Handrails, Guardrails and Stairs for One and Two Family Residential Buildings

from the 2005 Connecticut State Building Code

SECTION R311
MEANS OF EGRESS

R311.1 General. Stairways, ramps, exterior exit balconies, hallways and doors shall comply with this section.

❖ Sections R311.2 through R311.6 contains the requirements for the exit and the means of egress components.

R311.2 Construction.

❖ Sections R311.2.1 and R311.2.2 contain the provisions for attachment to the main structure of means of egress components and for fire protection of understair enclosures.

R311.2.1 Attachment. Required exterior exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

❖ It is necessary to attach exterior exit balconies, stairs, and similar exit facilities to the primary structure so that vertical and lateral forces will be resisted in order to avoid separation of the exit facilities from the structure. This is reiterating the requirement for a complete load path in Section R301.1. The reasons for doing so are 1) the need to maintain key elements of the egress system for emergency evacuations, and 2) the increased possibility of overlooking such connections. "Exterior exit balconies" and "exit facilities" are not defined or otherwise described in this code. The requirement for positive anchor to the primary structure applies to all exterior means of egress components used as part of an egress system whether part of the required exit or not.

R311.2.2 Under stair protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with $^1/_2$-inch (12.7 mm) gypsum board.

❖ Often times the space under a stairway is used for storage, since this space is often of little use for other purposes. The code permits the use of an open space beneath a stair without the need for any additional protection. Additionally, if the space is walled off and there is no access to the area, then the code is also not concerned. If, however, the area beneath the stairway is enclosed and any type of access is provided into the space, then the walls, soffits and ceilings of the enclosed space must be protected on the enclosed side with at least $^1/_2$-inch (12.7 mm) gypsum board.

R311.3 Hallways. The minimum width of a hallway shall be not less than 3 feet (914 mm).

❖ Hallways must be a minimum of 3 feet (914 mm) in width to accommodate moving furniture into rooms off the hallway and for the safe egress of people from the structure.

R311.4 Doors.

❖ Sections R311.4.1 through R311.4.4 contain the requirements for doors.

R311.4.1 Exit door required. Not less than one exit door conforming to this section shall be provided for each dwelling unit. The required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. Access to habitable levels not having an exit in accordance with this section shall be by a ramp in accordance with Section R311.6 or a stairway in accordance with Section R311.5.

❖ All dwelling units are required to have at least one exit door that complies with the provisions of Sections R311.4.2, R311.4.3 and R311.4.4. This door must have access to the exterior without the dwelling's occupants traveling through a garage where hazards could prevent a suitable means of egress. A ramp or stairway is required for access to habitable areas not having an exit.

R311.4.2 Door type and size. The required exit door shall be a side-hinged door not less than 3 feet in width and 6 feet, 8 inches in height. Other doors shall be permitted to be side-hinged, swinging, sliding, bi-fold or revolving doors, shall not be required to comply with the minimum door width and shall be permitted to be not less than 6 feet, 6 inches in height.

R311.4.3 Landings at exterior doors. There shall be a floor or landing a minimum of 3 feet in the direction of travel and 3 feet in width, or a width equal to the width of any adjacent stair, whichever is greater, on each side of each exterior door. The landing on the exterior side of doors shall not be more than $8^1/_4$ inches below the top of the threshold provided that the door, other than an exterior storm or screen door, does not swing over the landing. In the event that the

door, other than an exterior storm or screen door, swings over the landing, the landing shall not be more than 1.5 inches below the top of the threshold.

Exception: At other than the required exit door, a landing is not required for the exterior side of the door where a stairway of three or fewer risers, including the top riser from the dwelling to the top tread, is located on the exterior side of a door.

❖ Landings are required for exterior doors and must be provided on both the exterior and interior sides of the door. An exception allows the deletion of the landing if 3 or fewer stair risers are on the exterior side of a door if the door is other than an exit door. Thresholds must not be higher than 1.5 inches (38 mm) above floor level. See Commentary Figure R311.5.4.

Additionally, an exception permits the exterior landing of an exterior door be 8 ¼ inches (210 mm) below the top of the threshold. See Commentary Figure R311.4.3.

Landings must be the same width of the door they serve and must be at least 36 inches (914 mm) in length.

R311.4.4 Type of lock or latch. All egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

❖ This section mandates that the required exit door is under the control of and operable by the person seeking egress, thus the statement that the egress door be operable from the side from which egress is sought, without the need of a key or any special knowledge or effort. This section applies to all egress doors.

R311.5 Stairways.

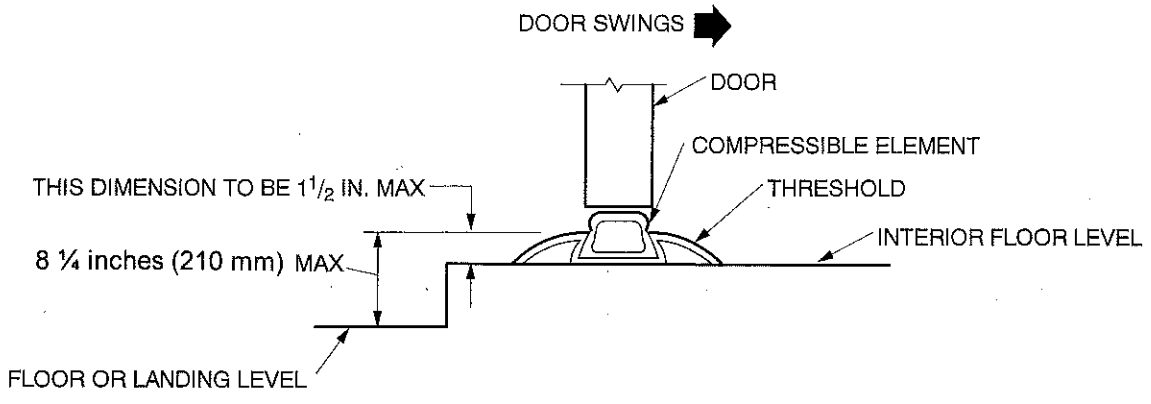
❖ The requirements for stairways are contained in Sections R311.5.1 through R311.5.8.

R311.5.1 Width. Stairways shall not be less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31.5 inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides.

Exceptions:

1. The width of spiral stairways shall be in accordance with Section R311.5.8.
2. The width of existing or replacement stairways serving existing unfinished attics or existing unfinished basements being converted to habitable space shall not be less than 32 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4 inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 28 inches where a handrail is installed on one side and 24 inches where handrails are provided on both sides.

At and below the handrail height, the required width for the stairway including treads and landings is 27 inches (686 mm) if handrails are provided on each side and 31 1/2 inches (800 mm) if there is a handrail installed on only one side. In essence, the code is not concerned about elements such as trim, stringers or other items that may be found below the level of the handrail, as long as they do not exceed the handrail's projection. This reduced width below the handrail is based on a body's movements as a person walks on a stair or other surface. See Commentary Figure



For SI: 1 inch = 25.4 mm.

Figure R311.4.3
THRESHOLD HEIGHTS

R311.5.1. The exception and the provisions of Section R311.5.8 will permit a minimum width of 26 inches (660 mm) for spiral stairways.

R311.5.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet, 8 inches measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

Exception: The minimum headroom in all parts of existing or replacement stairways serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 6 feet, 6 inches, measured as above.

R311.5.3 Stair treads and risers.

❖ The riser height, tread depth, and profile requirements for stairways are specified in Sections R311.5.3.1 through R311.5.3.3.

R311.5.3.1 Riser height. The maximum riser height shall be $8^1/_4$ inches. The minimum riser height shall be 4 inches. Riser height shall be measured vertically between leading edges of adjacent treads.

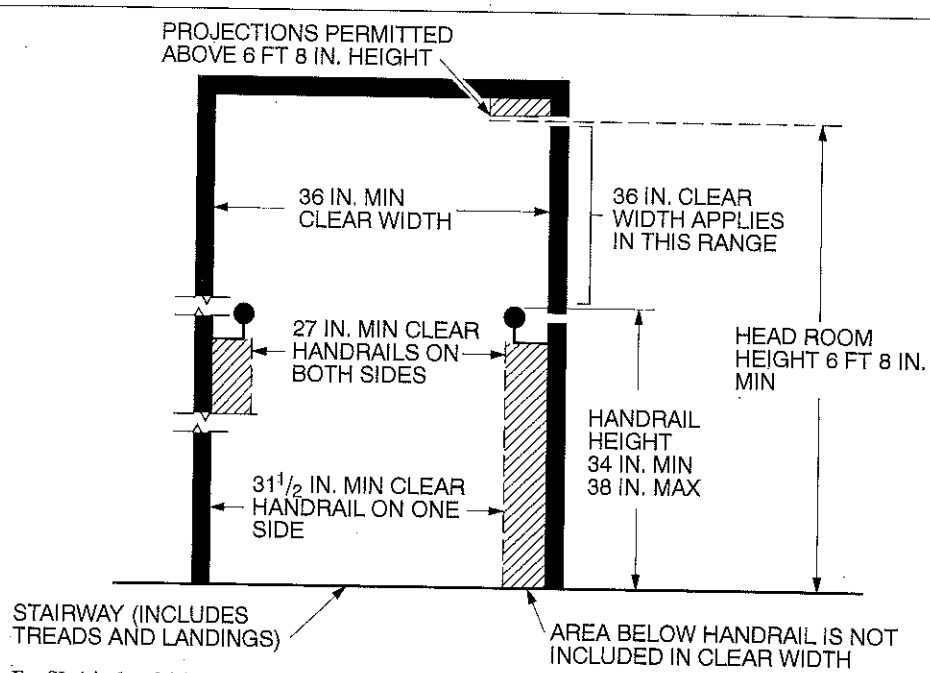
Exception: The maximum riser height of existing or replacement stairs serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 9 inches, measured as above.

The greatest riser height within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch.

R311.5.3.2 Tread depth. The minimum tread depth shall be 9 inches. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge.

Exception: The minimum tread depth of existing or replacement stairs serving existing unfinished attics or existing unfinished basements being converted to habitable space shall be 8 inches, measured as above.

The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch. Winder and circular stairway treads shall have a minimum tread depth of 9 inches measured as above at a point 12 inches from the sides where the treads are narrower. Winder treads shall have a minimum tread depth of 6 inches at any point. The greatest winder tread depth at the 12-inch walk line within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch. The greatest circular tread depth at any walking line within any circular flight of stairs, measured at a consistent distance from a side of the stairway, shall not exceed the smallest by more than $^3/_8$ inch.

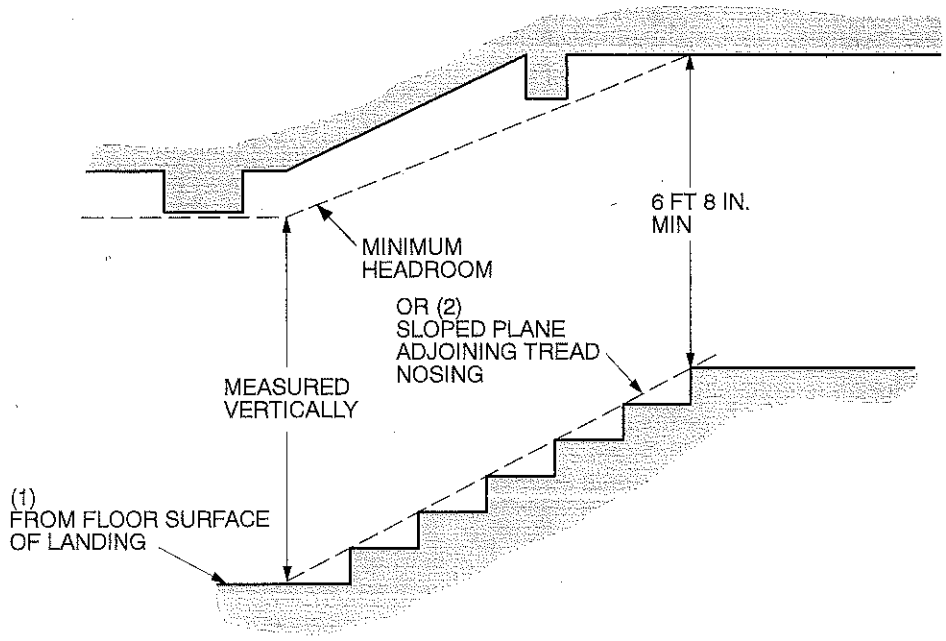


For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Figure R311.5.1
STAIRWAY CLEARANCES

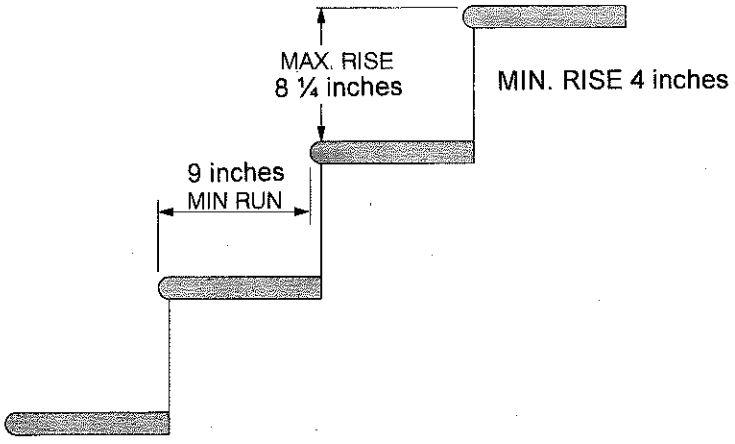
❖ The code establishes the minimum tread depth. The provisions specify how the tread depth is to be measured. See Commentary Figure R311.5.3.1(1). To obtain the best uniformity possible in a flight of stairs, the maximum variation between the greatest and smallest tread depth is limited to $^3/_8$ inch (9.5 mm). See the commentary for Section R311.5.3.1 for a discussion on uniformity. The same criteria apply to winder treads. However, the depth is to be measured at the "walk line." The "walk line" is at a point 12 inches (305 mm) from the side where the treads are narrower.

A stairway may consist of straight treads, or it may be constructed using winders. If winders are used, they can either be used for an entire flight of a stairway,



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Figure R311.5.2
MINIMUM HEADROOM



For SI: 1 inch = 25.4 mm.

Figure R311.5.3.1(1)
CONVENTIONAL STAIRWAY

as a portion of a stairway such as at a change of direction, or to form a circular stairway. Winders consist of tapered treads that are narrow on one end and widen out, pie-shaped, toward the opposite side of the stairs. Since they are primarily used to change the direction of the stair, and they create a change in the rhythm for the stair users, it is important that winders comply with the specified dimensional criteria. Winder treads must have a minimum depth of 6 inches (152 mm) at any point. See Commentary Figure R311.5.3.2(1) for examples of winders used as a portion of a stairway at a change of direction. See Commentary Figure R311.5.3.2(2) for an example of winders used to form a circular stairway.

R311.5.3.3 Profile. The radius of curvature at the leading edge of the tread shall be no greater than $^9/_{16}$ inch (14.3 mm). A nosing not less than $^3/_4$ inch (19 mm) but not more than $1^1/_4$ inch (32 mm) shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than $^3/_8$ inch (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosing shall not exceed $^1/_2$ inch (12.7 mm). Risers shall

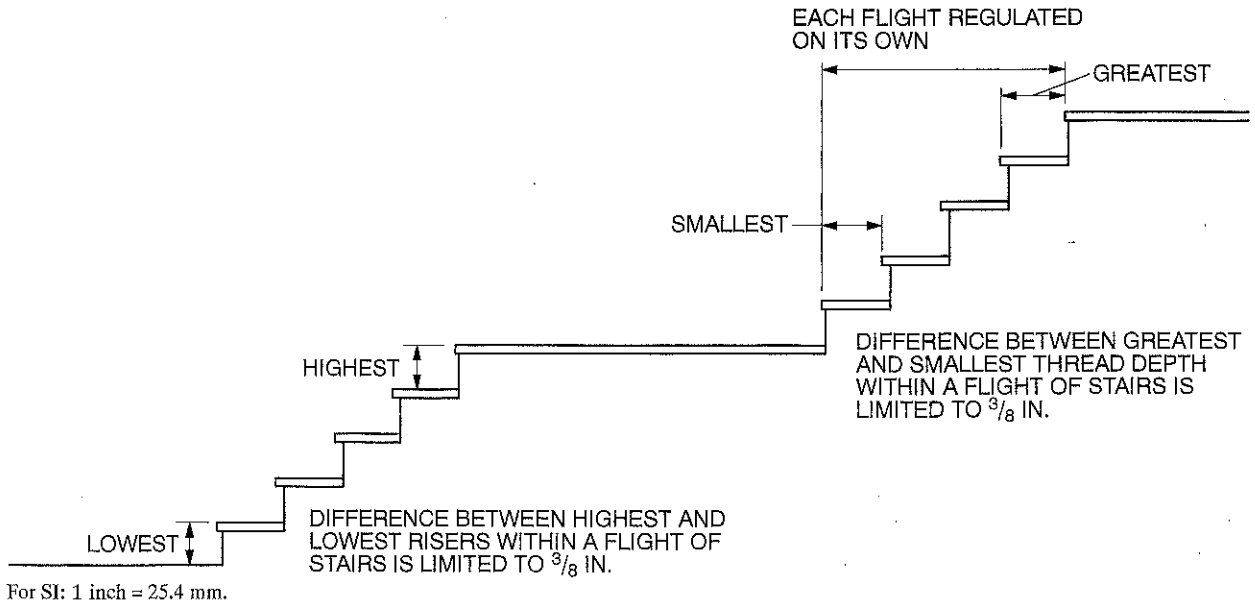


Figure R311.5.3.1(2)
STAIR TOLERANCES

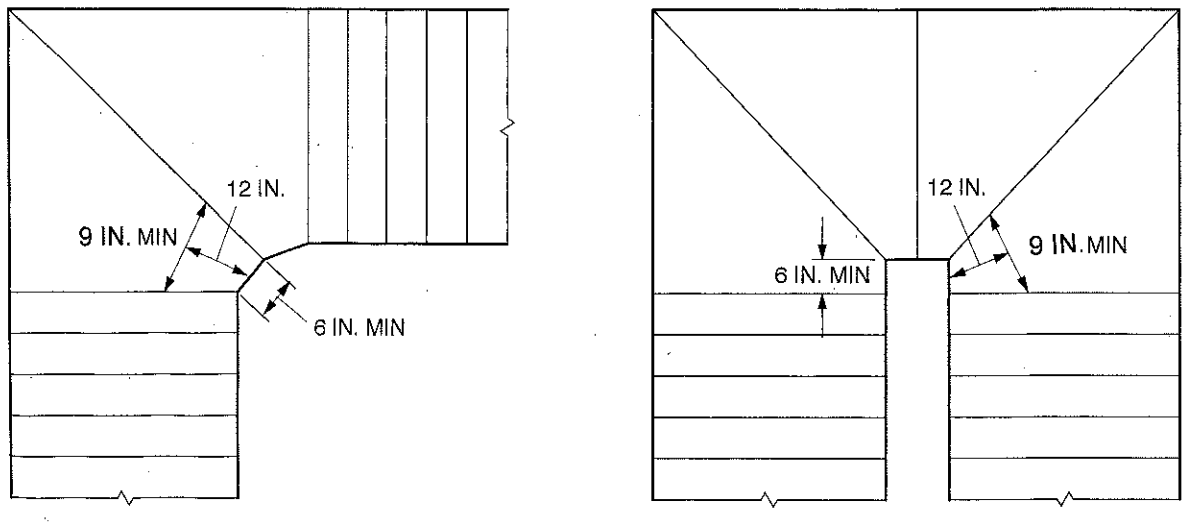


Figure R311.5.3.2(1)
WINDERS

be vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 (0.51 rad) degrees from the vertical. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.

Exceptions:

1. A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).
2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

❖ The leading edge or nosing of the treads is limited to a maximum radius of $^{9}/_{16}$ inch (14.3 mm). This varies from the $^{1}/_{2}$ inch (12.7 mm) maximum used in the *International Building Code*. These limitations apply to not only the nosings on the stair treads, but also to nosings at the level of floors or landings that are a part of the stairway. The *International Residential Code* places a requirement for a minimum nosing of $^{3}/_{4}$ inch (19.1 mm) when the stair has a solid riser. This also varies from the *International Building Code*, which does not specify a minimum nosing requirement. However, the first exception will eliminate the nosing requirement if the stair tread is at least 11 inches (279 mm) in depth. Tread nosings are limited to a maximum projection of $1^{1}/_{4}$ inches (32 mm). The nosing projection is to be consistent from one story level to the next, instead of simply within each flight as is required for the treads and risers. The greatest variation permitted for the nosing is $^{3}/_{8}$ inch (9.5 mm), which is a construction tolerance and not a design variation. See Commentary Figure R311.5.3.3 for examples of the profile provisions. The code does not require solid risers, but where the height of the stairway exceeds 30 inches (762 mm), either solid risers or another method to limit the opening between adjacent treads is needed. As with the guard provisions of Section R312, a 4-inch (102 mm) sphere is used to determine compliance for any type of open riser system.

R311.5.4 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway.

Exception: A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

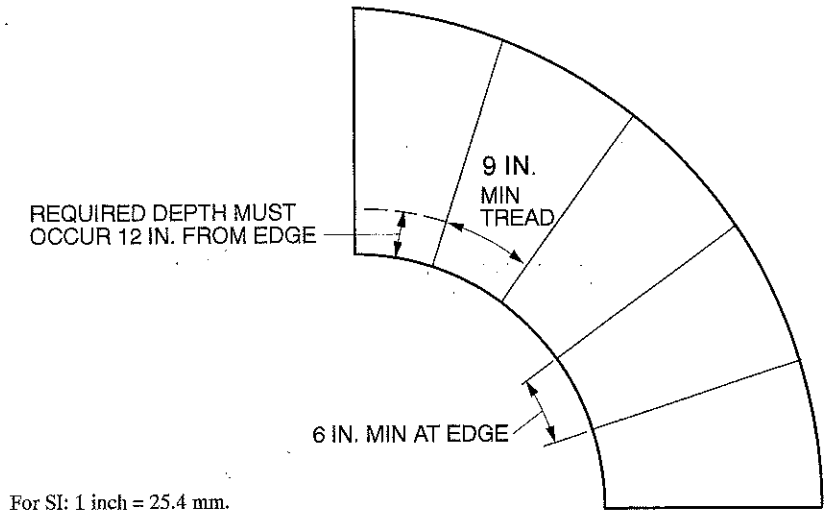
A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

The width of each landing shall not be less than the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

❖ A landing is required at the top and bottom of each stairway; however, a landing is not required at the top of interior stairways provided a door does not swing over the stairway. See Commentary Figure R311.5.4.

R311.5.5 Stairway walking surface. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit vertical in 48 inches horizontal (2-percent slope).

❖ The slope of the walking surfaces must provide drainage to stairs and landings that may be subjected to accumulation of liquids such as water, rain or melting snow. The section also provides for a safe limit of the slope so as not to yield an unsafe walking surface. This requirement applies to all stairs and landings, both exterior and interior.



For SI: 1 inch = 25.4 mm.

Figure R311.5.3.2(2)
WINDERS USED FOR CIRCULAR STAIRWAY

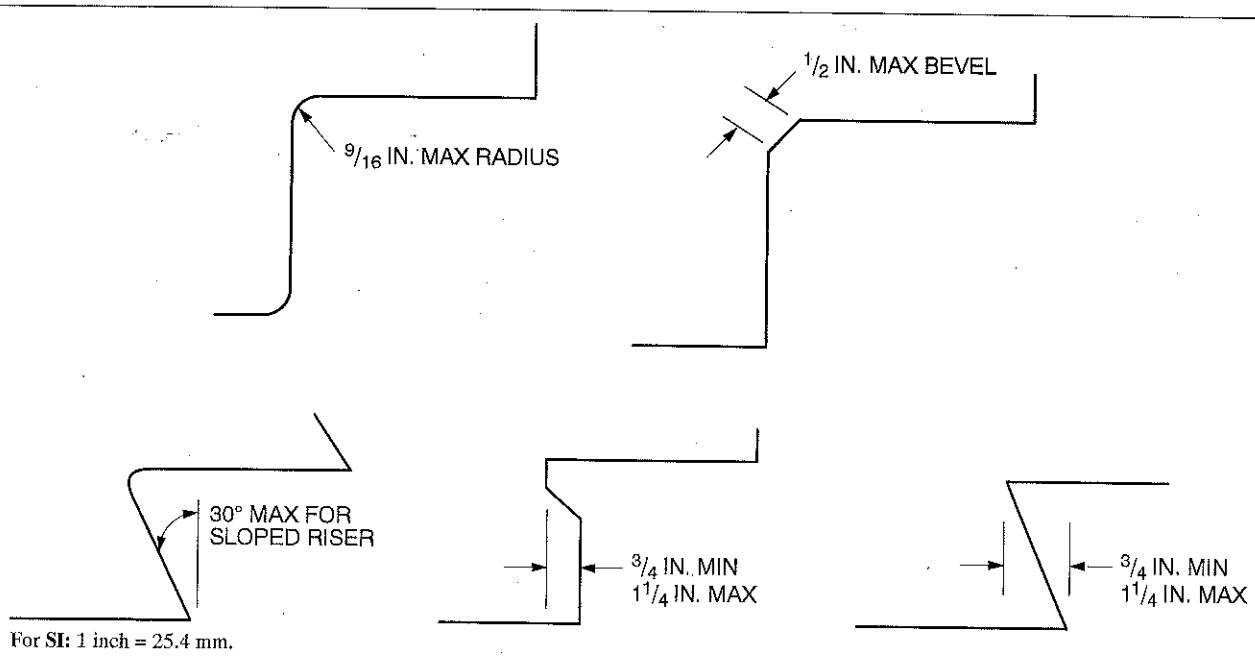


Figure R311.5.3.3
TREAD PROFILE

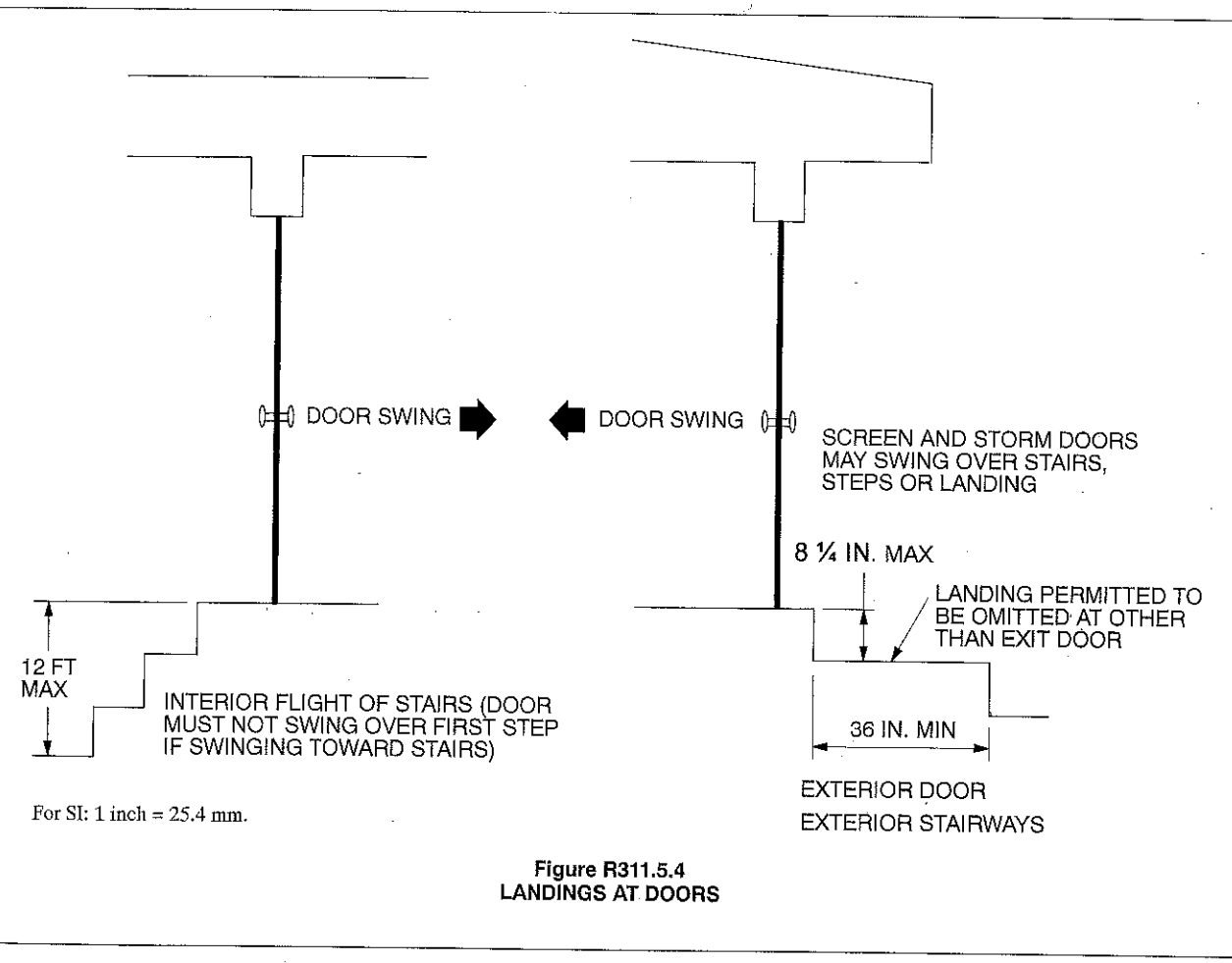


Figure R311.5.4
LANDINGS AT DOORS

R311.5.6 Handrails. Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

❖ One of the best means of creating safer stairs and assisting stairway users is to provide a graspable handrail. This can be used for support and guidance as people travel from one level to the next or to assist in arresting a fall should they slip while they are on the stairs. Other than controlling the people who use stairs by making them pay attention and not carry things while on the stairs, the handrail probably will provide the greatest benefit in increased safety for the least amount of cost. It will never be known how many missteps, accidents, injuries or even fatalities have been prevented by having a properly installed, sturdy handrail.

The *International Residential Code* requires that a handrail be provided on at least one side of any stairway that has four or more risers. The code does not provide any exemption for the elimination of handrails if the stairway has four or more risers.

R311.5.6.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

❖ Where handrails are required, they must be installed at a height of at least 34 inches (864 mm) and not more than 38 inches (965 mm), measured vertically from the nosing of the stair treads. This height should be measured to the top of the handrail at the point that it is directly above the nosing.

R311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of each flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned to a wall or shall terminate in newel posts or safety terminations. Handrails adjacent to a wall shall have a space of not less than $1^1/_2$ inch between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at a level landing.
2. The use of a volute, turnout, starting easing or starting newell shall be permitted over the lowest tread.

❖ This required handrail is to be "continuous" for the length of the stairs. See Commentary Figure R311.5.6.2. The term "continuous" means not only that a single handrail must run from the top riser to the bottom riser, but it also indicates that users should be able to grasp the handrail and maintain their grasp without having to release the rail where it is supported. There is no requirement within the code for a second handrail to be installed, but depending on the design and the placement of the required handrail, Section R316 and the requirement for a guard should be reviewed. The two exceptions to this section create situations where the graspable portion of the handrail may not end up being completely continuous from the top riser to the bottom riser. These traditional situations have routinely been accepted in the past and therefore are permitted by the code.

In view of the desire to make the handrail graspable, and considering the requirement that the handrail be continuous, it is necessary to provide a clear space of at least $1^1/_2$ inches (38 mm) between the handrail and any abutting wall. Under normal handrail use this distance will permit the fingers to slide past any adjacent rough surface that may cause injury, and it will provide an adequate distance so that the handrail may be quickly grabbed to help arrest a fall.

One important aspect of this section is the requirement for the ends of handrails to be returned to the wall or floor or to terminate in some type of end that will not catch clothing or limbs. It is still common to find many locations where handrails into unfinished basements or from raised deck areas do not have the ends properly protected.

R311.5.6.3 Handrail grip size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least $1^1/_4$ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than $6^1/_4$ inches (160 mm) with a maximum cross section of dimension of $2^1/_4$ inches (57 mm).
2. Type II. Handrails with a perimeter greater than $6^1/_4$ inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of $^3/_4$ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least $^5/_{16}$ inch (8 mm) within $^7/_8$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least $^3/_8$ inch (10 mm) to a level that is not less than $1^3/_4$ inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be $1^1/_4$ inches (32 mm) to a maximum of $2^3/_4$ inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

❖ To be effective, a handrail must be of a size that can easily be grasped by the vast majority of users. If it is too large, then it is difficult for a user to get a strong enough grip to provide the needed support. Due to the variations in people's sizes and physical conditions, it is often very difficult to determine which types of commonly used handrails fall into this acceptable range.

The code specifies that the handrail be either a Type I or Type II. A Type I can be either circular or noncircular in shape. See Commentary Figure R311.5.6.3(1) for examples of Type I handrails.

A Type II handrail has a perimeter greater than $6^1/_4$ inches (160 mm) with graspable finger recess area on both sides of the profile. See Commentary Figure R311.6.6.3(2) for the limitations of a Type II handrail.

R311.5.7 Illumination. All stairs shall be provided with illumination in accordance with Section R303.6.

❖ This section provides a reference to the illumination provisions of Section R303.6. The proper illumination of stairways is an important aspect for stairway safety. This lighting can assist users by making sure the level changes do not occur in areas with shadows or in area with contrasting light, which would make the changes difficult to perceive. See the discussion at Section R303.6 for additional information.

R311.5.8 Special stairways. Circular stairways, spiral stairways, winders and bulkhead enclosure stairways shall comply with all requirements of Section R311.5 except as specified below.

❖ Sections R311.5.8.1 and R311.5.8.2 provide exceptions to the general requirements for stairways as prescribed in Section R311.5.

R311.5.8.1 Spiral stairways. Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a $7^1/_2$-inches (190 mm) minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no more than $9^1/_2$ inches (241

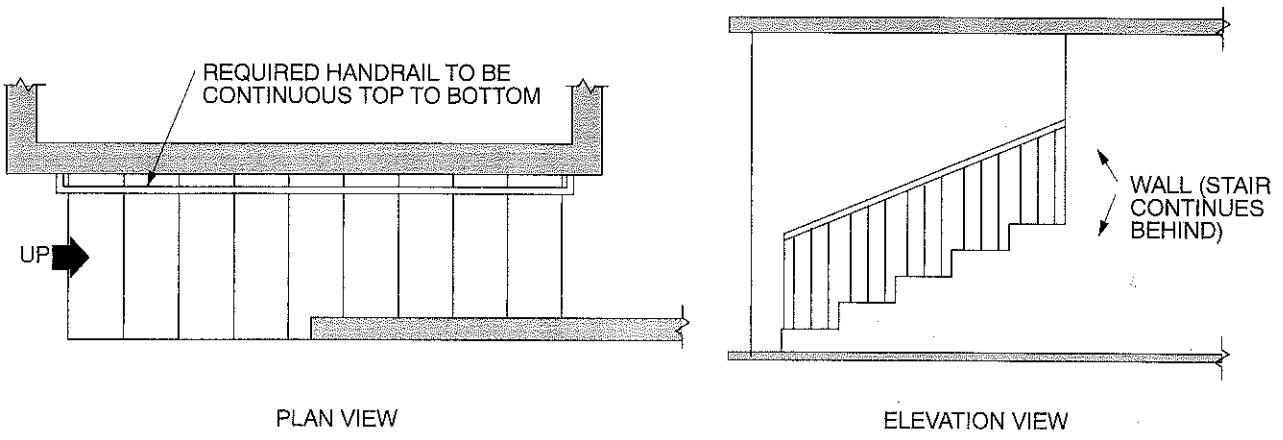
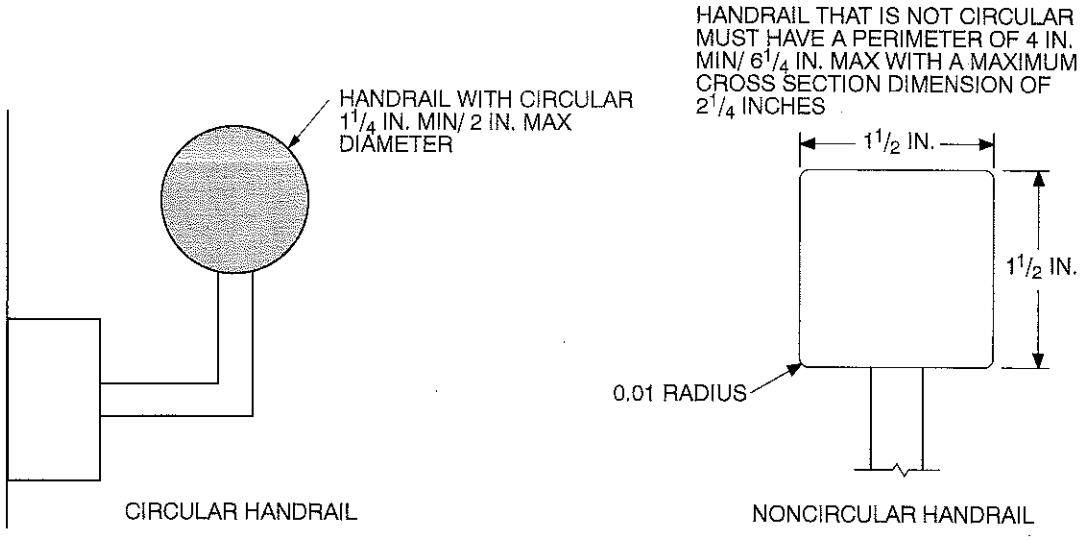


Figure R311.5.6.2
HANDRAILS



For SI: 1 inch = 25.4 mm.

Figure R311.5.6.3(1)
TYPE I HANDRAIL

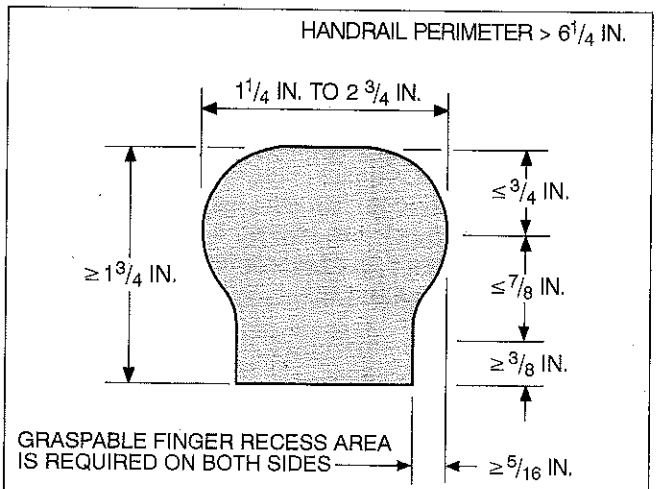


Figure R311.5.6.3(2)
TYPE II HANDRAIL

mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

❖ A spiral stairway is one of several types of special stairs that the code permits. Although a spiral stair may be difficult to use for moving furniture from one level to another, the code places no limitations on its use within the egress system provided it meets the size requirements of this section. A spiral stairway that meets these requirements may provide the only means of egress from a level regardless of the occupant load or size of area served.

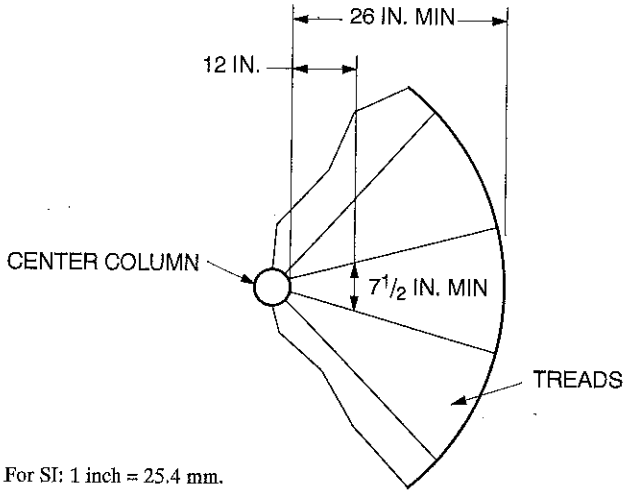
A spiral stairway is one in which the treads radiate from a central pole. Such a stair must provide a clear width of at least 26 inches (660 mm). Each tread must be identical and have a minimum dimension of 7½ inches (191 mm) at a point 12 inches (305 mm) from its narrow end. The stair must have at least 6 feet, 6 inches (1981 mm) of headroom measured vertically from the leading edge of the tread. The rise between treads can be as much as but not more than 9½ inches (241 mm). Commentary Figure R311.5.8.1 depicts the required dimensions of a spiral stairway.

R311.5.8.2 Bulkhead enclosure stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections R311.4.3 and R311.5 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 8 feet (2438 mm), and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

❖ This section exempts exterior bulkhead enclosure stairways from the landing, stairway, and handrail requirements in Chapter 3, and it therefore permits a situation that has been fairly common in some areas. See Commentary Figure R311.5.8.2 for an illustration of the requirements. Since these stairways are not a part of the building's egress system and serve only as a convenient way to access the basement from the exterior, the code exemption will not greatly affect the occupants' safety. Through this exemption, the size of the enclosure that is needed to provide weather protection for the stairway is greatly reduced.

R311.6 Ramps.

❖ Section R311.6 provides the code requirements for ramps, which are defined by this code as being a walking surfaces that have a running slope steeper than 1 unit vertical in 20 units horizontal (5-percent slope).



For SI: 1 inch = 25.4 mm.

Figure R311.5.8.1
SPIRAL STAIRS

R311.6.1 Maximum slope. Ramps shall have a maximum slope of one unit vertical in eight units horizontal (12.5-percent slope).

❖ Section R311.6.1 places a maximum slope of 1 unit vertical in 8 units horizontal (12.5-percent slope) on ramps. This requirement applies to all ramps, including those on circulation routes and those leading to an exit. This maximum slope matches what is permitted by the *International Building Code* for ramps that are not a part of the means of egress. Egress ramps under the IBC have a maximum slope limit of 1:12 due to accessibility requirements.

R311.6.2 Landings required. A minimum 3-foot-by-3-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps,
2. Where doors open onto ramps,
3. Where ramps change direction.

❖ The code requires a minimum 3-foot-by-3-foot (914 mm by 914 mm) landing at three specific locations related to the ramps. These dimensions are not tied to the actual width of the ramp. Item 2, dealing with doors that open onto ramps, calls for a larger size landing if it is also required by Section R311.4.3. The specified landing dimensions coordinate with the requirements for nonaccessible dwelling units, which are found in exceptions in the *International Building Code*.

R311.6.3 Handrails required. Handrails shall be provided on at least one side of all ramps exceeding a slope of one unit vertical in 12 units horizontal (8.33-percent slope).

❖ Where a ramp exceeds a slope of 1 unit vertical in 12 units horizontal (8.33-percent slope) the code requires that a handrail be provided on at least one side to assist ramp users. This provision differs from that in the *International Building Code*, where a slope of 1 unit

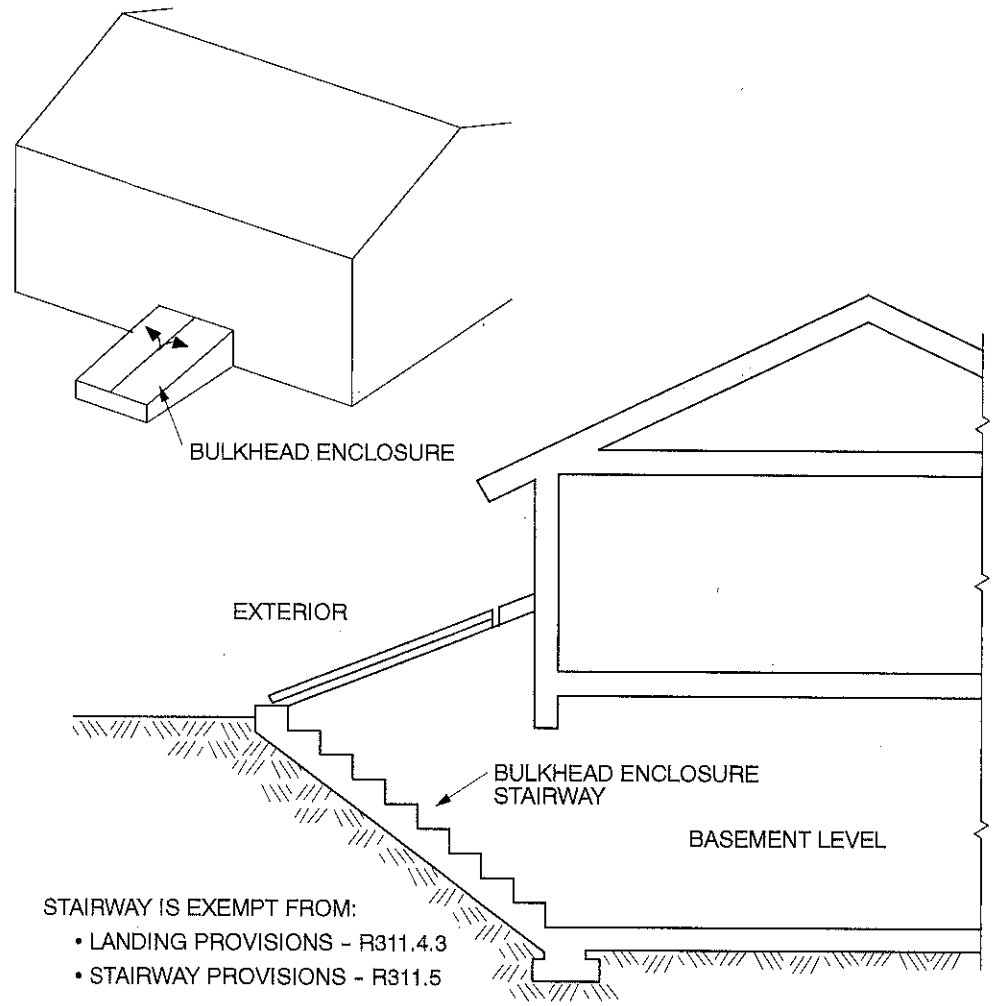


Figure R311.5.8.2
BULKHEAD ENCLOSURE STAIRWAY

vertical in 20 units horizontal (5-percent slope) and a ramp rise of 6 inches (152 mm) establish the limits.

R311.6.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

❖ Where handrails are required, they must be installed at a height of at least 34 inches (864 mm) and not more than 38 inches (965 mm), measured vertically from the finished surface of the ramp slope. This height should be measured to the top of the handrail.

R311.6.3.2 Handrail grip size. Handrails on ramps shall comply with Section R311.5.6.3.

❖ See the commentary for Section R311.5.6.3.

R311.6.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1.5 inches (38 mm) between the wall and the handrails.

❖ The continuity requirement for the ramp handrail is similar to the continuity requirement for the stair handrail. See the commentary for Section R311.5.6.2

SECTION R312
GUARDS

R312.1 Guards required. Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

❖ The guard provisions of this code address the issue of providing protection for occupants from falling off of any type of elevated walking surface. The provisions in Section R312 provide the scoping requirements as well as the general construction requirements for the guards. Code users should be aware that Section R301.5 as well as this section contain the design load criteria for guards.

Section R312.1 establishes the requirement for and the minimum height requirements for guards. The code provides for guard protection at open sides along raised floor or walking surfaces such as those at balconies, mezzanines, stairways, ramps, porches, and landings that are more than 30 inches (762 mm) above the grade or floor surface below. The requirements for guards on stairs are different from other guard requirements in two ways. The first is the scoping requirements that establish the need for the guard, and the second is the required height of the guard. The scoping requirement for guards along open sides of stairs not only applies to the portion of a stairway that is more than 30 inches (762 mm) above the adjacent floor, but it also applies to the entire open side of the stair, including the parts that are less than 30 inches (762 mm) above the floor. This requirement applies to the entire open side of the stairway if any point of the open side is greater than 30 inches (762 mm) in height. See Commentary Figures R312.1(1) and (2) for examples of how this provision is applied.

Where a guard is required, it must be of an adequate height to prevent someone from falling over the edge of the protected areas. It must as well be designed to prevent someone, including small children, from falling through or under the top rail. Therefore, the code establishes 36 inches (914 mm) as the minimum acceptable height for guard protection. While this height matches what has commonly been accepted within residential occupancies, it is less than the 42-inch (1067 mm) height that is generally required by the *International Building Code* and that places the top of the rail above the center of gravity for the vast majority of the general population. The height of a guard located on the open side of a stair is permitted to be a minimum of 34 inches (864 mm) when measured above the nosing of the tread. See Commentary Figure R312.1(3). As mentioned in the discussion of Section R311.5.6.1, this height should be measured to the top of the guard. This 34-inch height (864 mm) is acceptable on the stairs because the handrail height on a stairway is required to be between 34 and 38 inches (864 and 965 mm). Since reduced-height rails have been used on the open sides of stairs for years, the code has continued this practice, so a single element can serve as both a handrail and as a guard.

Insect screening is not of sufficient strength to prevent someone from falling under a top rail. For this reason a guard is required for porches and decks enclosed with insect screening where the walking surface is located more than 30 inches above a floor or grade below.

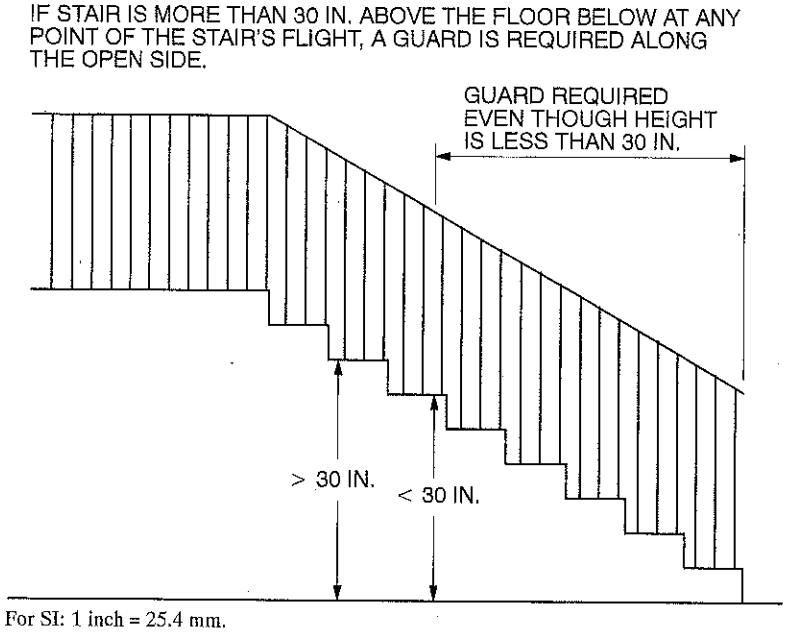
R312.2 Guard opening limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere 4 inches (102mm) or more in diameter.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through.

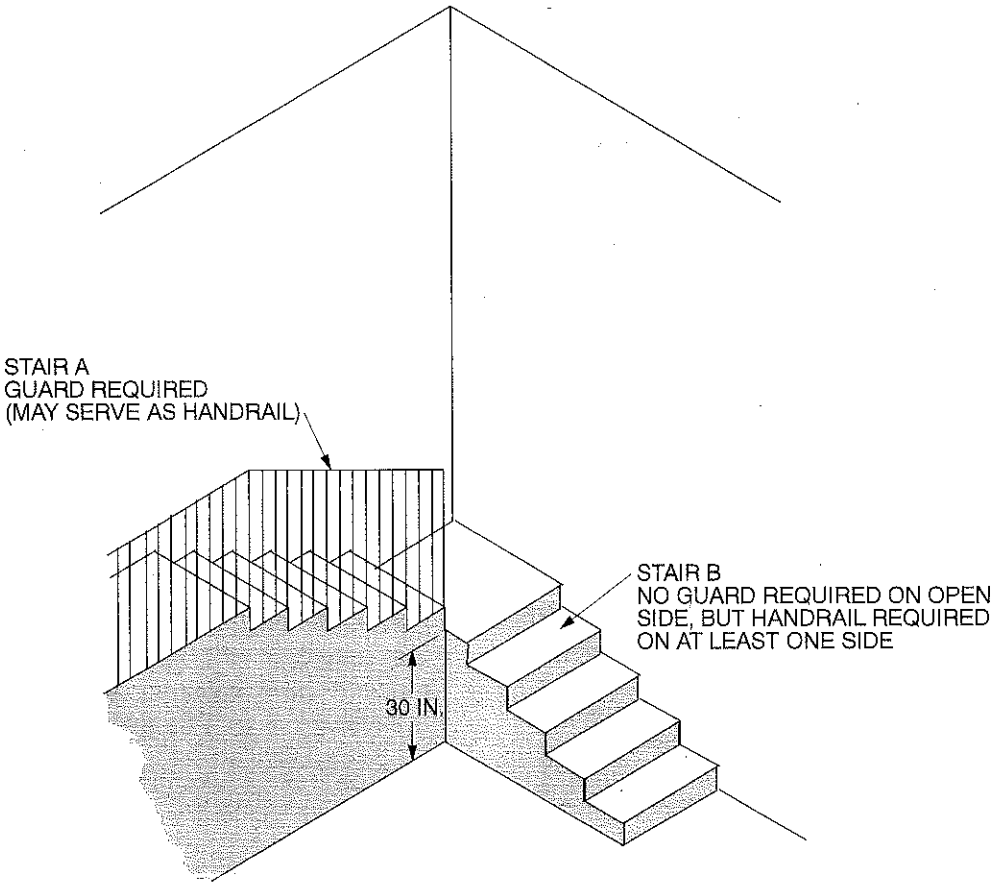
2. Openings for required guards on the sides of stair treads shall not allow a sphere $4^3/_8$ inches (107 mm) to pass through.

❖ Guards must be constructed so that they not only prevent people from falling over them but also prevent smaller occupants such as children from falling through them. To prevent people from slipping through a guard, any required guard would need to have supports, spindles, intermediate rails, or some type of ornamental pattern so that a 4-inch (102 mm) sphere cannot pass through it. This spacing was chosen after many years of discussion and because information was submitted to show that based on the size of a child's head, very few children would be able to crawl or walk through a 4-inch opening. The code does provide two exceptions for this spacing requirement, permitting the use of a 6-inch (152 mm) sphere for the triangular area formed by the riser, tread and bottom rail of a guard along the open side of a stair and 4 3/8 inch (111 mm) sphere for the guard on open side of stair treads. See Commentary Figure R312.2 for an illustration of the guard requirements.



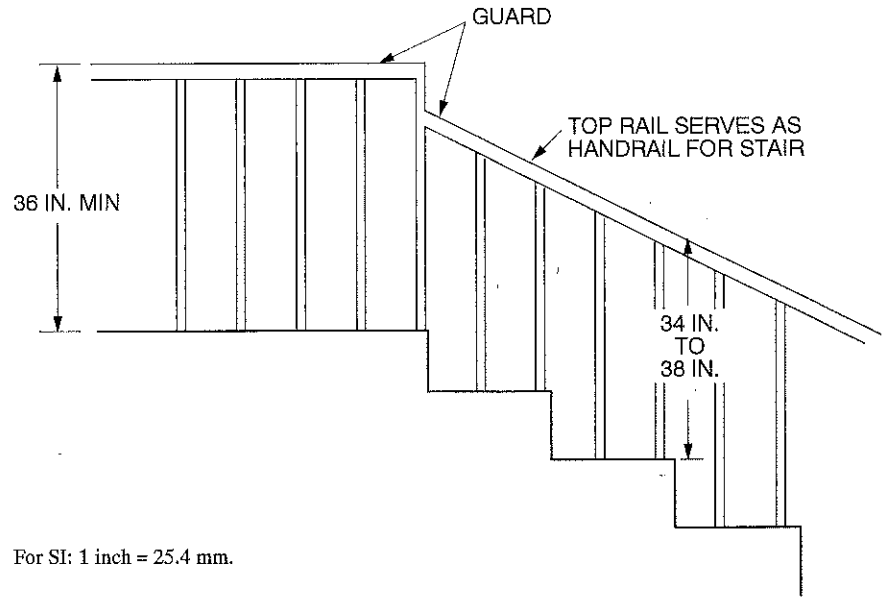
For SI: 1 inch = 25.4 mm.

Figure R312.1(1)
STAIRWAY GUARD



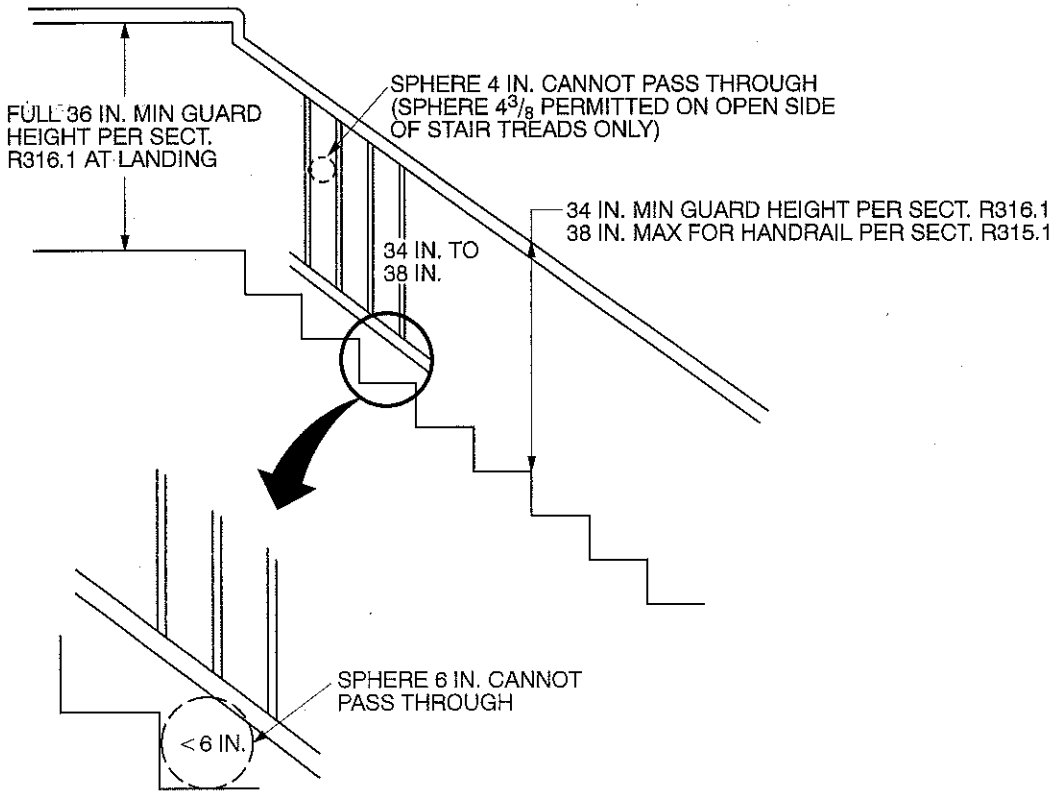
For SI: 1 inch = 25.4 mm.

Figure R312.1(2)
STAIRWAY GUARD



For SI: 1 inch = 25.4 mm.

Figure R312.1(3)
STAIRWAY GUARD



For SI: 1 inch = 25.4 mm.

Figure R312.2
GUARD REQUIREMENTS