

SECTION 1011 STAIRWAYS

1011.1 General.

Stairways serving occupied portions of a building shall comply with the requirements of [Sections 1011.2](#) through [1011.13](#). *Alternating tread devices* shall comply with [Section 1011.14](#). Ship's ladders shall comply with [Section 1011.15](#). Ladders shall comply with [Section 1011.16](#).

Exception: Within rooms or spaces used for assembly purposes, stepped aisles shall comply with [Section 1029](#).

❖ It is important for stairway safety that all stairways meet the provisions in this section. This would include all elevation changes using stairways; everything from one riser to multiple flights and landings between stories (see the definitions for “[Stair](#).” and “[Stairway](#)” in [Chapter 2](#)). These provisions will be applicable for interior exit access stairways, interior exit stairways and exterior exit stairways, as well as any steps along the paths for exit access or exit discharge. It is intended that this section be applicable to required stairways as well as what can be called “convenience” stairways.

It is important to understand the terminology. Exit stairways are stairways that provide a protected path of travel between the exit access and the exit discharge. Interior exit stairways are required to be enclosed in accordance with [Section 1022](#). Exterior exit stairways are protected by the exterior wall of the building and must comply with [Section 1027](#). Exit access stairways are typically unenclosed interior stairways and comply with [Section 1019](#) when they provide access between stories. Exit access travel distance stops at an exit stairway enclosure, but includes any travel down an exit access stairway. Stairways that are outside and provide a route from the level of exit discharge to grade are considered part of the exit discharge. See the commentary in [Chapter 2](#) for the defined term, “[Exit discharge, level of.](#)”

[Sections 1011.2](#) through [1011.13](#) provide criteria for the typical stairway. Special provisions are provided for curved stairways ([Section 1011.9](#)), spiral stairways ([Section 1011.10](#)), and stairways to the roof for fire department access and for elevator equipment service ([Sections 1011.12](#) and [1011.13](#)).

Items that provide vertical access similar to stairways are also addressed in this section: alternating tread devices ([Section 1011.14](#)), ship's ladders ([Section 1011.15](#)) and ladders ([Section 1011.16](#)). These devices are only permitted to provide access to very limited spaces.

The exception indicates that stepped aisles (previously called aisle stairs) are addressed in [Section 1029](#). Having this exception at the beginning of the stairway section negated the need for repeated exceptions throughout the stairway provisions. While both stairways and stepped aisles are a series of treads and risers, how occupants move on and off and configurations are very different. Occupants leave and join stepped aisles along the entire run, while occupants only enter the stairways at the top and bottom. Stepped aisles have center handrails with breaks to allow for access into the seating, while most stairways have handrails on both sides. Stepped aisles can be nonuniform in some locations to allow for parabolic seating bowls, while with stairways, uniform tread and riser configurations are required. [Section 1029](#) should be used for

stepped aisles between and immediately adjacent to seating or where the steps are a direct continuation of the stepped aisles and lead to a level cross aisle or floor. [Section 1011](#) is used for stairways that lead from the balcony, concourse or cross aisle to a floor level above or below the seating areas (see [Sections 1011.5.2](#), [1011.5.4](#) and [1011.6](#)).

1011.2 Width and capacity.

The required capacity of *stairways* shall be determined as specified in [Section 1005.1](#), but the minimum width shall be not less than 44 inches (1118 mm). See [Section 1009.3](#) for accessible *means of egress stairways*.

Exceptions:

1. *Stairways* serving an *occupant load* of less than 50 shall have a width of not less than 36 inches (914 mm).
2. *Spiral stairways* as provided for in [Section 1011.10](#).
3. Where an incline platform lift or stairway chairlift is installed on *stairways* serving occupancies in Group R-3, or within *dwelling units* in occupancies in Group R-2, a clear passage width not less than 20 inches (508 mm) shall be provided. Where the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

❖ To provide adequate space for occupants traveling in opposite directions and to permit the intended full egress capacity to be developed, minimum dimensions are dictated for means of egress stairways. A minimum width of 44 inches (1118 mm) is required for stairway construction to permit two columns of users to travel in the same or opposite directions. The reference to [Section 1005.1](#) is for the determination of stairway width based on the occupant load it will serve (i.e, capacity). The larger of the two widths is to be used.

Exception 1 recognizes the relatively small occupant loads of less than 50 that permit a staggered file of users when traveling in the same direction. When traveling in opposite directions, one column of users must stop their ascent (or descent) to permit the opposite column to continue. Again, considering the relatively small occupant loads, any disruption of orderly flow will be infrequent. The use of this exception is limited to buildings where the entire occupant load of each upper story and/or basement is less than 50.

Exception 2 permits a spiral stairway to have a minimum width of 26 inches (660 mm) when it conforms to [Section 1011.10](#), on the basis that the configuration of a spiral stairway will allow nothing other than single-file travel.

Exception 3 addresses the use of inclined platform lifts or stairway chairlifts for individual dwelling units. For clarification on the types of lifts, see the commentary to [Section 1109.8](#). Both types of lifts may be installed to aid persons with mobility impairments in their homes. The code and [ASME A18.1](#) allow for a reduction in the width of the stair to a minimum of 20 inches (508

mm) of clear passageway to be maintained on a stairway where a lift is located. If a portion of the lift, such as a platform or seat, can be folded, the minimum clear dimension is to be measured from the folded position. If the lift cannot be folded, then the 20 inches (508 mm) is measured from the fixed position. The track for these lifts typically extends 9 to 12 inches (229 to 305 mm) from the wall, making the 20-inch (508 mm) clear measurement actually 24 to 27 inches (610 to 686 mm) from the edge of the track.

The code does not have any specific provisions for where incline platform lifts are utilized along stairways in locations other than within dwelling units. [Section 1109.8](#) limits the use of platform lifts in new construction to mainly areas with minimal occupant loads or where elevators and ramps are impracticable. IEBC [Sections 410.8.3](#) and [705.1.3](#) allows for platform lifts anywhere in existing buildings in order to gain accessibility for persons with mobility impairments. When in the closed and off position, the platform lifts should not block the clear width required for the stairway, or use of the handrails. The industry is currently working on different options to address the concern that the lift may be in operation during an event that requires evacuation.

1011.3 Headroom.

Stairways shall have a headroom clearance of not less than 80 inches (2032 mm) measured vertically from a line connecting the edge of the *nosings*. Such headroom shall be continuous above the *stairway* to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the *stairway* and landing.

Exceptions:

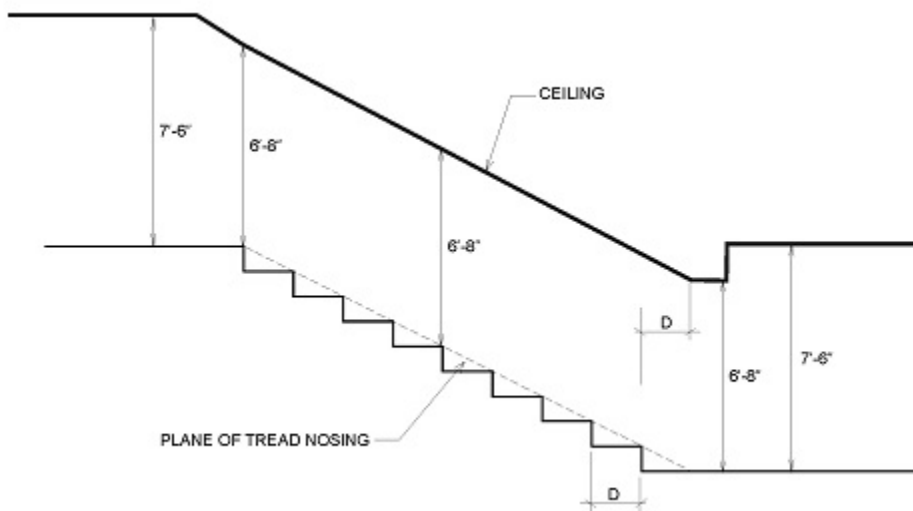
1. *Spiral stairways* complying with [Section 1011.10](#) are permitted a 78-inch (1981 mm) headroom clearance.
2. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual *dwelling units* in Group R-2 occupancies; 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 be allowed to project horizontally into the required headroom not more than 4³/₄ inches (121 mm).

❖ This headroom requirement is necessary to avoid an obstruction to orderly flow and to provide visibility to the users so that the desired path of travel can be planned and negotiated. Height is a vertical measurement above every point along the stairway stepping and walking surfaces, with minimum height measured vertically from the tread nosing or from the surface of a landing or platform up to the ceiling [see Commentary [Figure 1011.3\(1\)](#)].

[Sections 1003.2](#) and [1208.2](#) require a minimum ceiling height within a room of 7 feet, 6 inches (2307 mm). A bulkhead or doorway at the bottom of the stairway would be allowed to meet the minimum headroom height of 80 inches (2032 mm), as permitted in [Section 1003.3](#).

Exception 1, allowing for a clear headroom of 6 feet, 6 inches (1981 mm) for spiral stairs, correlates with the provisions of [Section 1011.10](#).

Exception 2 recognizes a common method of stairwell construction in which the stringer on the open side of a stair is supported by the same floor joists or wall that supports the edge of the opening through which the stairway passes to the floor above, thus resulting in the stairway being wider at the lower portion than at the top portion. In this case, headroom is not required for a distance of up to $4\frac{3}{4}$ inches (121 mm) measured horizontally from the edge of the opening above to the handrail or guard system, which limits the clear width on the lower open sides of the stairway. The $4\frac{3}{4}$ inches (121 mm) maximum is derived from the finished width of a typical 2 by 4 supporting wall and is not critical to obstructing orderly flow or visibility in the desired path of travel [see Commentary [Figure 1011.3\(2\)](#)].



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

Figure 1011.3(1)

STAIRWAY HEADROOM REQUIREMENTS



Figure 1011.3(2)

EXAMPLE OF [SECTION 1011.3](#), EXCEPTION 2

1011.4 Walkline.

The walkline across *winder* treads shall be concentric to the direction of travel through the turn and located 12 inches (305 mm) from the side where the *winders* are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear *stair* width at the walking surface of the *winder*. Where *winders* are adjacent within the *flight*, the point of the widest clear *stair* width of the adjacent *winders* shall be used.

❖ This requirement is essential for smooth, consistent travel on stairs that turn with winder treads. It provides a standard location for the regulation of the uniform tread depth of winders. Because of the wide range of anthropometrics of stairway users, there is no one line that all persons will travel on stairs; however, the code recognizes a standard location of a walkline is essential to design and enforcement. Each footfall of the user through the turn can be associated with an arc to describe the path traveled. As a user ascends or descends the flight, the turning at each step should be consistent through the turn. The walkline is established concentric to, or having the same center (approximately parallel) as, the arc of travel of the user. The tread depth dimension at the walkline is one of two tread depths across the width of the stair at which winder tread depth is regulated, cited in [Section 1011.5.2](#). The second is the minimum tread depth. Regulation at these two points controls the angularity of the turn and the configuration of the flight. In order to establish consistently shaped winders, tread depths must always be measured concentric to the arc of travel. The walkline 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. However, Exception 2 of [Section 1011.5.4](#) recognizes that winder tread depth need not be compared to rectangular tread depths for dimensional uniformity in the same flight because the location of the walkline is chosen for the purpose of providing a standard and cannot be specific to the variety of actual paths followed by all users. This specific line location is determined by measuring along each nosing edge 12 inches (305 mm) from the extreme of the clear width of the stair at the surface of the winder tread or the limit of where the foot might be placed in use of the stair. If adjacent winders are present, the point of the widest clear stair width at the surface of the tread in the group of adjacent consecutive winders is used to provide the reference from which the 12-inch (305 mm) dimension will be measured along each nosing. The tread depth may be determined by measuring between adjacent nosings at these determined intersections of the nosings with the walkline. It is important to note that 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 not consequential to use of the stair, consistent travel or location of the walkline.

1011.5 Stair treads and risers.

Stair treads and risers shall comply with [Sections 1011.5.1](#) through [1011.5.5.3](#).

❖ The provisions for treads and risers contribute to the efficient use of the stairway, facilitating 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 that are elements of a stairway. The allowed proportion of maximum riser height and minimum tread depth provide for a maximum angle of ascent but there is no maximum tread depth to consider with the 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 larger tread depths and controlling the point at which a tread might be wide enough to require more than one step to cross, which can vary significantly when considering ascent and descent movement patterns. Especially in areas where all segments of the public might use the stairs, those persons requiring two smaller sequential steps to cross the tread would progress at significantly different rates than those who might be able to stretch or jump and lead to dangerous complications, especially in egress. Of equal significance is the use of shorter risers without increasing tread depth resulting in a proportion that could cause overstepping. With these same limitations for proportion in mind, however, 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.

[Section 1011.5.1](#) provides for consistent identification of the surfaces that are to be measured. This is as critical to the users' experience throughout the built environment as it is to determining all the dimensions in this section as they must relate to each other and the ultimate design and construction of a safe stairway.

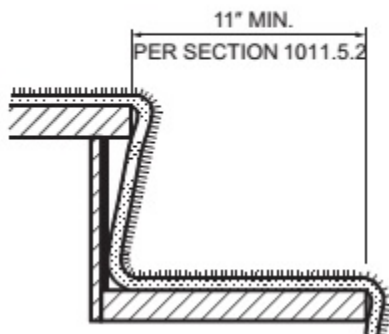
The remaining sections address the uniformity and essential attributes of the tread and riser. Of particular note is the nosing or leading edge of the tread. The nosing shape and projection affect the determination of the tread depth and the riser height and are regulated at all steps throughout the stairway, including the nosings at landings to provide for smooth and consistent travel. Furthermore, the line connecting the nosings is used to determine handrail height, guard height and headroom, causing consistent nosings to be a dependent integral of every element of the stairway design, construction and regulation.

1011.5.1 Dimension reference surfaces.

For the purpose of this section, all dimensions are exclusive of carpets, rugs or runners.

❖ 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 because of the removal of nonpermanent carpeting throughout the life of a structure and provides a standard enforcement methodology that will provide consistency across the build environment for all users. When owners or occupants add carpeting, rugs or runners, they need 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 [Section 1011.5.4](#) (see Commentary [Figure 1011.5.1](#)).

TREAD DEPTH = HORIZONTAL DIMENSION
FROM LEADING EDGE TO LEADING EDGE



For SI: 1 inch = 25.4 mm.

Figure 1011.5.1

TREAD DEPTH MEASUREMENT

1011.5.2 Riser height and tread depth.

Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured vertically between the *nosings* of adjacent treads. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's *nosing*. *Winder* treads shall have a minimum tread depth of 11 inches (279 mm) between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the *stair*.

Exceptions:

1. *Spiral stairways* in accordance with [Section 1011.10](#).
2. *Stairways* connecting stepped *aisles* to cross *aisles* or concourses shall be permitted to use the riser/tread dimension in [Section 1029.13.2](#).
3. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual *dwelling units* in Group R-2 occupancies; the maximum riser height shall be 7³/₄ inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum *winder* tread depth at the walkline shall be 10 inches (254 mm); and the minimum *windertread* depth shall be 6 inches (152 mm). A *nosing* projection not less than ³/₄ inch (19.1 mm) but not more than 1¹/₄ inches (32 mm) shall be provided on *stairways* with solid risers where the tread depth is less than 11 inches (279 mm).
4. See [Section 403.1](#) of the *International Existing Building Code* for the replacement of existing *stairways*.
5. In Group I-3 facilities, *stairways* providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m²) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).

❖ The riser height—the vertical dimension from tread surface to tread surface or tread surface to landing surface—is typically limited to not more than 7 inches (178 mm) or less than 4 inches (102 mm). The minimum tread depth—the horizontal distance from the leading edge (nosing) of one tread to the leading edge (nosing) of the next adjacent tread or landing—is typically limited to not less than 11 inches (279 mm) [see Commentary [Figure 1011.5.2](#)]. The minimum tread depth of 11 inches (279 mm) is intended to accommodate the largest shoe size found in 95 percent of the adult population, allowing for an appropriate overhang of the foot beyond the tread nosing while descending a stairway. Tread depths under 11 inches (279 mm) could cause a larger overhang (depending on the size of the foot) and could force users with larger feet to increase the angle of their foot to the line of travel while descending a stairway. Based on the probability of adequate foot placement, the rate of misstep with various step sizes and consideration for the user's comfort and energy expenditure, it was agreed that the 11-inch (279 mm) minimum tread depth and maximum 7-inch (178 mm) riser height resulted in the reasonable proportion of riser

height and tread depth for stairway construction. A minimum riser height of 4 inches (102 mm) is considered to allow the visual identification of the presence of the riser in ascent or descent.

The precise location of rectangular tread depth and riser measurements is to be perpendicular to the tread's nosing or leading edge. This is to duplicate the user's anticipated foot placement in traveling the stairway.

The size for a winder tread is also considered for proper foot placement along the walkline [see Commentary [Figure 1011.9](#) and the commentary for [Section 1011.4](#)]. The dimensional requirements are consistent with the straight tread.

The exceptions apply only to the extent of the text of each exception. For example, the entire text of [Section 1011.5.2](#) is set aside for spiral stairways conforming to [Section 1011.10](#) (see Exception 3). However, Exception 3 allows a different maximum riser and minimum tread under limited conditions, but retains the minimum riser height and measurement method of [Section 1011.5.2](#).

The requirements for dimensional uniformity are found in [Sections 1011.5.4](#) and [1011.5.4.1](#).

Exception 1 is for spiral staircases, a unique type of stairway. [Section 1011.5.2](#) is not applicable to this stair type, again because of construction issues and limited applications. For a discussion on spiral staircases, see [Section 1011.10](#).

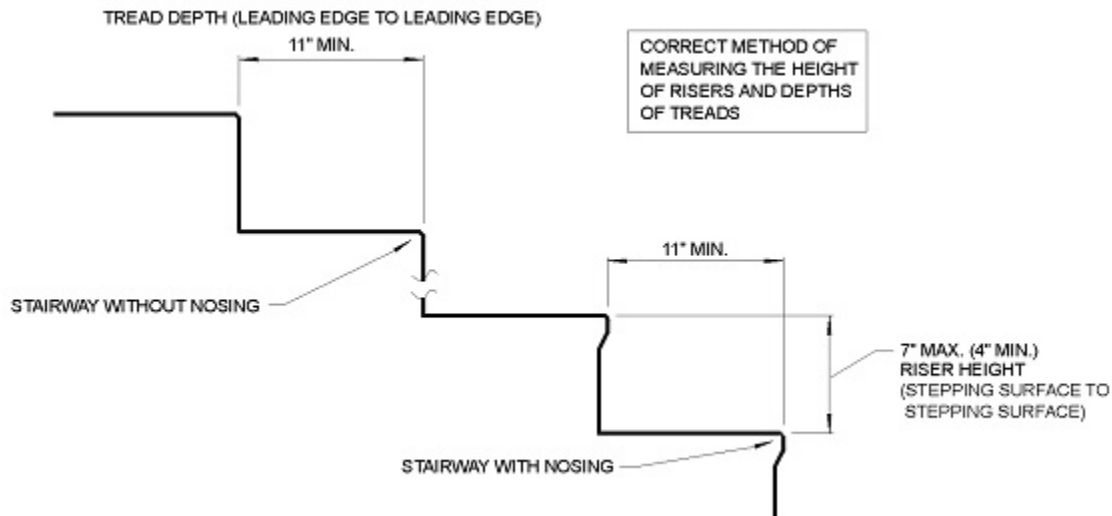
Exception 2 provides a practical exception where assembly facilities are designed for viewing. See [Sections 1029.13](#) through [1029.13.2.4](#) for assembly stepped aisle-walking surfaces. This exception is limited to when stairways are a direct continuation of the path of travel from the level cross aisle to the stepped aisles. It is not permitted for other stairways within the assembly space.

Exception 3 allows revisions to the 7 inches/11 inches (178 mm/279 mm) riser/tread requirements for Group R-3 and any associated utility (such as barns, connected garages or detached garages) and within individual units of Group R-2 and their associated utility areas (such as attached garages). This change is allowed because of the low occupant load and the high degree of occupant familiarity with the stairways. When this exception is taken for stairways that have solid risers, each tread is required to have a nosing projection with a minimum dimension of 3/4 inch (19.1 mm) and maximum dimension of 1 1/4 inches (32 mm) where the tread depth is less than 11 inches (279 mm). Nosing projections are created where the nosing of the tread above extends beyond the trailing edge of the tread below or when a solid riser is angled under the tread above and connected to the trailing edge of the tread below. Nosing projections are not required for residential stairs with open risers and 10-inch (254 mm) treads. A nosing projection provides a greater stepping surface for those ascending the stairway. For users descending the stairway, the nosing projection allows the toe of the foot to be placed further away from the riser above, providing the necessary clearance for the heel of the foot as it swings down in an arc to its position on the tread (see Commentary [Figure 1011.5.3](#)).

Exception 4 allows for the replacement of an existing stair. Where a change of occupancy would require compliance with current standards, this exception allows a stairway that may be steeper

than that permitted, provided it does not constitute a hazard [see *International Existing Building Code*® (IEBC®) [Section 403.1](#)].

Exception 5 allows steeper stairs in spaces of not more than 250 square feet (23 m²) in correctional facilities (Group I-3) with a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm) because of the minimal occupant load and the familiarity of the users with the stairway. Although not stated in this exception, utilizing a nosing projection to provide effective tread depth, as stated in Exception 3 for tread depths less than 11 inches (279 mm), is a good design practice.



For SI: 1 inch = 25.4 mm.

Figure 1011.5.2

TREAD/RISER DIMENSIONS

1011.5.3 Winder treads.

Winder treads are not permitted in *means of egress stairways* except within a *dwelling unit*.

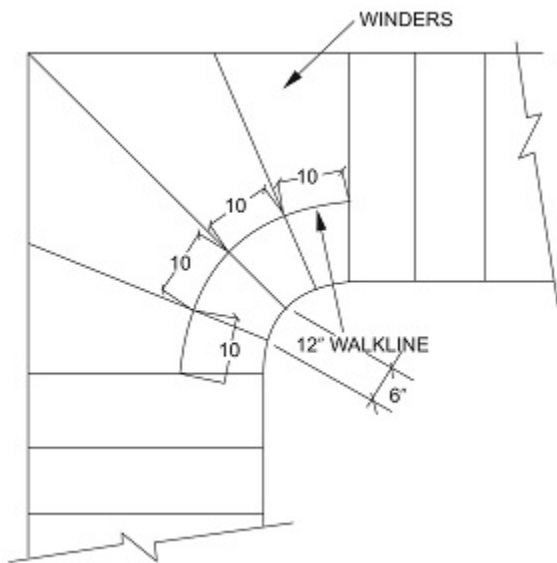
Exceptions:

1. Curved *stairways* in accordance with [Section 1011.9](#).
2. *Spiral stairways* in accordance with [Section 1011.10](#).

❖ The intent of this section is to coordinate the general provisions for stairway tread and riser dimensions in [Section 1011.5.2](#) with the provisions for winder treads permitted in curved and spiral stairways (see [Sections 1011.9](#) and [1011.10](#)). Winders are permitted in means of egress stairways within dwelling units where occupant loads are smaller and occupants have increased familiarity (see Commentary [Figure 1011.5.3](#) and [Section 1011.5.2](#), Exception 3). This is consistent with provisions in the [International Residential Code](#)® (IRC®).

Winders are used to change the direction of a flight by introducing a consistent incremental turn associated with each tread. The risk of injury in the use of stairways constructed with winders is considered to be greater than for stairways constructed as straight runs where users may be restricted by the presence of other users limiting visual clues or influencing the rate of travel. Additional user attention in the turn and the aid of the turn in arresting falls similar to turns at landings is also understood to negate this.

The employment of winders in stairway construction may necessitate the change of the user's gait in both ascent and descent where the tread depth of the winder is not equal to the tread depth of any rectangular treads in the same flight. For example, a person descending a straight flight of stairs will develop a particular gait conforming to the proportion of the riser height and tread depth that will be consistent throughout the flight. However, in a flight that includes winders and rectangular treads, the user must accommodate a change in the proportion of the riser height and tread depth as determined by the path of travel chosen. Visual clues are important to the users' instinctive responses to alter the path of travel, the length of the stride, or a combination of both that may result in nonconcentric movement. To ensure users of the visual clues necessary to alter their gait and limit the need to alter the path of travel in conditions of higher occupant loading, flights with winders must meet the specific safety provisions listed for curved or spiral stairways unless they are within a dwelling unit.



For SI: 1 inch = 25.4 mm.

Figure 1011.5.3

STAIR WINDERS WITHIN A DWELLING

1011.5.4 Dimensional uniformity.

Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed $\frac{3}{8}$ inch (9.5 mm) in any *flight* of *stairs*. The greatest *winder* tread depth at the walkline within any *flight* of *stairs* shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

Exceptions:

1. *Stairways* connecting stepped *aisles* to cross *aisles* or concourses shall be permitted to comply with the dimensional nonuniformity in [Section 1029.13.2](#).
2. Consistently shaped *winders*, complying with [Section 1011.5](#), differing from rectangular treads in the same *flight* of *stairs*.
3. Nonuniform riser dimension complying with [Section 1011.5.4.1](#).

❖ Dimensional uniformity in the design and construction of stairways contributes to safe stairway use. When ascending or descending a stair, users establish a gait based on the instinctive expectation or “feel” that each step taken will be at the same height and will land in approximately the same position on the tread as the previous steps in the pattern. A change in tread or riser dimensions in a stairway flight in excess of the allowed dimensional tolerance can break the rhythm and cause a misstep, stumbling or physical strain that may result in a fall or serious injury. Therefore, this section limits the dimensional variations to a tolerance of $\frac{3}{8}$ inch (9.5 mm) between the largest and smallest riser or tread dimension in a flight of stairs. A “flight” of stairs is defined as a run of stairs between landings.

For special conditions of construction and as a practical matter, this section allows some greater variations in stairway tread and riser dimensions than the general limitations specified above.

Exception 1 provides a practical exception where assembly facilities are designed for viewing. See [Sections 1029.13](#) through [1029.13.2.4](#) for assembly stepped aisle walking surfaces. This exception is limited to when stairways are a direct continuation of the path of travel from the level cross aisle to the stepped aisles. It is not permitted for other stairways within the assembly space.

Exception 2 addresses winder treads, which must be consistent along the walkline (see Commentary [Figure 1011.5.4](#)) when compared to other winder treads in the same flight but are not required to meet the tolerance when compared to the uniform dimension of rectangular treads in the same flight.

Exception 3 is in recognition of the situation where a stairway moves down to a surface that slopes up or down perpendicular to the stairway. See the commentary to Section 1105.4.1.

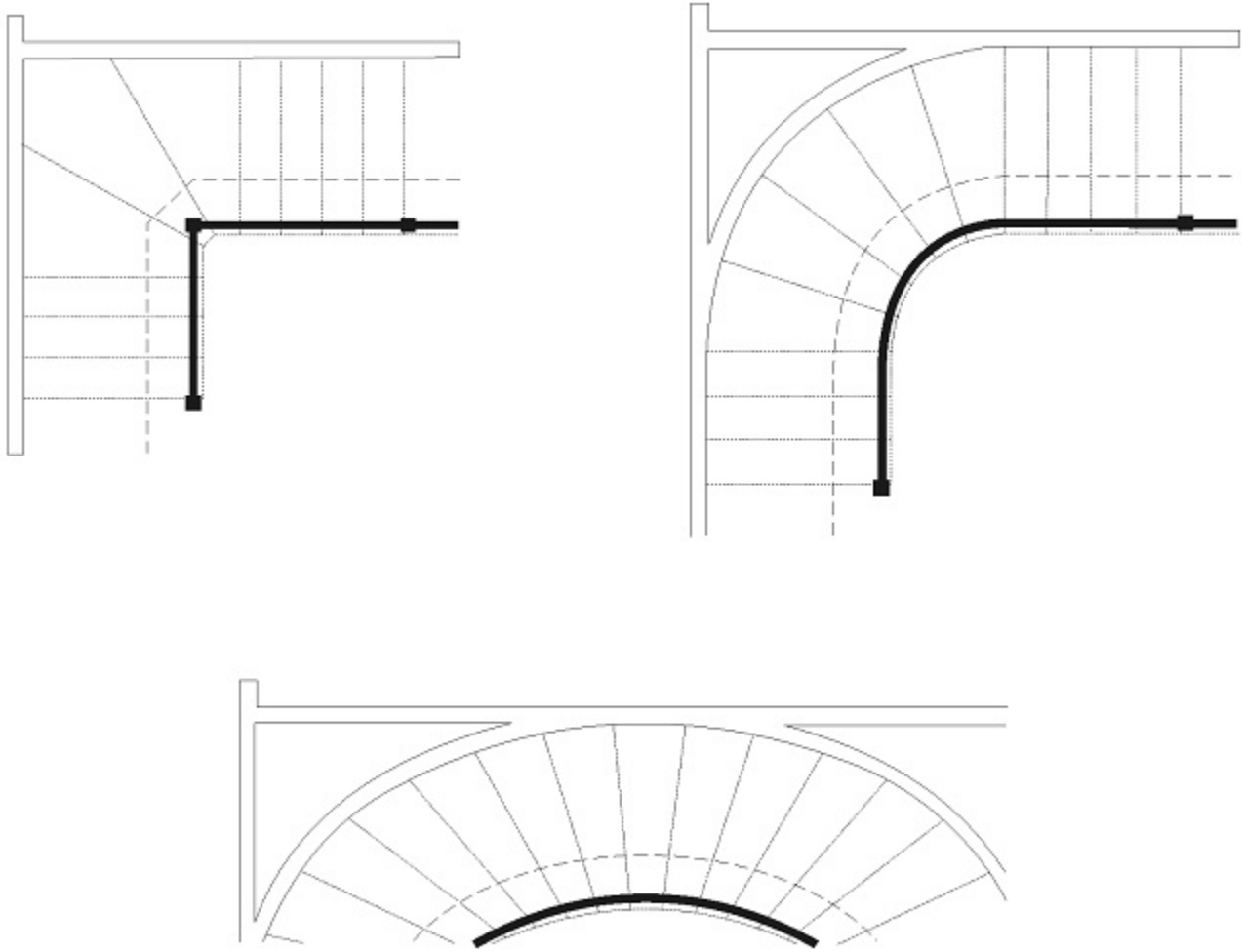


Figure 1011.5.4

CONSISTENTLY SHAPED WINDERS

1011.5.4.1 Nonuniform height risers.

Where the bottom or top riser adjoins a sloping *public way*, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8-percent slope) of *stair* width. The *nosings* or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other *nosings* marking provided on the *stair flight*. The distinctive marking stripe shall be visible in descent of the *stair* and shall have a slip-resistant surface. Marking stripes shall have a width of not less than 1 inch (25 mm) but not more than 2 inches (51 mm).

❖ This section addresses the situation where the bottom riser of a flight of stairways meets a sloped landing, such as a public way, walk or driveway (see Commentary [Figure 1011.5.4.1](#)). Because the sidewalk landing is sloped perpendicular to the stairway run, stepping off the bottom tread on one side will result in a higher riser than stepping off the bottom tread on the other side. This is permitted provided the bottom riser is marked so that someone using the stairs will be aware of the hazard of a nonuniform riser.

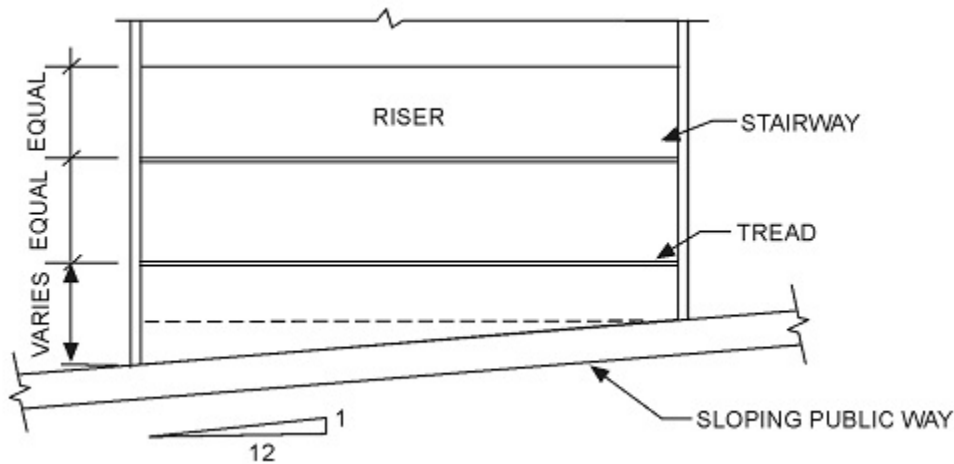


Figure 1011.5.4.1

SLOPED LANDING

1011.5.5 Nosing and riser profile.

Nosings shall have a curvature or bevel of not less than $\frac{1}{16}$ inch (1.6 mm) but not more than $\frac{9}{16}$ inch (14.3 mm) from the foremost projection of the tread. Risers shall be solid and vertical or sloped under the tread above from the underside of the *nosing* above at an angle not more than 30 degrees (0.52 rad) from the vertical.

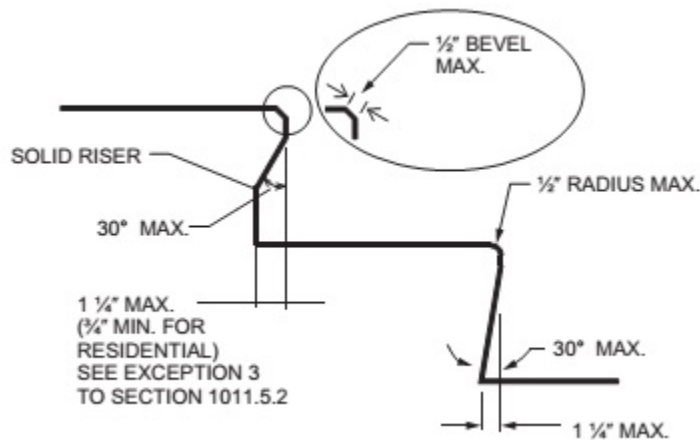
❖ The profiles of treads and risers contribute to stairway safety. The radius or bevel of the nosing eases the otherwise square edge of the tread and prevents irregular chipping and wear that can become a maintenance issue and seriously affect the safe use of the stair. The minimum curvature or bevel of $\frac{1}{16}$ inch (1.6 mm) eliminates a sharp square edge that will cause greater injury in falls and provides a certain contrast from the other surfaces of the stair for easier visual location of the start of the tread surface. The $\frac{9}{16}$ -inch (14.3 mm) limit of beveling and 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 onto the tread without catching on a square edge. This section also states that risers shall be solid; however, [Section 1011.5.5.3](#) specifically states exceptions to this requirement that are to be applied. The sloping of risers allows the step profile to have a nosing projection without a lip that might cause a foot to catch when dragged up

the face of the riser. Such designs are subject to the maximum nosing projection stated in [Section 1011.5.5.1](#) that must be considered when choosing the angle to slope the riser.

1011.5.5.1 Nosing projection size.

The leading edge (*nosings*) of treads shall project not more than 1¹/₄ inches (32 mm) beyond the tread below.

❖ 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 on a tread that is effectively deeper than if no nosing projection is used. Nosing projections are so common in stair design that they are usually only noticed by users when they are absent since the lack of nose projection can affect one's gait. Treads with vertical risers are allowed with or without a nosing projection. A nosing projection may also be accommodated by slanting the riser under the tread above. The nosing projection is limited to 1¹/₄ inch (32 mm) maximum. Treads designed with rounding or bevel on the underside would reduce the chance that a user's toe might catch while ascending the stairway (see Commentary [Figure 1011.5.5.1](#)).



For SI: 1 inch = 25.4 mm, 1 degree = 0.01745 rad.

Figure 1011.5.5.1

TREAD/RISER PROFILE (SOLID RISER)

1011.5.5.2 Nosing projection uniformity.

Nosing projections of the leading edges shall be of uniform size, including the projections of the *nosing*'s leading edge of the floor at the top of a *flight*.

❖ See the commentary to [Section 1011.5.5.1](#).

1011.5.5.3 Solid risers.

Risers shall be solid.

Exceptions:

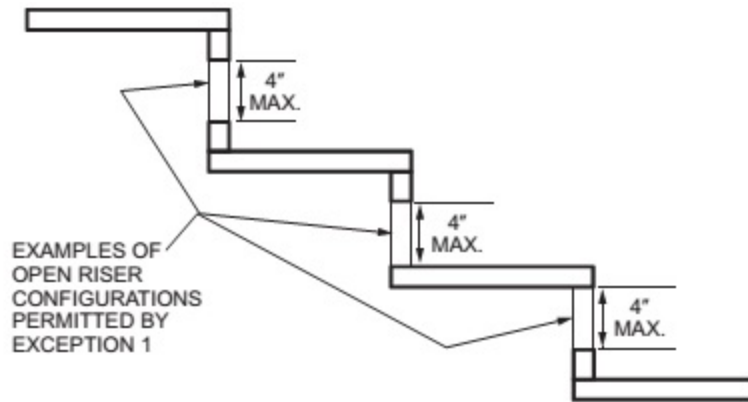
1. Solid risers are not required for *stairways* that are not required to comply with [Section 1009.3](#), provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. Solid risers are not required for occupancies in Group I-3 or in Group F, H and S occupancies other than areas accessible to the public. There are no restrictions on the size of the opening in the riser.
3. Solid risers are not required for *spiral stairways* constructed in accordance with [Section 1011.10](#).

❖ The code does not address when a riser could contain openings and still be considered “solid.” However, the intent is so that someone would not catch their toe as they moved up the stairway (see the commentary for nosing projections in [Section 1011.5.5](#)). It is not the intent to prohibit risers made of grills or other designs where a toe would not catch. Grill stairways are often used in exterior locations to allow for the passage of snow or rain and decrease the chance of accumulation and possible slips and falls on the stairways.

Exception 1 allows the use of open risers on all stairs that are not part of an accessible means of egress. Where the riser is allowed to be open, the opening is limited to be consistent with the requirements for guards (see Commentary [Figure 1011.5.5.3](#)). While not required, the second option shown in Commentary [Figure 1011.5.5.3](#) would limit the possibility of a toe catch as someone moved up the stairways and would be a safer design. The code does not reference [ICC A117.1](#) for stairways, because stairways are not part of an accessible route; however, the code and standard provide opening limitations in tread surfaces. [Section 1011.7.1](#) does allow for treads to have a maximum opening that allows for a 1/2-inch (12.7 mm) sphere.

Exception 2 recognizes that open risers are commonly used for stairs in occupancies such as detention facilities, storage, industrial and high-hazard areas for practical reasons. In detention facilities, open risers provide a greater degree of security and supervision because people cannot effectively conceal themselves behind the stair. Factories, high-hazard buildings and storage facilities have areas where workers may need the open risers to decrease the chance of spillage, water or snow accumulating on the stairs. See [Section 1011.7.1](#) for permitted openings in the treads.

Exception 3 recognizes open risers as necessary for adequate foot placement in spiral stairways. The 4-inch (102 mm) opening limitations of Exception 1 are not applicable to spiral stairways.



For SI: 1 inch = 25.4 mm.

Figure 1011.5.5.3

TREAD/RISER PROFILE (OPEN RISER)

1011.6 Stairway landings.

There shall be a floor or landing at the top and bottom of each *stairway*. The width of landings shall be not less than the width of *stairways* served. Every landing shall have a minimum width measured perpendicular to the direction of travel equal to the width of the *stairway*. Where the *stairway* has a straight run the depth need not exceed 48 inches (1219 mm). Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into a landing. Where *wheelchair spaces* are required on the *stairway* landing in accordance with [Section 1009.6.3](#), the *wheelchair space* shall not be located in the required width of the landing and doors shall not swing over the *wheelchair spaces*.

Exception: Where *stairways* connect stepped *aisles* to cross *aisles* or concourses, *stairway* landings are not required at the transition between *stairways* and stepped *aisles* constructed in accordance with [Section 1029](#).

❖ A level portion of a stairway provides users with a place to rest in their ascent or descent, to enter a stairway and to adjust their gait before continuing. Landings also break up the run of a stairway, especially at a turn, to aid in the arrest of falls that may occur (see [Section 1011.8](#)).

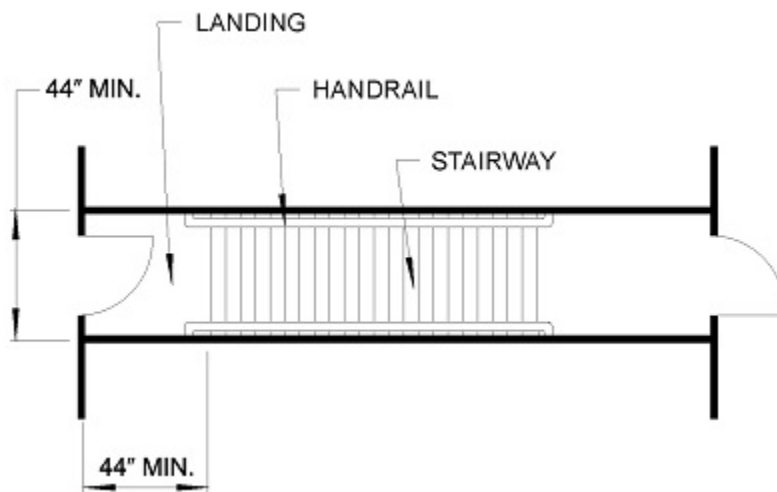
The minimum size (width and depth) of all landings in a stairway is determined by the actual width of the stairway. If [Section 1011.2](#) requires a stairway to have a width of at least 44 inches (1118 mm) and the stairway is constructed with that minimum width, then all landings serving that stairway must be at least 44 inches (1118 mm) wide and 44 inches (1118 mm) deep [see Commentary [Figure 1011.6\(1\)](#)]. If a stairway is constructed wider than required, landings must increase accordingly so as to not create a bottleneck situation in the egress travel. However, when a stairway is configured so that it has a straight run, the depth of the landing between

flights in the direction of egress travel is not required to exceed 48 inches (1219 mm), even though the actual width of the stair may exceed 48 inches (1219 mm) [see Commentary [Figure 1011.6\(2\)](#)].

It is not the intent of this section to require that a stairway landing be shaped as a square or rectangle. A landing turning the stairway 90 degrees (1.57 rad) or more with a curved or segmented outside periphery would be permitted, as long as the landing provides an area described by an arc with a radius equal to the actual stairway width [see Commentary [Figure 1011.6\(3\)](#)]. In this case, the space necessary for means of egress will be available.

The last portion of the requirement limits the extent to which doors that swing onto landings may interfere or encroach upon the required landing space. This limits the arc of the door swing on a landing, so that the effect on the means of egress is minimized [see Commentary [Figure 1011.6\(4\)](#)]. This is consistent with a door opening into an exit access corridor in [Section 1005.7](#). For safety reasons and to ensure the means of egress is continually available for everyone, where an area of refuge/wheelchair space must be located on a landing, the wheelchair spaces must not be within the required landing width and the entrance door to the stair enclosure may not swing over the wheelchair spaces [see Commentary [Figure 1009.3\(1\)](#)].

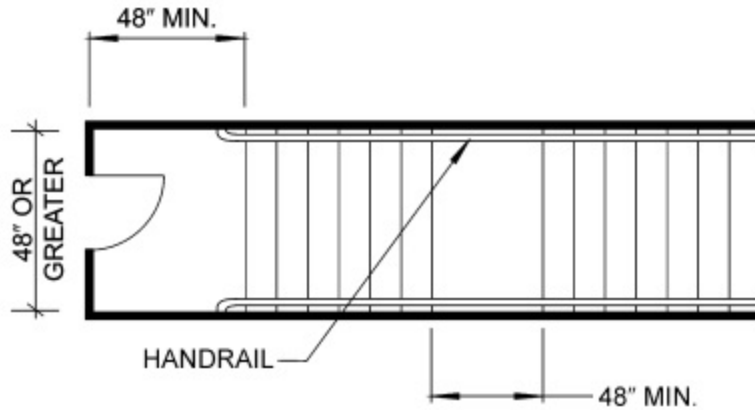
Exception 1 provides a practical exception where assembly facilities are designed for viewing. See [Sections 1029.13](#) through [1029.13.2.4](#) for assembly stepped aisle walking surfaces. This exception is limited to when stairways are a direct continuation of the path of travel from the level cross aisle to the stepped aisles. It is not permitted for other stairways within the assembly space.



For SI: 1 inch = 25.4 mm.

Figure 1011.6(1)

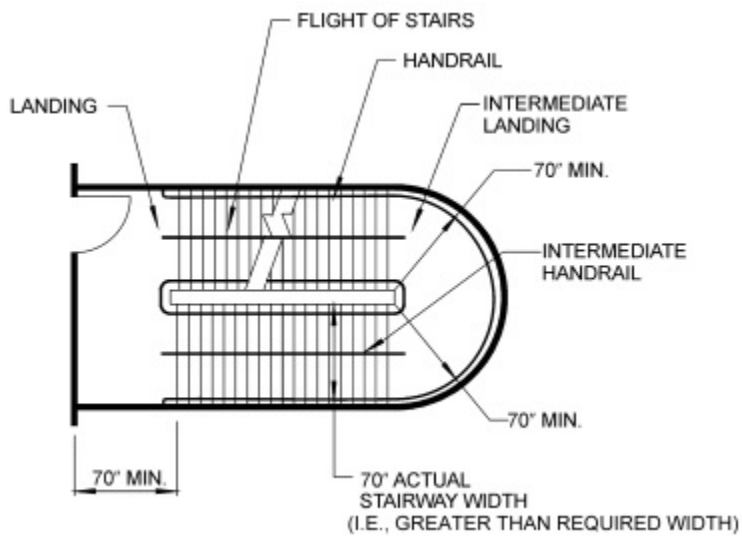
TYPICAL LANDING DIMENSIONS STRAIGHT-RUN STAIRWAY



For SI: 1 inch = 25.4 mm.

Figure 1011.6(2)

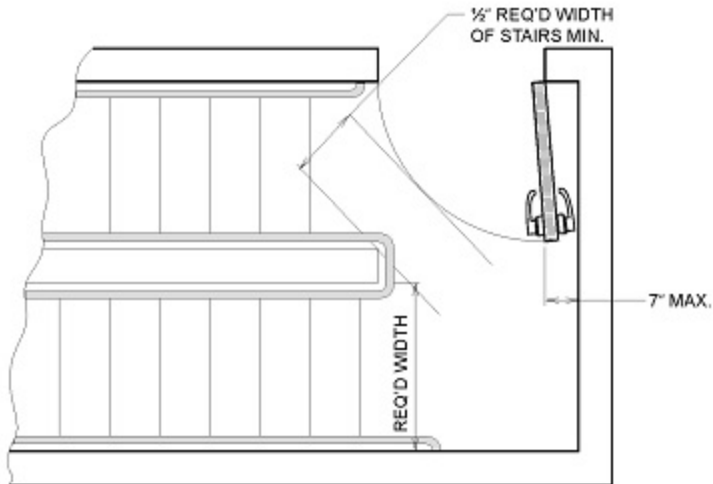
TYPICAL LANDING DIMENSIONS STRAIGHT-RUN STAIRWAY WIDER THAN 48 INCHES



For SI: 1 inch = 25.4 mm.

Figure 1011.6(3)

REVERSING RUN STAIRWAY



For SI: 1 inch = 25.4 mm.

Figure 1011.6(4)

DOOR CLEARANCE REQUIREMENTS IN STAIRWAY

1011.7 Stairway construction.

Stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood *handrails* shall be permitted for all types of construction.

❖ In keeping with the different levels of fire protection provided by each of the five basic types of construction designated in [Chapter 6](#), the materials used for stairway construction must meet the appropriate combustibility/noncombustibility requirements indicated in [Section 602](#) for the particular type of construction of the building in which the stairway is located. This is required whether or not the stair is part of the required means of egress. Any structure supporting the stairway and the stairway enclosure must be fire-resistance rated consistent with the construction type; however, the stairway components inside the enclosure need only comply with the material limits for the type of construction.

If desired, wood handrails may be used on the basis that the fuel load contributed by this combustible component of stairway construction is insignificant and will not pose a fire hazard.

1011.7.1 Stairway walking surface.

The walking surface of treads and landings of a *stairway* shall not be sloped steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. *Stairway* treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

Exceptions:

1. Openings in *stair* walking surfaces shall be a size that does not permit the passage of 1/2-inch-diameter (12.7 mm) sphere. Elongated openings shall be placed so that the long dimension is perpendicular to the direction of travel.
2. In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided a sphere with a diameter of 1 1/8 inches (29 mm) cannot pass through the opening.

❖ It is the intent of this section that both landing and stair treads be solid and level with firmly attached surface materials; however, the 1:48 slope should be adequate to allow for drainage to limit the chance for an accumulation of water where someone might slip.

The exceptions permit the use of open grate-type material or slotted grill for stairway treads and landings in two different situations.

Exception 1 allows for a maximum 1/2-inch (12.7 mm) opening on stairway treads in public areas and serving any use (see Commentary [Figure 1011.7.1](#)). This is very beneficial on exterior stairways where snow, ice or water may accumulate. The 1/2-inch (12.7 mm) limitation is based on the size of a crutch or cane tip and is consistent with [ICC A117.1](#) and federal accessibility requirements. The opening limitation is also small enough that most shoe heels will not get stuck. If a slotted grill pattern is used, the slots must run side to side on the stairway tread, not nosing to back.

Exception 2 is applicable in factory, industrial, storage and high-hazard occupancies. This provision is intended to apply primarily to stairs that provide access to areas not required to be accessible, such as pits, catwalks, tanks, equipment platforms, roofs or mezzanines. Walking surfaces with limited-size openings are typically used because open grate-type material is less susceptible to accumulation of dirt, debris or moisture, as well as being more resistant to corrosion. Most commercially available grate material is manufactured with a maximum nominal 1-inch (25 mm) opening; therefore, the limitation that the openings not allow the passage of a sphere of 1 1/8 inches (29 mm) diameter allows the use of most material as well as accounting for manufacturing tolerances.

The allowances for openings in risers is addressed in [Section 1011.5.5.3](#).



Figure 1011.7.1

OPEN TREAD IN ACCORDANCE WITH EXCEPTION 1

1011.7.2 Outdoor conditions.

Outdoor *stairways* and outdoor approaches to *stairways* shall be designed so that water will not accumulate on walking surfaces.

❖ Outdoor stairways and approaches to stairways are to be constructed with a slope that complies with [Section 1011.7.1](#) or are required to be protected such that walking surfaces do not accumulate water. While not specifically stated, any interior locations, such as near a pool, should also have the stair designed to limit the accumulation of water in order to maintain slip resistance (see [Section 1003.4](#)).

Where exterior stairways are used in moderate or severe climates, there may also be a concern to protect the stairway from accumulations of snow and ice to provide a safe path of egress travel at all times. Maintenance of the means of egress in the [IFC](#) requires an unobstructed path to allow for full instant use in case of a fire or emergency (see [Section 1031.3](#) of the IFC). Typical methods for protecting these egress elements include roof overhangs or canopies; heated slabs; grated treads and landings; or, when approved by the building official, a reliable snow removal maintenance program.

1011.7.3 Enclosures under interior stairways.

The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by 1-hour fire-resistance-rated construction or the fire-resistance rating of the stairway enclosure, whichever is greater. Access to the enclosed space shall not be directly from within the stairway enclosure.

Exception: Spaces under *stairways* serving and contained within a single residential dwelling unit in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

❖ This section addresses the fire hazard of storage under an interior stairway, whether it is an exit access stairway or exit stairway. The stairway must be protected from a storage area under it, even if the stair is not required to be enclosed. The section also requires that the storage area not open into a stairway enclosure. This limits the potential of a fire that starts in the storage area from affecting the means of egress. The exception provides specific criteria for separation for storage areas under an interior stairway for the indicated residential occupancies.

1011.7.4 Enclosures under exterior stairways.

There shall not be enclosed usable space under *exterior exit stairways* unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under *exterior stairways* shall not be used for any purpose.

❖ If the space under an exterior stairway is to be used, such as for storage, the area below the stairway must be separated from the stairway with walls and a ceiling with a fire-resistance rating of at least 1 hour. If the space under the exterior stairway is open, it must remain free and clear. A fire occurring in this space would jeopardize the use of the stairway for exiting during an emergency.

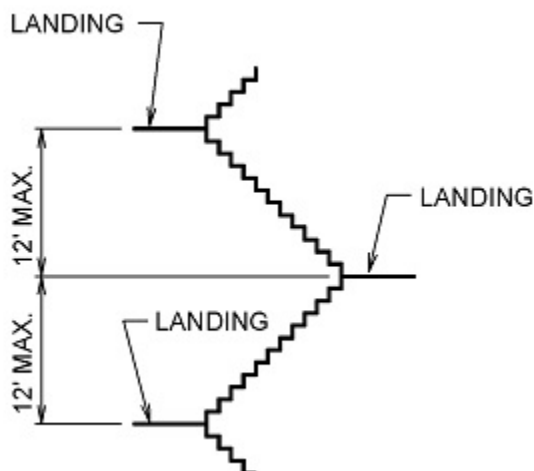
1011.8 Vertical rise.

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

Exception: Spiral stairways used as a means of egress from technical production areas.

❖ Between landings and platforms, the vertical rise is to be measured from one landing walking surface to another (see Commentary [Figure 1011.8](#)). 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.

The exception allows for spiral stairways that only serve technical production areas to eliminate intermediate landings regardless of height. These stairways typically have limited use and serve areas such as catwalks or lighting booths in stadiums and theaters. In addition, there is the technical difficulty of maintaining proper headroom in a spiral stairway with an intermediate landing.



For SI: 1 foot = 304.8 mm.

Figure 1011.8

STAIRWAY RISE LIMITATION

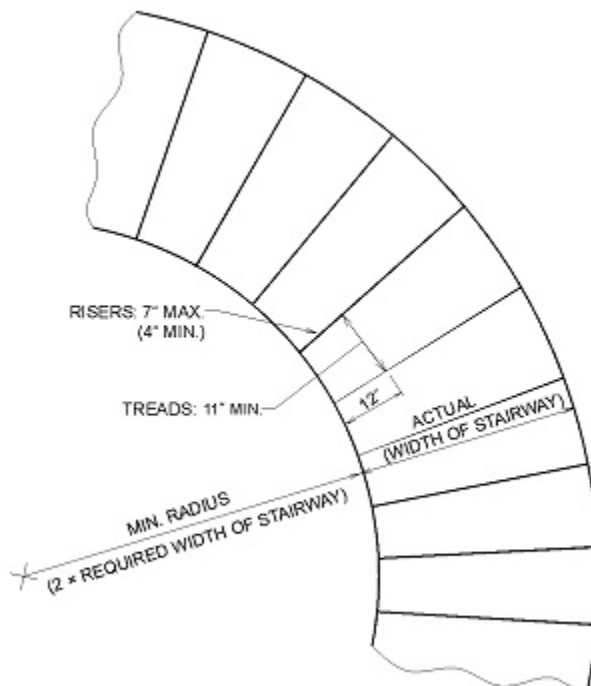
1011.9 Curved stairways.

Curved stairways with winder treads shall have treads and risers in accordance with [Section 1011.5](#) and the smallest radius shall be not less than twice the minimum width or required capacity of the stairway.

Exception: The radius restriction shall not apply to curved stairways in Group R-3 and within individual dwelling units in Group R-2.

❖ Curved stairway construction consists of a series of winder treads that form a stairway configuration. Options are many, including circular, S-shaped, oval, elliptical, hourglass, etc. The commentary to [Section 1011.5.3](#) regarding the possible event of nonconcentric movement on stairways with winders also applies to curved stairways. This type of stairway is allowed to be used as a component of a means of egress when tread and riser dimensions meet the requirements or exceptions of [Section 1011.5](#). This section also requires that the shorter radius must be equal to or greater than twice the required width (see [Section 1011.2](#)) of the stairway to limit the degree of turning thereby expediting egress from higher occupancies (see Commentary [Figure 1011.9](#)).

The exception for residential units eliminates the minimum radius requirement where the occupants are familiar with the extent of the turning of the stair through the curve.



For SI: 1 inch = 25.4 mm.

Figure 1011.9

CURVED STAIRWAYS—MINIMUM DIMENSIONAL REQUIREMENTS

1011.10 Spiral stairways.

Spiral stairways are permitted to be used as a component in the *means of egress* only within *dwelling units* or from a space not more than 250 square feet (23 m²) in area and serving not more than five occupants, or from *technical production areas* in accordance with [Section 410.6](#).

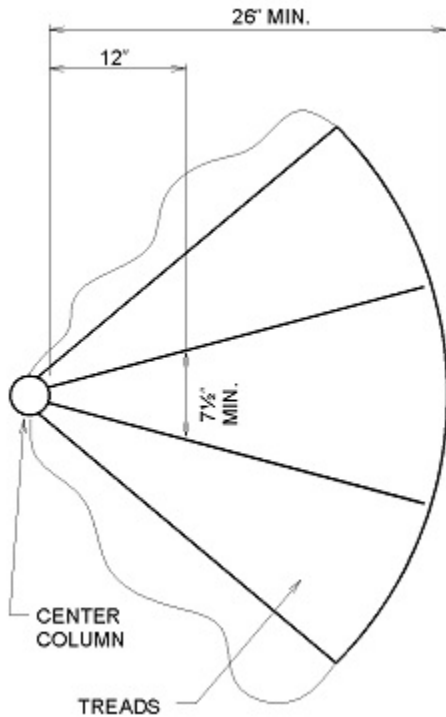
A *spiral stairway* shall have a 7¹/₂-inch (191 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than 9¹/₂ inches (241 mm). The minimum *stairway* clear width at and below the *handrail* shall be 26 inches (660 mm).

❖ Spiral stairways can be used within an individual dwelling unit, from small spaces in other occupancies and from technical production areas in spaces such as theaters. Spiral stairways are permitted to provide access between the levels within a live/work unit (see [Section 419.3.2](#)).

Spiral stairways are generally constructed with a fixed center pole that serves as either the primary or the only means of support from which pie-shaped treads radiate to form a winding stairway. The term “spiral” in the geometrical sense describes a curve that diminishes in radius and relates to the form of the stair as viewed in perspective from above or below; however, “spiral” does not describe the actual geometry of the stair. The unique turning of spiral stairs allows the center pole to act as the guard at the inside of the stair and the typically narrow width requires users to choose a walkline along the outer perimeter near the only required handrail. On spiral stairways of larger widths, where two users can pass and restrict access to the single handrail, the provision of a handrail at both sides should be considered.

The commentary to [Section 1011.5.3](#) regarding the possible event of nonconcentric movement on stairways with winders also applies to spiral stairways. The nature of stairway construction is such that it does not serve well when used in emergencies that require immediate evacuation, nor does a spiral stairway configuration permit the handling of a large occupant load in an efficient and safe manner. Furthermore, it is impossible for fire service personnel to use a spiral stairway at the same time and in a direction opposite that being used by occupants to exit the premises, possibly causing a serious delay in fire-fighting operations. Therefore, this section allows only very limited use of spiral stairways when used as part of a required means of egress.

Spiral stairways may be used in any occupancy as long as such stairways are not a component of a required means of egress. Spiral stairways are required to have dimensional uniformity. The stairway must have a clear width of at least 26 inches (660 mm) at and below the handrail. The depth of the treads must not be less than 7¹/₂ inches (191 mm) measured at a point that is 12 inches (305 mm) out from the narrow edge (see Commentary [Figure 1011.10](#)). Riser heights are required to be the same throughout the stairway, but are not to exceed 9¹/₂ inches (241 mm). Minimum headroom of 6 feet, 6 inches (1981 mm) is required.



For SI: 1 inch = 25.4 mm.

Figure 1011.10

SPIRAL STAIRWAYS

1011.11 Handrails.

Stairways shall have handrails on each side and shall comply with [Section 1014](#). Where glass is used to provide the handrail, the handrail shall comply with [Section 2407](#).

Exceptions:

1. Stairways within dwelling units and spiral stairways are permitted to have a handrail on one side only.
2. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
3. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require handrails.
4. Changes in room elevations of three or fewer risers within dwelling units and sleeping units in Group R-2 and R-3 do not require handrails.

❖ Handrails are required along each side of a flight of stairs; however, handrails are not required along stairway landings. Handrail continuity and extensions that will overlap the landings are addressed in [Sections 1014.4](#) and [1014.6](#).

Handrails have four recognized functions in stairway use. First, they serve to guide persons in ascent and descent along the path of egress travel, especially important for those with low vision, and in cases of fire where vision might be obscured by smoke. Second, they provide a tool for the user to exert stabilizing forces longitudinally (along the length of the rail), vertically and, most importantly, transversely (perpendicular) to the rail as the body transfers weight from side to side with each leg swing of the unique gait used on stairs. Third, they provide for pulling when arms are used to augment legs in ascent of steeper angles or when such climbing strategies result in more efficient use of the strengths of the user. Fourth, they are a tool that can be utilized to help in the arrest of a fall. In these capacities handrails serve to aid in the use of the stairway and are required on both sides of stairways in compliance with [Section 1014](#) to allow passing users unencumbered access to a handrail. Finally, when glass is the material used to provide the handrail, it must comply with [Section 2407](#).

Note that if the handrail extension is at a location that could be considered a protruding object, the handrail must return to the post at a height of less than 27 inches (686 mm) above the floor. Handrails along the stair runs are not considered protruding objects.

The exceptions state conditions where handrails are only required on one side or are not needed at all. By the nature of their construction, spiral stairways can only have a single handrail (see Exception 1). In accordance with Exceptions 1 and 4, within dwelling units, all stairways can have a handrail on one side only, and stairs with three or fewer rises are not required to have any handrails. Since “Stair” is defined as one or more risers, Exceptions 2 and 3 are necessary. Exception 3 exempts the single step at the front or back door of a Group R-3 dwelling unit (i.e., townhouse). Decks, patios and walkways often move down with the grade. When there are single steps, either off a patio or deck to grade, or along the surface, a handrail is not required (Exception 2, see Commentary [Figure 1011.11](#)). Many of these exceptions dealing with residential units are consistent with the [IRC](#).

For guard requirements at stairways, see [Section 1011.13](#).



Figure 1011.11

EXAMPLE OF [SECTION 1011.11](#), EXCEPTION 2

1011.12 Stairway to roof.

In buildings four or more stories above *grade plane*, one *stairway* shall extend to the roof surface unless the roof has a slope steeper than four units vertical in 12 units horizontal (33-percent slope).

Exception: Other than where required by [Section 1011.12.1](#), in buildings without an occupied roof access to the roof from the top story shall be permitted to be by an *alternating tread device*, a ship's ladder or a permanent ladder.

❖ Because of safety considerations, roofs used for habitable purposes such as roof gardens, observation decks, sporting facilities (including jogging or walking tracks and tennis courts) or similar uses, must be provided with conventional stairways that will serve as required means of egress. Access by ladders or an alternating tread device for such uses is not permitted.

In buildings four or more stories high, roofs that are not used for habitable purposes must be provided with ready access by conventional stairways or by an alternating tread device (see [Section 1011.14](#)). If this stair is also to provide access to an elevator penthouse on the roof, see additional requirements in [Section 1011.12.1](#). Two reasons for this are access for roof or rooftop equipment repair and fire department access during a fire event. Sloping roofs with a rise greater than 4 inches (102 mm) for every 12 inches (305 mm) in horizontal measurement (4:12) are exempt from the requirements of this section because of the steepness of the construction and the inherent dangers to life safety.

While it is not specifically required that roof access be through an exit stairway enclosure, since part of the intent is for fire department access to the roof, it is strongly advised. [Section 1023.9](#) requires signage at the level of exit discharge indicating whether the stairway has roof access.

1011.12.1 Stairway to elevator equipment.

Roofs and penthouses containing elevator equipment that must be accessed for maintenance are required to be accessed by a stairway.

❖ The requirement for a stair to the roof for maintaining elevator equipment correlates the code with [ASME A17.1/CSA B44, Safety Code for Elevators and Escalators](#). This referenced standard (see [Section 3001.2](#)) has required stairs and a door to access elevator equipment since 1955. More specifically, Section 2.27.3.2.1 of [ASME A17.1/CSA B44](#) states the following: “a stairway with a swinging door and platform at the top level, conforming to 2.7.3.3 shall be provided from the top floor of the building to the roof level. Hatch covers as a means of access to the roofs shall not be permitted.” Alternating tread devices or ladders are not permitted as an alternative to the stairway for access to the elevator penthouse. This provision is more specific; therefore, while not prohibiting using the same stairway for access to the roof and the elevator penthouse (see [Sections 1011.12](#) and [1011.12.2](#)), access to that elevator penthouse must be via a stairway with door access, not an alternating tread device and hatch.

1011.12.2 Roof access.

Where a stairway is provided to a roof, access to the roof shall be provided through a penthouse complying with [Section 1510.2](#).

Exception: In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m²) in area and having a minimum dimension of 2 feet (610 mm).

❖ The purpose of the penthouse or stairway bulkhead requirement in this section is to protect the walking surface of the stairway to the roof. The exception provides for situations when roof access is only needed for service or maintenance purposes, and where the access may be permitted by alternatives such as alternating tread devices, ship’s ladders or ladders.

1011.13 Guards.

Guards shall be provided along stairways and landings where required by [Section 1015](#) and shall be constructed in accordance with [Section 1015](#). Where the roof hatch opening providing the required access is located within 10 feet (3049 mm) of the roof edge, such roof access or roof edge shall be protected by guards installed in accordance with [Section 1015](#).

❖ While guards are required at the edge of a normally occupied roof by [Section 1015](#), there is also a safety concern for roof areas that need to be accessed by service personnel, inspectors and emergency responders. This requirement for guards provides a minimum measure of safety when the roof access is close to the roof edge. This is consistent with the requirements at mechanical equipment in [Section 1015.6](#) and [1015.7](#).

1011.14 Alternating tread devices.

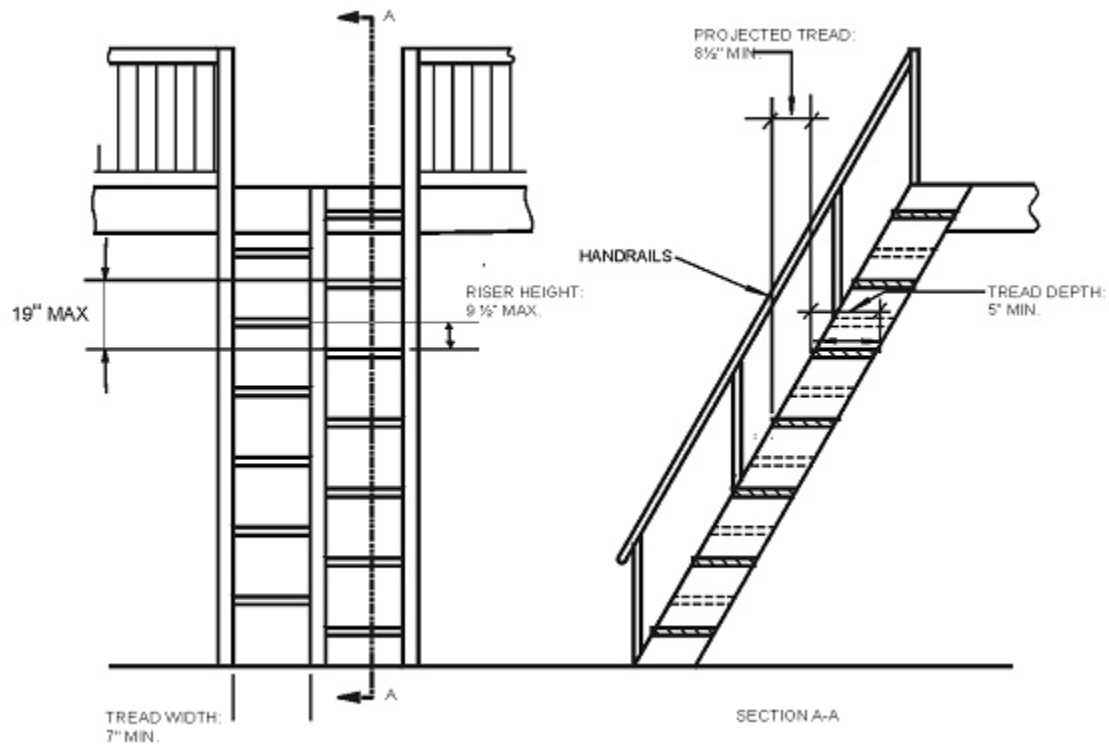
Alternating tread devices are limited to an element of a *means of egress* in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m²) in area and that serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m²) in area and for access to unoccupied roofs. *Alternating tread devices* used as a means of egress shall not have a rise greater than 20 feet (6096 mm) between floor levels or landings.

❖ This type of device is constructed in such a way that each tread alternates with each adjacent tread so that the device consists of a system of right-footed and left-footed treads (see Commentary [Figure 1011.14](#)).

The use of center stringer construction, half-treads and an incline that is considerably steeper than allowed for ordinary stairway construction makes the alternating tread device unique. However, because of its structural feature, only single-file use of the device (between handrails) is possible, thus preventing the occupants from passing one another. The pace of occupant travel is set by the slowest user, a condition that could become critical in an emergency situation. Furthermore, it is impossible for fire service personnel to use an alternating tread device at the same time and in a direction opposite that being used by occupants to exit the premises, possibly causing a serious delay in fire-fighting operations. For these reasons, this section greatly restricts the use of alternating tread devices as a means of egress.

Alternating tread devices may be used in any occupancy as long as such stairways are not a component of a required means of egress. Alternating tread devices are considered a modest improvement to ladder construction and, therefore, can be used as an unoccupied roof access in accordance with the requirements of [Section 1011.12](#).

Alternating tread devices are permitted 20 feet (6096 mm) between landings given their limited application and low occupant loads. In addition, it is recognized a vertical rise higher than the typical stairway is needed for these steeper devices which are used where space is often too restrictive for a regular stairway.



For SI: 1 inch = 25.4 mm.

Figure 1011.14

TYPICAL ALTERNATING TREAD DEVICE

1011.14.1 Handrails of alternating tread devices.

Handrails shall be provided on both sides of alternating tread devices and shall comply with [Section 1014](#).

❖ For the safety of occupants, this section references the dimensional requirements for handrail locations to be used in conjunction with the special construction features of alternating tread devices provided in [Section 1011.14](#). Because of the steepness of these devices, handrails on both sides are essential for safe functional use and additional clearances are required so that hand movement will not be encumbered by obstructions. [Section 1015.3](#), Exception 5, permits the handrails along alternating tread devices to also serve as guards.

1011.14.2 Treads of alternating tread devices.

Alternating tread devices shall have a minimum tread depth of 5 inches (127 mm), a minimum projected tread depth of 8¹/₂ inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9¹/₂ inches (241 mm). The tread depth shall be measured horizontally

between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception: *Alternating tread devices* used as an element of a *means of egress* in buildings from a mezzanine area not more than 250 square feet (23 m²) in area that serves not more than five occupants shall have a minimum tread depth of 3 inches (76 mm) with a minimum projected tread depth of 10^{1/2} inches (267 mm). The rise to the next alternating tread surface shall not exceed 8 inches (203 mm).

❖ Alternating tread stairways (see Section 1009.13) are required to have tread depths of at least 5 inches (127 mm). Tread projections are not to be less than 3^{1/2} inches (89 mm) when measured from tread nosing to tread nosing [next adjacent tread to the left or right to provide a minimum projected tread depth of 8^{1/2} inches (216 mm)] (see Commentary [Figure 1011.14](#)).

The risers are to be not more than 9^{1/2} inches (241 mm) when measured from tread to alternating tread (next adjacent tread to the left or right). The rise between treads on the same side would be 19 inches (482 mm) maximum. Applying the limiting dimensions stated above results in a device with a very steep incline that is common to ladders; however, because the device may be walked facing down in descent, it is considered a type of stairway in the code.

Tread widths are required to be a minimum of 7 inches (178 mm) or more. With a center support, the total width will be more than 15 inches (381 mm). Although no maximum width of the tread is stated, the device must be of a width to provide for functional use of both handrails at the same time in ascent and descent. For this same reason, handrail heights for alternating tread devices are modified from those stairways in [Section 1014.2](#).

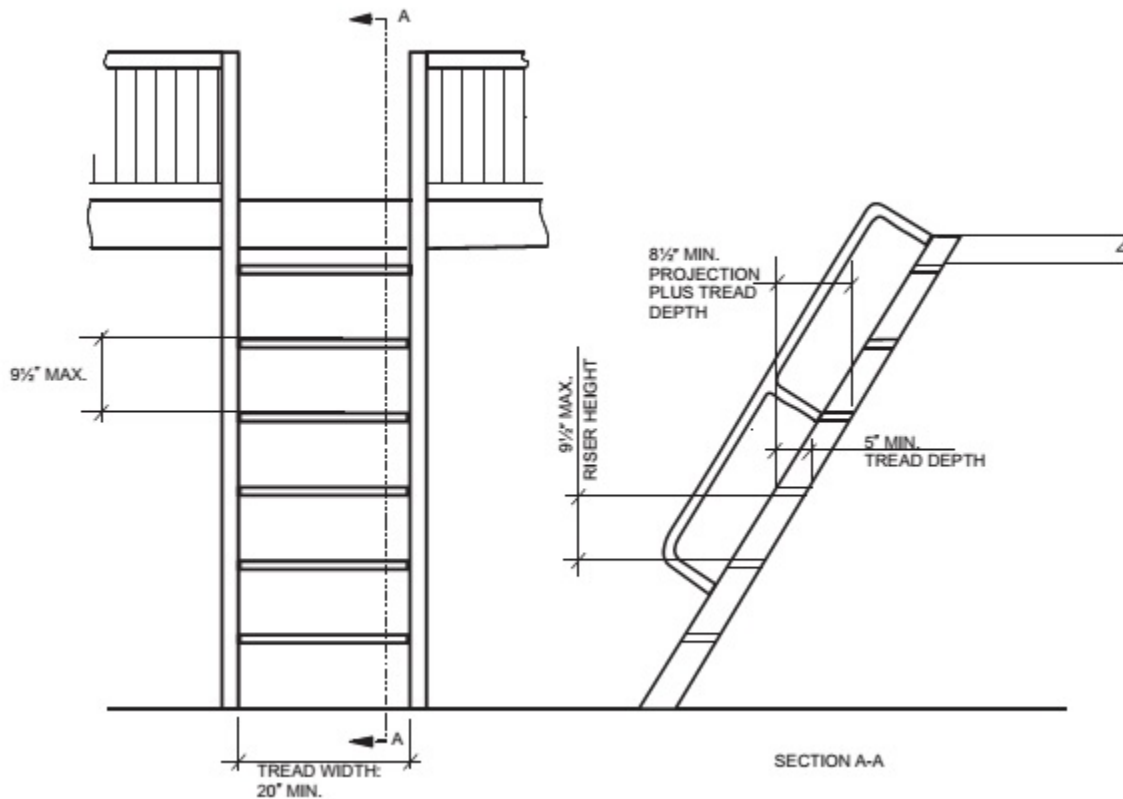
Just using the dimensions could result in an alternating tread device with an angle greater than 75 degrees (1.3 rad). In any case, the overall angle of the device must be between 50 and 70 degrees (0.87 and 1.22 rad).

For alternating tread devices used as a means of egress from small-area mezzanines as prescribed in the exception, the treads must project at least 7^{1/2} inches (191 mm) as compared to the 3^{1/2} inches (89 mm) stated above; treads are to be at least 3 inches (76 mm) in depth [compared to 5 inches (127 mm)] and risers are not to exceed 8 inches (203 mm) in height [compared to 9^{1/2} inches (341 mm)].

1011.15 Ship's ladders.

Ship's ladders are permitted to be used in Group I-3 as a component of a *means of egress* to and from control rooms or elevated facility observation stations not more than 250 square feet (23 m²) with not more than three occupants and for access to unoccupied roofs. The minimum clear width at and below the *handrails* shall be 20 inches (508 mm).

❖ Ship's ladders can be used in correctional facilities for access to small control rooms, observation stations and unoccupied roofs. Where approved by the code official, ship's ladders could be used for access to unoccupied roofs in other occupancies. Ship's ladders are of similar gradient or pitch to alternating tread devices; however, the treads span the full width like that of a ladder rather than being staggered to either side (see Commentary [Figure 1011.15](#)).



For SI: 1 inch = 25.4 mm.

Figure 1011.15

TYPICAL SHIP'S LADDER

1011.15.1 Handrails of ship's ladders.

Handrails shall be provided on both sides of ship's ladders.

❖ Handrails are needed on both sides to assist in ascent and descent and the absence of a maximum width. [Section 1015.3](#), Exception 5, permits the handrails along ship's ladders to also serve as guards.

1011.15.2 Treads of ship's ladders.

Ship's ladders shall have a minimum tread depth of 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the *nosing* projection is not less than 8¹/₂ inches (216 mm). The maximum riser height shall be 9¹/₂ inches (241 mm).

❖ See Commentary [Figure 1011.15](#) for an example of this configuration.

1011.16 Ladders.

Permanent ladders shall not serve as a part of the *means of egress* from occupied spaces within a building. Permanent ladders shall be permitted to provide access to the following areas:

1. Spaces frequented only by personnel for maintenance, repair or monitoring of equipment.
2. Nonoccupiable spaces accessed only by catwalks, crawl spaces, freight elevators or very narrow passageways.
3. Raised areas used primarily for purposes of security, life safety or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers or lifeguard stands.
4. Elevated levels in Group U not open to the general public.
5. Nonoccupied roofs that are not required to have *stairway* access in accordance with [Section 1011.12.1](#).
6. Ladders shall be constructed in accordance with [Section 306.5](#) of the *International Mechanical Code*.

❖ Permanent ladders are permitted as a means of ingress and egress to very limited spaces. Typically, these spaces are not considered occupied and, as such, are not required to have a means of egress. While the term “technical production areas” is not used in this section, [Section 410.6.3.4](#), Item 6, allows for ladders to be used to access technical production areas. Item 6 of this section references the [IMC](#) for when ladders can be used to access mechanical equipment that is located in an elevated space or in a room. The details and construction requirements for a permanent ladder are also found in that section. This will help make sure that permanent ladders are safe and useable, while providing consistency for both the designer and the building official.