These requirements are not applicable to steps that might occur as part of the landscaping or steps leading to spaces that are not normally accessed, such as crawl spaces or nonhabitable attics.

R311.7.1 Width. *Stairways* shall be not less than 36 inches (914 mm) in clear width at all points above the permitted *handrail* height and below the required headroom height. The clear width of *stairways* at and below the *handrail* height, including treads and landings, shall be not less than $31^1/_2$ inches (787 mm) where a *handrail* is installed on one side and 27 inches (698 mm) where *handrails* are installed on both sides.

Exception: The width of *spiral stairways* shall be in accordance with Section R311.7.10.1.

❖ This section requires a minimum stairway width of 36 inches (914 mm). Generally, when the code specifies a required width of a component in the egress system, the width will be the clear, net, usable, unobstructed width. In this case, however, the width is specified as applying only to the area "above the permitted handrail height and below the required headroom height."

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 R311.7.1). The exception and the provisions of Section R311.7.10.1 will permit a minimum width of 26 inches (660 mm) for spiral stairways.

It is important to note that each of the three key elements in the means of egress—hallways, stairways and the egress door—have a required minimum width.

Handrail projections into stairways are addressed by Section R311.7.8.2.

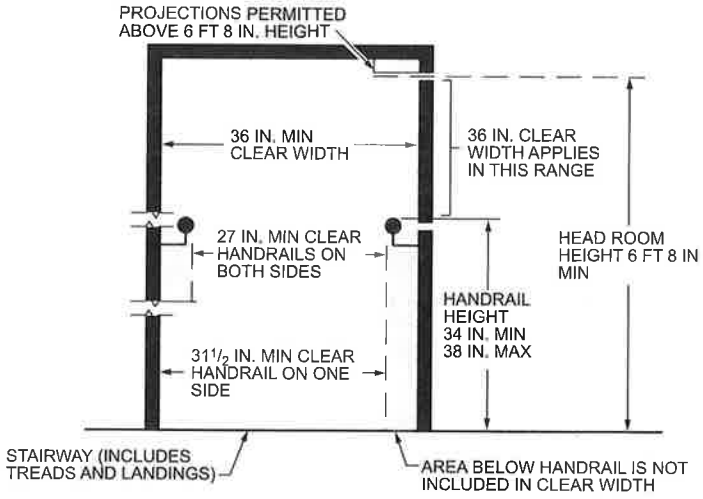
R311.7.2 Headroom. The headroom in *stairways* shall be not less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread *nosing* or from the floor surface of the landing or platform on that portion of the *stairway*.

Exceptions:

1. Where the *nosings* of treads at the side of a flight extend under the edge of a floor opening through which the *stair* passes, the floor opening shall not project horizontally into the required headroom more than $4^3/_4$ inches (121 mm).
2. The headroom for spiral *stairways* shall be in accordance with Section R311.7.10.1.

❖ A minimum headroom clearance of 6 feet 8 inches (2032 mm) is required in connection with every stairway. This includes not only the above-the-tread portion, but also above any landings serving the stairway. The clearance is to be measured vertically above a plane that connects the stair nosings and also vertically above any landing or floor surface that is a part of the stairway [see Commentary Figure R311.7.2(1)]. This specific height requirement overrides the general ceiling height limitations of Section R305 and is modified for spiral stairways by Section R311.7.10.1.

Exception 1 clarifies interpretation and practice by recognizing the common method of stairwell construction in which the open side of a stair is supported by the same structure as the side of the opening through which the stairway passes. The exception allows for common stairways that are slightly wider at the bottom and narrow in width as they ascend through a smaller width opening in the floor above. In this case, the plane of the nosings, from which headroom is determined, at the side of the stairs, extends under the ceiling or joist above at the edge of the floor opening. The exception allows this offset to be a maximum of $4^3/_4$ inches (121 mm) without being considered a projection into the required headroom. It is important to note that this exception only applies at the side of stairs [see Commentary Figure R311.7.2(2)].



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

Commentary Figure R311.7.1
STAIRWAY CLEARANCES

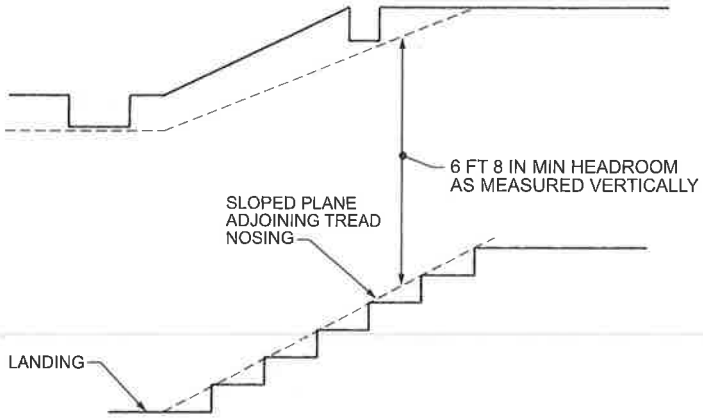
Exception 2 sends the user to Section R311.7.10.1 for headroom requirements at spiral stairways.

R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet 7 inches (3835 mm) between floor levels or landings.

❖ Between landings and platforms, the vertical rise is to be measured from one landing walking surface to another. The limited height provides a reasonable interval for users with physical limitations to rest on a level surface and also serves to alleviate potential negative psychological effects of long and uninterrupted stairway flights. This intermediate landing could also help someone stop if they fell on the stairway.

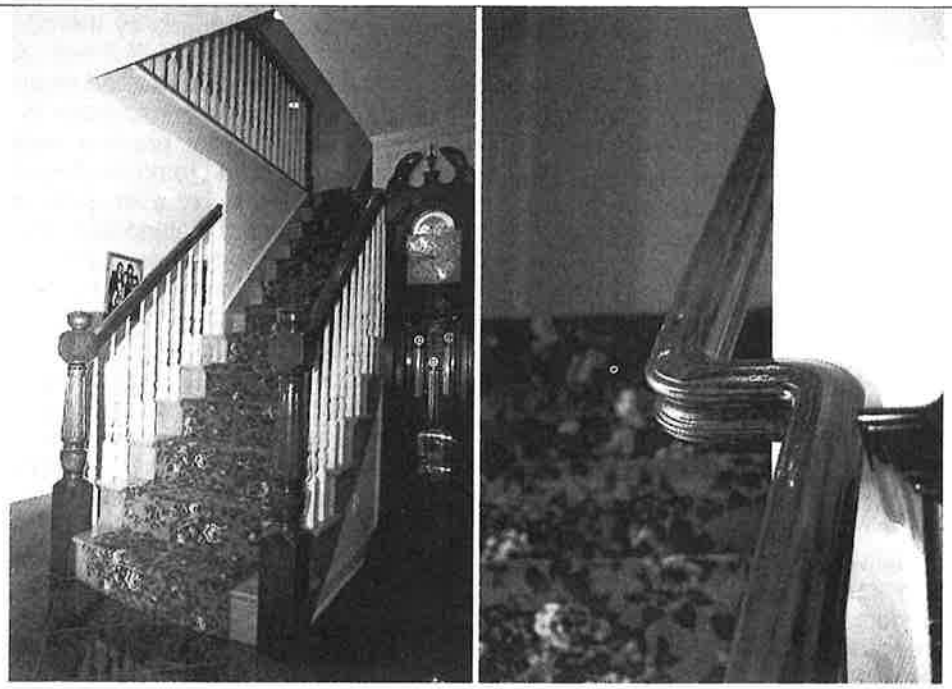
R311.7.4 Walkline. The walkline across *winder* treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where *winders* are adjacent within a flight, the point of the widest clear stair width of the adjacent *winders* shall be used.

❖ The walkline is the code-assumed path of travel along a stair. This concept is essential to establish smooth, consistent travel along stairs that turn or change directions using winder treads. Due to the wide range of anthropometrics of stairway users, there is no one line



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

Commentary Figure R311.7.2(1)
MINIMUM HEADROOM



Commentary Figure R311.7.2(2)
EXAMPLE OF EXCEPTION TO SECTION R311.7.2

that all persons will travel on stairs. However, the code recognizes that a prescribed location of a walkline is essential to safe stair design.

Changes in direction within a given stairway are typically accomplished by one of two means: a landing between stair flights or one or more winder treads. In scenarios where landings are not provided at changes in direction between flights of stairs, changes in the direction of travel at winder treads typically result in an arc for some portion of the walkline. This arc has a center point around which occupants travel, and the arc of the walkline at each of the winder treads at any given turn have the same center point, thus the code uses the term "concentric." As a user ascends or descends a flight, the turning at each winder tread step should be consistent through the turn.

At winder treads, the specific walkline location is determined by measuring 12 inches (305 mm) from the narrow side, or inside radius, of the "clear stair width," or the limit of where the foot might actually be placed at the narrow side of the winder tread [see Commentary Figures R311.7.5.2.1(1) and R311.7.5.2.1(2)]. The portion of treads that are on the side of guardrails or balustrades that are opposite the walkline, for example, are not considered part of the winder treads' "clear stair width." The "clear stair width" is only that portion of the stair width that is clear for passage. Portions of the stair beyond the clear width are inconsequential to use of the stair, consistent travel or location of the walkline.

For winder treads, Section R311.7.5.2.1 prescribes two critical dimensional requirements: a 10-inch minimum tread depth at the walkline and a 6-inch minimum tread depth at the narrow side of the clear width of the winder tread. Regulation at these two points controls the geometry of the turn. In order to establish consistently shaped winders, tread depths at turns must always be determined by measuring between the points formed where the arc that is the walkline, or the assumed arc of travel, intersect the nosings of adjacent treads, as measured horizontally and in a straight line.

The walkline of winder treads is unique as the only line or path of travel where winder tread depth is controlled by the same minimum tread depth as rectangular treads. At all other points, the tread depths of winder and rectangular treads differ.

The winder requirements of Section R311.7.5.2.1 recognize that winder tread depth need not be compared to rectangular tread depths for dimensional uniformity in the same flight if the code-prescribed walkline is located with the intent to provide a reasonable standard to followed by all users.

The language "and parallel to the direction of travel entering and exiting the turn" Is intended to describe the straight portion of the occupant's path along the straight portions of stairways as they approach winder treads at a change in stair travel or direction.

It is important to note that, because winders must have a minimum tread depth of 6 inches (152 mm) in accordance with Section R311.7.5.2.1, they cannot meet at a common point on the walkline side of a guard or wall.

For completely curved stairways, each tread is a winder, the narrow side of each winder tread is an arc when viewed from above, and the walk line at the entire stair is an arc, without any straight portion [see Commentary Figure R311.7.5.2.1(2)].

For additional details related to winder treads, see the commentary to Section R311.7.5.2.1.

R311.7.5 Stair treads and risers. *Stair* treads and *risers* shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

❖ The riser height, tread depth and profile requirements for stairways are specified in Sections R311.7.5.1 through R311.7.5.3. These provisions facilitate smooth and consistent travel. This section provides dimensional ranges and tolerances for the component elements to allow the flexibility required to design and construct a stair or a flight of stairs, which are elements of a stairway. The allowed proportion of maximum riser height and minimum tread depth provides for a maximum angle of ascent, but there is no maximum tread depth or minimum riser height that would define a minimum angle for a stairway. Nor is the proportion of riser height to tread depth compared with the limitations of the length of the user's stride on stairways, which is significantly foreshortened from the user's stride on the level. For this reason, care should be taken when incorporating large tread depths or short risers to proportion the riser height and tread depth to avoid a step that is wide enough to require more than one step to cross or a short narrow step, which can be easily stepped over. With these same limitations for proportion in mind, by controlling the minimum depth of rectangular treads and the minimum depth and angularity of winder treads, these components can control the configuration of the plan of a flight of stairs to provide for smooth and consistent travel. Carpets, rugs and runners, like furniture, are frequently changed by the occupants and are not regulated by the code. For this reason, it is essential that the riser height and tread depth be regulated exclusive of these transitory surfaces to provide an enforceable standard. This practice minimizes the possible variation due to the removal of nonpermanent carpeting throughout the life of a structure and provides a standard enforcement methodology that will provide consistency across the built environment for all users. When owners or occupants add carpeting, rugs or runners they need to be able to add it to all tread and landing surfaces in the stairway. It is important that the tread and landing surfaces are consistent and comply with the code prior to the addition of carpet. This methodology of enforcement makes it unnecessary to reconstruct floor and stair elevations in the stairway when nonpermanent carpet surfaces are changed that do not require a building permit and eliminates the resulting variations in the built environment that will not comply with the tolerance in Sections R311.7.5.1 and R311.7.5.2.

R311.7.5.1 Risers. The *riser* height shall be not more than $7^3/_4$ inches (196 mm). The *riser* height shall be measured vertically between leading edges of the adjacent treads. The greatest *riser* height within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm). *Risers* shall be verti-

cal or sloped from the underside of the *nosing* of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open *risers*, openings located more than 30 inches (762 mm), as measured vertically, to the floor or *grade* below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on *spiral stairways*.
2. The *riser* height of *spiral stairways* shall be in accordance with Section R311.7.10.1.

❖ The code establishes that the maximum riser height is $7^3/_4$ inches (197 mm). The provisions specify how the riser height is to be measured [see Commentary Figure R311.7.5.1(1)]. The uniformity of risers and treads is a safety factor in any flight of stairs. The section of a stairway leading from one landing to the next is defined as a flight of stairs. This is important because variations in excess of the $^3/_8$-inch (9.5 mm) tolerance could interfere with the rhythm of the stair user. It is true that adequate attention to the use of the stair can compensate for substantial variations in risers and treads; however, the stair user does not always give the necessary attention.

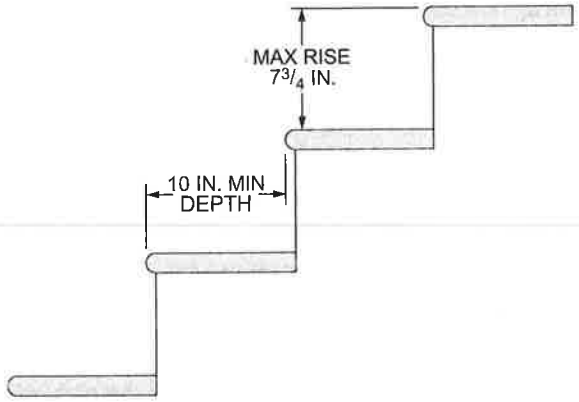
To obtain the best uniformity possible in a flight of stairs, the maximum variation between the highest and lowest risers is limited to $^3/_8$ inch (9.5 mm). This tolerance is not to be used as a design variation, but its inclusion is in recognition that normal construction practices give rise to variables that make it impossible to get exactly identical riser heights and tread dimensions in constructing a stairway. Therefore, the code allows the variation indicated in Commentary Figure R311.7.5.1(2).

The risers must be vertical or slope back, effectively providing a wider overall tread depth. The code does not require solid risers, but riser openings that are located more than 30 inches above the floor or grade below must not allow the passage of a 4-inch-diameter sphere. This is consistent with the guard provisions of Section R312, where a 4-inch (102 mm) sphere is used to determine compliance.

For spiral stairways, the openings between adjacent treads are not limited and riser heights are regulated by Section R311.7.10.1.

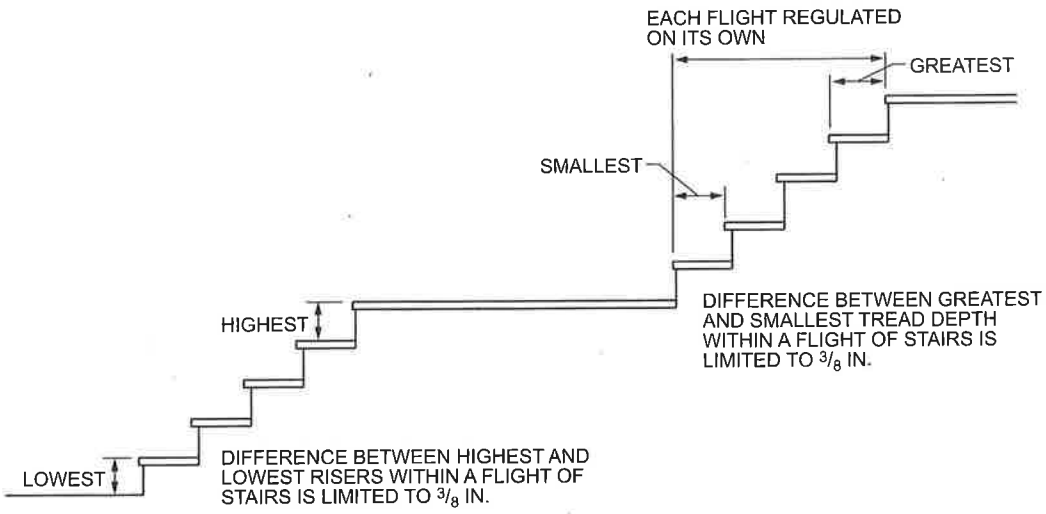
R311.7.5.2 Treads. The tread depth shall be not less than 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm).

❖ The code establishes that the minimum tread depth is 10 inches (254 mm). The provisions specify how the tread depth is to be measured [see Commentary Figure R311.7.5.1(1)]. To obtain the best uniformity possible in a flight of stairs, the maximum variation between



For SI: 1 inch = 25.4 mm.

Commentary Figure R311.7.5.1(1)
CONVENTIONAL STAIRWAY



For SI: 1 inch = 25.4 mm.

Commentary Figure R311.7.5.1(2)
STAIR TOLERANCES

the greatest and smallest tread depth is limited to $^3/_8$ inch (9.5 mm). See the commentary to Section R311.7.5.1 for the discussion on uniformity.

R311.7.5.2.1 Winder treads. *Winder* treads shall have a tread depth of not less than 10 inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. *Winder* treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the *stair*. Within any flight of stairs, the largest *winder* tread depth at the walkline shall not exceed the smallest *winder* tread by more than $^3/_8$ inch (9.5 mm). Consistently shaped *winders* at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within $^3/_8$ inch (9.5 mm) of the rectangular tread depth.

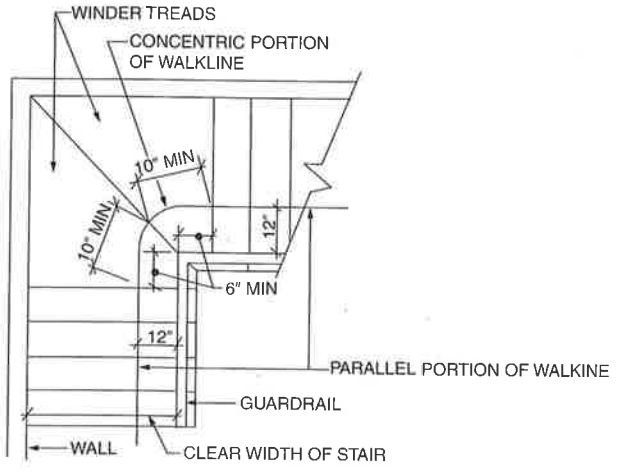
Exception: The tread depth at *spiral stairways* shall be in accordance with Section R311.7.10.1.

❖ The same criterion for rectangular treads applies to winder treads. However, the depth is to be measured as the horizontal distance between the points where the nosing of the adjacent treads intersects with the walkline. The location of the walkline is defined in Section R311.7.4. Winder treads must have a minimum depth of 6 inches (152 mm) at any point. A stairway may have straight treads and winder treads within the same flight. If winders are used, they can either be used for an entire flight of a stairway, as a portion of a flight to provide a change of direction or to form a curved stairway. Because winder treads are used to change the direction of the stair it is important that winders comply with the specified dimensional criteria. See Commentary Figure R311.7.5.2.1(1) for examples of winders used as a portion of a stairway at a change of direction. See Commentary Figure R311.7.5.2.1(2) for an example of winders used to form a circular stairway. Rectangular treads can be used in combination with winder treads. The goal is to allow the foot placement along the walkline to be consistent along the length of the flight. For spiral stairs, tread depth is regulated by Section R311.7.10.1. See the commentary to Section R311.7.4 for additional winder tread details.

R311.7.5.3 Nosings. *Nosings* at treads, landings and floors of *stairways* shall have a radius of curvature at the *nosing* not greater than $^9/_{16}$ inch (14 mm) or a bevel not greater than $^1/_2$ inch (12.7 mm). A *nosing* projection not less than $^3/_4$ inch (19 mm) and not more than $1^1/_4$ inches (32 mm) shall be provided on *stairways*. The greatest *nosing* projection shall not exceed the smallest *nosing* projection by more than $^3/_8$ inch (9.5 mm) within a *stairway*.

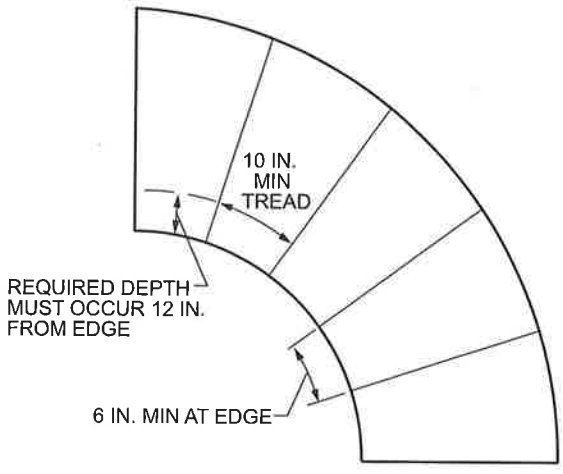
Exception: A *nosing* projection is not required where the tread depth is not less than 11 inches (279 mm).

❖ The sectional parameters of the components of a step or stair contribute to stairway safety. The radius or bevel of the nosing eases the otherwise square edge of the tread and prevents irregular chipping that can become a maintenance issue seriously affecting the safe use of the stair and eliminates a sharp square edge that will cause greater injury in falls. A radius or bevel allows light modeling, reflecting light at various angles, providing a certain contrast from the other surfaces of the stair, allowing easier visual location of the start of the tread surface. The maximum radius of curvature at the leading edge of the tread is intended to allow descending foot placement on a surface that does not pitch the foot forward or allow the ball of the foot to slide off the treads and ascending foot placement to slide on to the tread without catching on a square edge. If a stairway design uses a beveled nosing configuration, the bevel is limited to a depth of $^1/_2$ inch (12.7 mm). A nosing projection allows the descending foot to be placed further forward on the tread and the heel to then clear the nosing of the tread above as it swings down in an arc landing further away from the riser on the tread that is effectively deeper than if no nosing projection is used. Nosing projections are so common in stair design that they are noticed by users when absent as affecting their gait and anticipated clearance for their heels from the riser in descent. A nosing projection may also be accommodated by slanting the riser under the tread above. The nosing projection is between $^3/_4$-inch minimum (19 mm) and $1^1/_4$- inch (32 mm) maximum (see Commentary



For SI: 1 inch = 25.4 mm.

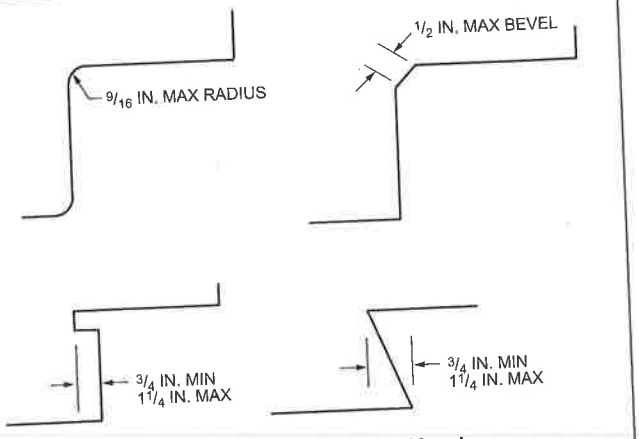
Commentary Figure R311.7.5.2.1(1)
WINDERS



For SI: 1 inch = 25.4 mm.

Commentary Figure R311.7.5.2.1(2)
WINDERS USED FOR CIRCULAR STAIRWAY

Figure R311.7.5.3). It is critical that all tread and landing nosings associated with each step in the stairway be uniform to ensure that the user does not experience an effective change in tread depth outside the $^3/_8$ inch (9.5 mm) between stories. Critical to this understanding is that tread depth is regulated by measuring between the nosing edges of treads or a tread and a landing. The lack of a uniform nosing at the top landing of a flight is a serious safety problem that may not be apparent in initial rough inspections. Treads with a tread depth of at least 11 inches (279 mm) are allowed with or without a nosing projection.



For SI: 1 inch = 25.4 mm, 1 degree = 0.01749 rad.

Commentary Figure R311.7.5.3
NOSINGS

R311.7.5.4 Exterior plastic composite stair treads. *Plastic composite* exterior stair treads shall comply with the provisions of this section and Section R507.2.2.

❖ Stair treads made of wood/plastic composite materials must meet the requirements for installation, labeling and compliance of ASTM D7032 in accordance with Section R507.2.2, in addition to the requirements for stairways.

R311.7.6 Landings for stairways. There shall be a floor or landing at the top and bottom of each *stairway*. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the *stairway* has a straight run, the depth in the direction of travel shall be not less than 36 inches (914 mm).

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

❖ A landing is required at the top and bottom of each stairway; however, a landing is not required at the top of interior stairways, including at stairways in an enclosed garage, if a door does not swing over the stairway [see Commentary Figure R311.7.6(1)]. Section R311.7.3 states that flights must be interrupted by a landing or floor such that they do not have a total rise of more than 12 feet (3658 mm).

The width of landings for stairways is measured perpendicular to the direction of travel. It is not the intent to require specifically shaped landings. Landings may have curved or segmented periphery edges, provided that the width perpendicular to the direction of travel is not less than the width of the stairway served. For a straight stairway run, the minimum dimension of 36 inches (914 mm) in the direction of travel is intended to provide a minimum depth at the landing that cannot be overstepped in descent of a straight run stairway. Landings that are square or rectangular serve to limit the minimum angle of turn of a landing to 90 degrees (1.57 rad) for at least 36 inches (914 mm). Landings for turns of 90 degrees (1.57 rad) or less or of any shape are permitted, provided that the depth of the tread at the walkline and the total area of the landing are the same as a quarter circle with a radius the same as the stairway width. See Commentary Figure R311.7.6(2) for an example.

R311.7.7 Stairway walking surface. The walking surface of treads and landings of *stairways* shall be sloped not steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

Exception: Where the surface of a landing is required elsewhere in the code to drain surface water, the walking surface of the landing shall be sloped not steeper than 1 unit vertical in 20 units horizontal (5-percent slope) in the direction of travel.

❖ 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 use of such a slope, called a "wash," is a common technique used on all stairs to allow the nosing to be at a lower elevation than the remainder of the tread surface. This technique of building the flight to a slightly shorter total rise than the actual condition slopes the entire flight forward and better accommodates the placement of the user's foot as it slides onto the tread. It also serves to prevent long-term wear and tear at the nosing limiting problematic maintenance and safety issues. This section provides a limit of the slope to maintain a safe walking surface. This requirement applies to all stairs and landings, both exterior and interior.

This exception is intended to allow for a steeper slope on the landing, typically at the bottom, where required for parking areas (Section R309.1) and surface drainage (Section R401.3).

R311.7.8 Handrails. *Handrails* shall be provided on not less than one side of each flight of stairs with four or more *risers*.

❖ Requiring handrails increases safety when used by occupants while ascending and descending stairs. Handrails are used for guidance, stabilization, pulling and to assist in arresting a fall. This section states that a handrail must be provided on at least one side of flights of four or more risers. Handrails may be provided on both sides and this eliminates choosing the best side to securely attach the handrail. Otherwise, the generally preferred location is for use by the right hand in descent when feasible. Sections R311.7.8.1 through R311.7.8.3 contain provisions essential to the height, continuity and grip size of the handrail provided.

R311.7.8.1 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).

Exceptions:

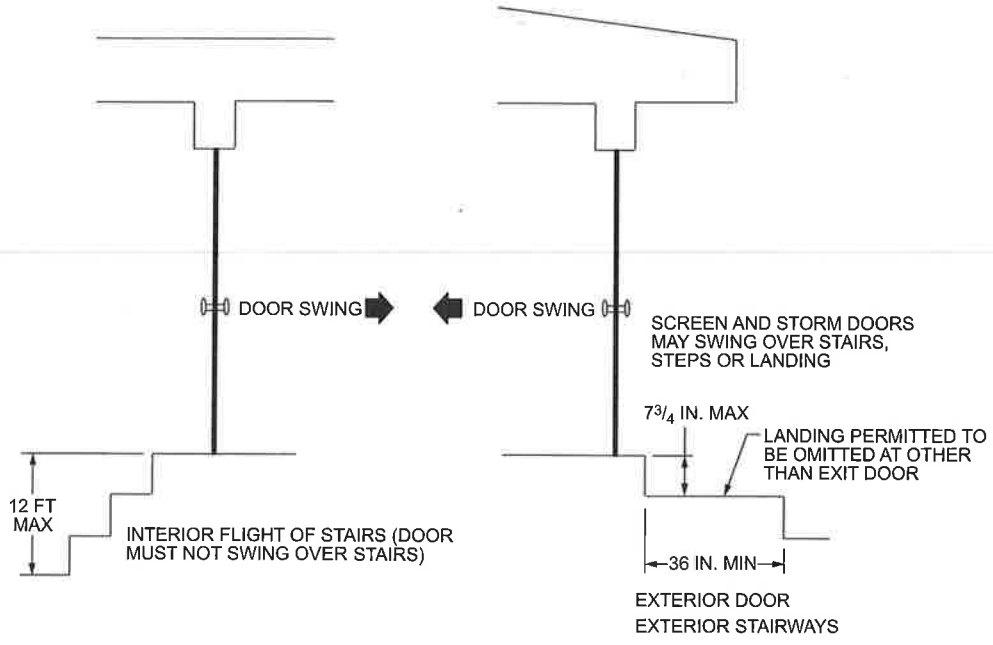
1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. Where *handrail* fittings or bendings are used to provide continuous transition between flights, transitions at *winder* treads, the transition from *handrail* to *guard*, or used at the start of a flight, the *handrail* height at the fittings or bendings shall be permitted to exceed 38 inches (965 mm).

❖ Where handrails are required, they must be installed at a height of not less than 34 inches (864 mm) and not more than 38 inches (965 mm). This height is to be measured vertically to the top of the handrail from the plane adjoining the tread nosings of the flight or the surface of the ramp slope. Exception 1 allows common starting fittings used as terminals over the lowest tread to fall outside the required height range. Exception 2 allows transition fittings to exceed the required height when used to provide a continuous rail at changes in the pitch of the rail within the stairway.

It must be noted that a guard is the vertical barrier that stops a fall. A handrail is a horizontal or sloped rail for guidance or support. A handrail can be placed on top of a guard (Section 312.1.2).

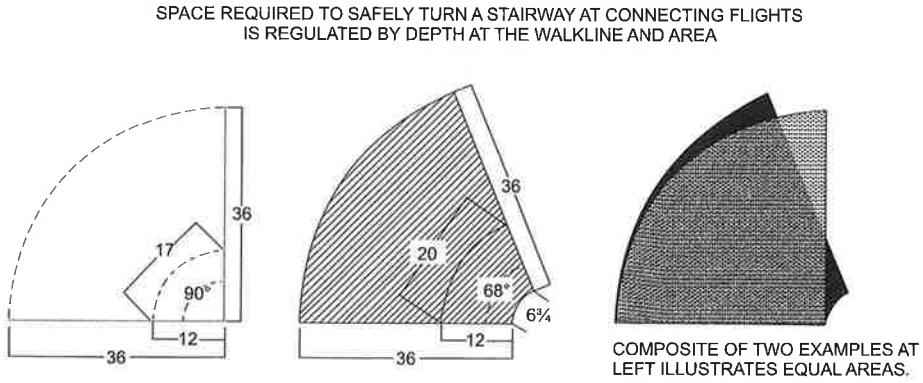
R311.7.8.2 Handrail projection. *Handrails* shall not project more than $4^1/_2$ inches (114 mm) on either side of the *stairway*.

Exception: Where *nosings* of landings, floors or passing flights project into the *stairway* reducing the clearance at passing *handrails*, *handrails* shall project not more than $6^1/_2$



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

Commentary Figure R311.7.6(1)
LANDINGS AT STAIRS AND DOORS



Commentary Figure R311.7.6(2)
EXAMPLE OF LANDING OF SHAPES OTHER THAN SQUARE OR RECTANGULAR

inches (165 mm) into the *stairway*, provided that the stair width and *handrail* clearance are not reduced to less than that required.

❖ The $4^1/_2$-inch maximum handrail projection into stairways is related to the stair width requirements of Section R311.7.1. See the commentary to Section R311.7.1 for more details.

At dogleg/switchback stairs, the skirt board and tread return of the flight above often project into the stair below approximately 2 inches (51 mm), reducing the required clearance of passing handrails. A similar condition occurs where landing treads and fascias at floors or landings project into the stairway where handrails pass. The exception provides a maximum limit of the handrail projection to provide the required minimum handrail clearance and assures the required stair width is not reduced.

R311.7.8.3 Handrail clearance. *Handrails* adjacent to a wall shall have a space of not less than $1^1/_2$ inches (38 mm) between the wall and the *handrails*.

❖ This provision requires that there is adequate room between handrails and any nearby walls, guards or other elements so that handrails can be readily grasped and provide their intended level of fall protection.

R311.7.8.4 Continuity. *Handrails* shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. A *handrail* end shall be returned continuous to itself or toward a wall, guard or walking surface, or shall terminate to a post.

Exceptions:

1. *Handrail* continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

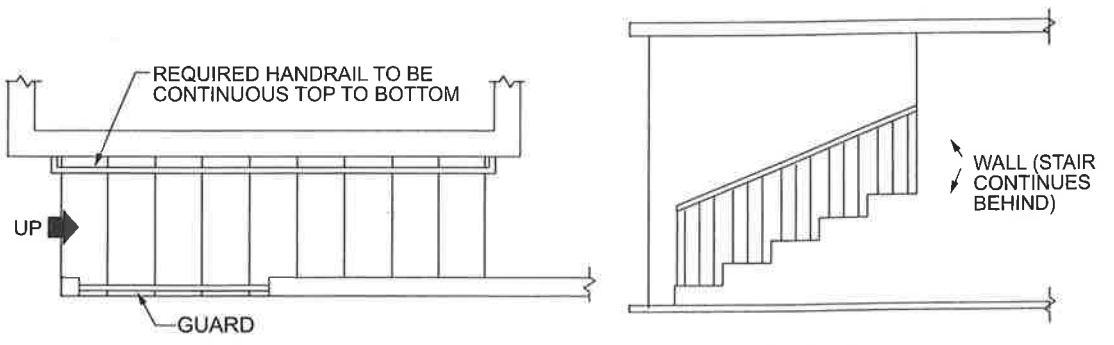
❖ The required handrail is to be continuous for the length of the flight, with exceptions. Where stairway flights are separated by landings or floor levels, handrails are not required at the landing (see Commentary Figure R311.7.8.4). The term "continuous" means not only that a single handrail must run 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 installation of a second handrail but depending on the design and the placement of the required handrail, the requirement for a guard should be reviewed (see Section R312). The two exceptions to this section create situations where the graspable portion of the handrail may not be completely continuous from the top riser to the bottom riser. These traditional situations are well known to the occupants and have not been shown to represent a safety hazard requiring their restriction. Exception 1 also allows newel posts at winders to interrupt handrail continuity.

The ends of handrails are to be returned to the wall, floor or newel post, or to end in some type of terminal that will not catch clothing or limbs.

R311.7.8.5 Grip size. 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 not less than $1^1/_4$ inches (32 mm) and not greater than 2 inches (51 mm). If the *handrail* is not circular, it shall have a perimeter of not less than 4 inches (102 mm) and not greater than $6^1/_4$ inches (160 mm) and a cross section of not more than $2^1/_4$ inches (57 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).
2. Type II. *Handrails* with a perimeter greater than $6^1/_4$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within $^3/_4$ inch (19 mm) measured vertically from the tallest portion of the profile and have a depth of not less than $^5/_{16}$ inch (8 mm) within $^7/_8$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $^3/_8$ 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 width of the *handrail* above the recess shall be not less than $1^1/_4$ inches (32 mm) and not more than $2^3/_4$ inches (70 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).

❖ To be effective, a handrail must be easily grasped by the vast majority of users. If it is too large, it is difficult for a user to get a strong enough grip to provide the needed support. If it is too small, the fingers wrap and



Commentary Figure R311.7.8.4
HANDRAILS

interfere with the thumb and palm and cannot close in a sufficient grip. For this reason, Type I rails have minimum and maximum perimeters to restrict their use to the effective size range. Tests have proven that it is beneficial to have graspable recesses for the fingers and opposing thumb such that wider and taller shapes can provide graspability comparable to rails within the Type I size range limitations. The Type II handrail requirements provide details for the location and depth of the recess as it relates to the variables of crown height and width to ensure that the design is of a graspable shape. The mountings of smaller profiles can cause interference, as well. Care should be taken to minimize the interference caused by brackets and balusters supporting profiles that require the bottom mounting surface to be grasped.

The code specifies that the handrail be either Type I or Type II or be equivalently graspable. A Type I handrail can be either circular or noncircular in shape. See Commentary Figure R311.7.8.5(1) for examples of Type I handrails.

A Type II handrail has a perimeter larger than $6^1/_4$ inches (160 mm) with graspable finger recess area on both sides of the profile. See Commentary Figure R311.7.8.5(2) for the limitations of a Type II handrail.

R311.7.8.6 Exterior plastic composite handrails. *Plastic composite* exterior *handrails* shall comply with the requirements of Section R507.2.2.

❖ Handrails made of wood/plastic composite materials must meet the requirements for installation and labeling and comply with ASTM D7032 in accordance with Section R507.2.2, in addition to the general requirements for handrails in this section.

R311.7.9 Illumination. *Stairways* shall be provided with illumination in accordance with Sections R303.7 and R303.8.

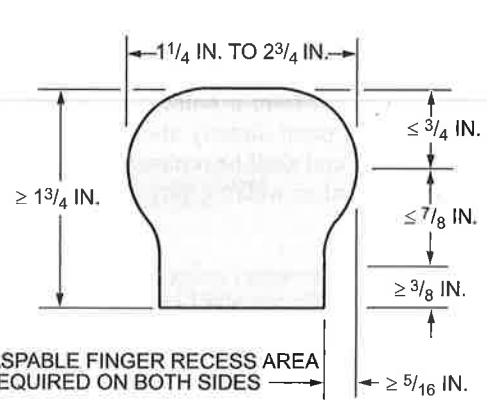
❖ This section contains references to the illumination provisions of Sections R303.7 and R303.8 for minimal lighting on interior and exterior stairways. The proper illumination of stairways is an important part of stairway safety. This lighting can assist users by making sure the level changes do not occur in areas with shadows or in contrasting light, which would make them difficult to see. See the commentary to Sections R303.7 and R303.8 for additional information.

R311.7.10 Special stairways. *Spiral stairways* and bulkhead enclosure *stairways* shall comply with the requirements of Section R311.7 except as specified in Sections R311.7.10.1 and R311.7.10.2.

❖ Spiral stairways (Section R311.7.10.1) and bulkhead enclosed stairways (Section R311.7.10.2) are exceptions to the general requirements for stairways.

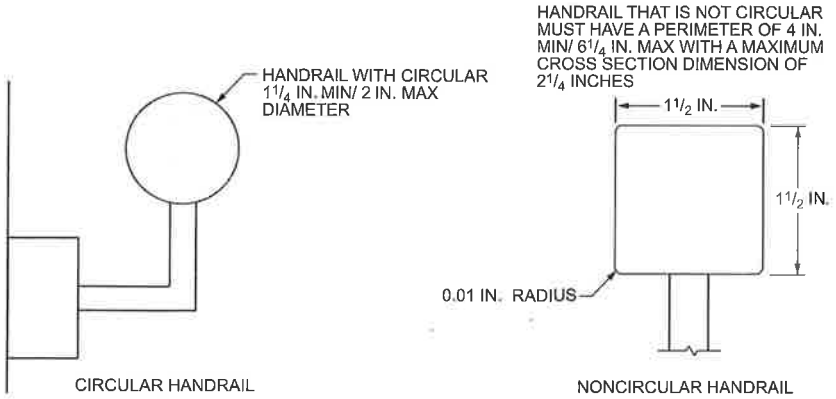
R311.7.10.1 Spiral stairways. The clear width at and below the *handrails* at *spiral stairways* shall be not less than 26 inches (660 mm) and the walkline radius shall be not greater than $24^1/_2$ inches (622 mm). Each tread shall have a depth of not less than $6\ ^3/_4$ inches (171 mm) at the walkline. Treads shall be identical, and the rise shall be not more than $9^1/_2$ inches (241 mm). Headroom shall be not less than 6 feet 6 inches (1982 mm).

❖ A spiral stairway is one of two types of special stairs that the code permits. Although a spiral stair may be difficult to use to move furniture from one level to



For SI: 1 inch = 25.4 mm.

Commentary Figure R311.7.8.5(2)
TYPE II HANDRAIL



For SI: 1 inch = 25.4 mm.

Commentary Figure R311.7.8.5(1)
TYPE I HANDRAIL