

# Quick Reference Guide - Stairs

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## Stair Terms

Tread - The part of the stair which is actually walked on.

Riser – The board placed between consecutive treads.

Landing – A platform separating two flights of stairs.

Stringer or Carriage – The part of the stair construction which is cut out to receive the risers and treads and which supports the steps.

Nosing – The portion of the tread which projects beyond the riser face. The width of the nosing is added to the tread run to obtain the tread width.

Unit Rise – The unit rise of a stairway is the vertical distance from the top of one tread to the top of the next tread. A stairway is mathematically correct only when any one rise dimension is exactly equal to any other rise dimension.

Total Rise – The total rise of a stairway is the vertical distance from finish floor to finish floor, and is the basic measurement for all stair layout.

Unit Run – The unit run is the horizontal distance from the face of one riser to the face of the next riser.

Total Run – The total run is the overall horizontal distance occupied by a stairway. This measurement is obtained by multiplying the unit run by the number of treads plus the width of landing tread. The total run measurement is used to locate the exact position of the bottom or first riser.

Headroom – Headroom refers to the minimum vertical clearance 80" between a tread nosing in a stairway and the open end of the well hole.

Line of Travel – The line along which most people walk as they proceed up a stair.

## Designing a Stairway

The following should be considered when designing a stairway.

### The Stair Width

- A. The room required for two people to pass comfortable.
- B. Allowance for the passage of furniture.
- C. The width should be at least 36", however, 42" would be more ideal.

### Headroom

- A. F.H.A. requires not less than 6'8".
- B. Ideally headroom should measure between 7'4" and 7'7".

### Rise-Run Relationship

Slope or angle of stairway should be between 30 degrees and 37 degrees. To achieve this angle, the rise should measure generally between 6" and 8 ¼" and the run should measure between 9" and 11".

### Type of Stairway

The type of stair construction used depends largely on the location and the intended use of the stairway.

- A. Straight stairways are the most simplified, but not necessarily the least expensive to build. It is the easiest to construct in that there are no intermediate landings or runs. Straight stairs however require a long hallway, thus using valuable floor space.
- B. A platform or landing stairway is constructed when it is necessary to change directions between levels. "U" and "L" type platform stairs are typical and are used where limited floor space is available.

### Stairway Styling

- A. Post to Post

A post to post system reflects a stately appearance. The bold, dignified lines of square top newels and coordinating balusters are what makes this system popular. The post to post system can be installed with or without goosenecks. This system can be applied to both traditional and contemporary applications.

- B. Over the Post or Continuous Rail

The smooth, sweeping effect of a continuous, uninterrupted hand rail is both functional and beautiful. This system incorporates starting fittings such as volutes, turnouts, and easings at the start of the stair, and goosenecks or level fittings at any change of direction or angle.

## Laying Out A Stairway

Before one can begin the actual stair layout, a number of mathematical calculations must be made to determine the basic stair measurements. These measurements include:

Total Rise	Headroom Clearance
Unit Rise	Stairwell Size
Unit Run	Upper Construction Thickness
Total Run	Stair Horse or Stringer Length

### Step 1 – Determining Total Rise

The total rise is the basis for all stairway layouts. To determine this dimension exactly, allowance must be made for the thickness of the finished flooring on both levels.

### Step 2 – Determining number of Risers

This can be done by taking the total rise in inches and dividing by 7. The result will usually be a whole number and a remainder. The whole number is the number of risers in the stair. The remainder is ignored at this point.

A second method of determining the number of risers is to take the total rise in inches and divide by 8. The result will be a whole number and remainder. In this method the result is rounded off to the next full number to get the number of risers.

Using method one to determine the number of risers in a stair generally results in a greater number of risers with a smaller unit rise and a lesser incline. The use of method two will result in a smaller number of risers for a given total rise, but with a greater unit rise and greater incline. The stair with the greater number of risers in a given total rise will have a similar incline and therefore, be easier to ascend. However, the stair with the fewer risers in a given total rise will take up less horizontal space.

### Step III – Determining The Unit Rise

The unit rise is determined by dividing the total rise by the number of risers. The answer should be carried out to the nearest one-hundredth of an inch.

### Step IV- Determining The Unit Run

As a general rule, the unit rise of a stair should be kept between 7" and 8 ¼". Formula one – Unit rise plus unit run should equal 17" to 18". Formula Two – Two unit rises plus unit run should equal 24" to 25".

To determine the unit run, the designer must decide which stair formula to use. Formula one is the most simple and, therefore, the easiest to work with. It will result in a stair that is slightly steeper than formula two when the unit rise is below 7". However, at a unit rise over 7", it will result in a stair with a lesser incline than formula two. Formula two is desirable when the unit rise is below 7" and the angle of incline is to be held to a minimum. Formula two is also desirable when a lack of space requires the installation of a stair with a greater rise of 7" and a greater incline.

Unlike the unit rise which cannot be arbitrarily adjusted, the unit run may be adjusted slightly without violating the formulas.

#### Step V – Determining the Total Run

The total run of a stairway is determined by multiplying the unit run by the number of treads and the width of landing tread.

#### Step VI – Determining Headroom and Stairwell Size

The total rise, unit rise, and unit run are normally established before the length of the stairwell is determined. The desired headroom (6'8" minimum, 7'4" to 7'7" more ideal) must be established and added to the upper construction. The sum of headroom and upper construction is divided by the unit rise to determine the number of risers in the length of the stairwell opening. The result is usually rounded off to the next one-tenth. The minimum length of the stairwell is found by multiplying the number of treads in the stairwell opening by the unit run.

Example: (Headroom) 91" + 14" (Upper construction) = 105" / 7 ½"

(Unit Rise) = 14 (Risers). 14 (Risers are equal to)

13 (Treads) x 10" (Unit Run) = 130" (minimum length of stairwell).

After the mathematical length of the stairwell is found, an allowance should be made for the thickness of the riser and finish wall coverings.

## **Figuring A Bill Of Materials**

After you have determined the type and style of the stairway, you are ready to prepare a Bill of Materials needed for your stairway.

### Treads and Risers

From the basic measurements determine the proper treads, risers, stringer stock and accessories. Most stairs are built with a “nosing” or a protruding edge on the front of each tread. The projection of one tread over the tread below is usually about 1” and is designed to give the climber a wider base of support on each tread. The nosing is not considered when calculating the run of each tread, but must be considered when ordering materials.

The width of the stair should be at least 36”, however, 42” would be more ideal.

### Hand Rail

Determine the hand rail style, size, and lengths needed. Hand rail heights going up the rake of the stairs are measured from tread nosing to top of hand rail directly above it. This measurement should be no more than 38” and no less than 34” while rail height (balcony) should be from 36” to 42” depending on local codes. Hand rail rake lengths should be approximately the same as stringer lengths. Level (balcony) rail lengths should include a newel post every 8 to 10 feet for strength.

### Stairway Styling

Determine if styling preference is post to post or over the post. For over the post styling, select a starting fitting and starting step.

### Newel Posts

Newel posts are attached to stringers, risers, and treads of stairs to form a support for the balusters and hand rails. In a straight run staircase, newels are generally placed at the starting step (starting newel) and the top step (landing newel). In stairs with landings, there is a third post (angle newel). Newels are also used on balcony railing every 8 to 10 feet and at any change of direction.

### Balusters

Taper top balusters with bottom pins are set directly in pre-drilled holes in the treads and holes drilled on the underside of the rail.

Square top balusters are used in conjunction with plowed hand rails or sub rails under the hand rail. The pin on the bottom of the baluster is set into the pre-drilled hole in the tread.

The correct use of balusters is as follows:

34" – The first baluster on a tread. Also used for balconies (consult local building codes concerning balustrade heights).

36" – The second baluster on a tread when three per tread are desired.

39" – The third baluster as well under the turnouts.

41" – Used for balconies under volutes (consult local building codes concerning balustrade heights).

Concerning baluster spacing, the first baluster per tread should be vertically in line with the riser below and the stringer. The second baluster per tread is determined by dividing the unit run by 2 (balusters). (Example: 10" / 2 =5" center to center spacing). When using 3 balusters per tread, divide the unit run by 3 for spacing. Baluster spacing for level (balcony) runs should be no greater than 4" center to center.

#### Stair Rail Fittings

Fittings are used when a "rise" changes or a direction change occurs in the hand rail layout. Any fitting that has a "cap" is used in a conjunction with a newel. It is strongly recommended to use a fitting with a "cap" and a newel for added stability. The location of the fitting in relation to the height, both the incoming and outgoing rail, will determine the proper fitting. Gooseneck fittings are designed to provide rail flow at stair landings for level applications or continuing upward.