load* of licensed remises is being calculated all spaces are to be included except service reas such as washrooms, mechanical rooms, kitchens, coat checks, eparated storage rooms, exit stairways or exit corridors. All other areas, ncluding interior line up areas, seating areas, stand up areas, stage areas, ance floor areas, and areas for service staff behind bar counters, are to be ncluded in the calculation. fter the above area has been determined, the area of all substantial rchitectural, decor and service items within the occupancy will be deducted. hese will include pillars and planters, bar counters, free standing coolers and ce machines, pool tables, games tables, VLT's, and video games. The eduction of these or other areas that will not be occupied by a person from he above area will result in the "net useable floor space" figure. When an *operational occupant load* is being determined for a licensed remises and the premises is intended to allow for more than one function uch as dance floors, stand-up bars, seating areas, games areas, etc., the atio of 1.20 m^2 per person throughout the "net usable floor space" is onsidered appropriate. he required aisles and exits may be affected by the style and size of tables, hairs or furnishings within assembly occupancies. This may in turn dictate he need for adjustments to the calculated occupant load. The AHJ may equire a scaled drawing of the room or area and its furnishings and may djust the maximum occupant load to meet life safety requirements.	**1.20**

Calculation of Exit and Access to Exit Capacity

The AFC also uses the exits and access to exits to determine the allowable occupant load.

Means of egress is defined by the AFC and the ABC as being a continuous path of travel ovided for the escape of persons from any point in a building or contained open space to a parate building, an open public thoroughfare, or an exterior open space protected from fire posure from the building and having access to an open public thoroughfare. Means of egress cludes exits and access to exits.

The AFC refers to the ABC method of calculating the capacity of access to exits and exits. e ABC assigns a ratio expressed in mm per person to determine the capacity of an exit or an cess to exit. This ratio varies in accordance with the type of exit facility and with the type of ilding it is located in.

e capacity of an exit or an access to exit in a Group A occupancy may be calculated by viding 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, or
(ii) 8 mm per person for a stair consisting of steps whose rise is not more than 180 mm and whose run is not less than 280 mm, and
(ii) For ramps with a gradient of 1 in 8 or more, and for stairs by 9.2 mm per person.

In a Group A Division 4 by dividing aisles, stairs other than exit stairs, ramps, and ssageways in vomitories by 1.8 mm per person and by 2.4 mm per person in exit stairs.

There are minimum widths that 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,

. Posting of Occupant Loads

Alberta Building Code

ntence 3.1.17.1.(2) of the ABC states that where the occupant load of a room or floor area is signed for an occupant load other than that determined from Table 3.1.17.1. then the room or or area must be posted with a permanent sign indicating the occupant load for which the om or floor area was designed. The sign with the *design occupant load* must be posted at or ar the principle entrance to the room or floor area.

Alberta Fire Code

ticle 2.7.1.4. of the AFC requires that those areas in a building that are classified as assembly cupancies and have a maximum occupant load exceeding 60 people are to show the aximum occupant load on an acceptable sign in a conspicuous location near the principle trance.

here an owner has been required to provide a sign under Sentence 3.1.17.1.(2) of the ABC e occupant load number on the fire authority's sign should be the same. There may be tenuating reasons for having different numbers and each case must be evaluated on it's own erits. An example for having the same number posted applies to assembly buildings that may ntain a very large number of persons but the design number restricts the maximum occupant ad to 300 because the building does not have a fire alarm system. It would not be appropriate the fire authority to use a higher number because of the missing life safety system.

e fire authority can accept an owner's commitment to an occupant load that is less than what provided for in Table 3.1.17.1. In both cases an infraction would occur should the posted cupant load be exceeded.

SLES SPACES

e Fire Code requires that an aisle space leading to an egress doorway be provided in every en floor area:

:C 2.7.1.2.(1) Aisle in conformance with Sentences (2) to (4) shall be provided in every floor ea that
(a) is not subdivided into rooms or suites served by corridors giving access to exits, and
(b) is required by the Building Code to have more than one egress doorway.

:C 2.7.1.2.(2) Every required egress doorway shall be served by an aisle that
(a) has a clear width of not less than 1 100 mm,
(b) has access to at least one additional egress doorway, and
(c) at every point on the aisle, provides a choice of 2 opposite directions by which to reach an egress doorway.

ery open floor area in an assembly occupancy must include within the occupant load lculation, the area required for a clear aisle space leading to the required means of ress.

is calculation is required whether the assembly floor area contains standing room, tables and airs, non-fixed chairs or for a dining and beverage use.

sle spacing in assembly occupancies such as bars, taverns, beer gardens etc., is difficult to aintain due to patron movement. This is the reason why AFC Sentence 2.7.1.3.(3) and NFPA 1® Life Safety Code®[1] promotes the use of specific site drawings for each and every layout or ent that can take place in the building or floor area.

tablishing adequate aisle space is a critical component in determining the maximum rmissible occupant load of a floor space. Aisle space is determined on site after all of the niture and fixtures are in place. Aisle space must manage the capacity of persons entering e aisle to access the exit and needs to be determined in any situation where fixed seating, n-fixed seating and tables and chairs are part of the floor area use.

PECIAL CONDITIONS:
ATIOS – DECKS – ROOFTOPS & BEER GARDENS

e occupant load of a building may be affected when licensed establishments incorporate terior facilities such as a patio, deck, rooftop or beer garden for patron use. Exterior facilities ually have fences or similar barriers placed around the perimeter to restrict patron access and ress. Some establishments can more than double the capacity of the original building on her a permanent or temporary basis.

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e issue now becomes how do exterior facilities get approved?

exterior facility is not specifically addressed in the ABC. Therefore, it becomes a “use” issue d is regulated by the fire authority. In these cases, the patio, deck or rooftop can have an pact on the means of egress and life safety of occupants in the main building. In no case ould the required exits from the main building empty into an enclosed patio or contained terior space.

inclement weather, occupants from the outside would move into the building. Is there equate exit capacity for the combined occupant load?

he answer is yes, then the exterior occupant load has no impact on exit capacity quirements. If the answer is no, then the owner must decide whether to limit the number of trons on the exterior, or provide additional exits to achieve the required exit capacity. Exterior cilities with separate gates or exits may also pose the same exit capacity concerns.

erefore:

Where exterior facilities are enclosed requiring exiting through the building the egress stem and exit capacity must provide for the additional persons using the exterior enclosures.

Where exterior facilities are not enclosed and the building and the exterior facility are parate the capacity of the exterior facility should be determined by using the *operational cupant load* calculation.

Where exterior facilities have a fenced enclosure with access gates:

a. The capacity of the exterior facility is determined by the *operational occupant load* calculation, and
b. The exit capacity of the gate openings.

PECIAL EVENT OR TEMPORARY OCCUPANT LOADS

berta Gaming and Liquor Commission process requests for liquor permits at various venues. e terms “temporary” or “special event” are interchangeable for the authority having jurisdiction that the intent is to establish an occupant load use of a space for a duration other than a rmanent licensed beverage establishment. Examples of temporary or special event functions e beer gardens at rodeos, exhibitions, air shows, concerts in arenas, etc. The authority having isdiction can use any term necessary to address these special conditions. The common factor the event has a limited start and end date.

UTHORITY HAVING JURISDICTION

ere can be numerous circumstances that would require the authority having jurisdiction to nsider adjusting a calculated maximum permissible occupant load. Each case should be viewed independently through a formal process where the owner requests a variance from the thority having jurisdiction.