Occupant Load Determination – Assembly

Occupant load purposes

Occupant load factors have been established through studies showing how much space people take for activities and movement. These occupant load factors are based on how the space is being used. The state fire and building codes use occupant load calculations to establish:

- Egress provisions (such as the number of doors needed and the width of doors, stairs, aisles, and corridors).
- When fire protection systems are required (sprinklers, fire alarm systems, etc.).
- The type of occupancy (in some cases).

Determining the occupant load in assembly spaces

Determining the occupant load in assembly spaces is typically a little more complicated than in most other uses. The first step is to determine the type of seating: fixed or not fixed.

Fixed seating

Fixed seating is typically bleachers, benches, pews, or seats that are fixed in place and cannot be moved. Here are the common measurements for fixed searing:

- Bleachers and pews – one person for each 18 inches of length.
- Booths (as in a restaurant) – one person for each 24 inches of length.
- Seats (typically with arm rests) – one person per seat.

Areas without fixed seating

Here are the common occupant load factors used in assembly settings (such as restaurants, bars, places of worship, libraries, museums, etc.) that do not have fixed seating. These values come from Table 1004.5 of the 2020 Minnesota State Fire Code (MSFC):

- Table and chair seating – 15 sq. ft. per person (net area)
- Chair seating (no tables) – 7 sq. ft. per person (net area)
- Standing areas and dance floors – 7 sq. ft. per person (net area)
- Waiting, queuing areas – 5 sq. ft. person (net area)
- Exercise areas – 50 sq. ft. per person (gross area)

Gross vs. net areas

The fire and building codes measure these areas slightly differently. For most occupancies, gross floor area is used. Gross floor area is the space bounded by the walls and includes all spaces except for shafts or courts. In Figure 1 the shaded areas represent the gross floor area. The “X” represents a shaft or court that does not get included in the measurement.

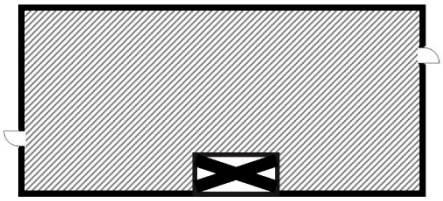


Figure 1 - Gross floor area

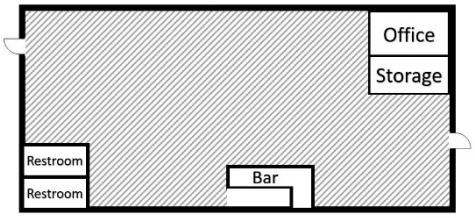


Figure 2 - Net floor area

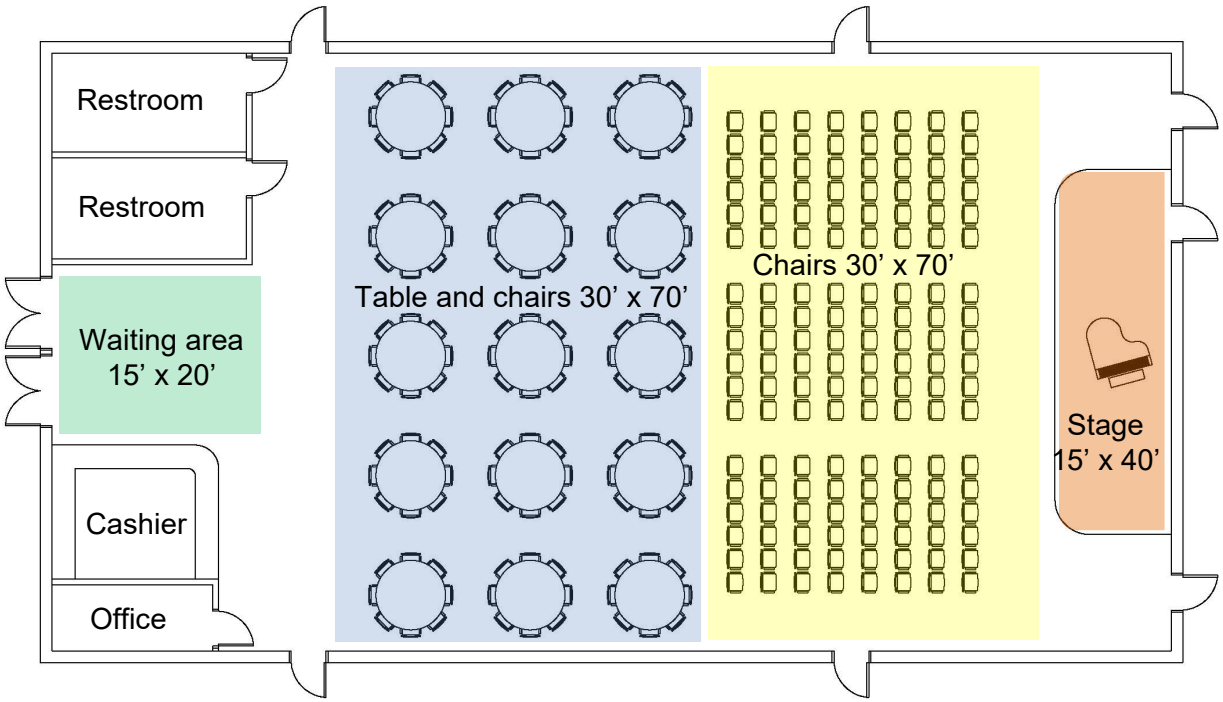
Net floor area is used where there are typically larger numbers of people. Net area is the space that can actually be occupied by people and excludes areas where people would not normally congregate (such as stairs, hallways, restrooms, mechanical rooms, etc.). In Figure 2, the shaded areas represent the net floor area. The white colored areas are not included in the measurements.

Applying occupant load factors to buildings

To determine the occupant load of a space, divide the size of the space by the occupant load factor(s) of Table 1004.5 (see common ones above). In many assembly settings, there will be more than one use. Please see the following example.

Example of occupant load determination

The following is an example of an assembly venue with multiple uses. The occupant load is determined by measuring the areas, dividing by the occupant load factors for each area, and adding the numbers together.



Since there are multiple uses here (chair seating, table and chair seating, waiting area, and a stage), there are multiple calculations:

- Chair seating (shown in yellow):
  - 30 ft. by 70 ft. = 2,100 sq. ft.
  - 2,100 sq. ft. divided by 7 sq. ft. per person = 300 persons
- Table and chair seating (shown in blue):
  - 30 ft. by 70 ft. = 2,100 sq. ft.
  - 2,100 sq. ft. divided by 15 sq. ft. per person = 140 persons
- Waiting / queuing area (shown in green):
  - 15 ft. by 20 ft. = 300 sq. ft.
  - 300 sq. ft. divided by 5 sq. ft. per person = 60 persons
- Stage area (shown in orange)
  - 15 ft. by 40 ft. = 600 sq. ft.
  - 600 sq. ft. divided by 15 sq. ft. per person = 40 persons
- Total occupant load = 540 persons (chair = 300, tables = 140, waiting = 60, stage = 40)