

# CHAPTER 4

## EGRESS

### SECTION 401 GENERAL

**401.1 General.** The means of egress for new bleachers, folding and telescopic seating, and grandstands shall comply with this chapter.

### SECTION 402 TRAVEL

**402.1 Exit access.** Travel within tiered seating shall be considered exit access. Exit access includes aisles, cross-aisles, sloped or level walking surfaces, vomitories, tunnels, stairs and ramps connecting the tiered seating structure to other portions of a building, structure or grade.

### SECTION 403 OCCUPANT LOAD

**403.1 Occupant load.** Where bench seating is used, the number of persons shall be based on one person for each 18 inches (457 mm) of length of the bench. Where individual seats are provided, the occupant load shall be based on one person per seat. The occupant load of reviewing stands and press boxes shall be based on 5 square feet (0.465 m<sup>2</sup>) per person for standing space and 7 square feet (0.65 m<sup>2</sup>) per person for movable chair seating space. The occupant load for security, audio and camera platforms shall be based on the actual number of occupants.

### SECTION 404 GENERAL MEANS OF EGRESS

**404.1 Minimum number of exits.** The minimum number of exits shall be provided from the seating area based on the occupant loads in Table 404.1 and in accordance with the calculated width requirement for egress capacity in Section 404.5. Accessible means of egress shall be provided as required by Section 1009 of the *International Building Code*.

**Exception:** For open-air assembly seating installations where the means of egress converge, a minimum of two egress paths shall be provided, sized to accommodate the occupant load served.

**Table 404.1  
MINIMUM NUMBER OF EXITS**

OCCUPANT LOAD	REQUIRED MEANS OF EGRESS
0–250	1
251–750	2
751–2,500	3
Over 2,500	4

**404.2 Room or space means of egress.** Rooms or spaces in which tiered seating is located shall be provided with the

required means of egress in accordance with the building code.

**404.3 Exterior installations.** For exterior installations, the exit discharge shall provide a direct and unobstructed access to a public way.

**Exception:** Where access to a *public way* cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate not less than 5 square feet (0.46 m<sup>2</sup>) for each person.
2. The area shall be located on the same lot not less than 50 feet (15 240 mm) from the structure requiring egress.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the structure.

**404.4 Travel distance.** For installations located inside a building, the travel distance from each seat to an exit shall comply with the building code. For exterior installations, the travel distance from each seat to the perimeter of the seating structure shall not exceed 400 feet (122 m). Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessway without travel over or on the seats.

**404.5 Required width.** The clear width of aisles and other means of egress for smoke-protected assembly seating shall not be less than the occupant load served by the egress elements multiplied by the appropriate factor in Table 404.5(1). The clear width of aisles and other means of egress for indoor assembly seating that is not smoke protected shall not be less than the occupant load served by the egress elements multiplied by the appropriate factor in Table 404.5(2). The clear width of aisles and other means of egress for open-air assembly seating shall not be less than the occupant load served by the egress elements multiplied by the appropriate factor in Table 404.5(3). The total number of seats specified shall be those within the space exposed to the same environment. Aisles shall also comply with Section 405. Where the width of the stair and stepped aisle exceeds 30 inches (762 mm) from a handrail, the capacity of the stair and stepped aisle shall be determined by adding the capacity of the aisle within 30 inches (762 mm) of the handrail and the capacity of the stair or stepped aisle beyond 30 inches (762 mm) of the handrail.

**404.5.1 Measurement.** The clear width of aisles and other means of egress shall be measured to walls, edges of seating and tread edges except for permitted projections. There shall be no obstructions in the required width of aisles except for handrails as provided in Section 409.7.

**404.6 Clear height.** Clear height shall comply with Section 306.1.

**SECTION 405  
AISLES**

**405.1 Aisles.** The minimum width of aisles shall be in accordance with Section 404.5, but not less than that required by this section. An aisle is not required in seating facilities where all of the following conditions exist.

1. Seats are without backrests.
2. The rise from row to row does not exceed 6 inches (152 mm) per row.
3. The row spacing does not exceed 28 inches (711 mm) unless the seatboards and footboards are at the same elevation.
4. The number of rows does not exceed 16 rows in height.
5. The first seating board is not more than 12 inches (305 mm) above the ground or floor below or a cross aisle.
6. Seatboards have a continuous flat surface.

7. Seatboards provide a walking surface with a minimum width of 11 inches (279 mm).
8. Egress from seating is not restricted by rails, guards or other obstructions.

**405.2 Minimum aisle width.** The minimum clear width of aisles shall be as follows.

1. Forty-eight inches (1219 mm) for stepped aisles having seating on each side.

**Exception:** Thirty-six inches (914 mm) where the aisle serves less than 50 seats.

2. Thirty-six inches (914 mm) for stepped aisles having seating on only one side.

**Exception:** Twenty-three inches (584 mm) between a stepped aisle handrail and seating where an aisle does not serve more than five rows on one side.

**TABLE 404.5(1)  
WIDTH OF AISLES AND MEANS OF EGRESS FOR INDOOR SMOKE-PROTECTED ASSEMBLY SEATING**

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY OCCUPANCY	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and stepped aisles with handrails within 30 inches	Stairs and stepped aisles without handrails within 30 inches	Passageways, doorways and ramps not steeper than in 1:10 slope	Ramps steeper than in 1:10 slope
Equal to or less than 5,000	0.200	0.250	0.150	0.165
10,000	0.130	0.163	0.100	0.110
15,000	0.096	0.120	0.070	0.077
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

Note: Interpolation is permitted between specific values shown.

**TABLE 404.5(2)  
WIDTH OF AISLES AND MEANS OF EGRESS FOR ASSEMBLY SEATING WITHOUT SMOKE-PROTECTION**

TOTAL NUMBER OF SEATS IN THE ASSEMBLY OCCUPANCY WITHOUT SMOKE PROTECTION	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and stepped aisles with handrails within 30 inches	Stairs and stepped aisles without handrails within 30 inches	Passageways, doorways and ramps not steeper than in 1:10 slope	Ramps steeper than in 1:10 slope
All seating configurations	0.3	0.375	0.2	0.22

For SI: 1 inch = 25.4 mm.

Note: The values in the table are applicable to steps with riser heights of 7 inches and below. Add 0.005 inch of additional stair and stepped aisles width for each occupant for each additional 0.10 inch of riser height above 7 inches.

**TABLE 404.5(3)  
WIDTH OF AISLES AND MEANS OF EGRESS FOR OPEN-AIR ASSEMBLY SEATING**

TOTAL NUMBER OF SEATS IN THE OPEN-AIR ASSEMBLY OCCUPANCY	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and stepped aisles with handrails within 30 inches	Stairs and stepped aisles without handrails within 30 inches	Passageways, doorways and ramps not steeper than in 1:10 slope	Ramps steeper than in 1:10 slope
Equal to or less than 15,000	0.080	0.080	0.060	0.066
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

Note: Interpolation is permitted between specific values shown.

3. Twenty-three inches (584 mm) between a stepped aisle handrail or guard and seating where the aisle has a mid-aisle handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

**Exceptions:**

1. Thirty-six inches (914 mm) where the aisle serves less than 50 seats.
2. Thirty inches (762 mm) where the aisle does not serve more than 14 seats.
5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.

**Exception:** Thirty inches (762 mm) where the aisle does not serve more than 14 seats.

**405.3 Aisle width.** The aisle width shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle in accordance with Section 404.5. The catchment area served by an aisle is that portion of the total space that is served by that section of the aisle. In establishing catchment areas, the assumption shall be made that there is a balanced use of all means of egress, with the number of persons in proportion to egress capacity.

**405.4 Converging aisles.** Where aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisles.

**405.5 Uniform width.** Those portions of aisles, where egress is possible in either of two directions, shall be uniform in width and shall be measured in accordance with Section 404.5.1.

**405.6 Dead ends.** The length of a dead-end aisle shall not exceed 16 rows in nonsmoke-protected assembly seating and 21 rows in smoke-protected assembly seating.

**Exceptions:** Dead-end aisles terminating at a cross aisle or vomitory providing access to an exit at only one end and complying with any one of the following shall be permitted.

1. In assembly seating without smoke protection, dead-end aisles exceeding 16 rows are permitted where seats beyond the 16<sup>th</sup> row are no more than 24 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for every additional seat beyond seven where seats have backrests or beyond ten where seats are without backrests in the row.
2. For smoke-protected or open-air assembly seating, dead-end aisles exceeding 21 rows are permitted where seats beyond the twenty-first row are no more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat beyond seven where seats have backrests or beyond ten where seats are without backrests in the row.

**405.6.1 Dead-end cross aisles.** Dead-end cross aisles shall not exceed 20 feet (6096 mm).

## SECTION 406 STAIRS AND STEPPED AISLES

**406.1 Stairs.** Stair treads and risers shall be as required by the building code. Stepped aisles shall comply with Sections 406.2 through 406.7.

**Exception:** A stair that connects a stepped aisle to a cross aisle shall be permitted to comply with the stepped aisle requirements of Sections 406.2 through 406.7.

**406.2 Treads and risers.** Stepped aisles shall consist of a series of treads and risers that extend across the full width of the aisle. Stepped aisles shall be constructed in accordance with the requirements of this section.

**406.3 Tread depth.** Tread depth shall be a minimum of 11 inches (279 mm). The tolerance between adjacent treads shall not exceed 0.188 inch (408 mm).

**406.4 Tread construction.** Treads constructed of more than two elements shall not have a gap of more than 0.50 inch (12.8 mm) between adjacent tread surfaces. Treads constructed of grating shall not permit a sphere of 0.50 inch (12.8 mm) in diameter to pass through.

**406.5 Tread marking stripe.** A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide.

**Exception:** The contrasting stripe is permitted to be omitted where the tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

**406.6 Riser height.** Riser height shall be not less than 4 inches (102 mm) nor more than 8 inches (203 mm).

**Exception:** Riser height not exceeding 9 inches (229 mm) shall be permitted where necessitated by the slope of the adjacent seating areas to maintain sightlines.

**406.7 Riser construction.** Risers shall be of solid construction.

**Exceptions:**

1. Openings in risers are permitted provided the opening does not exceed 0.5 inches (12.7 mm) in height and width.
2. Solid risers are not required in telescopic and folding seating where necessary to maintain opening and closing operational clearances.

**406.8 Dimensional uniformity.** Stepped aisle treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 0.375 inch (9.5 mm) in any flight of the stepped aisle.

**Exception:** Treads and risers in transition areas and parabolic seating configurations in accordance with Section 406.8.1.

**406.8.1 Tread and riser nonuniformity permitted.**

Treads and risers located in transition areas between adjacent tiered seating elements, parabolic seating configurations or onto or off of tiered seating are not required to be of uniform depth or height where a mid-aisle handrail is provided. The handrail shall meet the requirements of Section 409. Mid-aisle handrails in transition areas shall extend the full length of the transition and a minimum of one tread depth, parallel to the run of the stepped aisles, above and below the uppermost and lowermost riser in the transition. Where extensions of the aisle handrail interfere with adjacent means of egress, the handrail extension shall terminate at the riser.

**406.8.2 Tread marking stripe at nonuniformity.** Where tread or riser nonuniformity exceeds 0.188 inch (4.8 mm), a distinctive marking stripe shall be provided on each tread adjacent to the nonuniform tread or riser. The marking shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of 1 inch (25 mm) wide and a maximum of 2 inches (51 mm) wide. The edge marking stripe shall be distinctively different from the stepped aisle contrasting marking stripe of Section 406.5

**406.9 Transitions.** Transitions between *stairways* and stepped *aisles* shall comply with either Section 406.9.1 or 406.9.2.

**406.9.1 Transitions to stairways that maintain stepped aisle riser and tread dimensions.** Stepped *aisles*, transitions and *stairways* that maintain the stepped aisle riser and tread dimensions shall comply with Section 406 as one *exit* access component.

**406.9.2 Transitions to stairways that do not maintain stepped aisle riser and tread dimensions.** Transitions between *stairways* and stepped *aisles* having different riser and tread dimensions shall comply with Sections 406.9.2.1 through 406.9.3.

**406.9.2.1 Stairways and stepped aisles in a straight run.** Where *stairways* and stepped *aisles* are in a straight run, the transition shall have one of the following:

1. A minimum depth of 22 inches (559 mm) where the treads on the descending side of the transition have greater depth.
2. A minimum depth of 30 inches (762 mm) where the treads on the descending side of the transition have lesser depth.

**406.9.2.2 Stairways that change direction from stepped aisles.** Transitions where the *stairway* changes direction from the stepped *aisle* shall have a minimum depth of 11 inches (280 mm) or the stepped *aisle* tread depth, whichever is greater, between the stepped *aisle* and *stairway*.

**406.9.3 Transition marking.** A distinctive marking stripe shall be provided at each *nosing* or leading edge adjacent to the transition. Such stripe shall be a minimum of 1 inch (25 mm) and a maximum of 2 inches (51 mm) wide. The

edge marking stripe shall be distinctively different from the stepped *aisle* contrasting marking stripe.

**406.10 Stepped aisles at vomitories.** Stepped aisles that change direction at vomitories shall comply with Section 406.10.1. Transitions between a stepped aisle above a vomitory and a stepped aisle to the side of the vomitory shall comply with Section 406.10.2.

**406.10.1 Stepped aisles that change direction at vomitories.** Stepped aisle treads, where the stepped aisle changes direction at a vomitory, shall have a minimum depth of 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater. The height of a stepped aisle tread above a transition at a vomitory shall comply with Section 406.4.

**406.10.2 Stepped aisle transitions at the top of vomitories.** Transitions between the stepped aisle above a vomitory and stepped aisles to the side of a vomitory shall have a minimum depth of 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater

## SECTION 407 AISLE ACCESSWAYS

**407.1 Required aisle accessways.** Aisle accessways shall be provided above the first row of seating. Aisle accessways located more than 30 inches (762 mm) above the floor or ground below shall be constructed such that openings shall not allow the passage of a sphere greater than 4 inches (102 mm) in diameter. Where bleacher-type seating is utilized, such seats shall be a minimum depth of 9 inches (229 mm). Row-to row spacing shall be a minimum of 22 inches (559 mm).

**407.2 Minimum width.** The minimum clear aisle accessway width shall not be less than 12 inches (305 mm) measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats, the measurement shall be made with seats in the raised position. Where any seat in a row does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet arm in the use position.

**Exception:** For seats with folding tablet arms, row spacing is permitted to be determined with the tablet arm in the stored position where the tablet arm when raised manually to a vertical position in one motion automatically returns to the stored position by force of gravity.

**407.3 Dual access.** For rows of seating served by aisles or doorways at both ends, there shall not be more than 100 seats per row. The minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14 where seats have backrests or beyond 21 where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

**Exception:** For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway mini-

mum clear width shall be increased in accordance with Section 407.5.

**407.4 Single access.** For rows of seating served by aisles or doorways at only one end of the row, the minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven seats where seats have backrests or beyond ten where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

**Exception:** For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 407.5.

**407.4.1 Path of egress travel.** For rows of seating served by only one path of egress travel, the common path of egress travel shall not exceed 30 feet (9144 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits.

**Exceptions:**

1. In smoke-protected or open-air assembly seating, the common path of egress travel shall not exceed 50 feet (15 240 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits.
2. For areas serving less than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits.
3. Where bench-type seating without backrests is utilized and the top of the bench is no more than 7 inches (178 mm) above the footrest immediately behind, the common path of egress travel shall not exceed 75 feet (22 860 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits.

**407.4.2 Path through adjacent rows.** Where one of the two paths of travel is across the aisle through a row of seats to another aisle, there shall not be more than 24 seats between the two aisles; and the minimum clear width

between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat beyond seven where seats have backrests or beyond ten where seats are without backrests in the row between aisles.

**Exception:** For smoke-protected or open-air assembly seating there shall not be more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat beyond seven where seats have backrests or beyond ten where seats are without backrests in the row between aisles.

**407.5 Aisle accessways.** The design of aisle accessways in smoke-protected or open-air assembly seating shall comply with Table 407.5.

**SECTION 408  
GUARDS**

**408.1 Required guards.** Guards shall be provided in the following areas.

1. Along open-sided walking surfaces, cross aisles, stepped aisles, ramps and landings of tiered seating areas which are located more than 30 inches (762 mm) above the floor or grade below. Such guards shall be not less than 42 inches (1067 mm) high, measured vertically above the leading edge of the tread, adjacent walking surface or adjacent bench seat.

**Exception:** A guard is not required where the tiered seating is located adjacent to a wall and the space between the wall and the tiered seating is less than 4 inches (102 mm).

2. Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

**Exception:** Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

**TABLE 407.5  
AISLE ACCESSWAYS IN SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY SEATING**

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY OCCUPANCY	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY			
	Aisle or doorway at both ends of row		Aisle or doorway at one end of row only	
	Seats with backrests	Seats without backrests	Seats with backrests	Seats without backrests
Less than 4,000	14	21	7	10
4,000	15	22	7	10
7,000	16	23	8	11
10,000	17	24	8	11
13,000	18	25	9	12
16,000	19	26	9	12
19,000	20	27	10	13
22,000 and greater	21	28	11	14

For SI: 1 inch = 25.4 mm.

3. A guard shall be provided for the full width of an aisle where the lowest point of the aisle is more than 30 inches (762 mm) above the floor or ground below. The guard shall be a minimum of 36 inches (914 mm) high and shall provide a minimum 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest aisle step.
4. Unless subject to the requirements of Item 3, a guard with a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the guard would otherwise interfere with the sightlines of immediately adjacent seating.

**408.2 Opening limitations.** Open guards shall be constructed of materials such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 34 inches (864 mm). From a height of 34 inches (864 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.

**Exceptions:**

1. The triangular opening formed by the riser, tread and bottom rail at the open side of a stepped aisle or tiered seating shall be of a maximum size such that a sphere of 6 inches (152 mm) in diameter cannot pass through the opening.
2. Guards at the end of aisles where they terminate at a fascia of boxes, balconies and galleries shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) or greater above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.
3. The opening limitation shall not apply to guards required in accordance with Item 2 of Section 408.1.

**408.3 Guard design.** Guards and their attachment shall be designed to resist the loads indicated in Section 303.

## SECTION 409 HANDRAILS

**409.1 Required handrails.** Where seats are located on both sides of a stepped aisle, a minimum of one mid-aisle handrail shall be provided. Where seats are located on one side of a stepped aisle, a minimum of one handrail shall be provided on the side of the stepped aisle where there are no seats.

**Exceptions:**

1. A handrail is not required for a stepped aisle serving a single row of seating.
2. The mid-aisle handrail is permitted to be on one side of the aisle when the stepped aisle serves less than 50 seats.

**409.1.1 Mid-aisle handrails.** Where there is seating on both sides of the aisle, the mid-aisle handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and permit crossing

from one side of the aisle to the other. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the handrail shall have rounded terminations or bends. Such discontinuities shall also be permitted where there is seating on one or both sides of the aisle, and where there are guardrails complying with the graspability requirements for handrails. An additional rail shall be provided below the handrail, located parallel to, and approximately 12 inches (305 mm) below, the handrail. The additional rail need not comply with the graspability provisions of Section 409.3.

**409.2 Height.** Handrail height, measured above stepped aisle tread nosings, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

**409.3 Graspability.** Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches (32 mm) and not greater than 2 inches (51 mm) or shall provide equivalent graspability. If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6.25 inches (159 mm) with a maximum cross-section dimension of 2.25 inches (57 mm). Edges shall have a minimum radius of 0.01 inch (3.2 mm).

**409.4 Continuity.** Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

**Exceptions:**

1. Mid-aisle handrails in accordance with Section 409.1.1.
2. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1.5 inches (38 mm) of the bottom of the handrail shall not be considered to be obstructions.

**409.5 Handrail termination.** Handrails located on the side of a stepped aisle shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stepped aisle flight.

**409.5.1 Mid-aisle handrail termination.** Mid-aisle handrails shall not extend beyond the lowest riser and shall terminate within 18 inches (381 mm) measured horizontally, from the face of the lowest riser. Handrail extensions are not required.

**Exception:** Mid-aisle handrails shall be permitted to extend beyond the lowest riser where the handrail extensions do not obstruct the width of the cross aisle.

**409.6 Clearance.** Clear space between a handrail and a wall or other surface shall be a minimum of 1.5 inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

**409.7 Projections.** Projections into the required width at each handrail shall not exceed 4.5 inches (114 mm) at or below the handrail height.

**409.8 Handrail design.** Handrails and their attachment shall be designed to resist the loads indicated in Section 303.