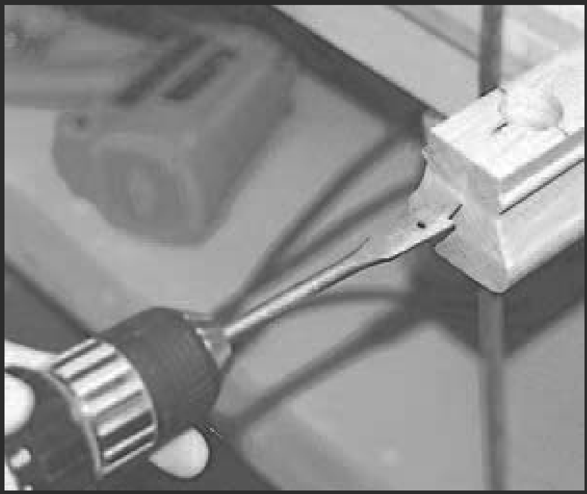
$12.95

Fitts™

STAIR INSTALLATION INSTRUCTION MANUAL



A STEP BY STEP GUIDE FOR INSTALLATION

Disclaimer

While this manual and the steps outlined describe accepted practices in the industry, Fitts Industries, Inc. cannot be held responsible for the installation of specific staircases. Users of this manual are urged to follow building code requirements to ensure the structural integrity of all products. All products and projects in this manual are for interior stair case and interior stair case components only.

Table of Contents

Introduction

Stair building is one of the most specialized components of construction. Building a staircase requires advanced planning, meticulous attention to detail, and good quality stair parts. Stairs can be built in a variety of forms ranging from the simple straight stair to the complex U-shaped stair. Regardless of the type of stair you wish to build, consideration must be taken with regards to comfort, building code requirements and cost.

Using This Manual

The Stair Installation Instruction Manual was written in conjunction with training provided by Stair Technologies, LLC. The manual was designed as a teaching tool for Stair Technology's Stair School. The goal of this manual is to explain the general principles of basic stair building, specifically focusing on the construction of the straight stair and the L-shaped stair. Due to the broad range of technical description this manual assumes a basic knowledge of carpentry in its depictions. If you are interested in the construction of more complex types of stairs, you should contact Stair Technologies for custom courses or advanced training.

As you use the text, you will notice sample boxes that have been provided for you to work the needed calculations associated with stair building. For your convenience, these calculations have also been placed at the end of the manual for you to use as you see fit. The calculations are marked with a large blue box to simplify the process and show you where a calculation is needed.

Recommended Tools

As with any major construction project, the stair builder is aided by the use of high quality tools. This manual provides a list of tools, some of which are designed specifically for stair building that will make the installation more efficient and effective. The following tools are recommended for stair construction:

- Drill
- Circular saw
- Belt sander
- Finish sander
- Jig saw

- Sliding compound miter saw
- Hammer
- Rubber mallet (white is preferred)
- Nail set
- 24” level
- 48” level
- Torpedo level
- Framing square, carpenter’s square
- Combination Square UI
- Sliding T bevel
- Rail bolt wrench**
- Rail bolt driver**
- Drill bits 1”, 3/4”, 5/8”, 1/2”, 1/4”**
- Pneumatic brad nailer (1-inch brad)
- Pneumatic finish nailer (2-inch finish nail)
- Socket set-3/8-inch drive
- Chalk line
- Back saw
- Ruler
- Plumb bob
- Wood chisels
- Vise grips
- Pinch clamps
- Bar clamps
- Utility knife
- Saw horses
- Block plane
- Screwdrivers (Phillips and straight head)
- Eye and ear protection

**Can be obtained when purchasing stair parts

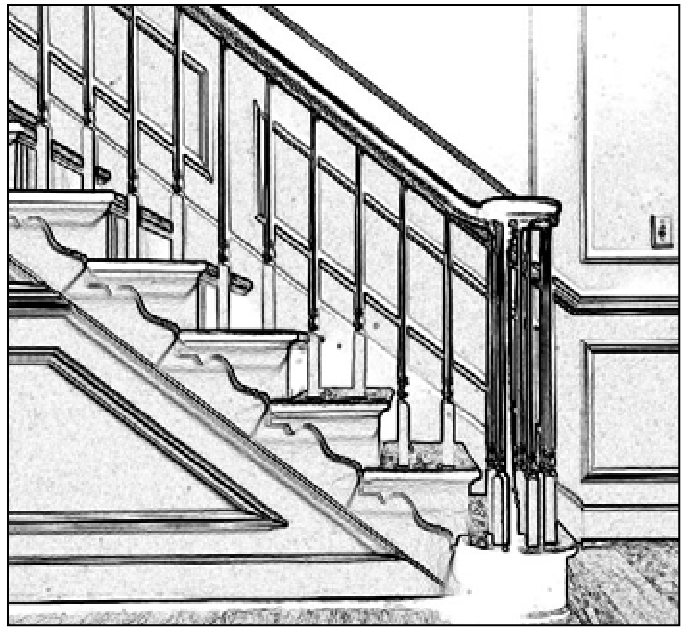
Stair Building and Safety

During the construction of a staircase, as with any form of construction, the builder always assumes a certain degree of risk. The Stair Installation Instruction Manual was designed to take personal safety into account. In order to minimize the risk of personal injury, we suggest the following basic safety precautions:

- The use of eye and ear protection
- The use of a dust mask
- The correct use of power tools (as recommended by the manufacturer)

Chapter 1
Laying out the Staircase

In this chapter:



Designing the Staircase

The critical design characteristic of any staircase is based on the fundamental calculation of total rise and total run. Total rise refers to the vertical distance a stair must climb from finished floor on the lower level to finished floor on the upper level. Total run, formerly referred to as "the going" of a stair, refers to the horizontal distance a stair must cover from the beginning of the first tread to the end of the last tread. Neither term should be confused with the rise and run, or unit rise and unit run, which are layout terms generally used to refer to the dimensions of each individual step.

Building codes dictate the rise and run of a staircase. *(Please note that local building codes must be determined before the design process is undertaken.) The dimension of each rise and run must be almost identical over the complete stair. Rise is the most important part of the calculation. Most building codes require that the variance between the highest and lowest risers not exceed 3/8-inch.

This chapter outlines the principles of rise and run and the fundamentals of laying out the main supporting structure of the staircase.

The Rise and Run of a Staircase

Calculating the Total Rise

The total rise must be calculated from finish floor to finish floor.

1. First, attain the rough floor-to-floor measurement. This measurement is taken by running a measuring tape down from the second floor to the first floor. The measurement should be as close to plumb – or exactly vertical – as possible.
2. From this measurement, add the thickness of the upper finished floor and subtract the thickness of the lower finished floor. (This will factor for flooring added after the installation of the staircase.) The following calculation provides the total rise of the stair finish floor to finish floor:

Total Rise

__________	Total distance from rough floor to rough floor
__________	+ Thickness of upper finished floor
__________	- Thickness of lower finished floor
__________	= Thickness rise (Finished floor to floor)

Figure 1-1 illustrates this concept.

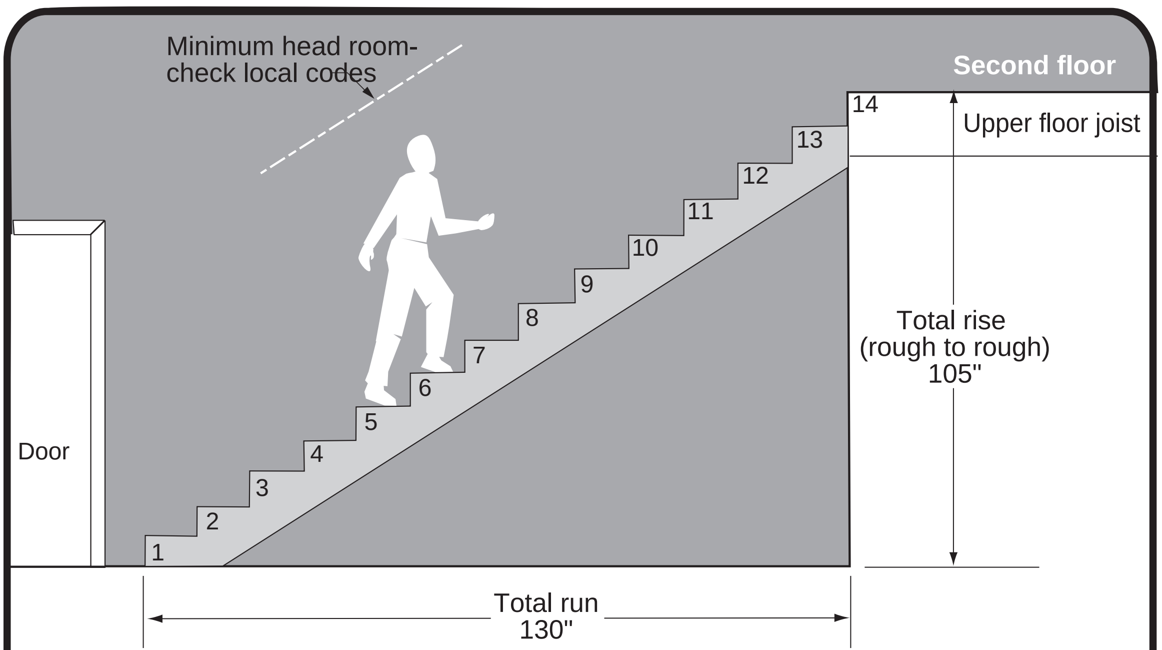


Fig. 1-1 *Calculating the total rise and total run of a straight staircase.*

Calculating the Total Run

Now you must determine the total horizontal distance that the stair must travel.

1. Plumb down from the upper floor joist to the lower floor and make a mark.
2. Place a mark on the floor where you would like the stair to end.

3. Measure the distance between the two marks. This distance is the total run. When calculating the total run, pay close attention to any obstructions such as walls, doors, or openings that may impede the design of the staircase. Make sure you have enough room for the desired total run and that the minimum headroom requirements are met. This is illustrated in figure 1-1.

Calculating the Unit Rise

The unit rise is the calculation of the height of each individual rise in the stair. Please note Fig. 1-2

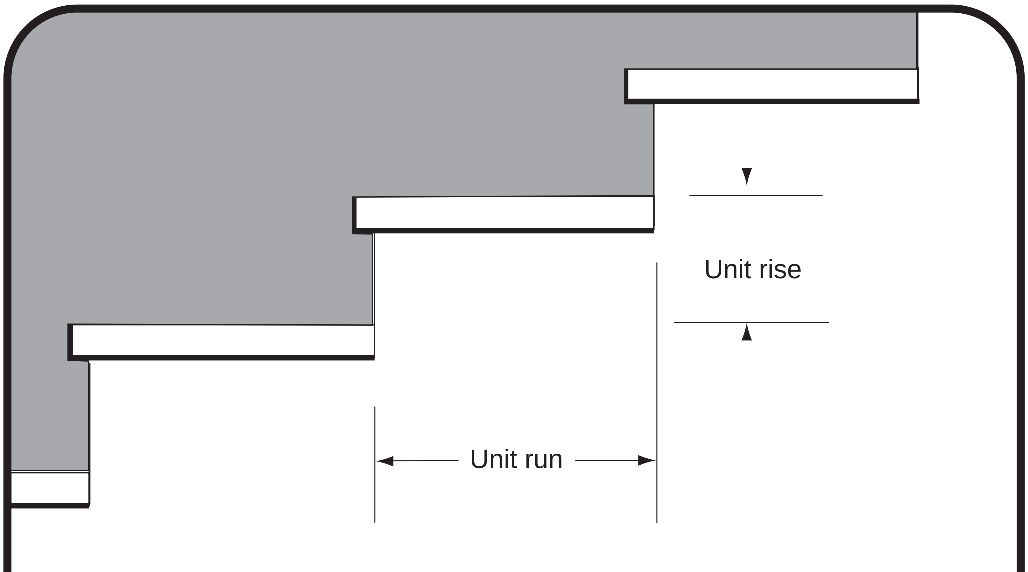


***Fig. 1-2** Unit rise and unit run of a staircase.*

** (Please note that local building codes can restrict maximum rise. In most areas this maximum distance is 7-3/4-inches.)*

1. To determine the minimum number of risers, divide the total rise of the stair by the maximum unit rise allowed. For instance, if the total rise of the stair was 105-inches and the maximum allowable unit rise was 7-3/4-inches, you would divide 105 by 7-3/4. This would give 13.54 rises. Since it is not possible to have a portion of a rise, you should round off to the next highest whole number. This would yield for a 14-rise staircase. The calculation is provided below.

Number of Risers

__________	Total rise (Finished floor to floor)
__________	÷ Maximum unit rise
__________	= Number of risers
	(Rounded to the next highest whole number)

Example: Total Finished Rise (105) / Maximum Unit Rise (7-3/4) = (13.54) or 14 Risers

2. Divide the total finished rise by the minimum number of risers to determine the height of each individual rise.

Unit Rise

__________	Total rise (Finished floor to floor)
__________	÷ Number of risers
__________	= Unit rise

Example: Total Finished Rise (105) / Number of Risers (14) = Unit Rise (7-1/2)

In this example the maximum rise would be 7-1/2-inches. It is important to note that this is the maximum unit rise of this particular stair. More risers may be added to create a stair with a more gradual rake (slope). Keep in mind that the addition of risers can take a considerable amount of floor space. Strive to keep the individual riser height to above 6-inches because too low of a rise may be considered awkward and unsafe. *(Statistics indicate that accidents are just as likely to occur on stairs with a 7-inch rise as those with an 8-inch rise: a stair with a 7-1/2-inch rise is considered the safest.) Carson Et Al, 1978 Study.

The numbers used in the last example were sample figures provided by Stair Technologies, LLC. They are in no way representative of all staircases.

Calculating the Unit Run

The unit run of a stair is the horizontal distance from the face of one riser to the face of the next. (Please note above Figure 1-2) It is once again important to check local building codes, because some areas restrict the run to be no less than 10-inches. The number of treads is determined by taking the total number of risers and subtracting one. The stair will have one less tread than it has risers since the stair starts and finishes with a riser.

Number of Treads

___________	Number of risers
___________	- One
___________	= Number of treads

Use the following formula to calculate unit run:

1. Multiply the number of treads by the minimum allowable unit run to get the minimum distance the stair must travel. In the example, this would be 13 multiplied by 10-inches or 130-inches of total run.

Minimum Total Run

___________	Number of treads
___________	(x) Maximum unit run
___________	= Maximum total run

Ex: Number of Treads (13) x Minimum Unit Run (10") = Minimum Total Run (130")

2. If you wish to increase the total run of the stair and there are no doors or obstacles, you must recalculate the actual run of the stair. To do this, divide the total desired run by the number of treads to determine the exact unit run. For instance, if the desired run in the example above was 136-1/2-inches, you should divide that by 13 to get a unit run of 10-1/2-inches.

Unit Run

__________ Desired total run

__________ 4 Number of treads

__________ = Unit Run

Note: While there are no limits to the maximum length of the unit run, be careful not to create a situation that requires the user to take a "half step" when climbing or descending the stair. This will happen if the unit run is too long.

Installing Stringers for Straight Stairs

The stringers, also known as carriages, are the supporting pieces of lumber that run the length of the staircase and support the treads, risers, and balustrade. Stringers are generally built from good quality lumber, usually 2 x 12's, preferably with a minimal crown. Always make sure to use appropriate-sized, as well as an adequate amount of lumber. Proper building materials will ensure the structural soundness of the staircase. ***(Staircases must meet load requirements of local building codes.)*

Calculating Stringer Length and Marking the Stringer

When building stringers, the first thing to determine is the length of the material that will be required. The two primary methods for determining stringer length are:

- The use of the Pythagorean Theorem
- The use of a framing square

The next two sections provide the methods for determining stringer length.

Note: It is important to remember that lumber is sold in even lengths. You are always suggested to "round up" to the next even number. It is better to have too much material than not enough.

Calculating Stringer Length Using the Pythagorean Theorem

The first way to calculate the rough stringer length is to use the Pythagorean theorem:

$$a^2 + b^2 = c^2$$

or, in this case, the run^2 plus the rise^2 equals the rake^2.

$$(Run)^2 + (Rise)^2 = (Rake)^2$$

Use a calculator to determine the square root of the sum of the run squared, and the sum of the rise squared. An understanding of this formula for right triangles is very helpful as all stair design is based on this relationship.

Stringer Lengths - Pythagorean theorem

$$(\text{Run})^2 + (\text{Rise})^2 = (\text{Rake})^2$$

$$(\_\_\_\_\_)^2 + (\_\_\_\_\_)^2 = (\_\_\_\_\_)^2$$

$$(\text{Rake})^2 = \_\_\_\_\_$$

$$(\quad)^2 = \_\_\_\_\_$$

$$\_\_\_\_\_ \div 12'' = \_\_\_\_\_$$

- or the length of the stringer. Round this to the next highest "even" number. The rounded number will give you the necessary 2 x 12-inch length you will need.

Calculating Stringer Length Using a Framing Square

Another way to determine the stringer length is to use a framing square and ruler.

1. On the blade of the square, mark the unit run; on the opposite side (or tongue) mark the unit rise.

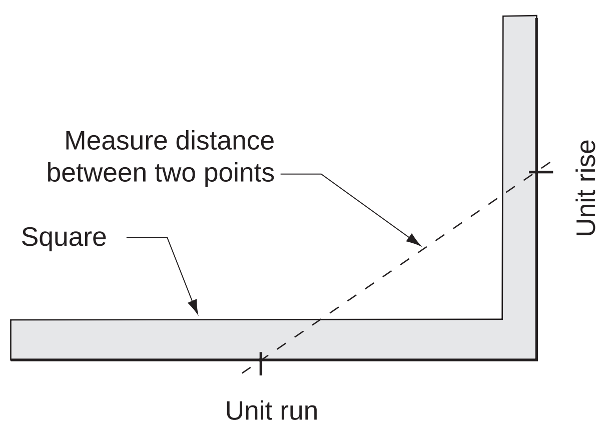


Fig. 1-3 *Using framing square and ruler to determine stringer length.*

2. Next, use a ruler to measure the distance between the two marks. Please note Fig. 1-3 here.
3. Multiply this distance by the number of treads in the stair to determine stringer length.

Marking the Stringers Using a Framing Square

A framing square is also used to mark the stringer for cutting.

1. Mark the blade at a point that is equal to the unit run of the stair, and then mark the tongue at a point equal to the unit rise of the stair. Make sure both marks are on the outside edge of the square.
2. Now, clamp a straight edge to the square on the outside of those marks. You are now ready to mark your stringer. This can also be done using small clamps called stair gauges that are made strictly for marking rise and run. Please note Fig. 1-4 here.

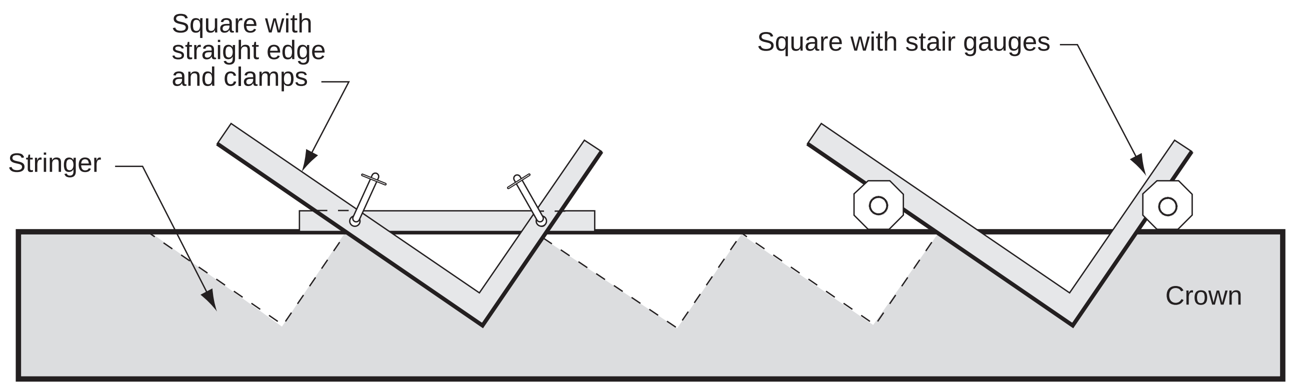


Fig. 1-4 *Using framing square and ruler to mark stringer*

3. Next, sight down the piece of lumber to determine whether it is straight or has a slight crown or bow to it. Usually boards are slightly arched in the middle.
4. Lay out the stringers so that the crowned edge is up, thus the crown is pointing opposite the load.
5. With the stringer lying flat, place the square so that its corner points are away from the wood's crowned edge.
6. Mark a line along the outside edges of the square, and then slide it down so it aligns exactly with the previous mark.
7. Mark the next cut.
8. Repeat this process until the proper number of risers has been marked. *You are suggested to number each riser as you go.*

Cutting the First and Last Riser on the Stringer

When cutting the stringer, it is essential to accommodate for the thickness of the tread material. The first (or bottom riser) of the stringer needs to be lowered by an amount equal to the thickness of the tread material. This provides the correct vertical height of the stringer. The following steps illustrate the process:

1. Subtract the thickness of the tread material and add the thickness of finished floor from the height of the unit rise. *(Remember that the rise is the vertical cut on a stair and the run is the horizontal cut.)*

Calculating First Riser Heights

__________ First unit rise

__________ - Tread thickness

__________ + Finished floor thickness

__________ = First Riser height

Note: If you are installing a rough tread now and covering it later with another material, add both thicknesses' together.

2. Measure down a distance equal to the first riser height (calculated above) on the stringer and draw a line square with the riser. This is the line for the bottom level cut of the stair. Please note figure 1-5.
3. Make a cut along the scribed line.

Cutting the Top of the Stringer

1. At a point even with the back of the last run, scribe a line perpendicular to the run.
2. Cut top end of stringer.

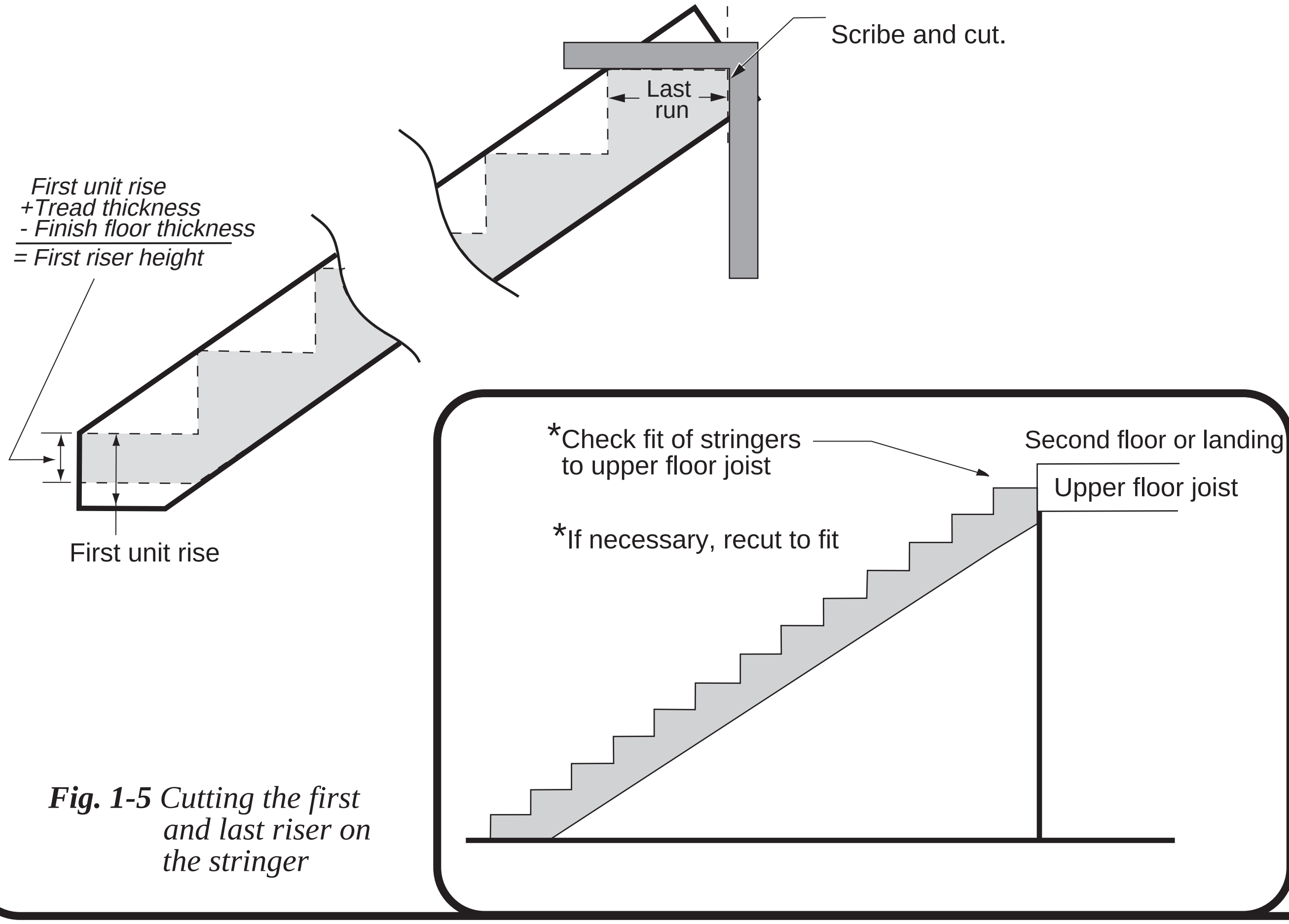


Fig. 1-5 *Cutting the first and last riser on the stringer*

Cutting the First Stringer

1. Clamp the stringer to two sawhorses and begin cutting the rise and run. Cut along the previously scribed lines.

   Caution: Be careful not to cut beyond the point where the rise and run lines meet, as this will weaken the stringer. For the best result, finish each cut with a handsaw or jigsaw.

2. Cut one stringer at a time.

Checking the Fit of Stringers

1. Place the top of the stringer in the wellhole so that from the rough second floor framing, the distance is equal to: one unit rise plus one tread thickness minus the finished floor thickness of the second floor or landing. Please note Fig. 1-6 here.

Checking the Fit of the Stringer

________	Unit Rise Height
________	+ Tread thickness
________	- Finished floor thickness
________	= Distance of the stringer below rough cut

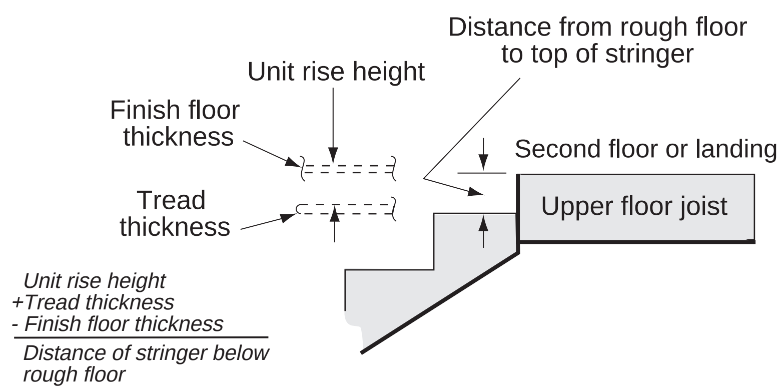


Fig. 1-6 *Checking the fit of stringers.*

2. Next, take a two-foot level and check that the runs of the stringer are as close to level as possible.
3. Check to make sure there is adequate room at the bottom of the stair as well as headroom clearance down the stair. Minor adjustments may be necessary.

Note: If too many adjustments are required, it may be necessary to start over and recalculate the rise and run.

Cutting the Other Stringers

1. Lay the first stringer on top of the other stringers with the crown up.
2. Using the completed stringer as a template, mark and then cut the other stringers. When cutting, make sure to cut out the width of a pencil line to ensure a tight fit.

Installing the Stringers

1. Nail a 2 x 4, (called the kicker plate or thrust block), equal to the width of the staircase, to the floor at the point where the staircase will end. Please note Fig. 1-7 here.

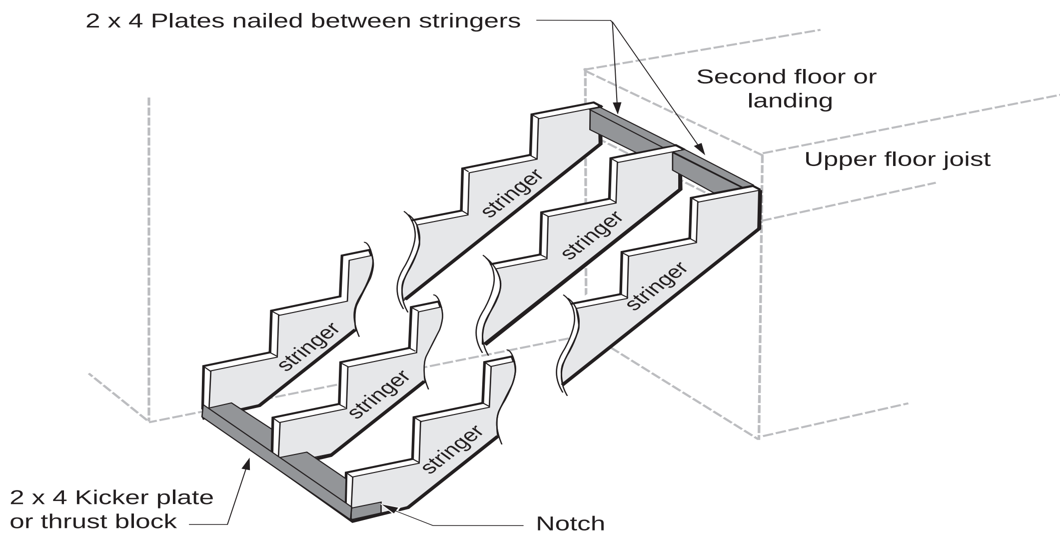


Fig. 1-7 *Installing the stringers with use of a 2x4 plate and securing the stringers against the upper floor.*

2. Notch the bottom of the stringers to accept the 2 x 4 plate.
3. Stand the stringers up in the wellhole with the bottom of the stringer resting on the 2 x 4 plate, and the top of the stringer resting against the upper floor joist.
4. Nail 2 x 4 plates horizontally against the upper floor joist between the stringers to support the back of the last tread.

Note: Because the framing of a structure may be out of square, plumb, or level, make sure to check the alignment of the stringers before attaching them.

5. Properly attach stringers to upper floor joist to ensure they comply with local building codes

Note: Sometimes the inside stringer is placed 1-1/2-inches from the wall so that the skirt and the sheet rock can easily be slipped behind the stringer. Please note Fig. 1-8 here.

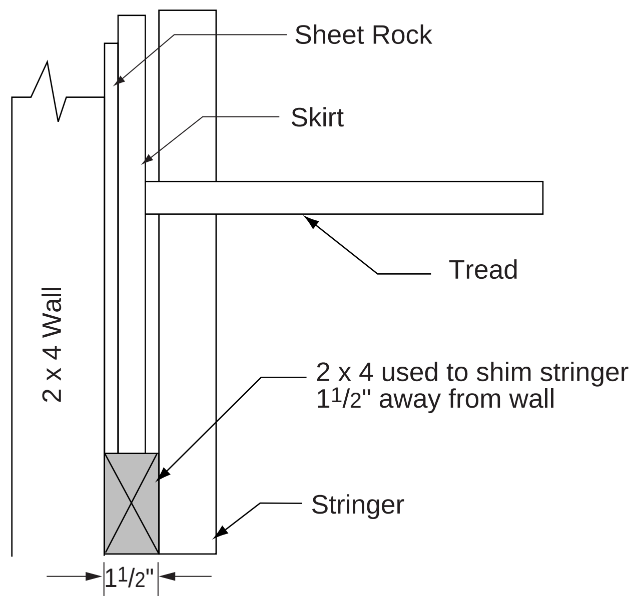


Fig. 1-8 *Shimming inside stringer*

Laying out the L-shaped Staircases

The L-shaped staircase differs from the straight staircase with regards to its level of complexity. The design, which is quite versatile, consists of two straight stair sections separated by a landing. The landing is nothing more than a large tread that divides a single flight into two separate straight runs. This provides an added degree of safety in the event of a fall. **(Most building codes dictate that no flight of stairs should have a vertical rise of more than 12 feet.)*

The process of designing and laying out the L-shaped staircase is similar to that of the straight staircase. See instructions under the straight stair section to calculate the total rise and unit rise.

Calculating Landing Height

***(Please note that the following numbers are for sample purposes only.)**

When the total rise (105") and unit rise (7-1/2") are determined, you must next determine the landing size. The landing should be at least the width of the stair in each direction.

1. Plumb down from the face of the second floor to the first floor to have a reference point for landing measurements. Please note Fig. 1-9 here.

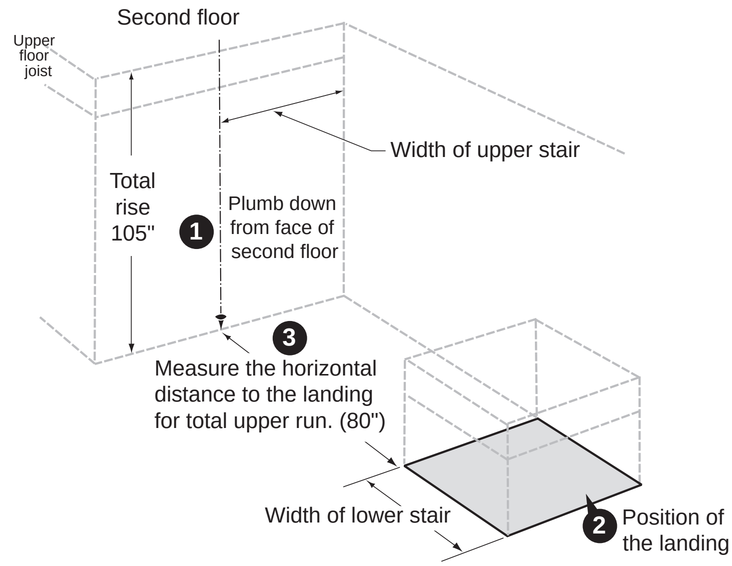


Fig. 1-9 *Determining position of landing and measuring total upper run*

2. Determine position of landing and then draw the landing out on the first floor.
3. Measure the horizontal distance between the landing and the upper floor reference point (80”).
4. Divide this number (80”) by the size of minimum allowable unit run (10”) and round this number down to the nearest whole number (8). This will give the total number of treads (8) possible on the upper section of the L-shaped stair. Please note Fig. 1-10 here.

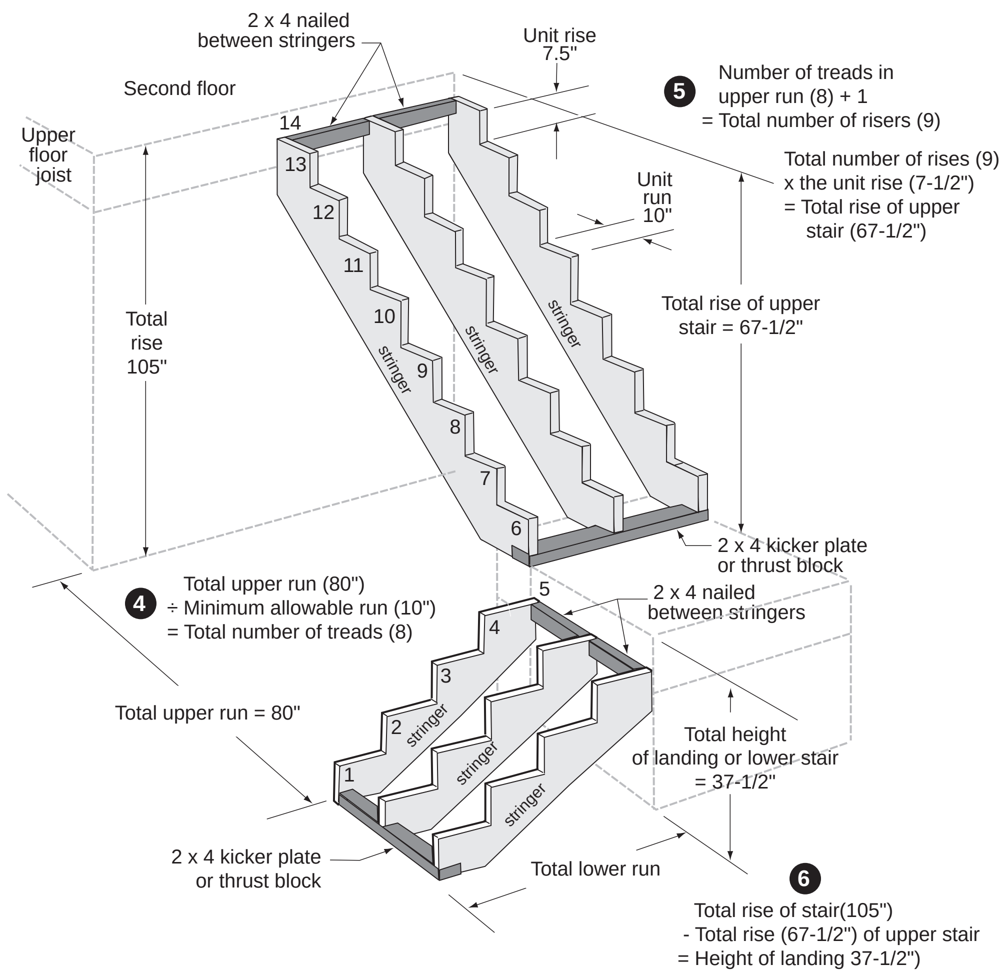


Fig. 1-10 *Calculating the total rise of upper stair and landing height.*

5. The L-shaped stair, like any other staircase, will start with a rise and end with a rise. Add one to the number of treads (8+1) determined for the upper stair and multiply this by the unit rise (7-1/2”) to determine the total rise for the upper stair.
6. Subtract the total rise of the upper stair from the total rise (67-1/2”) of the entire stair (105”). This will give the height of the landing (37-1/2”).

Once again, the numbers used in the last example were sample figures provided by Stair Technologies, LLC. They are in no way representative of all staircases.

Building the Landing Platform

The landing platform, as stated before, should be at least the same width as the stair in each direction. Since the upper stringers will need to sit on the landing platform, it should extend out the distance of one unit run toward the upper staircase. The landing platform should be treated like any other floor in the structure and framed accordingly.

Installing the Stringers

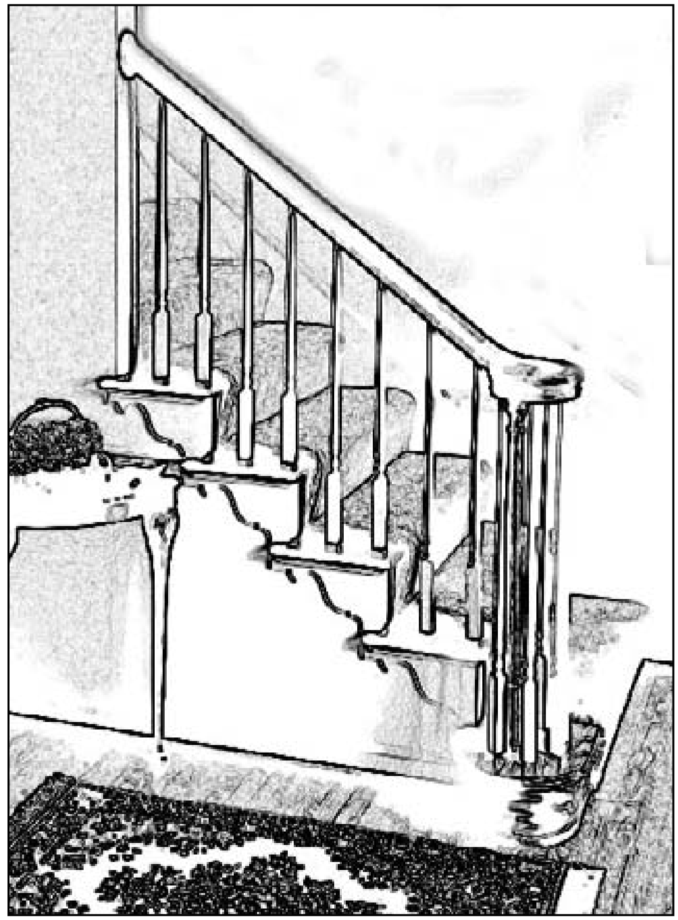
Now that a landing is in place, complete the stair as if it were two separate straight stairs. The only difference is that the unit run on both the upper and lower stairs should be equal.

Chapter 1: Things to Remember

1. Always consult local building codes before constructing or installing a staircase.
2. Bond all connecting surfaces with a quality wood glue or construction adhesive.
3. Add backing or blocking to all areas where newels will be attached.
4. Make sure to make the necessary adjustments to the first and last rise in order to allow for finished floor and tread thickness.
5. Make sure that the stringer material is the proper size so that it will meet the required structural standards.

Chapter 2
Installing Skirts, Treads, and Risers

In this chapter:



Installing Skirts, Treads, and Risers

Once the basic design and layout of the staircase have been established, you can proceed with adding the skirts, treads, and risers to the stairs. The treads and risers are the basic elements of the stair that make up its walking surface. Important considerations to take into account when installing treads and risers are safety and comfort. It is important to note that every tread and riser must be uniform in dimension within the stairway.

The skirt is basically a piece of trim used to cover the structural section of the stairs. Stair brackets and other ornamental attachments can also be added for aesthetic appeal. A skirt board is installed to the finished wall (sheet rock, paneling, etc.) once the open side of the stair has been finished.

This chapter will illustrate the principles of installing the skirts, treads and risers to the foundation of your staircase.

Installing Mitered Skirts

The first step when installing the mitered skirt is to determine the size of the skirt necessary for the application. The fundamental measurements include the length and the width. You must make sure to select a piece of material that is long enough to cover the total run of the staircase. The width should be at least 9-1/2-inches wide.

A second consideration is the thickness of the skirt board. Thickness is a variable that is based on aesthetical purposes and not for structural stability. The thickness may vary from 1/4-to 2-inches, depending on preference and cost.

The following steps describe the process:

1. Lay the skirt along the top of the stringer parallel with the stringer resting on the points.
2. Measure the width of the skirt on the plumb.
3. Measure up from the floor at the bottom of the stringer. Take this distance, less 1-inch, and scribe a line level with the floor at this point. Please note Fig. 2-1 here.
4. Cut the bottom of the skirt off on this line and make any necessary cuts or notches as to allow the top of the skirt to rest 1-inch above the points of the stringers.
5. Tack the skirt into place with small finish nails.
6. Mark the wall and the skirt so that the skirt can be taken down, cut, and put back into exactly the same position. Please note Fig. 2-2 here.

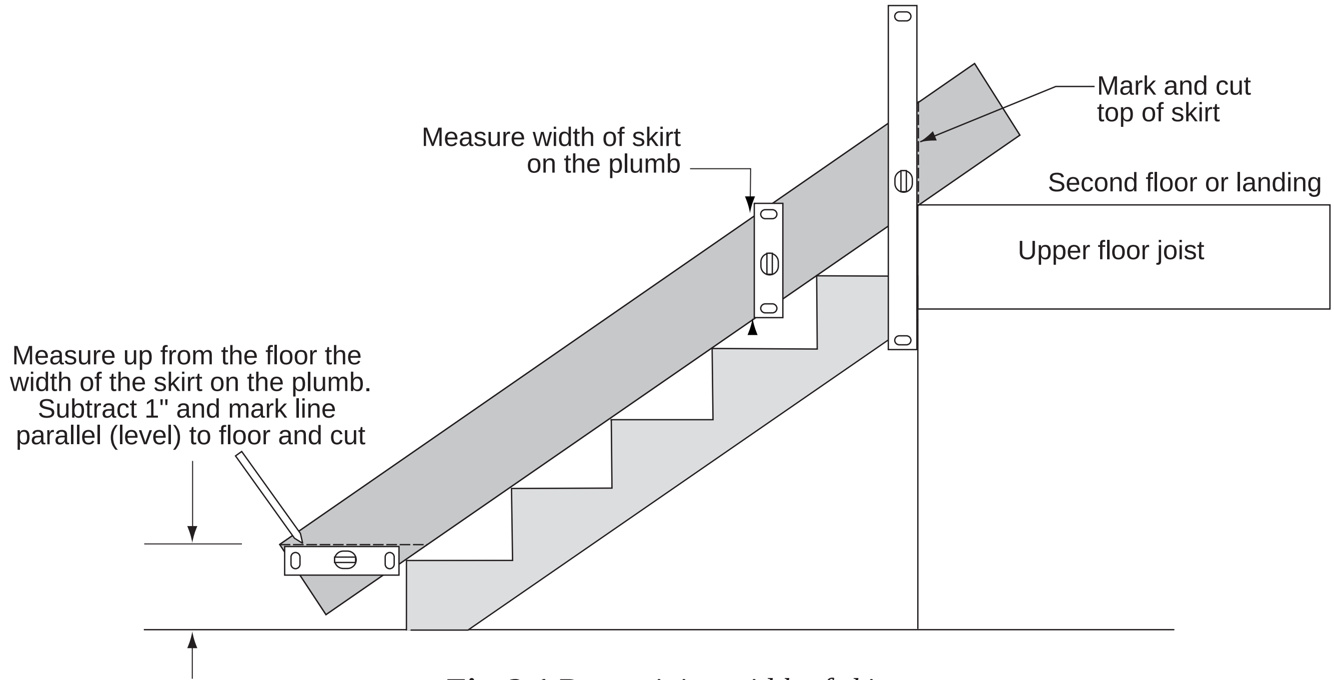


Fig. 2-1 *Determining width of skirt.*

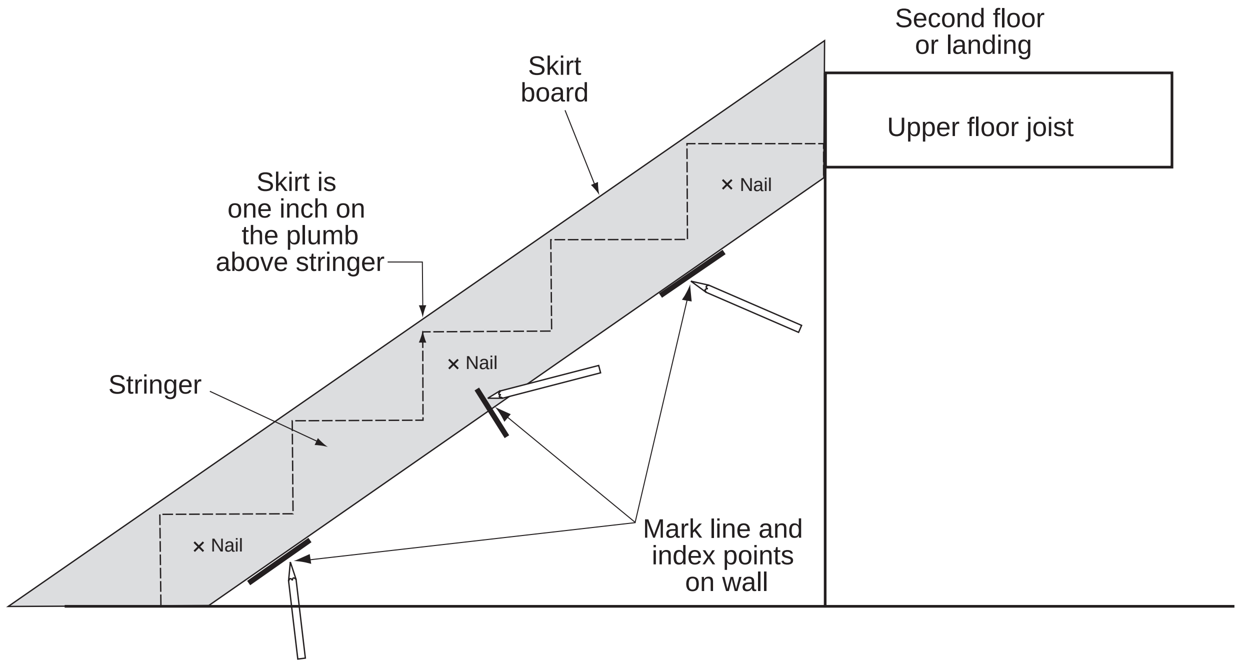


Fig. 2-2 *Marking wall skirt in place (index points on wall and skirt).*

Making and Using a Riser Jig

The riser jig is a pattern for transferring the stringer profile to the front face of the skirt, while at the same time, making allowances for riser's thickness so the skirt can be mitering properly. The riser jig is also useful for correcting minor rise and run flaws that may have occurred up to this point in the process. The following steps describe this process:

1. Cut a piece of material equal in thickness to the material to be used for risers (6-inch x 12-inch rectangle.) Please note Fig. 2-3 here.

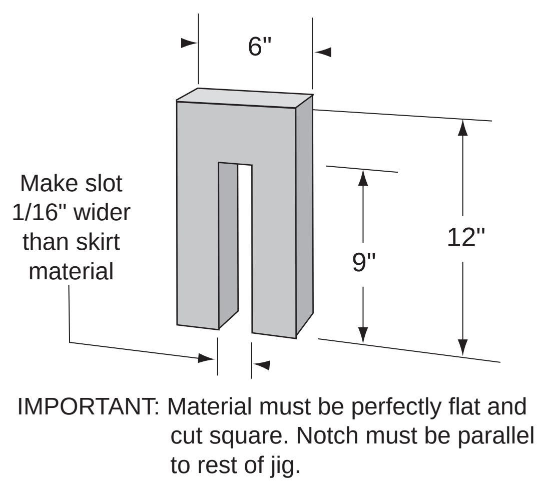


Fig. 2-3 *Making a riser jig.*

2. Cut a slot equal to the thickness of the skirt material 9-inches long in the center of the piece.
3. Slide the riser jig over the skirt, (A leg is resting on each side of the skirt with the stringer side of the jig touching the rise and run portion of the stringer in at least one place). Please note Fig. 2-4 here.

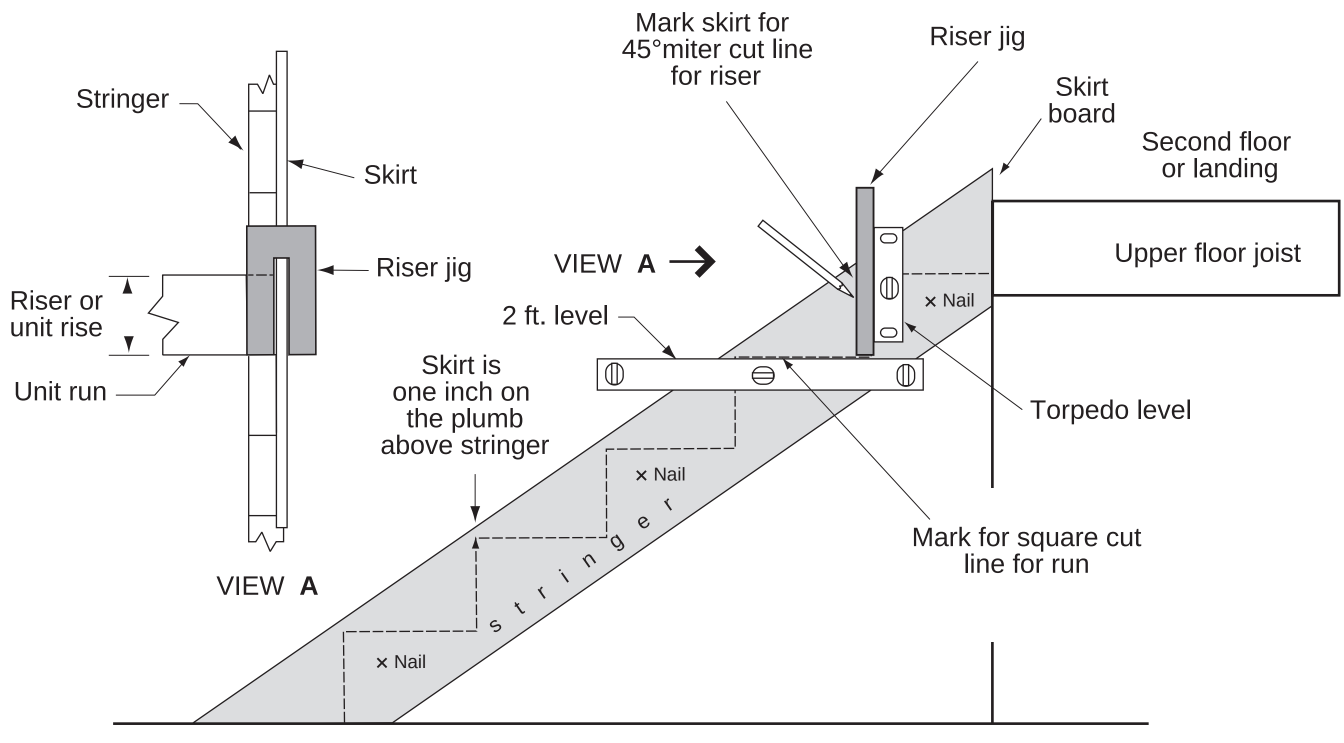


Fig. 2-4 *Using the riser jig*

4. Plumb the riser jig with a torpedo level.
5. Scribe a line on the front side of the jig for a 45 degree riser cut.
6. Scribe a line at the bottom of the riser jig to indicate length of the cut and the location of the run cut.
7. Repeat this process for all risers.
8. Using a two-foot level, scribe a line level with the floor on the bottom mark made by the riser jig. Each horizontal line (Run Cut) should connect two vertical lines. (Riser cut). Note: If a bull nose-starting step is used on the first step, make a square cut on the first rise of the skirt.

9. Remove the skirt and using a miter saw, cut all of the vertical lines at 45 degrees. Please note Figure 2-5 here.

***(Do not cut beyond the horizontal run line)**

10. Square cut all horizontal lines.
11. Using the reference marks, set the skirt back into place. Check the alignment at this point. Please note Fig. 2-6 here.
12. Attach skirt to the stringer with finish nails.

Installing Wall Skirt

The following steps describe this process:

1. Lay the skirt along the points of the stringer, butting the board against the wall. Tack the skirt board into place.
2. Using a two-foot level, scribe a line plumb with each riser. Please note Fig. 2-7 here.

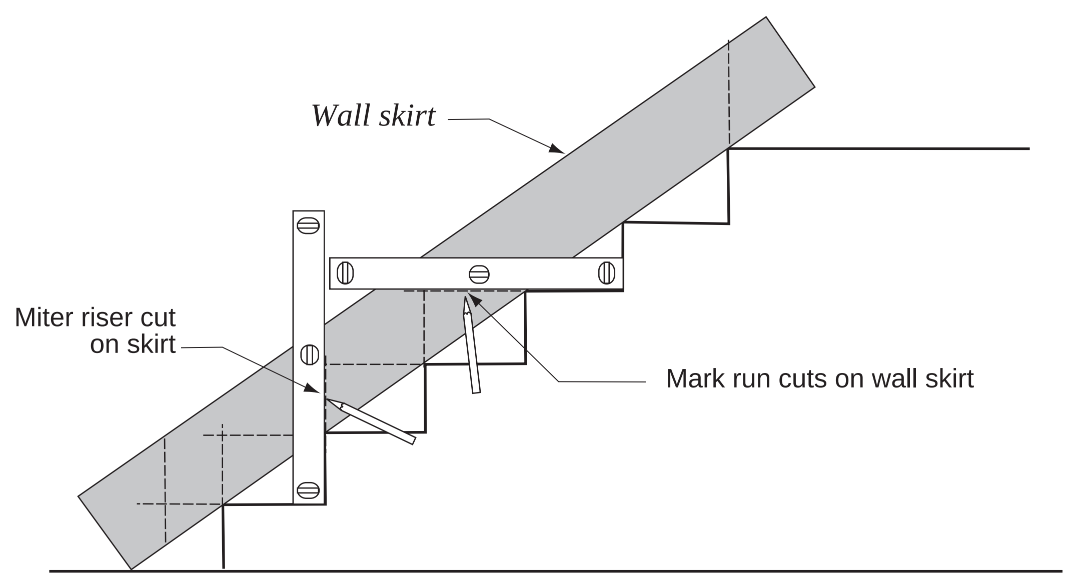


Fig. 2-7 *Measuring and cutting the wall skirt.*

3. Level across each tread and scribe a line on the skirt.
4. Square cut the lines on the skirt. Then, make any necessary notches to allow the skirt to rest on the stringers.

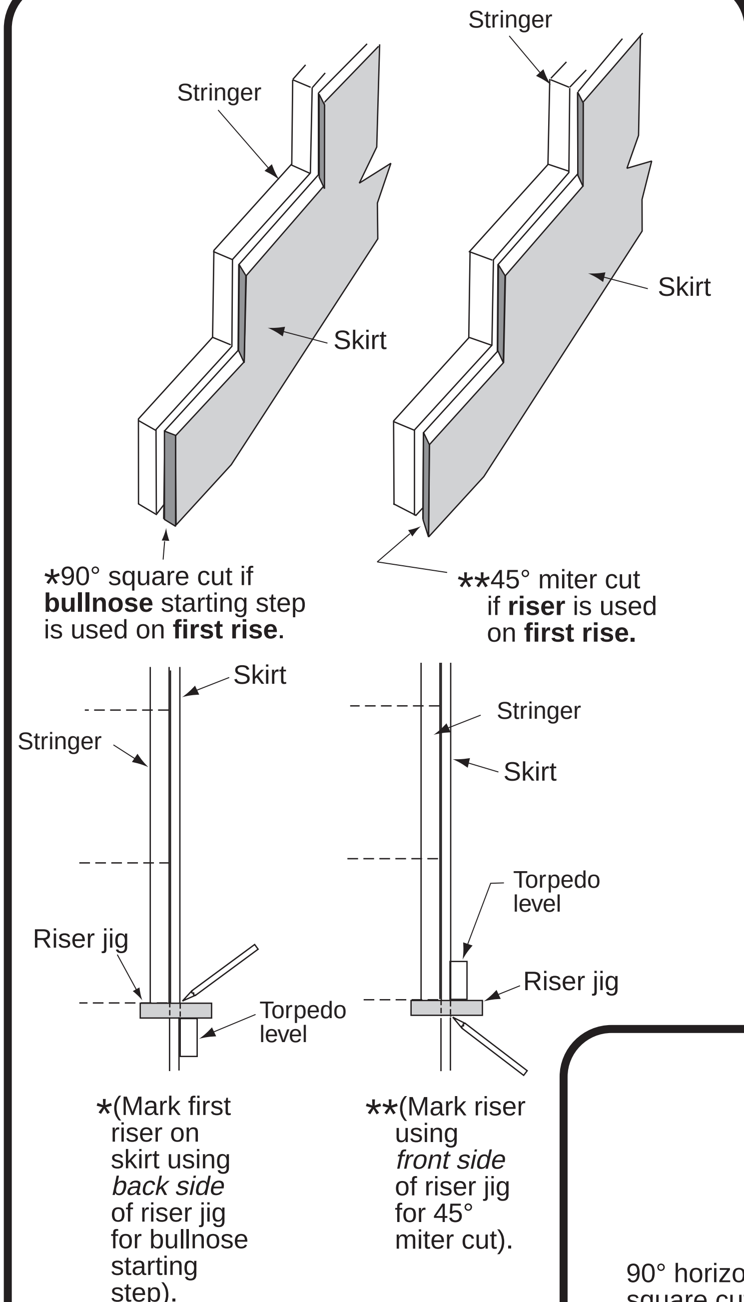


***Fig. 2-5** Cutting the skirt for Starting Step or Riser.*

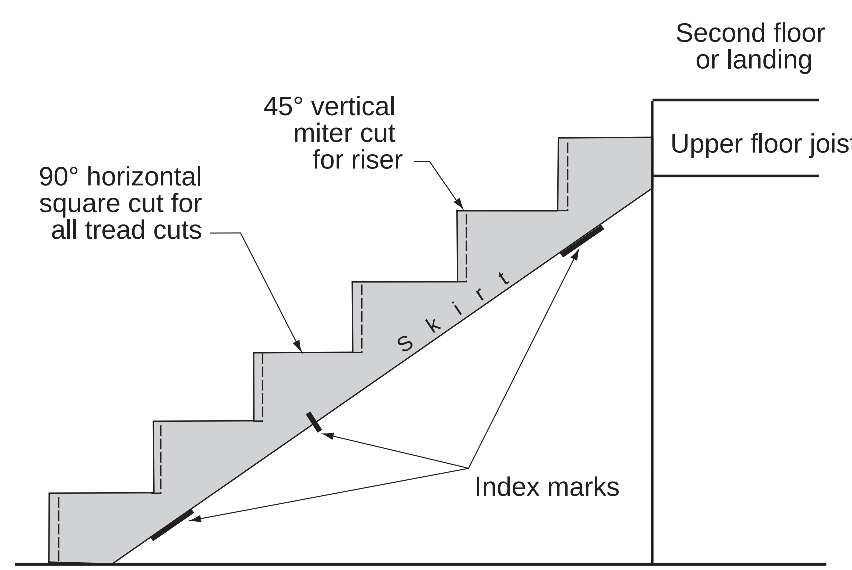


***Fig. 2-6** Attaching skirt to stringer*

5. Place the wall skirt onto the stringer and nail it against the wall or sheet rock. Please note Fig. 2-8 here.

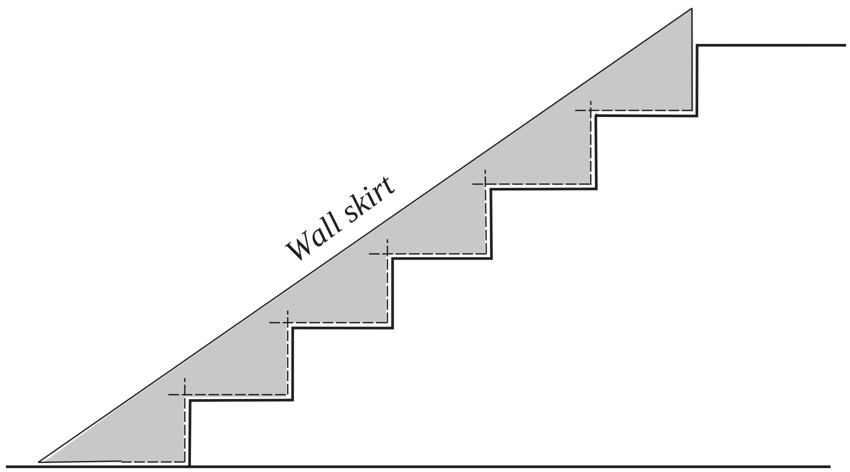


Fig. 2-8 *Installing the wall skirt.*

Note: Sometimes the inside stringer is placed 1-1/2-inches from the wall to allow for the skirt, sheet rock, etc. to be slipped behind the stringer. If you are using this method of installation, mark and cut the top and bottom end of the wall skirt. Then slide the skirt behind the inside stringer, and position it an equal distance above the stringer and finish nail into studs, and behind the sheet-rock. Please note Fig. 2-9 here.

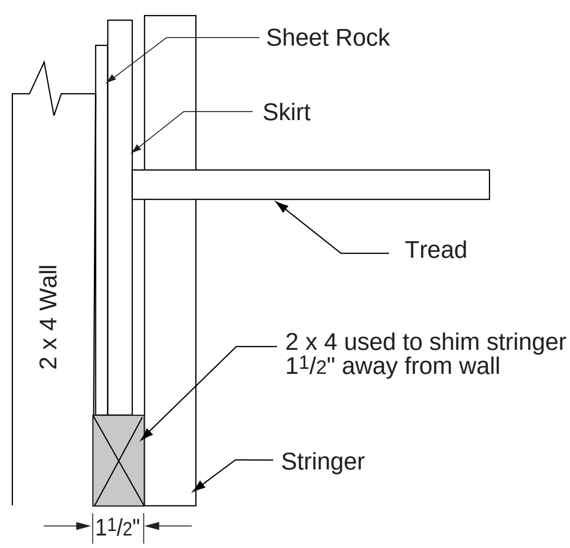


Fig. 2 -9 *Shimming inside stringer*

Installing Risers

Risers may be constructed out of a variety of species of wood. The determination is usually based on certain variables: whether the stair will be carpeted, whether the risers will be painted, or whether the risers will be stained. All risers should be nailed and glued securely to the stringer so to strengthen the stair and eliminate the possibility of creaks.

The following steps describe this process:

1. Cut a piece of material the height of the rise and 2-inches longer than the width of the stair.
2. Lay the riser across the stringers with the end flush against the wall skirt.
3. Scribe the riser to fit the wall skirt and cut.
4. Place the riser back onto the stringers and scribe a line even with the long point of the mitered skirt. Please note Fig. 2-10.

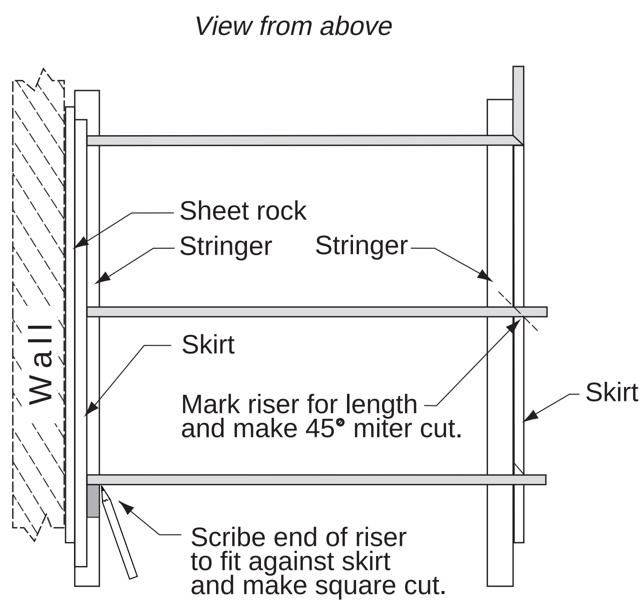


Fig. 2-10 *Cutting and installing risers.*

5. Make a square cut on this line at a 45-degree miter.
6. Place a small amount of wood glue on all areas where the riser is going to come in contact with the skirts. Use construction adhesive where the riser meets the stringers.

7. Set the riser in place and nail it to the skirts and stringers.

Note: Special attention should be given to the two mitered edges, which should form a sharp corner.

8. If necessary, shim the “wall side” of the riser to make it plumb.

9. Add blocking to the frame of the stair for the newel posts.

Adding a Bullnose Starting Step

The bullnose tread is a starting tread with riser that may have one or both ends rounded to a semi-circle. The bullnose end(s) will protrude beyond the face of the stair stringer. Also called a round end tread, the bullnose tread is larger and more decorative than a standard tread.

Installing the Bullnose Riser

The following steps describe this process:

1. Lay pre-bent bullnose riser in place.
2. Measure distance from the curved end of the riser to skirt. Please note Fig. 2-11 here.

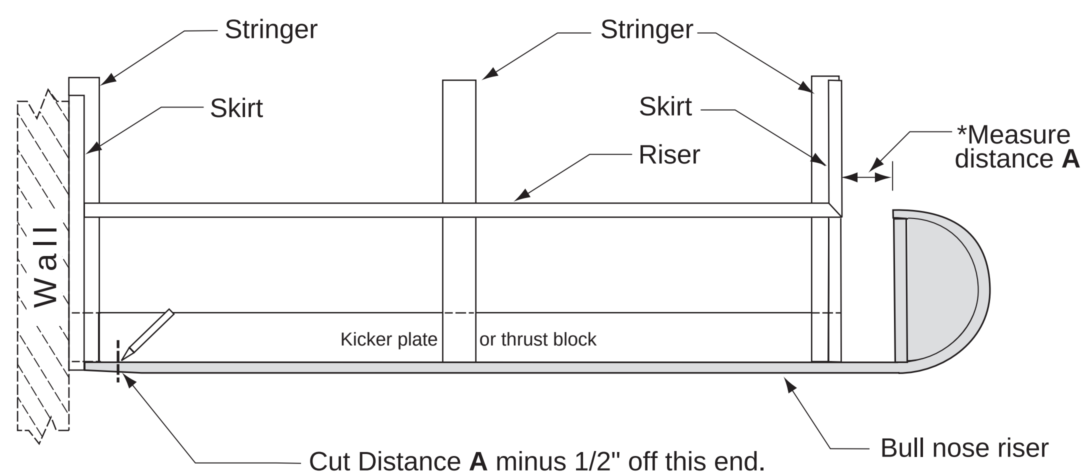


Fig. 2-11 *Measuring Bullnose Riser for rough cut.*

3. Subtract 1/2-inch from this distance; measure and scribe a line on the opposite end of the bull-nose riser.
4. Rough cut riser at this point.
5. Slide riser back into place.

6. Place a 3/4-inch scribe block between the curved end of the bullnose riser and the skirt. Please note Fig. 2-12 here.

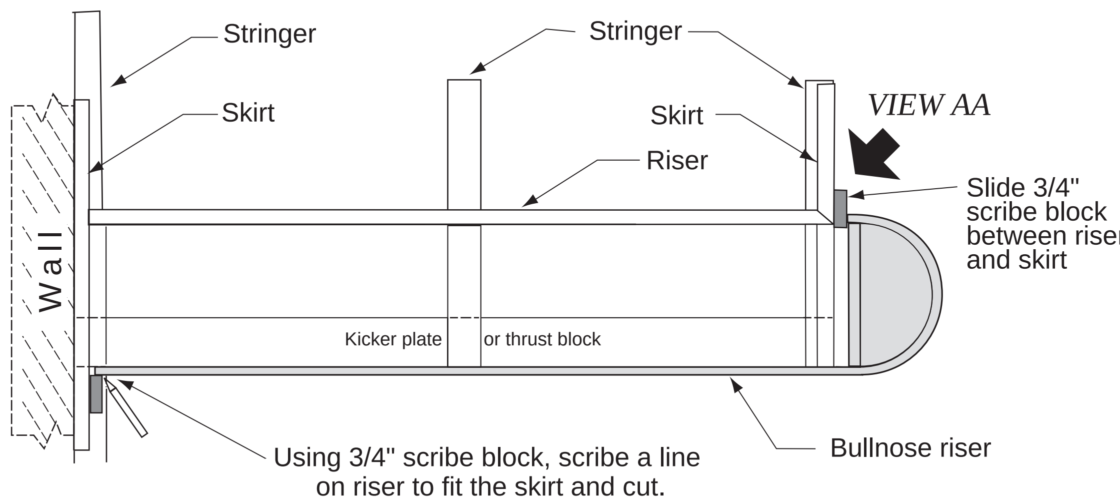


***Fig. 2-12** Measuring bullnose tread for finish cut using scribe block.*

7. Scribe the other end of the riser with the scribe block to fit the wall.
8. Make finish cut on riser.
9. Rip riser down to the necessary width to achieve proper height of your first riser.
10. Add blocking to attach bullnose riser to skirt. Please note Fig. 2-13 here.

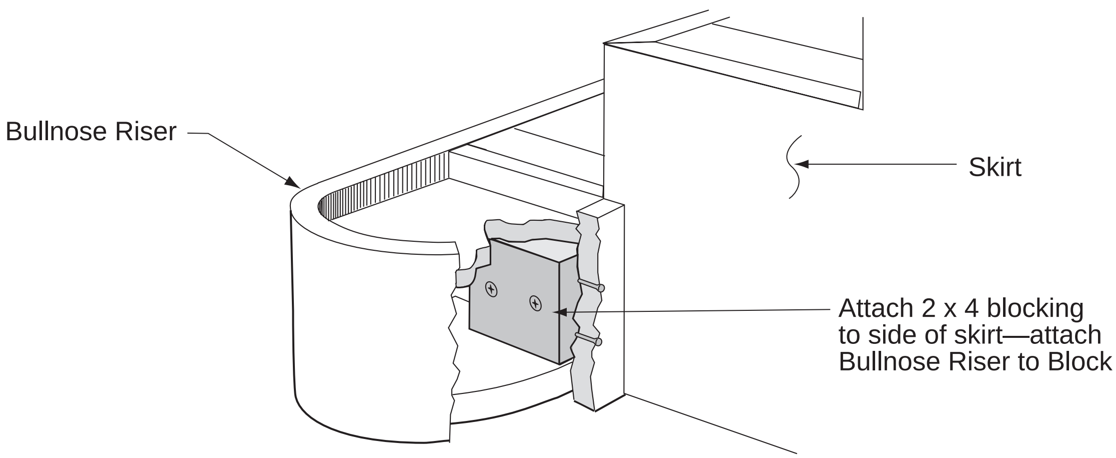


Fig. 2-13 VIEW AA

11. Attach riser to framing using a quality construction adhesive and nails (or screws). The framing usually consists of a 2 x 4 kicker plate or thrust block.

Installing the Bullnose Tread

The tread used with the bullnose is rounded (pre-made) in order to fit a pre-bent riser. (They are typically purchased as a set from your local stair parts distributor.)

The following steps describe this process:

1. Lay tread in place.
2. Measure distance from the offset to skirt. Please note Fig. 2-14 here.

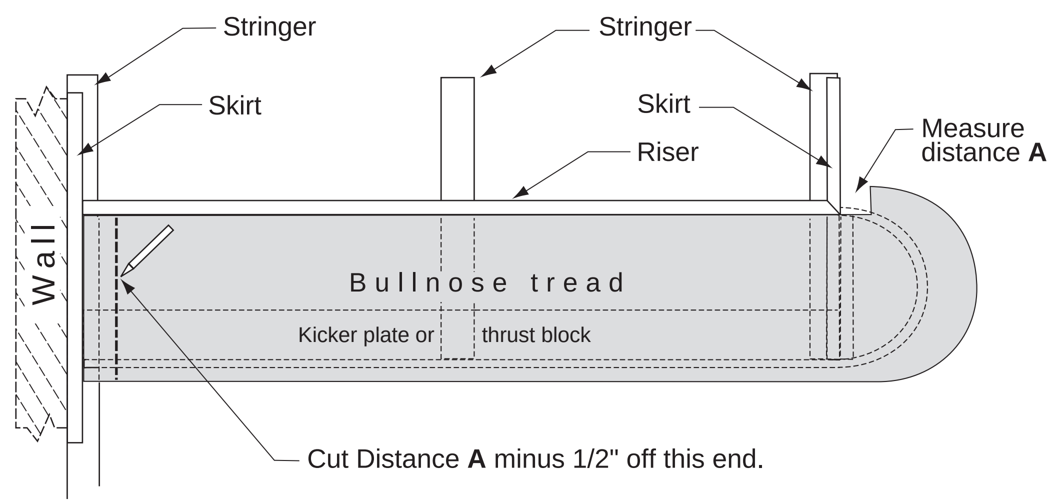


Fig. 2-14 *Measuring bullnose tread for rough cut.*

3. Subtract 1/2-inch from this distance; measure and scribe a line on the square end of the tread. Make a cut along the scribed line.
4. Place a 3/4-inch thick spacer between the offset and the mitered skirt. Please note Fig. 2-15 here.
5. Slide the spacer out, taking special care not to move the tread.
6. Using the same spacer, scribe a line on the other end of the tread to match the wall skirt. Please note Fig. 2-15 again.

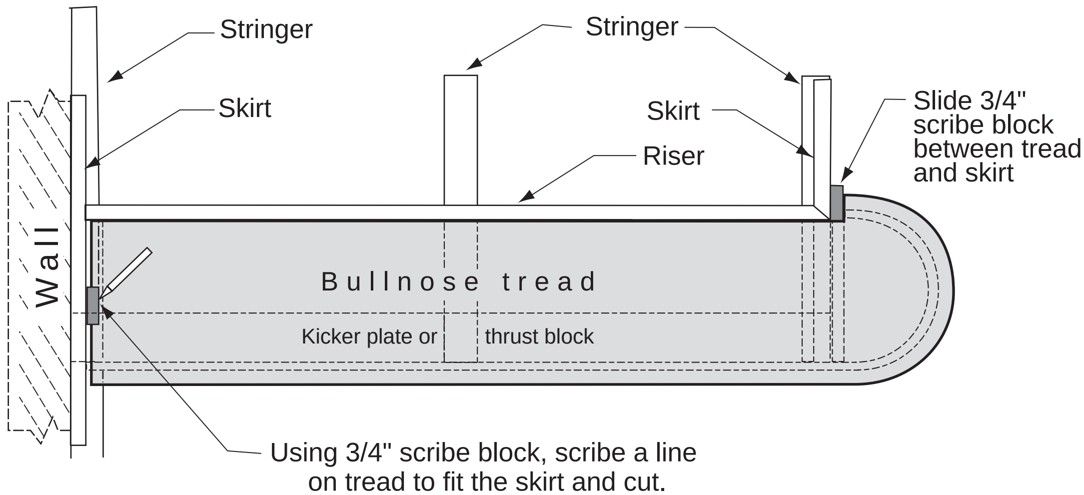


Fig. 2-15 *Measuring bullnose tread for finish cut using scribe block.*

7. Cut the bullnose tread to length following line scribed on wall skirt end. When cutting the tread, leave the width of the pencil line to allow for a tight fit.
8. Place construction adhesives on stringers, skirts, upper riser, and lower riser (everywhere the tread will come in contact).
9. Set the tread in place and push tight against all surfaces.
10. Nail the tread into stringers and into the front riser.
11. Reach around the back of the upper riser and nail riser to tread.
12. Trim bottom tread and riser with appropriate trim (cove and/or base shoe molding).

Installing Treads

The following steps describe this process:

1. Rip the tread to proper width. This is usually the run of the stair plus 1-1/4 -inches.
2. Measure distance from the offset to the skirt. Please note Fig. 2-16 here.

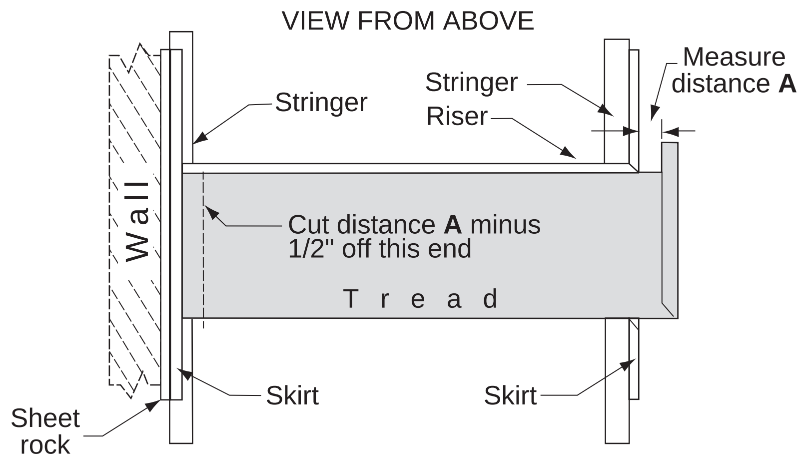


Fig. 2-16 *Measuring tread for rough cut.*

3. Subtract 1/2-inch from this distance; measure and scribe a line on the opposite end of the tread and cut.
4. Lay the tread in place.
5. Place a spacer that is 3/4-inch thick between the tread return and the mitered skirt. Please note Fig 2-17 here.

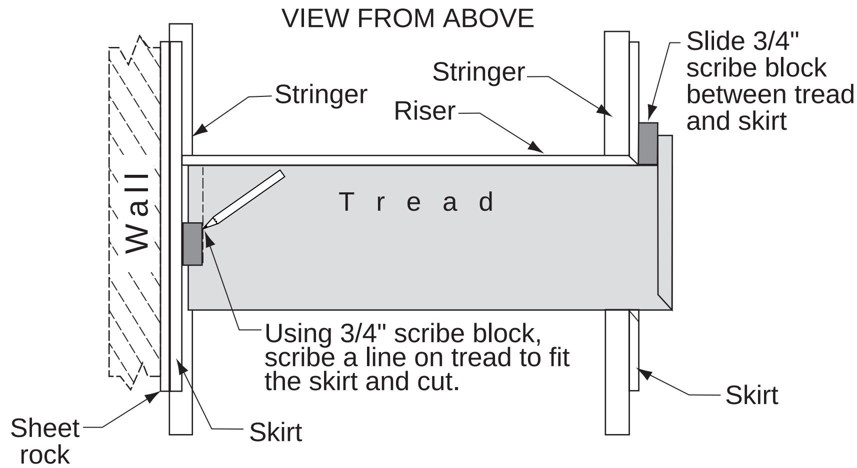


Fig. 2-17 *Measuring tread using scribe block for finish cut.*

6. Slide the spacer out, being careful not to move the tread.
7. Using the same spacer, scribe a line on the other end of the tread to match the wall skirt. Please note Fig. 2-17 again.
8. Cut the tread to length following the line scribed on wall skirt end. When cutting the tread, leave the width of the pencil line to allow for a tight fit.
9. Place construction adhesive on stringers, skirts, upper riser, and lower riser where tread will come in contact.
10. Set tread into place and push tightly against all surfaces.
11. Nail the tread into stringers and into the front riser. Please note Fig. 2-18 here.

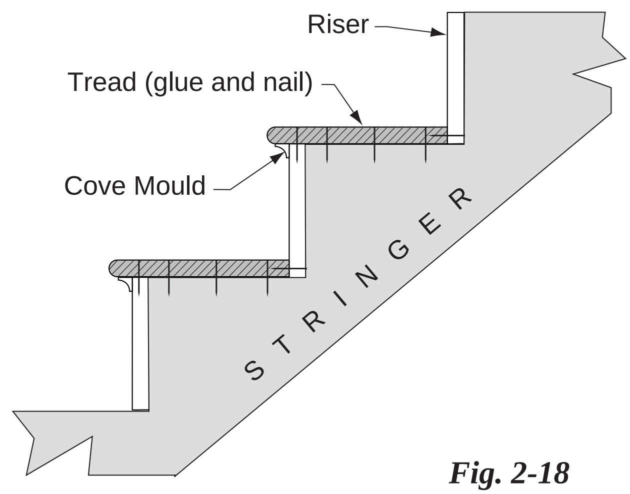


Fig. 2-18

12. Reach around the back of the upper riser and nail riser to tread.
13. Trim bottom of tread with appropriate molding. (This is usually cove molding.)

Installing False End Tread Caps and Risers

False tread caps are used on a carpeted staircase. The rough tread and riser must be in place before the false tread caps and risers can be installed.

1. Install mitered skirt. This was described in the earlier steps. Remember that false risers are 1/2-inch thick, so the riser jig should be made from 1/2-inch material.

**Please review Fig. 2-3 here.*

2. Notch the nosing of rough tread for the false riser. ***Note: Remember to allow for adding skirt when notching treads. Please note Fig. 2-19 here.***

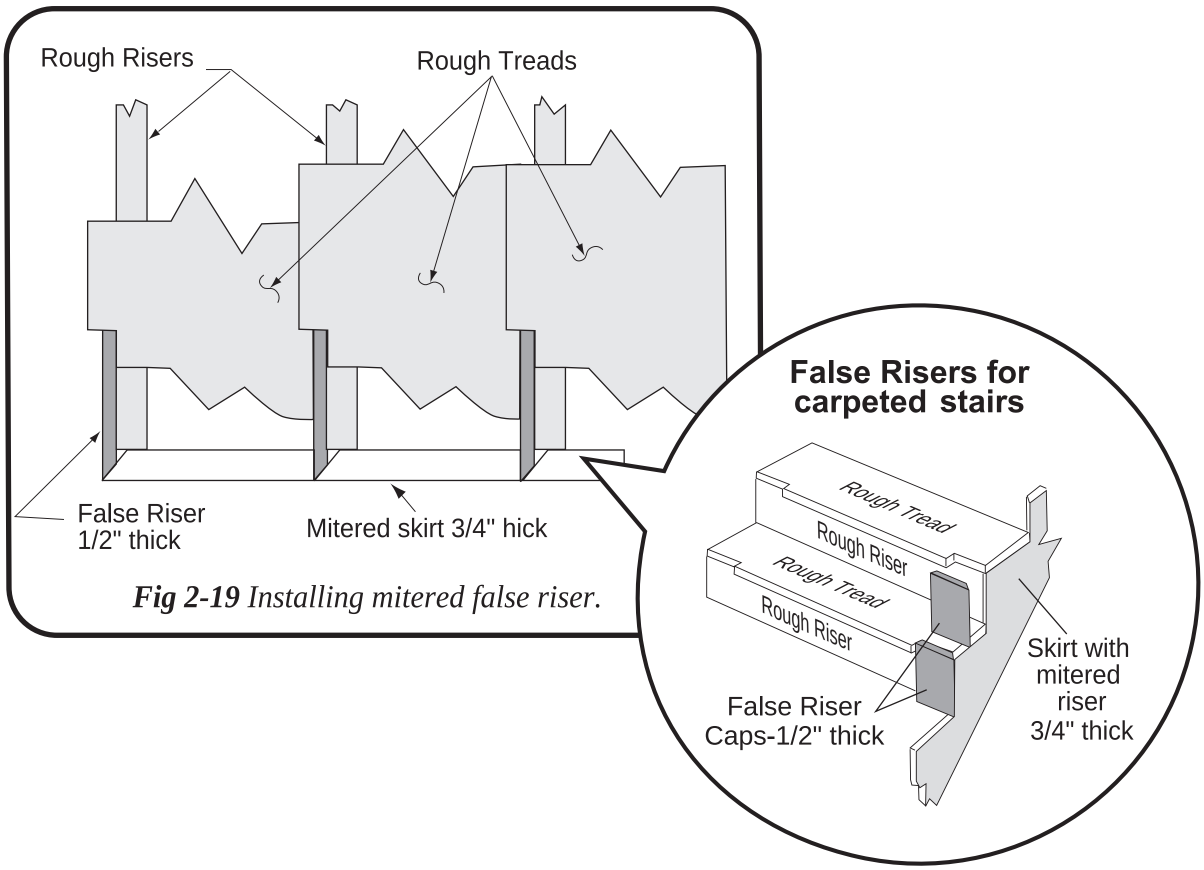


Fig 2-19 *Installing mitered false riser.*

3. Place false riser in position against the notched rough riser and rough tread. Scribe a line where the top of false riser meets the top of next tread. This is done to establish the height of the false riser.

4. Cut the false riser to the correct height and make a mitered end cut to connect to skirt.
5. Nail and wood glue the false riser to the mitered skirt. Apply construction adhesive between the false riser and the framing, and then nail securely in place. Make sure the riser is plumb and square with the skirt. Shim if necessary.
6. After all the false risers are attached, lay the false tread cap on corner of the first step. Mark and cut to match width of false riser.
7. Slide a scribe block between the first riser and underneath the front of the false tread cap between the nose, cove, and the first riser.
8. Holding the tread cap in place, slide the block out and place it on top of the false tread cap against the second riser.
9. Scribe a line at the second riser and cut the end off leaving the line.

Note: Do not cut into the nose and cove of the false tread cap, as this will damage the visible portion of the false tread cap.

10. Make a square cut on the end of the "tail" portion of the false tread cap molding leaving it as long as possible. Please note Fig. 2-20 here.

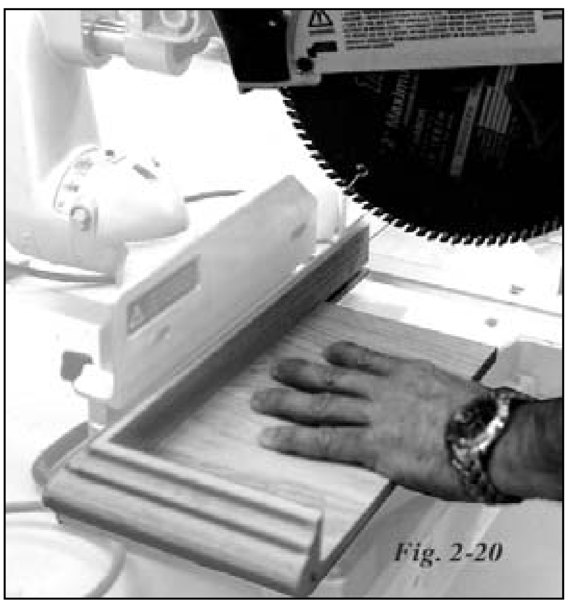


Fig. 2-20

11. Cut off a 45-degree angle wedge from the tail for the return. Please note Fig. 2-21 here.

Fig. 2-21

12. Cut another 45-degree angle in the reverse direction on the false end tread molding. Please note Fig. 2-22 here. Do not cut through the 1/2-inch tread panel when mitering the molding. This is accomplished by placing a spacer between the tread and the fence of the saw. Please note Fig. 2-23 here. This is done to position the false end cap in front of the center of the blade.

Fig. 2-22

Fig. 2-23

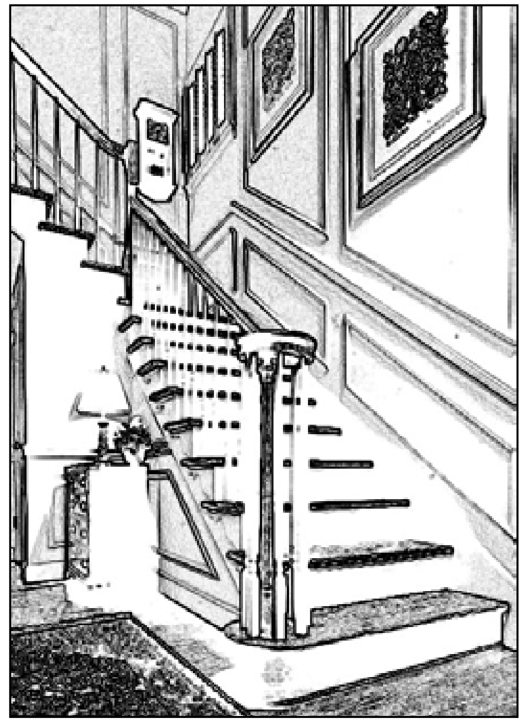
13. Place a bed of construction adhesive on the area of the rough framing where the false tread cap will be installed.
14. Lay the false tread cap in place and level it in all directions.
15. Nail the false tread cap in place. Put the nails through the nose and cove into the skirt and riser. ***Note: Do not nail through the top of the false tread caps as this may cause the tread to split.***
16. Wood glue the return into place.

Chapter 2: Things to Remember

1. Always consult your local building codes before building a stair.
2. Riser jig should be tight to framing (in at least one spot) and plumb before marking.
3. The riser jig must be same thickness as riser material.
4. All connecting surfaces should be bonded with a high quality wood glue and/or construction adhesive.
5. Add backing or blocking to all areas where newel posts will be attached.
6. Make all of the necessary adjustments to the first and last rise to allow for finished floor thickness.
7. Make sure that all treads are level and all risers plumb.
8. Securely fasten all bullnose treads to the floor and stair structure.
9. Before continuing, check all finished rise and run dimensions to verify compliance with local building codes.

Chapter 3
Installing Over-the-Post Railing on an L-Shaped Stair

In this chapter:



Over-the-Post vs. Post-to-Post

It is important to understand the difference between Post-to-Post balustrade systems and Over-the-Post balustrade systems. In simple terms, a Post-to-Post system is one in which the handrail runs between a series of newels. In the Over-the-Post balustrade system the rail runs over the newels with a series of fittings. This installation creates the aesthetic of a continuous section of handrail.

The Over-the-Post Balustrade System

The following diagram illustrates the Over-the-Post balustrade installation. Please note Fig. 3-1 here.

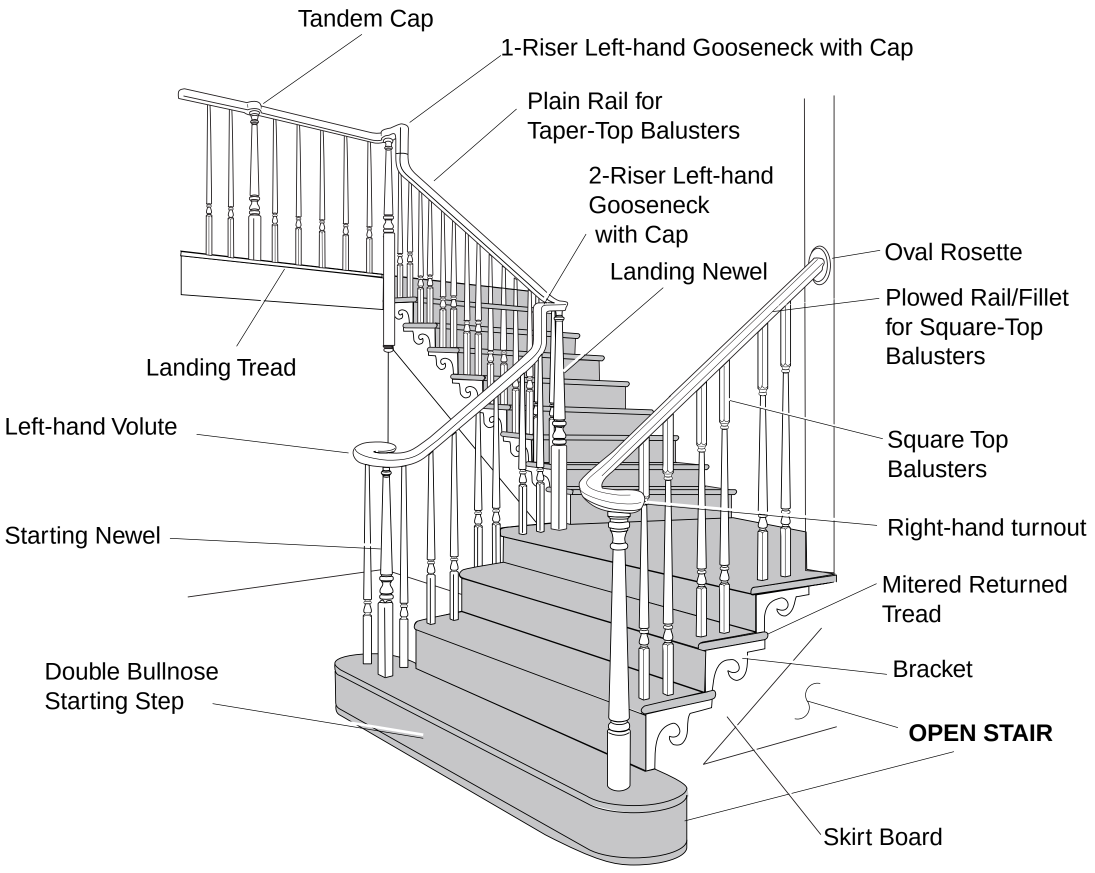


Fig. 3-1 *Over-the-post balustrade system*

In an over-the-post system the rail layout and positioning are the most critical elements of the structure. The newels are used to support the handrail of the balustrade. Newel placement becomes crucial to the structural stability of the balustrade.

This chapter explains how to attach the various fittings to the handrails. Instruction includes:

- Installation of the volute/turnout
- Installation of the gooseneck
- Installation of the balcony fittings

Many of the fitting applications are similar in an over-the-post system. The same principals can be used for almost all gooseneck and starting fittings.

Determining the Rail Centerline

The first step in installing a balustrade system is determining where the rail centerline should fall. The rail centerline, also known as the baluster line, indicates where the handrail and newels are placed on a staircase. There is no standard position for the rail centerline. It can be moved in as far as you prefer, as long as it does not impede on code width requirements. Please note Fig. 3-2 here. (Most building codes state that the average residential staircase should be at least 36 -inches wide). The rail centerline can also be moved out until the baluster misses the stair.

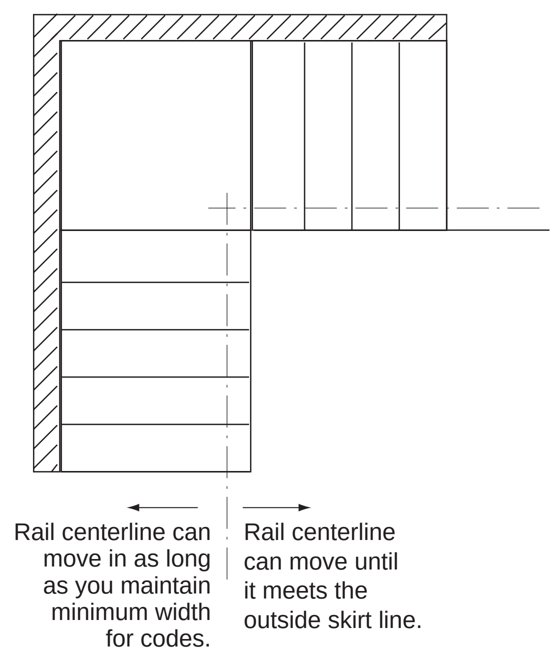


Fig. 3-2 *Variations on placement of rail centerlines*

There are two common approaches to determining rail centerlines: the top mount system and the half lap system. In a top mount system the newels are set fully on the tread or floor. Please note Fig. 3-3 here.

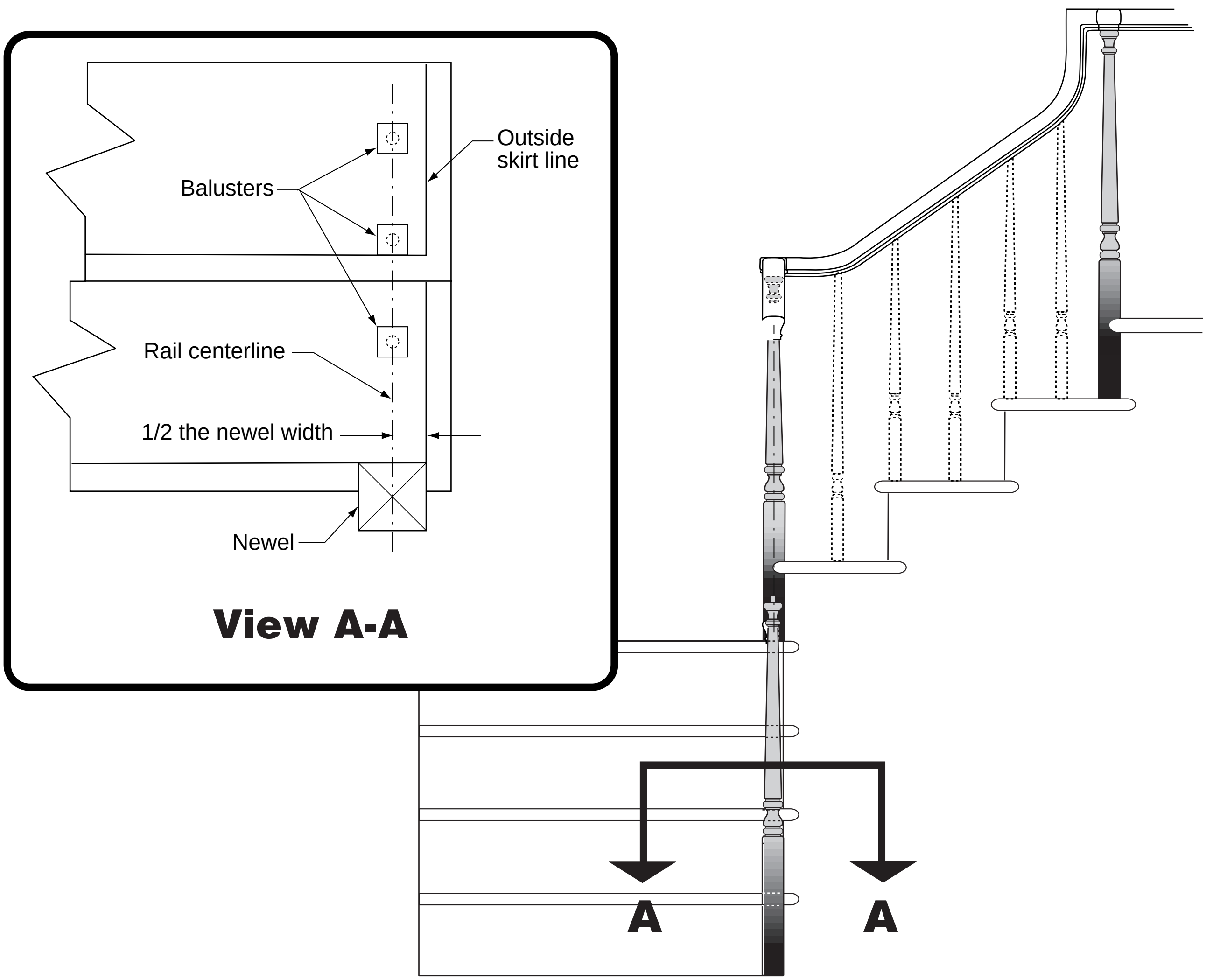


Fig. 3-3 *Top mount rail system*

This method will also decrease the width of the stair. In the top mount rail system, the newel position determines the rail centerline. In a half-lap system, the bottom of the newel must be notched to allow the newel to lap down the side of the stair. The baluster position is determining the rail centerline. Please note Fig. 3-4 here.

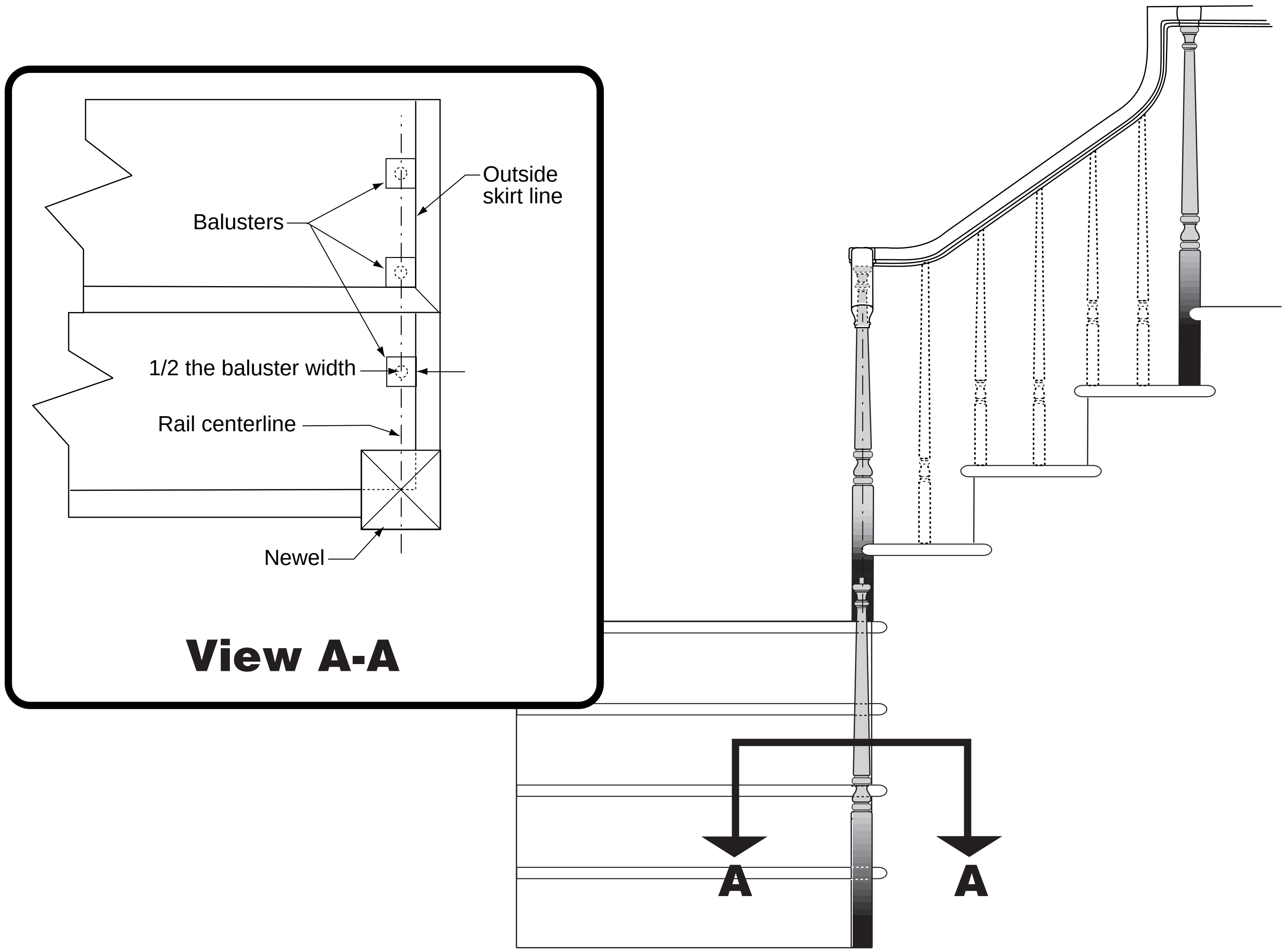


Fig. 3-4 Half lap rail system

Most U.S. stair builders use the top mount system since it is much faster and more efficient. As labor costs increase, it has become necessary to find less expensive ways to install handrails.

When determining the placement of the rail centerline, one must take into consideration the "starting" and "stopping" points of all of the rail sections. The rail centerline should be placed where it will provide balance and symmetry to the overall stair system.

Note: Due to the placement of walls, columns, doors, etc. the rail centerline may vary in the stair system.

Using Rail Bolts

Construction of the over-the-post balustrade requires an understanding of how to attach fittings to rail attachments using rail bolts.

The following steps describe the process:

1. Prepare a template by cutting a 3/16-inch wafer from the handrail.
   Please note Fig. 3-5 here.

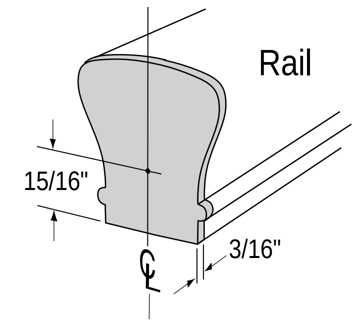


Fig. 3-5 Preparing a template from handrail.

2. Measure on the centerline 15/16 of an-inch from the bottom of the rail.
3. Drill a 1/16-inch diameter hole. This hole will be used to mark the location of the rail bolt.
4. Write “rail” on one side of the template and “fitting” on the other side.
5. Align the template and mark the rail and the fitting.
6. When marking the rail, be sure the rail side is visible; when marking the fitting, make sure the fitting side is visible. Always be consistent when marking to attain proper results. ***Note: You may elect to stabilize the rail and fitting during assembly by driving two small finish nails into the rail.*** Trim off head as illustrated. Leave approximately 1/8-inch protruding. Please note Fig. 3-6 here.

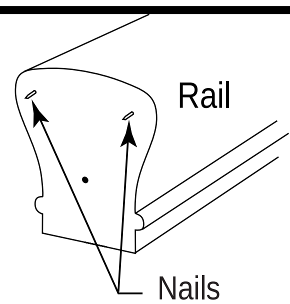


Fig. 3-6 Stabilizing rail and fitting with use of small finishing nails.

After you have learned how to make a template, you can then install the rail bolts to your fittings.

1. Drill 1/4-inch diameter hole into the fitting 1-3/4-inch deep in the location marked by the template. Make sure "fitting" side is facing out.
2. Drill 1-inch diameter hole in the bottom of the rail on the centerline, 1-1/2-inch from the end of the rail. This hole should be 1-3/4-inch deep. Please note Fig. 3-7 here.

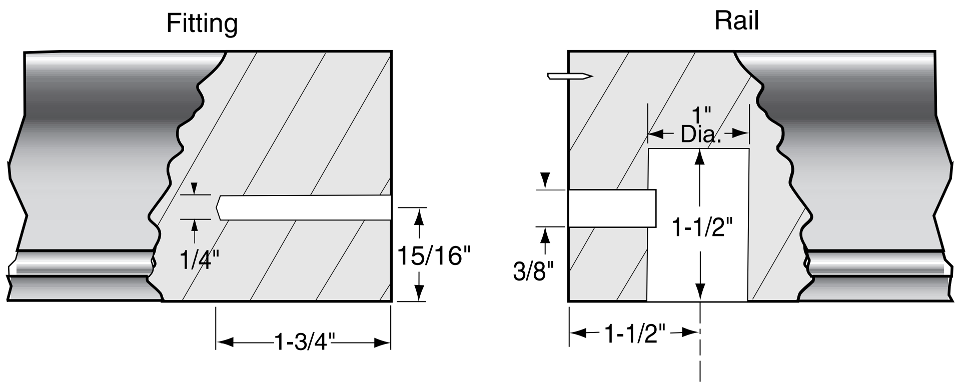


Fig. 3-7 *Drilling holes in fitting and rail for joining*

3. Using the mark made with the template, drill a 3/8-inch diameter hole in the end of the rail. This hole should be 1-1/2-inch deep. Make sure that the "rail" side is facing out.
4. Screw rail bolt into the fitting using a rail bolt driver. Leave at least 1-3/4-inches of the bolt protruding.
5. Assemble the rail and the fitting "dry" to check fit.
6. Slide rail bolt protruding from the fitting into the 3/8-inch diameter hole.
7. Use the radius washer, flat washer, and nut (in that order) to attach the two pieces together. Please note Fig. 3-8 here.

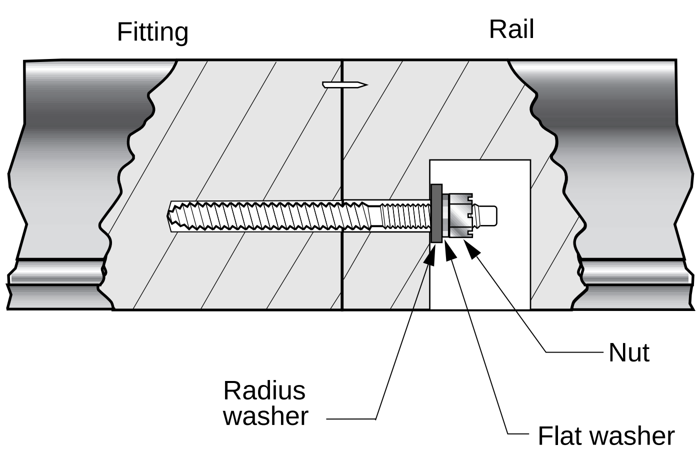


Fig. 3-8 *Assembling fitting and rail using rail bolt and accessories.*

8. Apply glue when making the final rail and fitting assemblies.
9. Apply glue to edges of plug provided and cover 1-inch diameter hole in bottom of rail. Sand smooth.

Making a Pitch Block

A pitch block can be used in several areas of stair and rail construction and is especially useful in over-the-post rail systems. Made from a triangular piece of wood, the pitch block represents the rise, run, and rake (slope) of a set of stairs.

The following steps describe the process:

1. Clamp a straight edge across the nose of several treads. Please note Fig. 3-9 here.

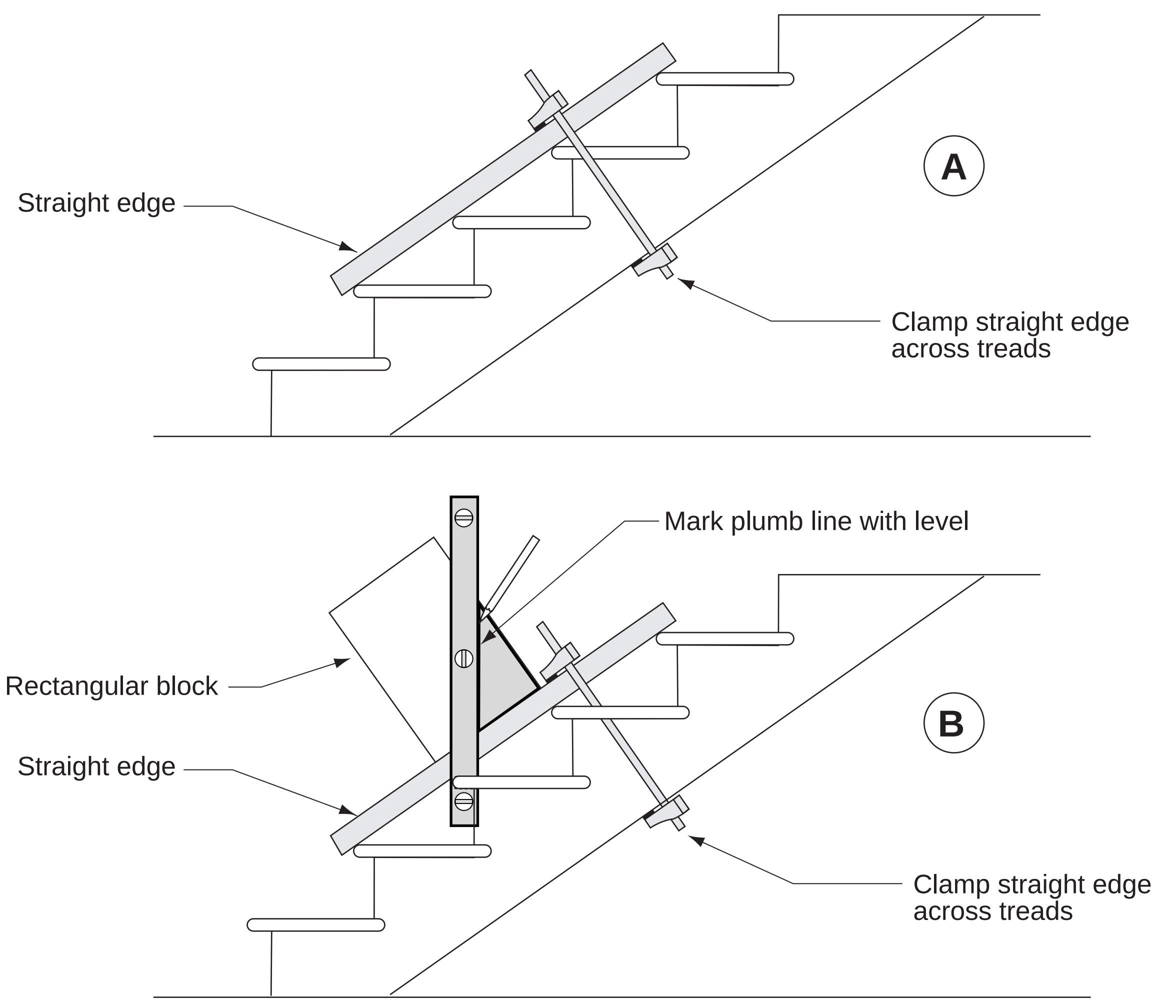


***Fig. 3-9** Determining angles on pitch block.*

2. Place a rectangular block with square corners on the straight edge.
3. Using your level, plumb and scribe a line on the block.
4. Cut the block on this line with a miter saw, taking note of the angle on the saw. Please note Fig. 3-10 here.

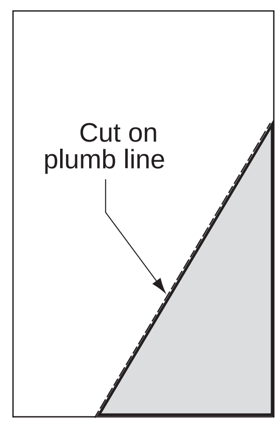


***Fig. 3-10** Cutting pitch block.*

5. Label the sides of the block "run," "rise," and "rake" (or slope). The finished block represents the angle of slope of the stair. Please note Fig. 3-11 here.

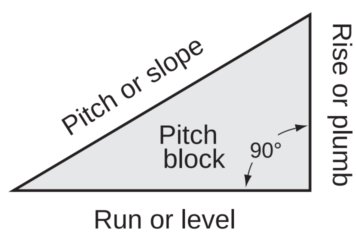


***Fig. 3-11** Finished pitch block showing rise, run, and slope of stair.*

Laying Out the Volute Newel

A volute is a specialized, spiral shaped section of handrail that is placed at the foot of the staircase. The volute serves the aesthetical purpose of forming the technical beginning of the staircase. Installed correctly, the volute adds interest and elegance to a staircase. It is generally used with several other specialized stair parts, including a bullnose starting step and a volute newel. The bullnose starting step provides the room necessary to install the volute newel and the ring of additional balusters that curve around the newel.

The layout of the volute on your staircase will vary depending on the placement of the rail centerline.

The following steps describe the process:

1. Mark the rail centerline on the bullnose-starting step.
2. Looking at the bottom of the volute, measure the distance from the center of the newel pin hole to the center of the straight section of the volute or rail centerline. Please note Fig. 3-12 here.

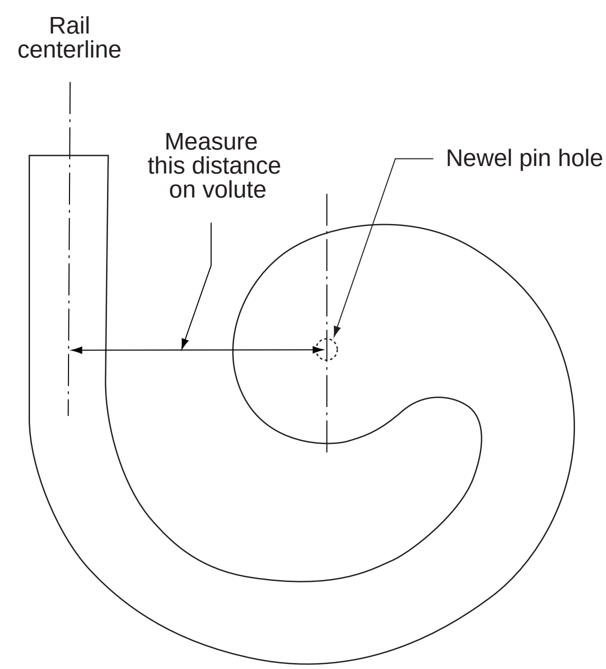


Fig. 3-12

3. On the bullnose tread, measure over this distance from the rail centerline, and mark newel centerline. Please note Fig. 3-13 here.

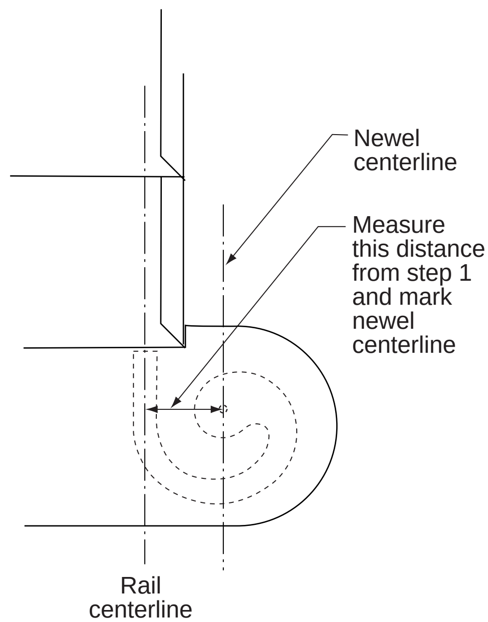


Fig. 3-13

4. Measure the width of the bullnose tread and divide by two. Most volute patterns call for the center of the newel to be placed 1-inch behind the center of the bullnose tread. The tread size and volute pattern may change this.
5. From the front of the tread, measure back this distance; add 1-inch and mark. These intersecting marks indicate the center of the volute newel. Please note Fig. 3-14 here.

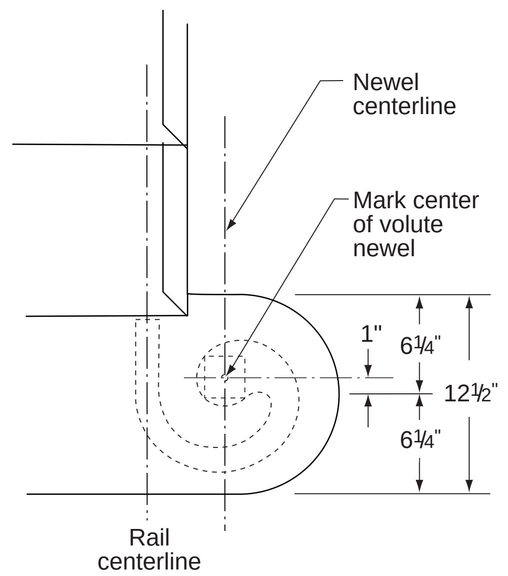
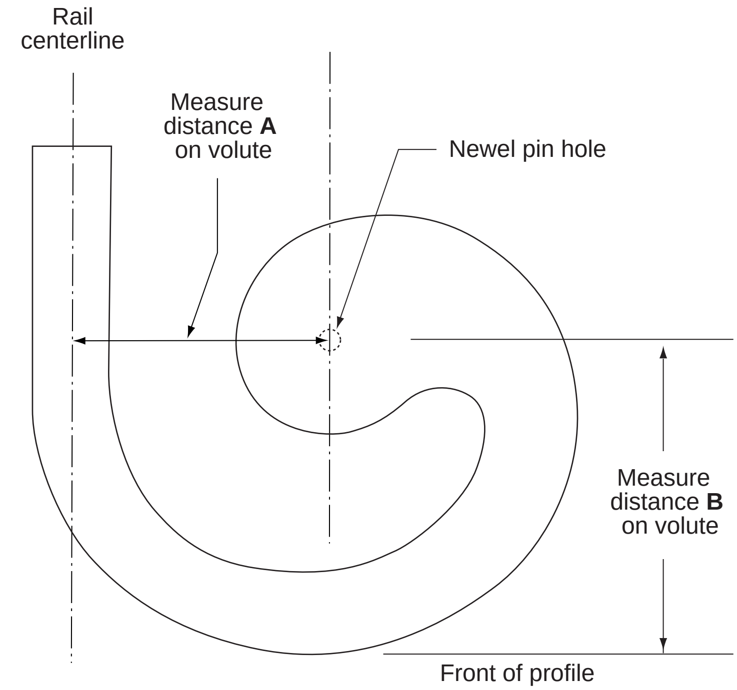
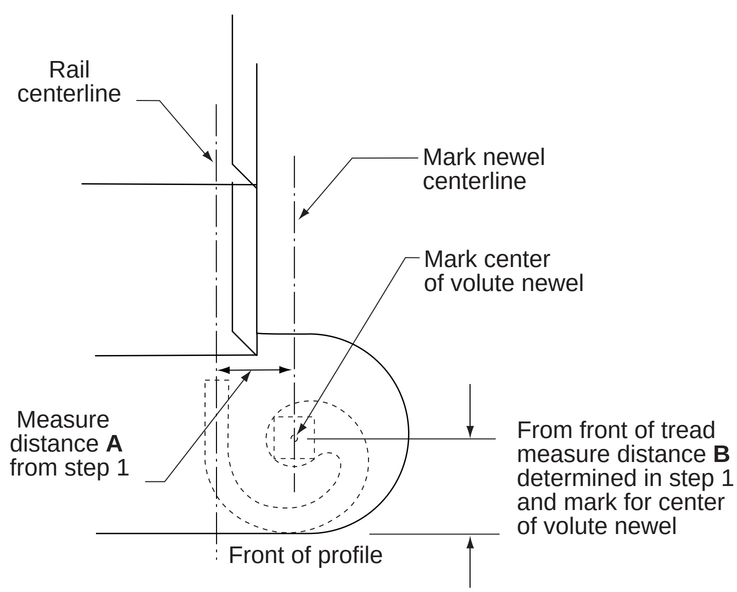


Fig. 3-14

Note: Some building codes require the front of the volute to be even with the front (or leading edge) of the tread. In this case, measure the distance from the front of the profile on the volute to the center of the newel pinhole. From the front of the tread, measure back this distance and draw a line that intersects with the volute layout line. This indicates the location of the center of the volute newel. Please note Fig. 3-15 here.



Step 1



Step 2

Fig. 3-15 *Layout of the volute for code exception*

Laying Out the Large Turnout Newel

The large turnout is another specialty piece of handrail most often used in an over-the-post balustrade system. It is simply a piece of handrail that turns out at the end, which adds interest to the balustrade.

The large turnout is generally used with several other specialized stair parts, including a bullnose starting step and a volute newel. The bullnose-starting step provides the necessary room to install the volute newel and the ring of additional balusters that curve around the newel.

The large turnout newel layout will depend on the placement of the rail centerline.

1. Mark the rail centerline on the bullnose-starting step.
2. Looking at the bottom of the large turnout, measure the distance from the center of the newel pinhole to the center of the straight section of the large turnout. Please note Fig. 3-16 here.

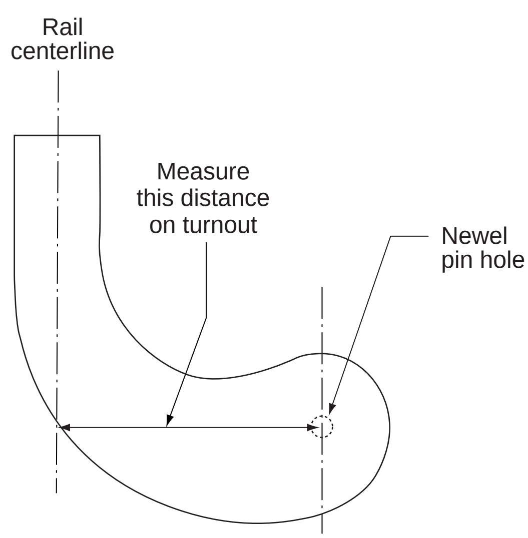


Fig. 3-16

3. On the bullnose tread, measure over this distance from the rail centerline and make a mark. Please note Fig. 3-17 here.

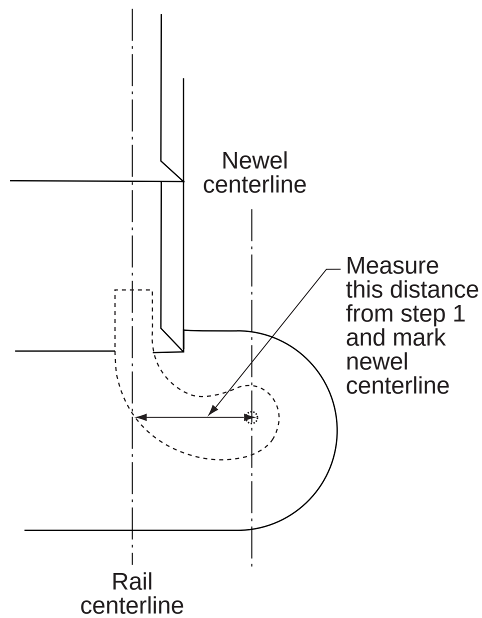


Fig. 3-17

4. Measure the width of the bullnose end of the tread and divide by two. Generally, the turnout newel is placed in the center of the tread. Please note Fig. 3-18 here.

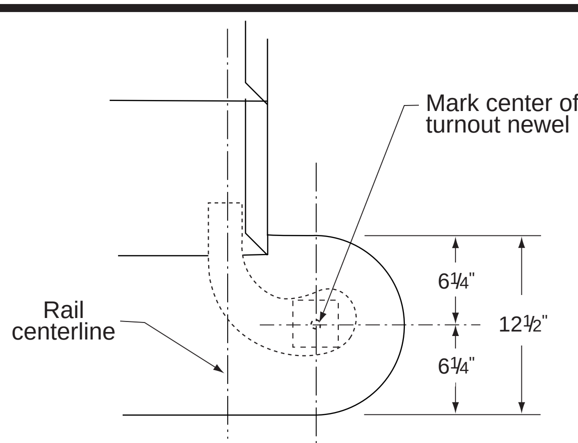


Fig. 3-18

5. From the front of the tread, measure "back" this distance and mark. These intersecting marks indicate the center of the turnout newel.

Note: Some building codes require the front of the large turnout be even with the front of the tread. In this case, measure the bottom of the turnout the distance from the front of the rail profile to the center of the turnout newel pinhole. From the front of the bullnose tread, measure back this distance and draw a line that intersects with the turnout centerline. This layout generally means that the newel will be placed partially off the tread. If so, it may be easier to simply mount the newel on the front of the riser, which will require a longer newel. Please note Fig. 3-

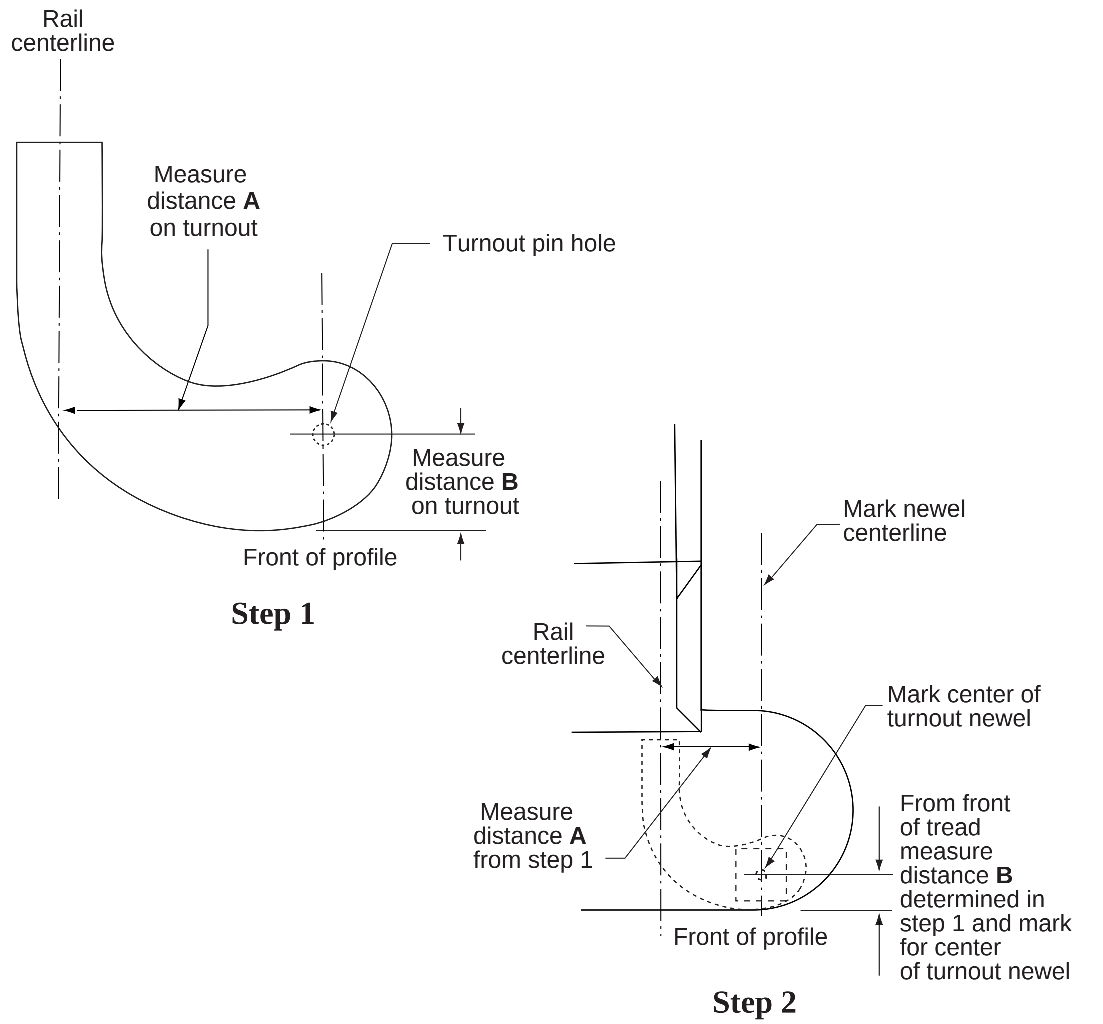


Fig. 3-19 *Layout of the large turnout for code exception*

Attaching Starting Fitting

Now that you have constructed a pitch block and located the placement of the starting newel, you are ready to cut and attach your fittings. The starting fitting consists of a volute, turnout, or starting easing.

The following steps describe the process:

1. Lay appropriate fitting on a flat surface with up easing curving upward.
2. Slide the pitch block with "run" side down against the up-easing and mark a small line where the block touches the fitting to locate cut line. Please note Fig. 3-20 here.

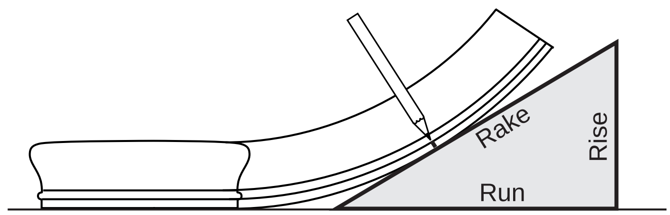


Fig. 3-20 *Marking location of cut line on up easing of starting fitting.*

3. Turn the pitch block with "rise" side down and align it with the mark; scribe the cut line across the side profile of the fitting. Please note Fig. 3-21 here.

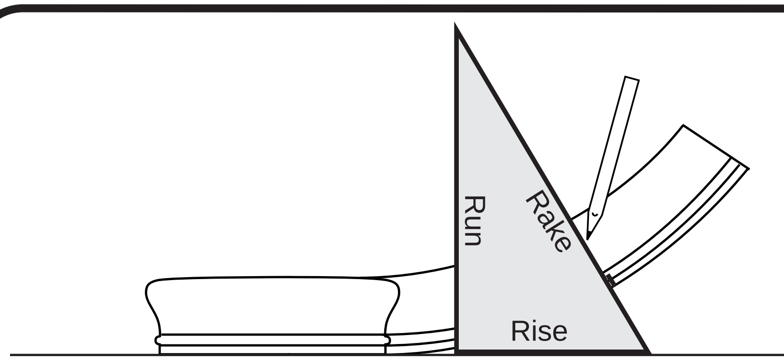


Fig. 3-21 *Marking cut line on up easing of starting fitting.*

4. Cut along this line with a miter saw.

Note: This procedure is used any time a rake (slope) rail is attached to a level fitting.

Connect the Starting Fitting to the Handrail

The following steps describe the process:

1. Make a square cut on the end of a length of handrail (long enough to connect first and second newel). This will be used for the handrail on the first run of the staircase.
2. Attach the starting fitting to the handrail with the proper rail bolt or hardware. (See section on rail bolt instructions.)
3. After the starting fitting has been connected, the next step is to check the fitting.

Checking the Fitting

1. Lay rail with attached starting fitting onto treads.
2. Check to see that the starting fitting is level. Please note Fig. 3-22 here.

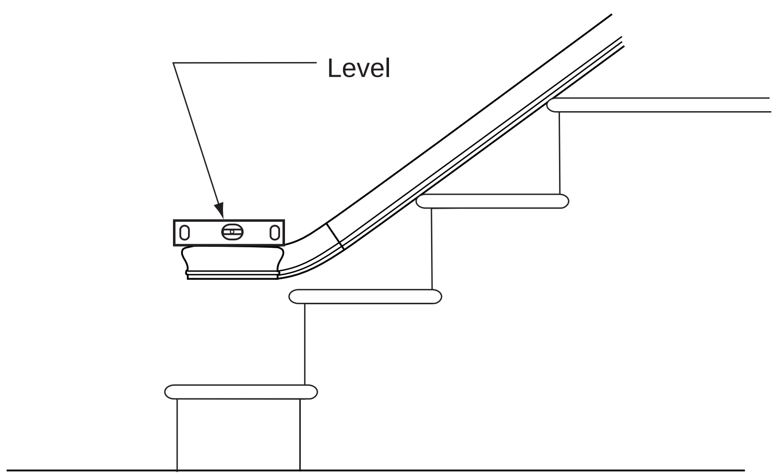


Fig. 3-22 *Make sure starting fitting (volute, turnout, starting easing) is level.*

3. If correction is needed, mark area to be cut and then unbolt fitting.
4. Bevel cut the end of the straight rail in the direction that would correct the connection.
5. Reattach the fitting to the rail.

Attaching Two-Rise Gooseneck

1. Lay cap and up easing portion of the two-rise gooseneck on a flat surface so that the up easing is curved upward.
2. Slide the pitch block with the "run" side down against the up easing; mark a small line where the block touches the fitting to locate cut line. Please note Fig. 3-23 here.

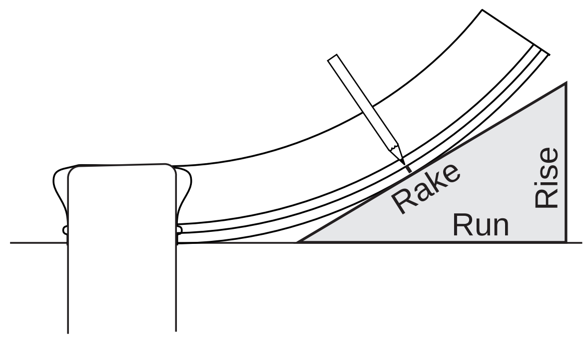


Fig. 3-23 *Marking location of cut line on two-rise gooseneck*

3. Turn the block with "rise" side down and align it with the mark; scribe the cut line across the side profile of the fitting. Please note Fig. 3-24 here.

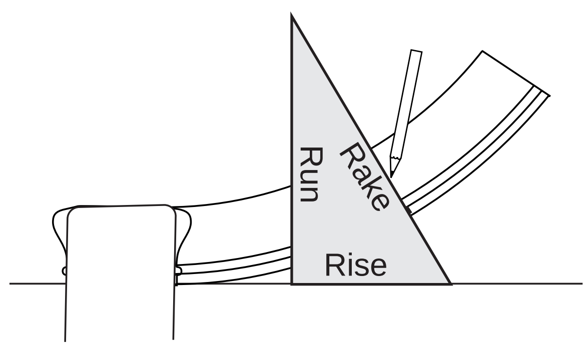


Fig. 3-24 *Marking cut line on two-rise gooseneck*

4. Cut along this line with a miter saw.

Connecting the Gooseneck Fitting to the Handrail

1. Make a square cut on the end of a piece length of handrail for the second run of the staircase. It should be long enough to connect the landing newel to the newel on the second floor.
2. Attach the two-rise gooseneck fitting to the handrail with the proper rail bolt (see rail bolt instructions).
3. After the fitting has been connected, the next step is to check the fitting.

Check Fitting

1. Lay rail with attached fitting onto treads.
2. Check to see that fitting is plumb and level. Please note Fig. 3-25 here.

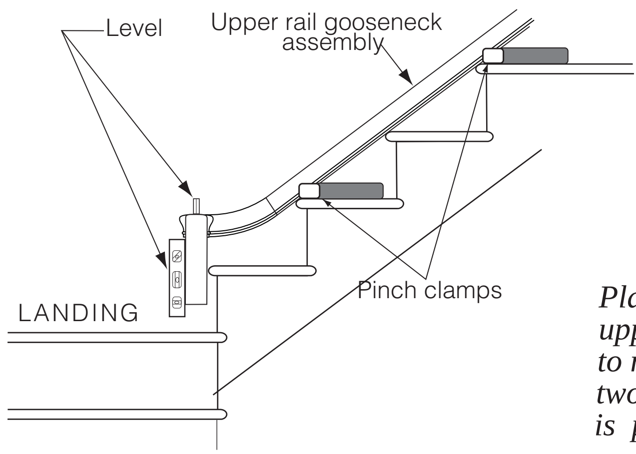
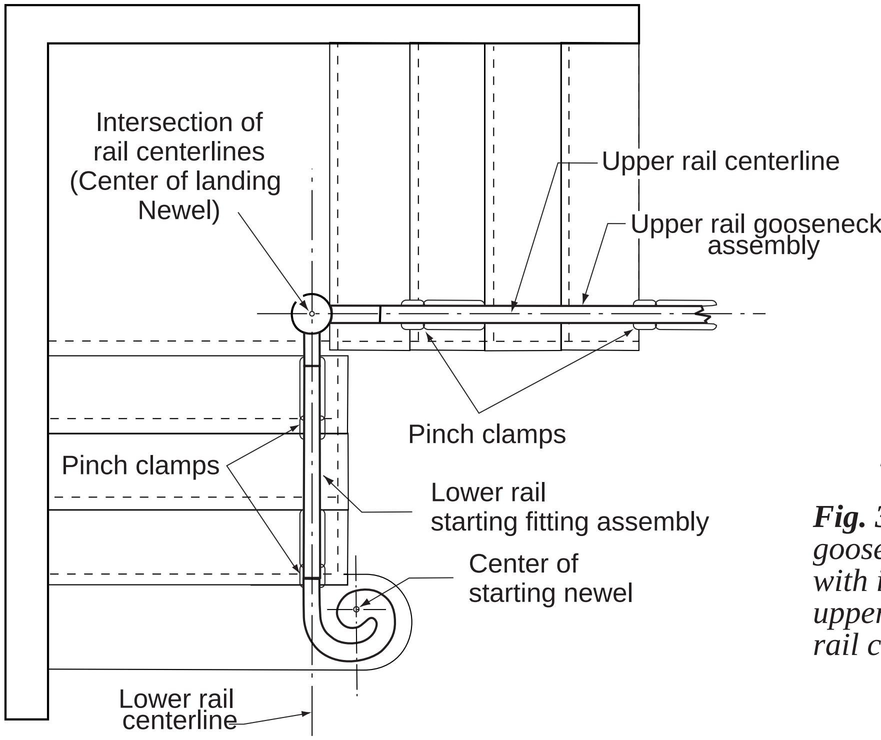


Fig. 3-25
Placing assembly on upper rail centerline to make sure two-rise gooseneck is plumb and level.

3. If correction is needed, mark area to be cut, then unbolt fitting.
4. Bevel cut the end of straight rail in the direction that will correct the connection.
5. Reattach fitting.

Determining Landing Two-Rise Gooseneck Length

1. With upper rail gooseneck assembly lying on the treads, position it on the upper rail centerline.
2. Align center of newel hole in the bottom of the cap and gooseneck with the intersection point of upper and lower rail centerlines. (Measure to distance from the bottom of the gooseneck cap to the landing. Measure and cut stabilizing blocks to hold assembly steady, positioning it on lower centerline). Please note Fig. 3-26 here.



TOP VIEW

Fig. 3-26 *Aligning gooseneck rail assembly with intersection of upper and lower rail centerlines.*

3. Clamp rail to treads.
4. Place the starting fitting rail assembly on the treads positioning it on the lower rail centerline and align the center of the newel hole with the center of the starting newel.

Note: Please note volute newel layout instructions. The starting easing newel is usually mounted to the face of the bottom riser.

5. Place the loose up easing against the lower rail holding it perpendicular to the rail with a small square. Keep the top of the rail and the top of the up easing even.
6. Now slide the up easing up the rail until the backside of the up easing is even with the backside of the gooseneck tail.
7. Mark the lower rail at the lower end of the up easing. Please note Fig. 3-27 here.

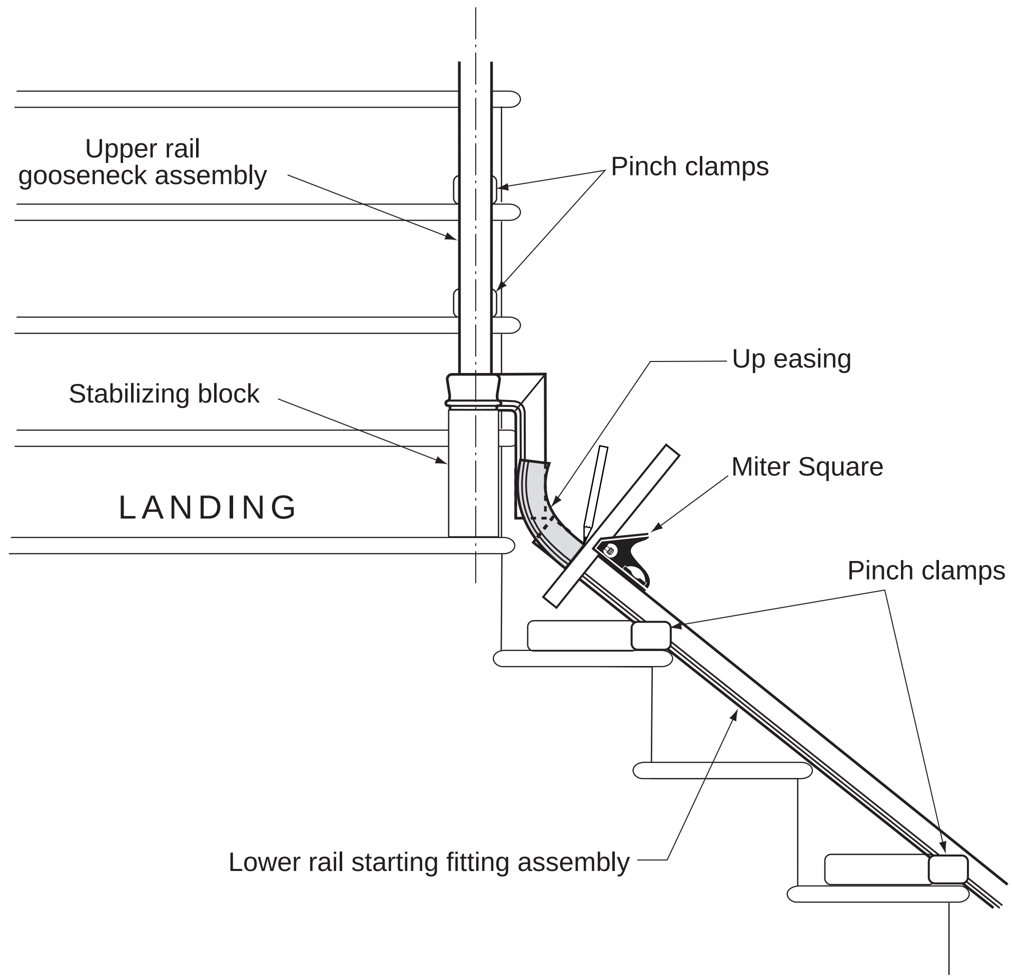


Fig. 3-27 *Mark lower rail at bottom end of up easing for square cut on lower rail.*

8. Make a square cut on the rail; attach the up easing to the rail using rail bolts.
9. Lay the rail on a flat surface with the gooseneck up easing curving into the air.
10. Slide the pitch block against the up easing with the “rise” side down and place a mark where the block touches the fitting. Please note Fig. 3-28 here.

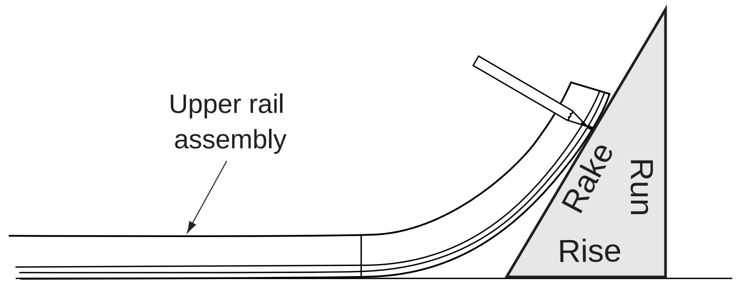


Fig. 3-28 *Marking location of cut on gooseneck up easing connected to upper rail assembly*

11. Turn the block "run" side down and align it with the mark and scribe a line across the side profile of the fitting. Please note Fig. 3-29 here.

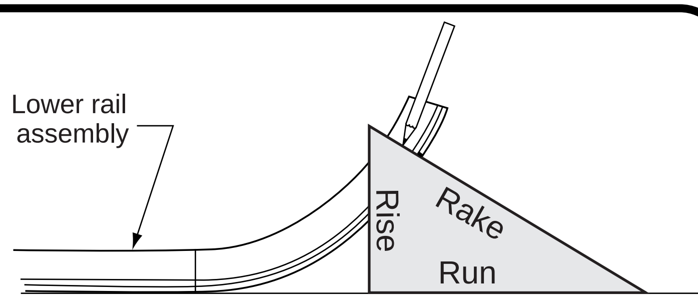


Fig. 3-29 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

12. Cut along this line with a miter saw.
13. Place lower rail assembly back on the treads with the starting fitting lined up with the lower newel center.
14. Scribe a line where the gooseneck up easing crosses the gooseneck. Please note Fig. 3-30 here.

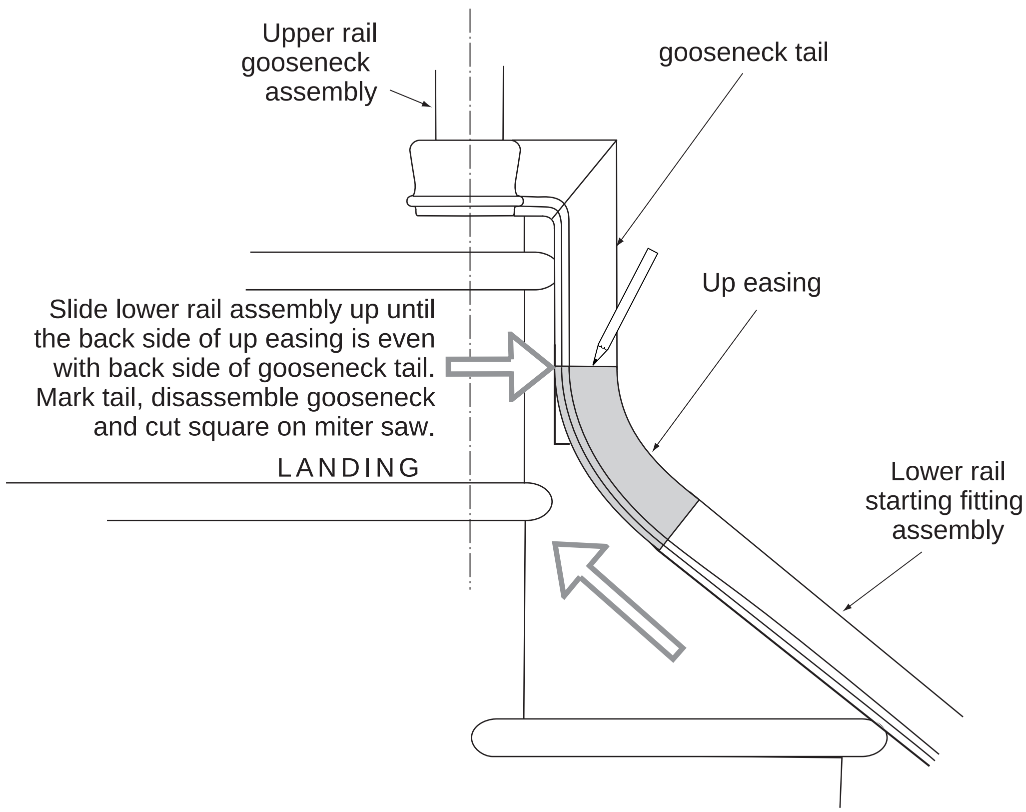


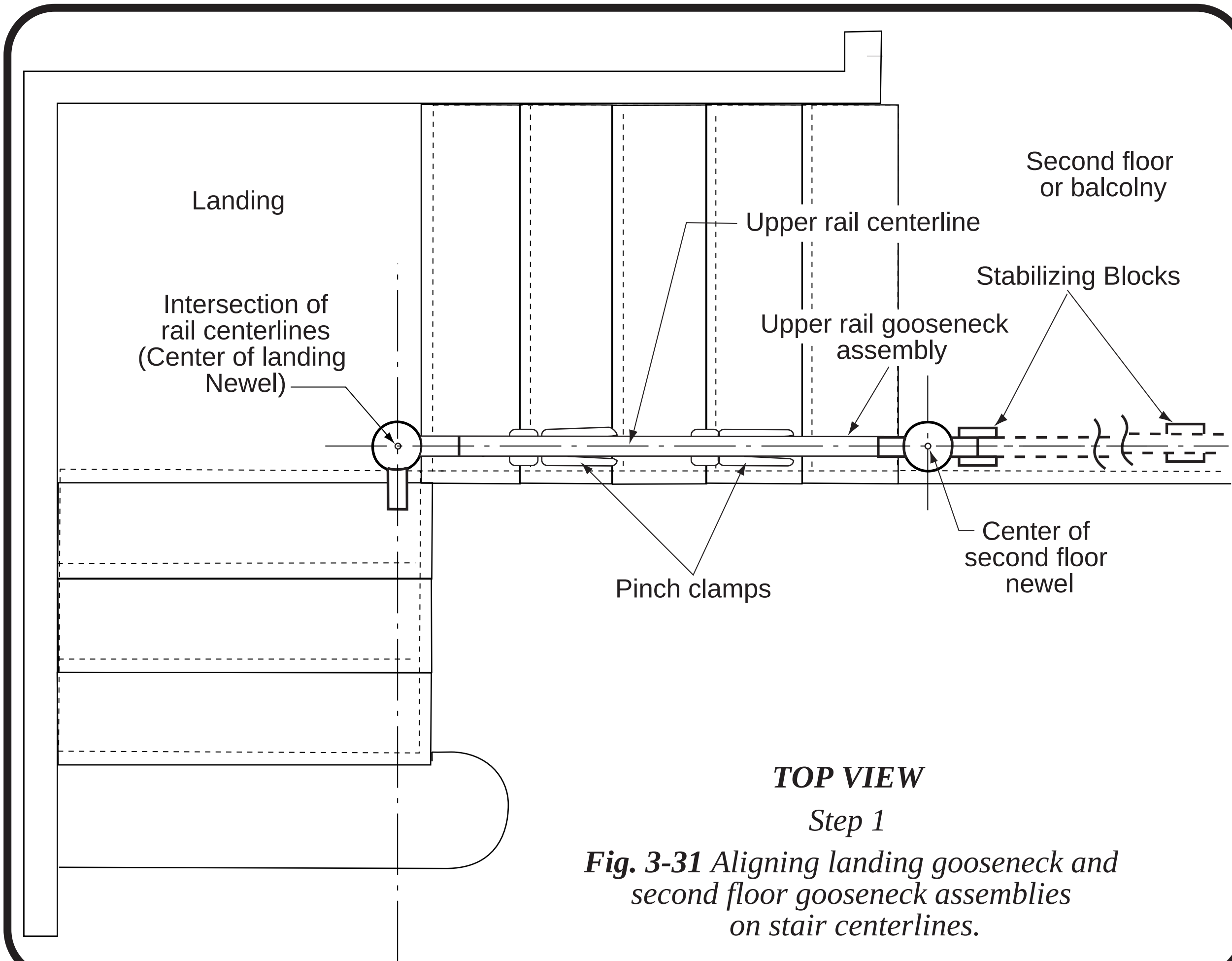
Fig. 3-30 *Marking landing Gooseneck tail for square cut.*

15. Disassemble gooseneck and cut gooseneck along this line with a miter saw.
16. Attach the two rail assemblies using rail bolts. Place block on upper and lower rail centerlines and recheck gooseneck making sure that the fitting is plumb and level.

Determining One Rise or Second Floor Gooseneck Length

1. Disassemble upper and lower rail assemblies. Set gooseneck assembly with upper rail on the treads. Align with upper rail centerline.

2. Align center of newel hole in the bottom of the cap with the point intersecting the upper and lower rail centerlines. Please note Fig. 3-31 here.



TOP VIEW

Step 1

Fig. 3-31 *Aligning landing gooseneck and second floor gooseneck assemblies on stair centerlines.*

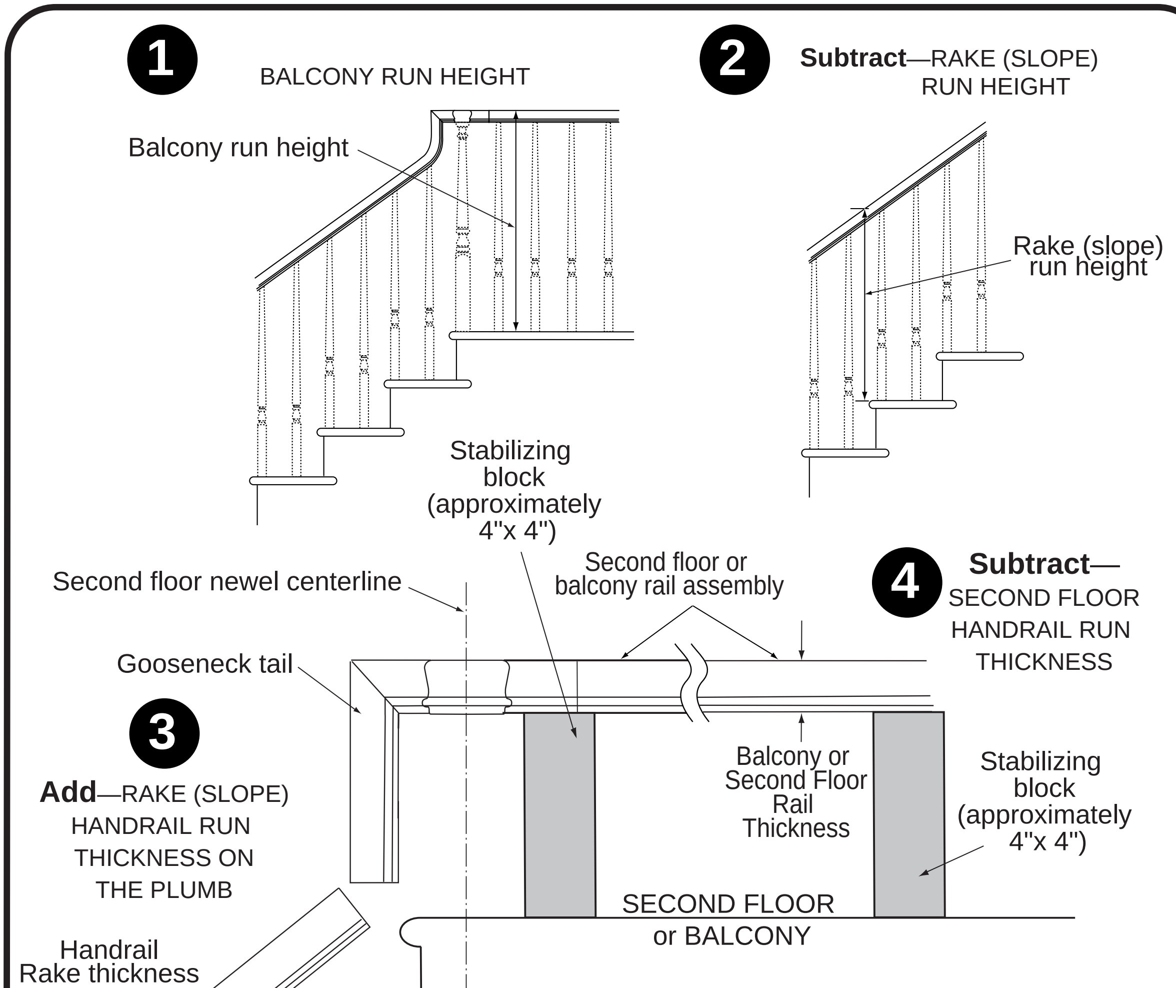
3. Clamp rail to tread.

4.Cut a piece of rail long enough to make balcony run from balcony gooseneck to the next newel or wall on the balcony, then attach rail to gooseneck balcony.

5. Cut stabilizing blocks for balcony rails. To determine the length of the blocks, take the desired balcony height, minus the desired rake height, minus the thickness of the balcony rail on the plumb, minus the desired rake height, plus the thickness of the rake rail on the plumb. Please note Fig. 3-32 here.

Note: It is recommended that this difference equal at least four -inches. Balcony rail heights can be 36 -inches or higher (refer to local building codes).

6. Place several stabilizing blocks along the area where the balcony rail will sit. Please note Fig. 3-32 (small boxed area).



Formula for calculating Stabilizing (support) block height

Measure Balcony Run Height
- Rake Run Height
+ Rake handrail run height on the plumb
- Balcony or second floor handrail run thickness
= Balcony stabilizing block height

Fig. 3-32 *Calculating Support Block Height for Second Floor or Balcony rail assembly.*

7. Place the balcony rail assembly, with the proper gooseneck rail-bolted to the end, onto the balcony with the newel pin in the bottom of the cap lined up with the first balcony newel center marks.
8. Place the loose up easing against the lower rail holding it perpendicular to the rail with a small square. Keep the top of the rail and the top of the up easing even.
9. Now slide the up easing, up the rail, until the backside of the up easing is even with the backside of the gooseneck.
10. Mark the lower rail at the lower end of the up easing. Please note Fig. 3-33 here.

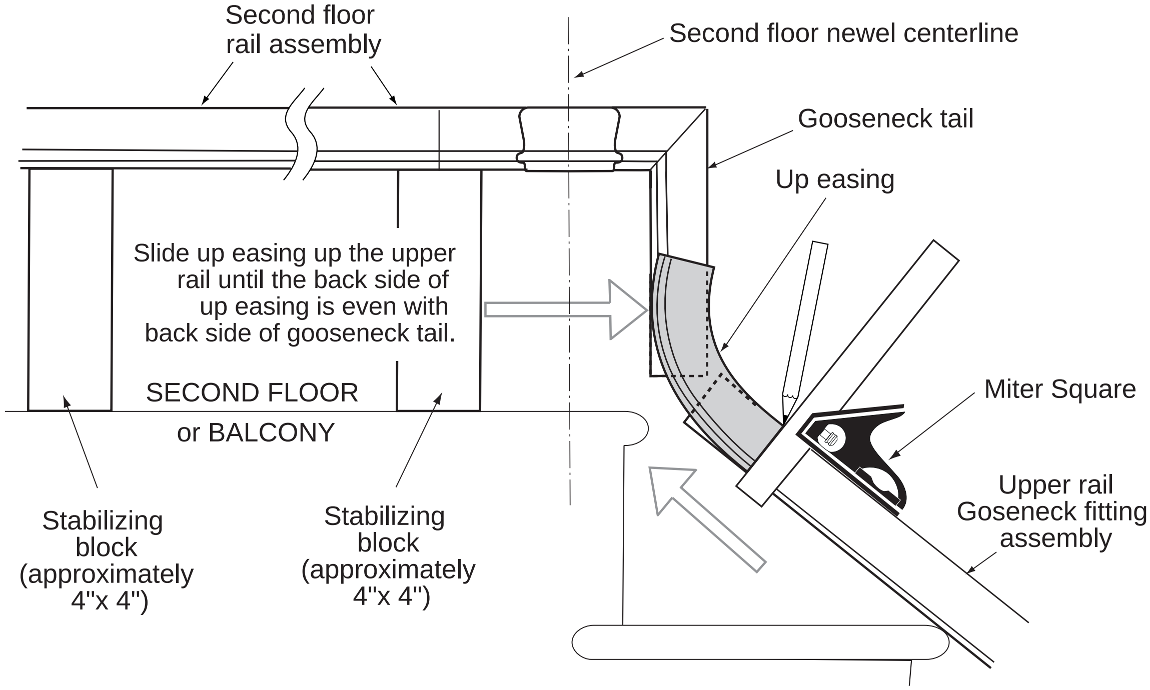


Fig. 3-33 *Marking top of upper rail gooseneck assembly for square cut*

11. Make a square cut on the rail; attach the up easing to the rail using rail bolts (see rail bolt instructions).
12. Lay the rail on a flat surface with the gooseneck up easing curving into the air.
13. Slide the pitch block against the up easing with the “rise” side down and place a small mark where the block touches the fitting. Please note Fig. 3-34 here.

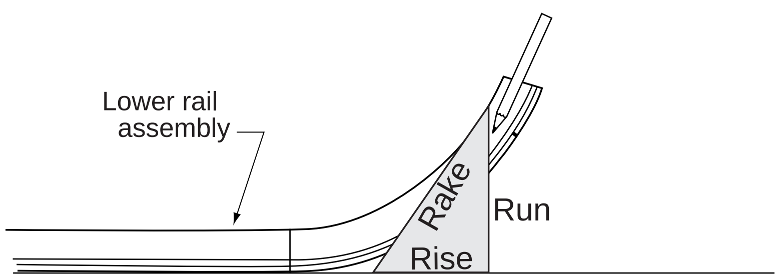


Fig. 3-34 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

14. Turn the block “run” side down and align it with the mark and scribe a line across the side profile of the fitting. Please note Fig. 3-35 here.

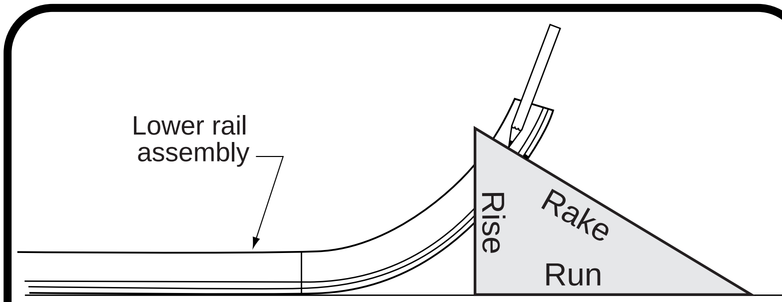


Fig. 3-35 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

15. Cut along this line with a miter saw.
16. Place upper rail assembly back on the treads with the gooseneck fitting lined up with the landing newel center.
17. Scribe a line where the upper gooseneck up easing crosses the gooseneck. Please note Fig. 3-36 here.

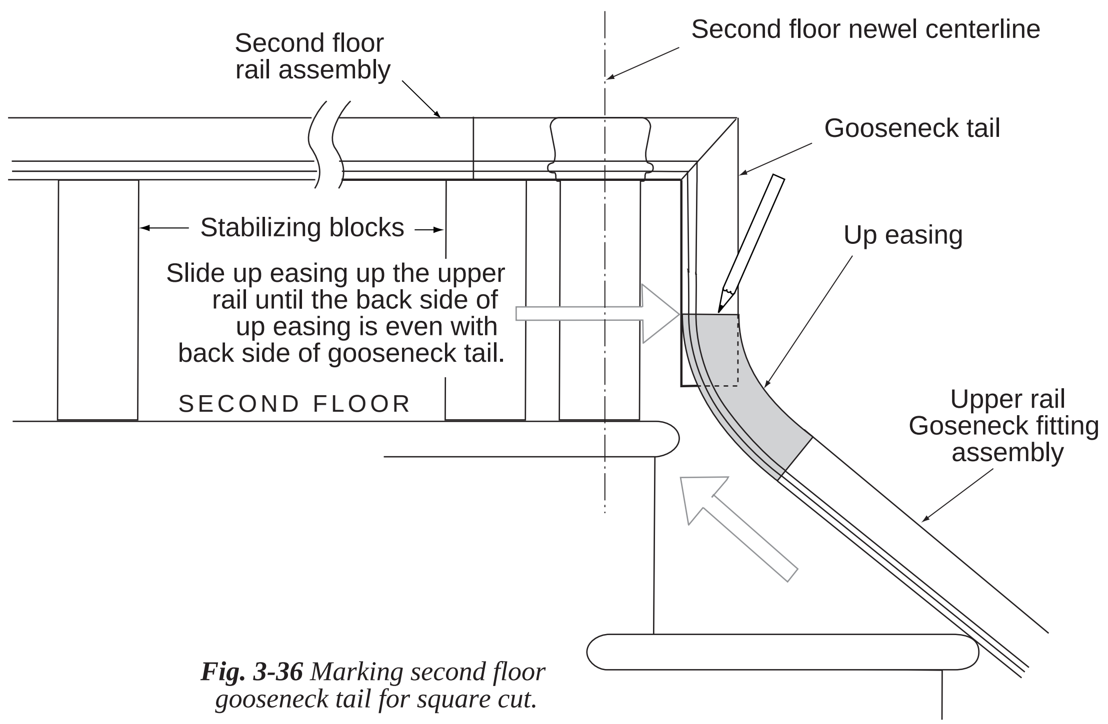


Fig. 3-36 *Marking second floor gooseneck tail for square cut.*

18. Attach balcony rail assembly to the rake (slope) rail assembly.

Note: Remember to leave the assembly dry at this time. Final assembly should take place after the newels are in place.

Cutting and Installing the Starting Newels

Newels are solid posts that provide the main support for the balustrade. The starting newel is the newel placed at the bottom of the staircase. In an over-the-post railing, the newel height is determined after the rails and fittings have been laid out and assembled dry.

The starting newel is typically bolted to the staircase frame or the bullnose-starting step and must be properly attached to ensure stability.

1. With the hole in the bottom of the starting fitting lined up with the center of the starting newel layout mark, measure the distance between the bottom of the starting fitting and the tread or floor. Please note Fig. 3-37 here.

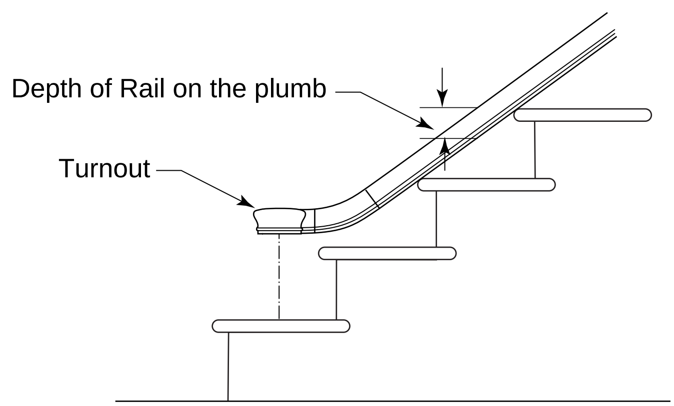


Fig. 3-37 *Determining starting newel height.*

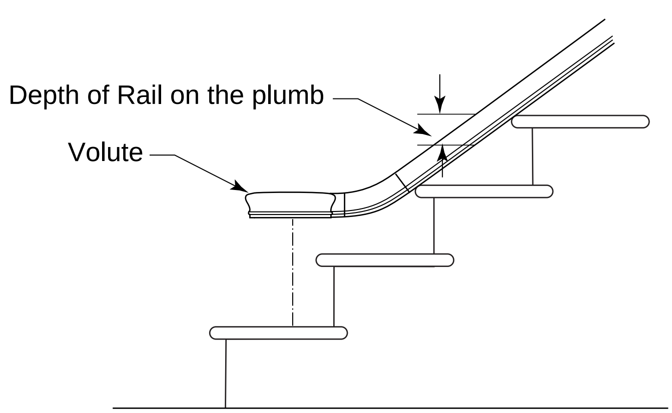


Fig. 3-38 *Determining starting newel height.*

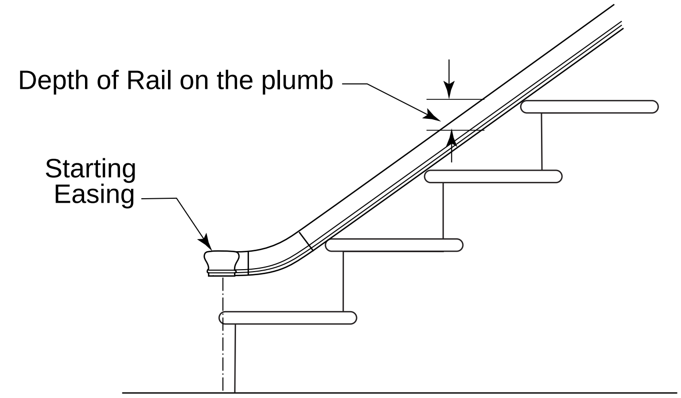


Fig. 3-39 *Determining starting newel height.*

This will depend on where you want the newel to sit.

2. Add this distance to the desired handrail height minus the depth of the rail on the plumb. The handrail is usually between 34 and 38 -inches. Please refer to local building codes for specific requirements. Please note Figs. 3-38/3-39 here.

Starting Newel Height

__________	Distance from the bottom of the fitting to the tread
__________	+ Desired rail height
__________	- Depth of the handrail
__________	= Starting newel height

3. Cut the bottom of the newel.
4. Make sure that the newel is plumbed, bolted, and glued securely to the staircase frame. ***Caution: It is critical that the newel is attached securely in order that the staircase complies with local building codes.***

Cutting and Installing the Landing Newel or Second Floor Newel

The landing newel, sometimes called a transitional newel, is a post situated at the landing or balcony. As with the starting newel, it provides support for the balustrade and should be securely attached.

1. With the hole in the bottom of the gooseneck cap aligned with the upper and lower rail-line intersection point, measure the distance between the bottom of the cap and the tread or floor.
2. Add this distance to the same distance used with the starting newel (the desired rail height minus the rail depth).
3. If the newel is to lap down the side of the stair or wall, add the desired tail length.
4. Cut the bottom of the newel and notch if required.
5. Make sure that the newel is plumbed, bolted, and glued securely to the staircase frame. *Caution: It is critical that the newel is attached securely in order that the staircase complies with local building codes.*

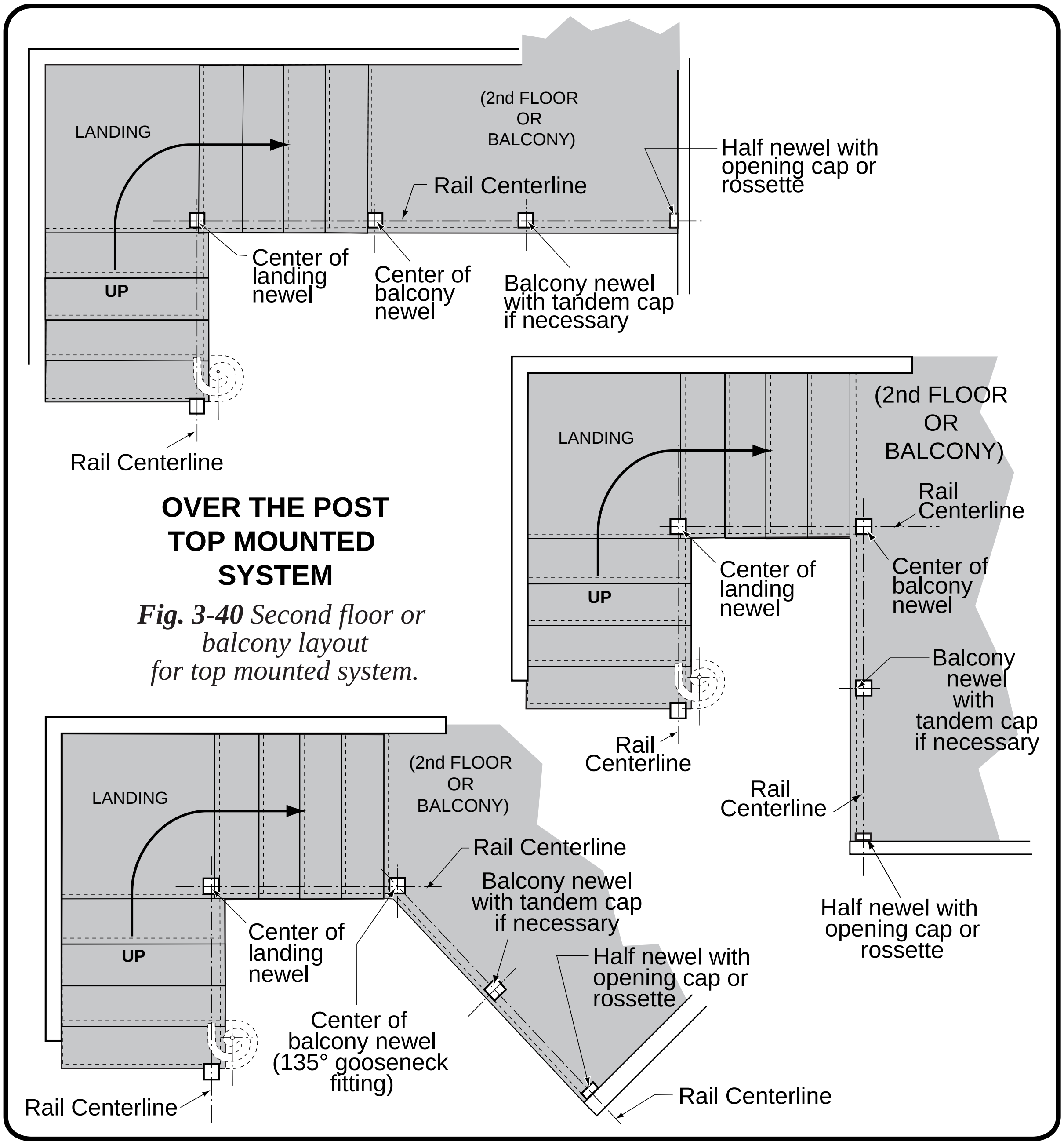
Repeat this process for the balcony to rake newel.

Over-the-Post Balcony Rail Installation

Over the post balcony balustrade systems are achieved by using either a tandem cap, quarter turn cap, 135-degree turn cap, 1/2-cap, end cap, or a level quarter turn.

Over-The-Post Balcony Balustrade Installation

1. Transition newel installation between rake rail and balcony rail can be found in the L-shaped stair section.
2. Draw rail centerline on floor on all balcony areas. Please note Fig. 3-40 here.



OVER THE POST TOP MOUNTED SYSTEM

Fig. 3-40 *Second floor or balcony layout for top mounted system.*

3. Draw newel layout at all intersecting points. It is critical that the intersecting point and the center of the newel are the same when you are using 135-degree fittings. Please note Fig. 3-41 here.

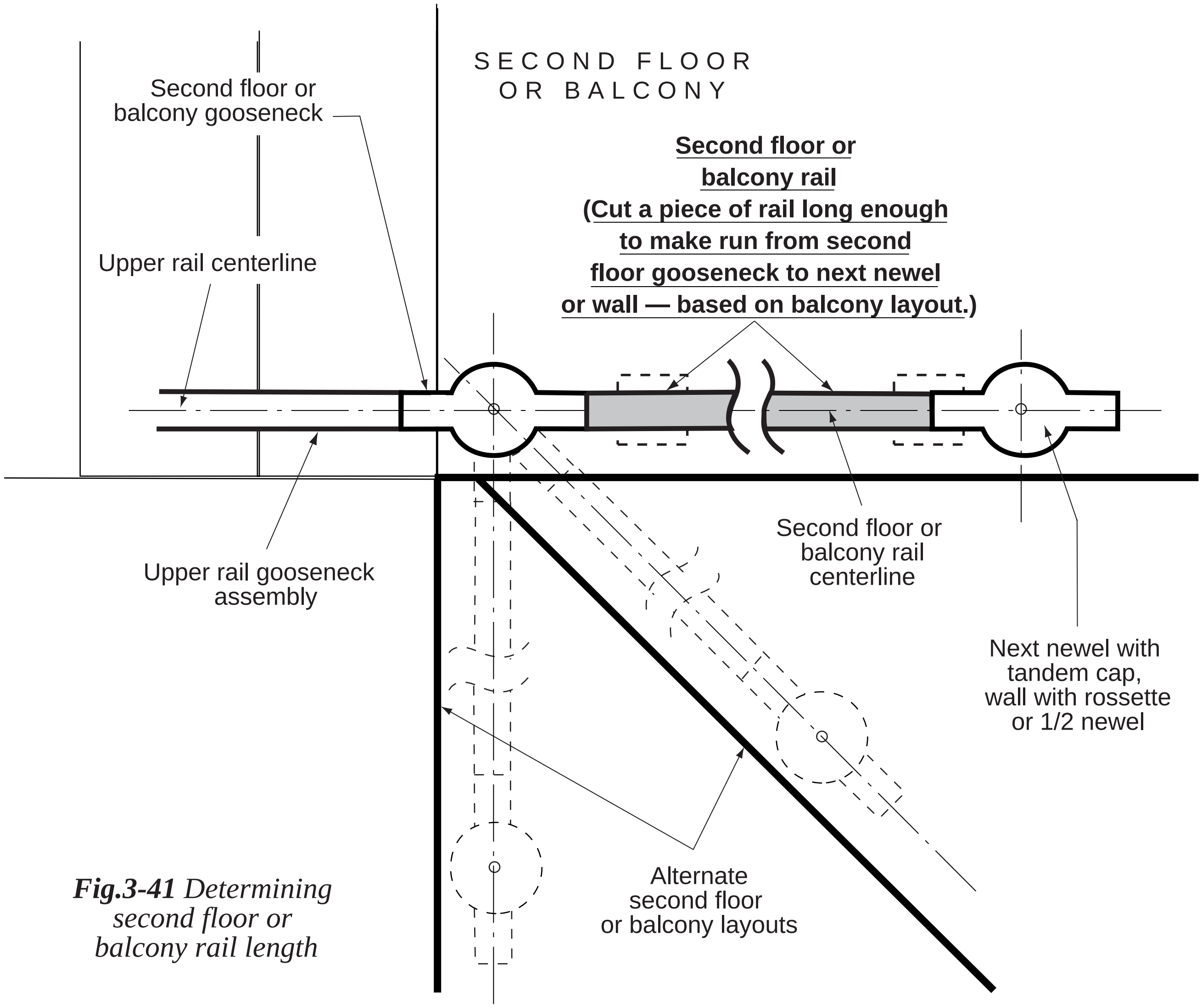


Fig.3-41 *Determining second floor or balcony rail length*

4. Straight rail sections may be divided into smaller sections with the use of a tandem cap. This is usually done either for structural reasons or aesthetics (to achieve balance and symmetry in the system).
5. Once you have completed the layout it is time to determine the newel height. The newel height is the desired rail height minus rail thickness. (Depending on the method of installation or hardware being used, there may be be a need to add a tail portion to your newel length. An example would be lapping the newel down the face of the balcony or extending the newel down into the floor framing).

Newel Height

__________	Desired rail height
__________	- Rail thickness
__________	= Newel height

6. Cut newel to proper length and make any necessary notches
7. Securely attach newel to framing.
8. Once the newels are attached, set the proper fitting on the top of each newel and push it down firmly on the pin.
9. Measure the distance between adjacent fittings. Please note Fig. 3-42 here.

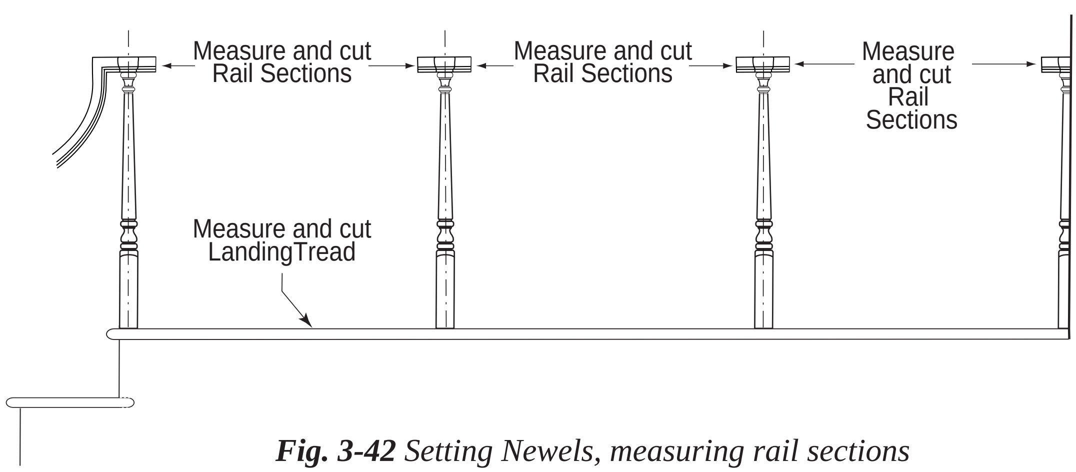


Fig. 3-42 *Setting Newels, measuring rail sections*

10. Cut rail to length and rail bolt into place. Please note Fig. 3-43 here.
11. Cut landing tread and fit landing tread between newels.
12. Using nails and construction adhesive, secure landing tread to floor.
13. Attach appropriate trim.

Over-the-Post Half Newel Installation

1. Cut a newel that has been split in half to the proper length. Half newels are typically available from your stair parts manufacturer.
2. Attach the half newel to the wall in the desired location. Please note Fig. 3-43 here.

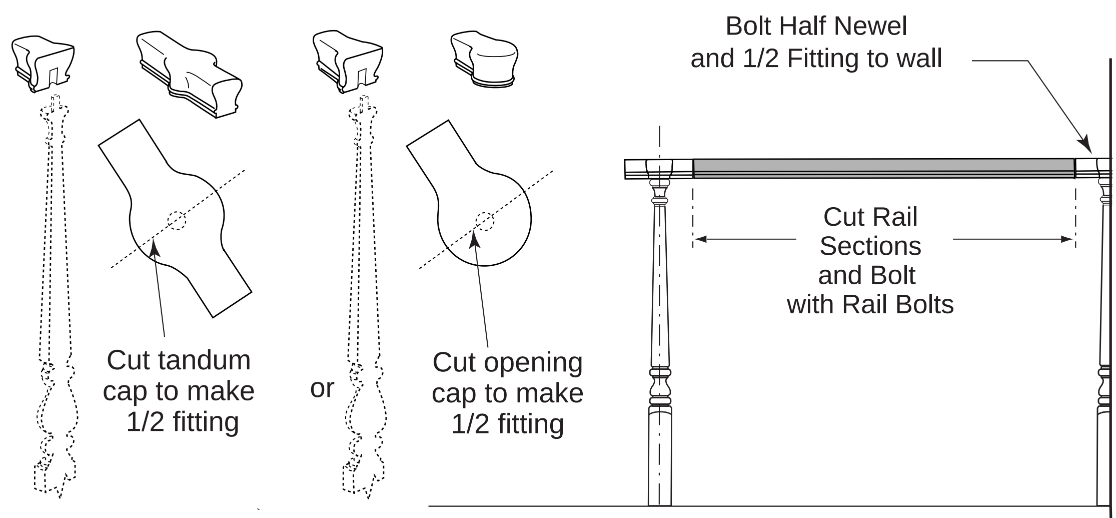


Fig. 3-43

3. Cut either a tandem or opening cap in half. Please note Fig. 3-43 here
4. Rail bolt this fitting to the wall above the half newel. *Remember that the half newel is only a decoration so the fitting must be attached to the wall separately.*
5. Measure the distance between adjacent fittings.
6. Cut rail to length and rail bolt into place.
7. Cut landing tread and fit the tread between the newels.
8. Using nails and construction adhesive, secure landing tread to floor.
9. Attach appropriate trim.

Installing Final Rail and Newel

1. Raise the rail assembly up and set it onto the newels so that the pins at the tops of the newels lock into the holes in the fittings.
2. With the rail in place, check to see if the rail fittings are sitting squarely on the newels and that the newels are still plumb.
3. Make small reference lines across the joints in the handrail and the fittings.
4. Remove the handrail from the newel.
5. Disassemble the fittings, add wood glue to the joints, and reassemble using the reference lines to realign. Please note Fig. 3-44 here.

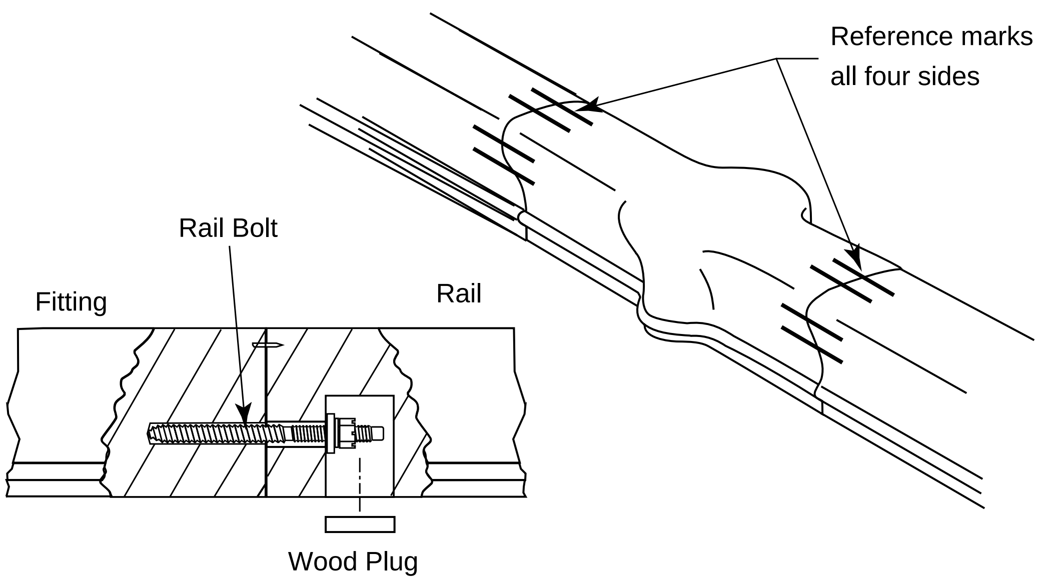


Fig. 3-44 *Installing Final Rail and Newel*

6. Plug rail-bolt holes using wood glue and 1-inch plug; then sand the surface flush.
7. Set rail assemblies back onto the newels and gently tap into place.

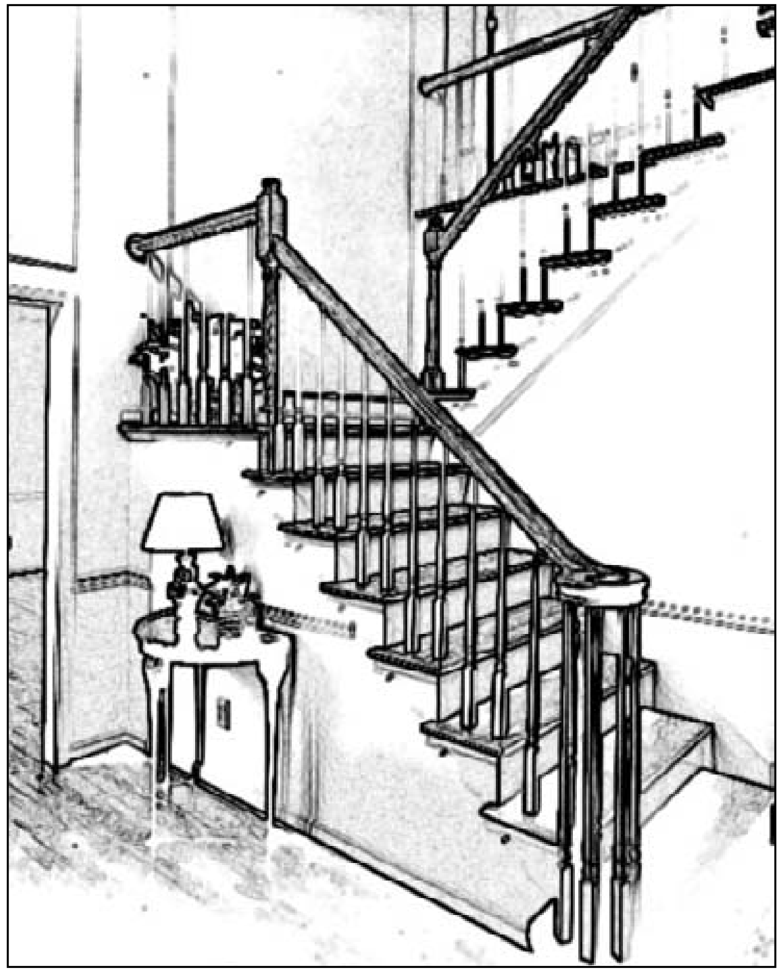
   Note: Installation practices may vary based on region of the country. Please refer to local building codes.
8. Depending on baluster installation, you may elect to glue fittings to newels at this time.

Chapter 3: Things to Remember

1. Always consult your local building codes before building a stair.
2. Take extra care in making the pitch block angles as accurate as possible.
3. Lay out rail centerline and newel placement prior to installation.
4. Center the newel and fittings at the intersecting points of the rail centerline.
5. Use proper side of pitch block when marking fittings.
6. Mark the exact center of the tangent point of the fitting and pitch block.
7. Take necessary time to align fittings with rail before final gluing.
8. Bond all connecting surfaces with high quality wood glue.
9. Before final assembly, check to see if all fittings are plumb and level.
10. Securely bolt and glue all newel posts to the framing.
11. Before final installation, plug any rail-bolt holes that will be difficult to access after installation.
12. Make sure that all newels are plumb.
13. Turn laminated side of newels in the least visible direction.
14. Check all rail heights prior to final installation.

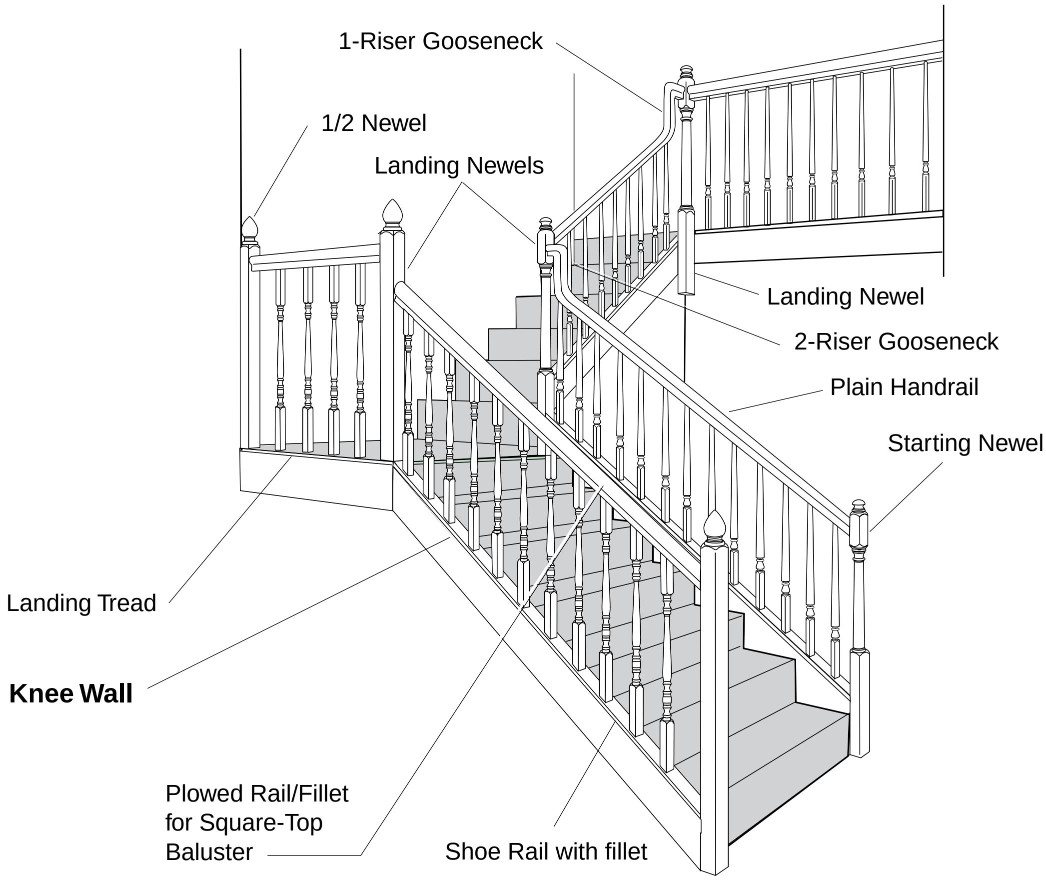
Chapter 4
Installing Post-to-Post Rails on L-Shaped Stairs

In this chapter:



The Post-to-Post Balustrade System

Post-to-post stair systems are designed with rail running between a series of newels.



Post-to-Post balustrade system

There are two types of post-to-post systems: the standard post-to-post and the post-to-post with fittings. This balustrade system is used on both the straight stair and the L-shaped stair.

In a post-to-post connection without fittings, the upper square section on the starting newel is shorter than the upper square section on the landing newel, which is longer to accommodate the change in rise between the first run and the second run of the staircase. Please note Fig. 4-1 here.

Post to Post

The handrail runs between the newel posts, with the top of the post projecting above the rail.

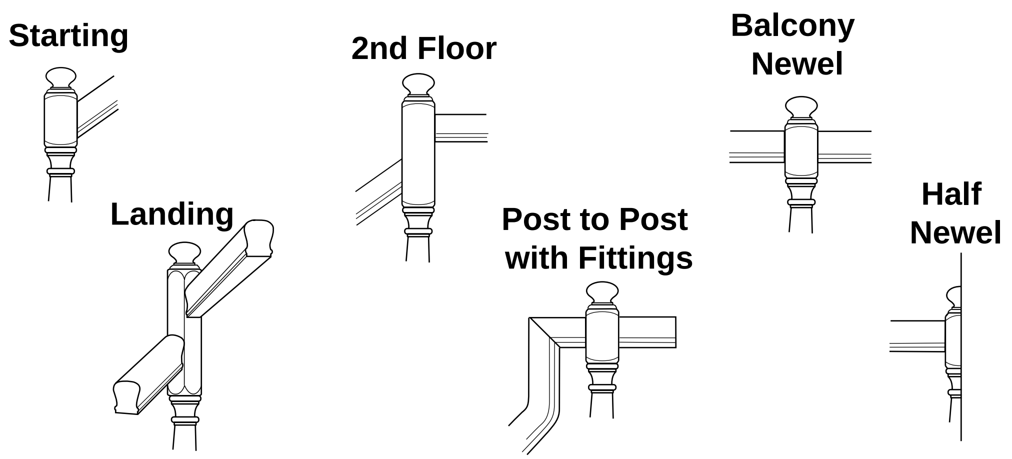


Fig. 4-1

A variation of the post-to-post balustrade is the post-to-post balustrade with fittings. This design provides a more elegant look and is more versatile than the standard post-to-post system. The stair builder is not confined by the length of the top square of the newels and can use the newels in a greater variety of locations.

This chapter explains how to install newel posts and then how to complete the rails for a standard post-to-post system and for a post-to-post system with fittings.

Standard Post-to-Post (No Fittings)

Installing the Starting Newel

Newels are solid posts that provide the major support for the balustrade. The two types of newels used with the post-to-post without fittings are starting newels and landing newels. Starting newels are located at the bottom of the staircase, hence the name “starting” newels.

The following steps describe the process:

1. After determining the centerline for the rail system (see Chapter 3), draw a square on the tread where the starting newel will be placed. There are no guidelines for the placement of the newel, but it is typically mounted on the face of the first riser. If necessary, notch the nosing of the tread to allow the newel to sit tightly against the frame of the staircase. Please note Fig. 4-2 here.

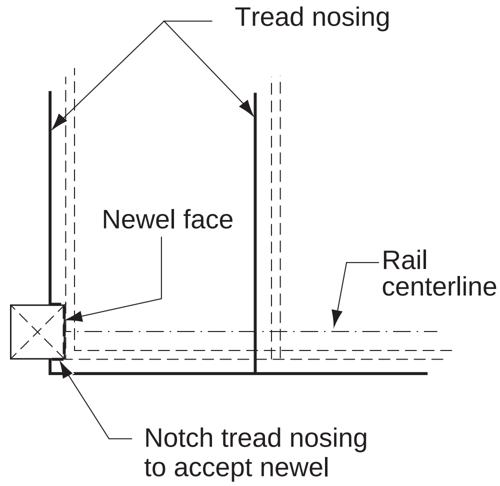


Fig. 4-2 *Placement of newel post.*

2. Next, find the slope difference or the distance the rail climbs from the nose of the tread to the back of the newel. Lay a straight edge on the treads. On the line where the back of the newel will sit, measure the distance between the tread and the straight edge. Please note Fig. 4-3 here.

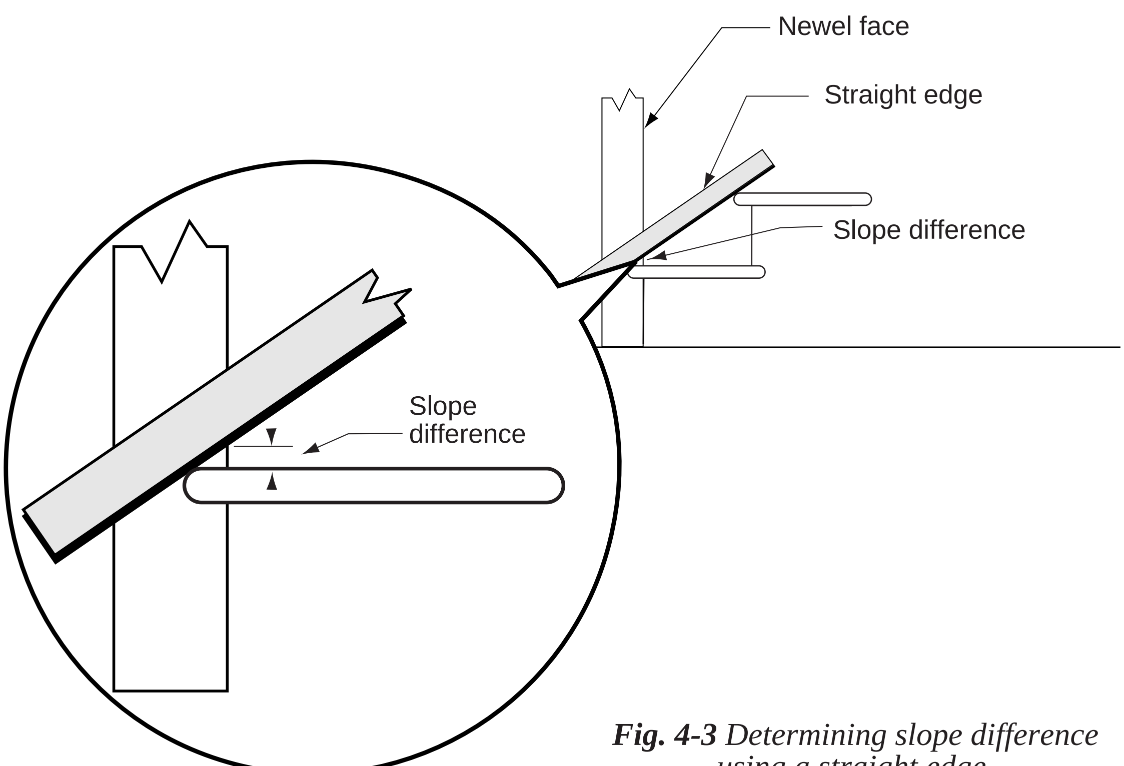


Fig. 4-3 *Determining slope difference using a straight edge.*

3. To determine the newel length, add the reveal (the distance from the top of the newel square to the top of the rail), the desired rail height (usually between 34 and 38-inches, refer to local building codes), the slope difference, and the riser height. Please note Fig. 4-4 here.

Starting Newel Height

__________	Distance from the bottom of the fitting to the tread
__________	+ Desired rail height
__________	- Depth of the handrail
__________	= Starting newel height

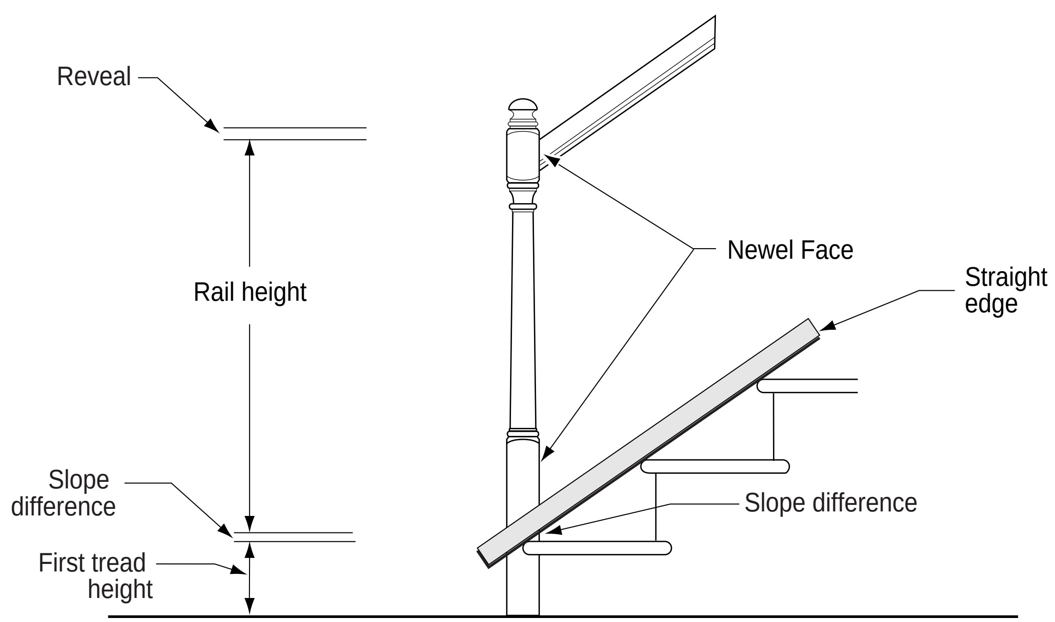


Fig. 4-4 Establishing newel height.

4. Cut the newel off with a miter saw and notch. (If required)
5 Make sure that the newel is plumb. Bolt and glue the newel to the staircase frame.

***Caution:* It is critical that the newel is attached securely in order for staircase to comply with local building codes.**

***Note:* Do not include decoration (finial) above top square of the newel post when determining newel length.**

Installing a Rake-to-Rake Landing Newel

A rake-to-rake landing newel or transitional newel connects the upper and lower railing system on an L-shaped stair. Before starting this process, make sure you have a landing or transitional newel, which has a top square length of at least 13-inches.

The following steps describe the process:

1. Draw a square the size of the newel at the intersecting point of the upper and lower centerlines of rake rails. The center of the square must be the same as the centerline intersecting point. Please note Fig. 4-5 here.

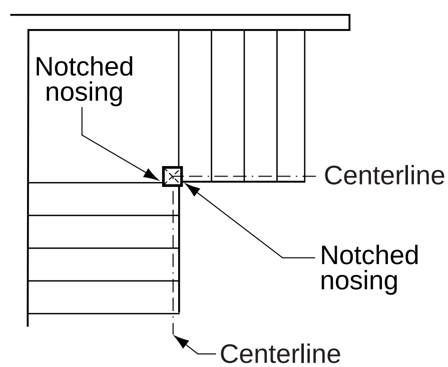


Fig. 4-5 *Placement of rake-to-rake landing newel.*

2. If necessary, notch the nosing of the tread and landing to allow the newel to sit tightly against the frame of the staircase.
3. Lay a straight edge on the upper rake and determine the slope difference, just as you did with the starting newel.
4. To determine the newel length, add the reveal, the rail height, the slope difference, and the riser height. Please note Fig. 4-6 here.

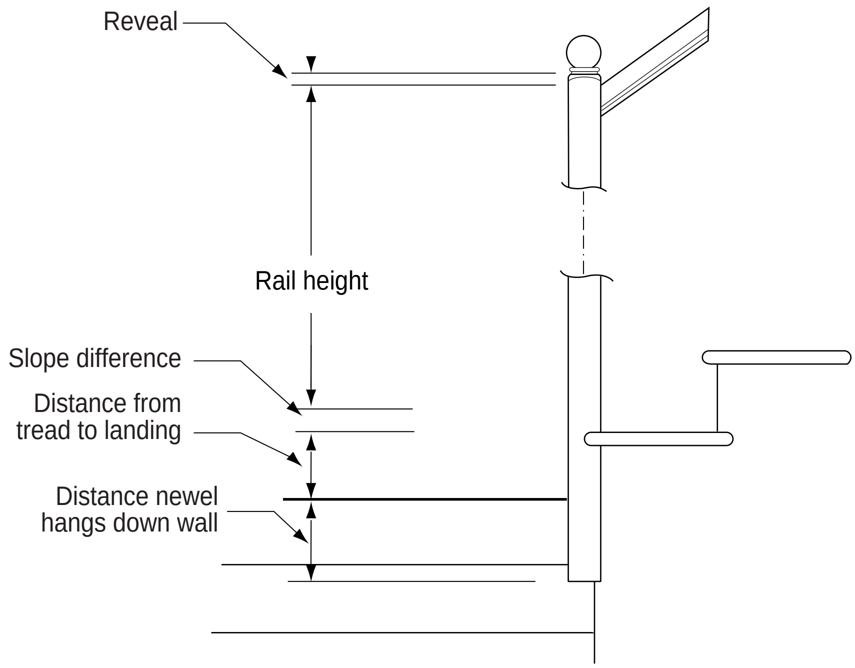


Fig. 4-6 *Determining newel length*

If the newel is to lap down the wall, also known as a half-lap installation, add the distance you wish to run the newel down the wall.

Rake-to-Rake Newel Length

__________	Reveal
__________	+ Rail Height
__________	+ Slope difference
__________	+ Tread height
__________	= Rake-to-rake newel length (TOP MOUNT SYSTEM)
__________	+ Tale or drop down length
__________	Rake-to-rake newel length (HALF LAP SYSTEM)

5. Cut the newel off with a miter saw and make any necessary notches.
6. Make sure that the newel is plumb. Bolt and glue newel to the staircase frame.

Caution: It is critical that the newel is attached securely in order for the staircase to comply with local building codes.

Note: Do not include the decoration above the top square when determining newel length.

Installing a Rake-to-Balcony Newel

The rake-to-balcony newel is used to support the rake rail and balcony rail as it makes the turn onto the balcony. A rake-to-balcony newel usually has a top square length of at least 10-inches.

1. Draw a square at the intersecting point of the rake rail centerline and the balcony rail centerline. Remember the center of the square must be the same as the intersecting point. Please note Fig. 4-7 here.

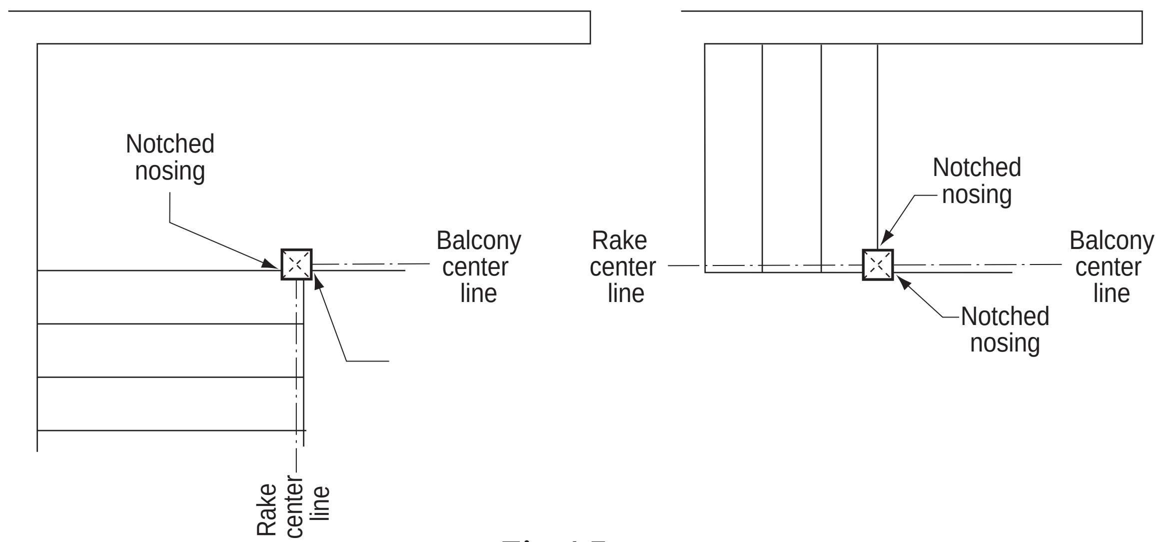


Fig. 4-7

2. If necessary, notch the nosing of the tread and landing tread to allow the newel to sit tightly against the frame of the staircase.

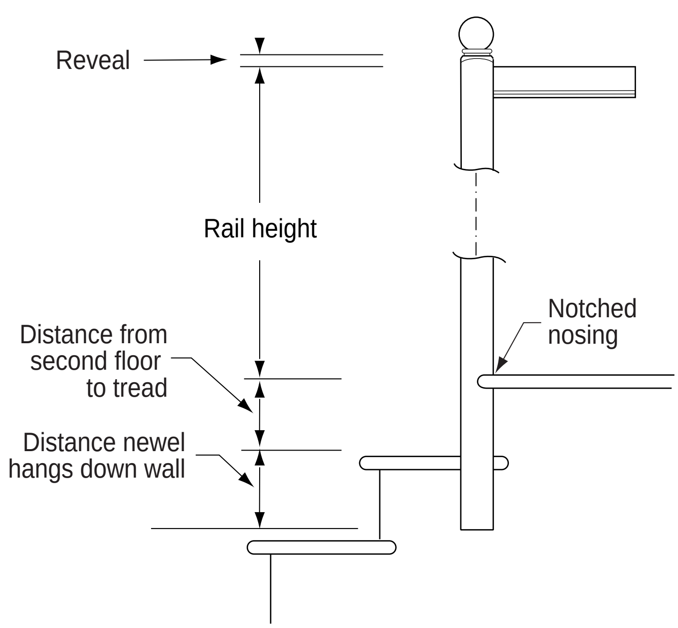


Fig. 4-8 *Installing rake to balcony newel.*

3. To determine the newel length, add the reveal, the desired balcony height (usually a minimum of 36-inches; refer to local building codes) and the distance from the second floor to the top of the tread (unless the newel is sitting entirely on the second floor). If the newel is to half lap down the wall, also add the distance you wish to run the newel down the wall. Please note Fig. 4-8 here.

Rake-to-Balcony Newel Length

________	Reveal
________	+ Rail Height
________	+ Tread height
________	= Newel Length (TOP MOUNT SYSTEM)
________	+ Tail or drop down length
________	Newel length (HALF LAP SYSTEM)

4. Cut the newel off with a miter saw and make any necessary notches.
5. Make sure that the newel is plumb. Bolt and glue the newel post to the staircase frame.

Caution: It is critical that the newel is attached securely for the staircase to comply with local building codes.

Installing Post-to-Post Balcony Rail Sections

1. Transition newel installation between rake rail and balcony rail can be found in the L-shaped stair section.
2. Draw rail centerline on floor on the balcony area.
3. Draw newel layout at all intersecting points. In this case, it is critical that the rail centerline matches up with the center of the newel sides.

4. Straight rail sections may be divided into smaller sections with the use of an extra newel. This is usually done either for structural reasons or aesthetics, or to achieve balance and symmetry in the system. Please note Fig. 4-9 here.

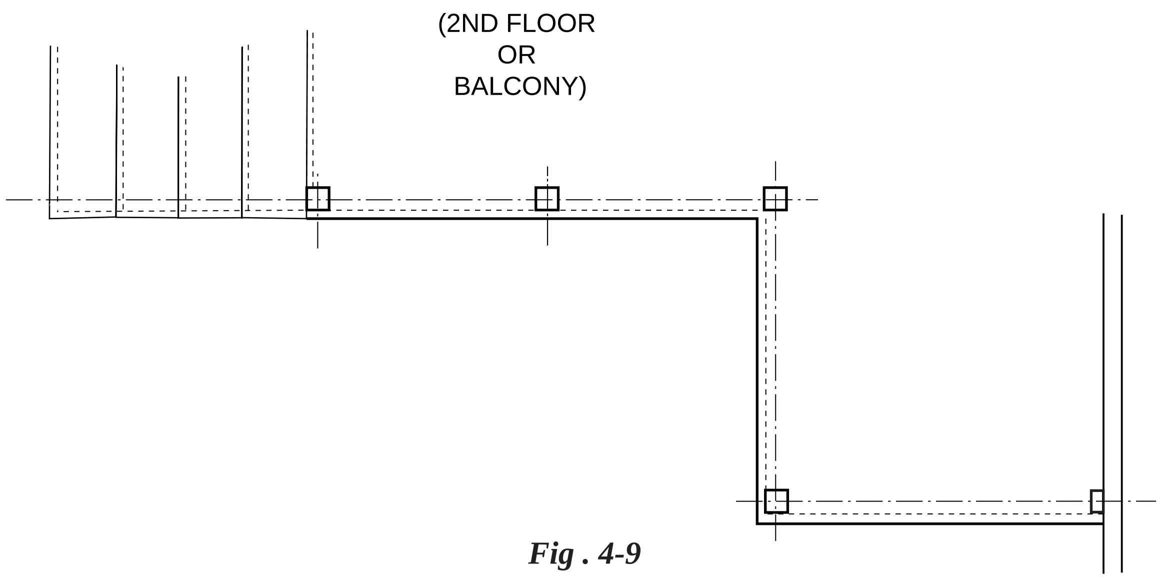


Fig . 4-9

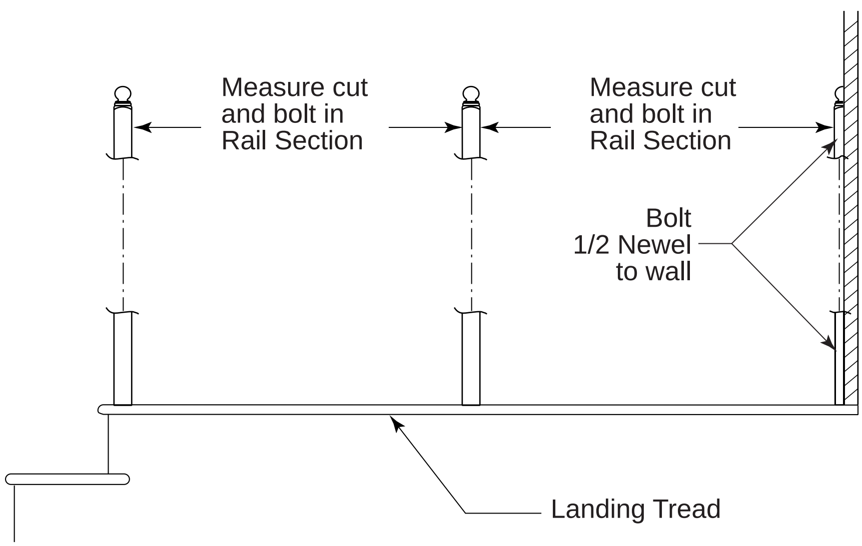


Fig . 4-10

5. Once you have completed your layout, you must determine the newel length.
6. The newel length is determined by adding the desired rail height plus the thickness of the finished floor plus the reveal from the top square to the top of the rail. If you are going to lap the newel down the face of the balcony or drop it down in the floor for mounting purposes, add this amount to the length.

Balcony Newel Length

__________ Reveal

__________ + Rail Height

__________ + Thickness of the finished floor

__________ = Newel Length (TOP MOUNT SYSTEM)

__________ + Tail or drop down length

__________ Newel length (HALF LAP SYSTEM)

7. Cut all newels to the proper length.
8. Bolt newels into place using the appropriate hardware. Make sure that the centerlines match up with the center of the corresponding newel side.
9. Measure down from the top of each newel the desired reveal and scribe a line.
10. Cut rail sections to fit in between each newel and rail bolt into place. Make sure each rail section is on the reveal line mark. Please note Fig. 4-10 on prior page.
11. Cut landing tread and fit the tread between newels.
12. Using nails and construction adhesive, secure landing tread to floor.
13. Attach appropriate trim.

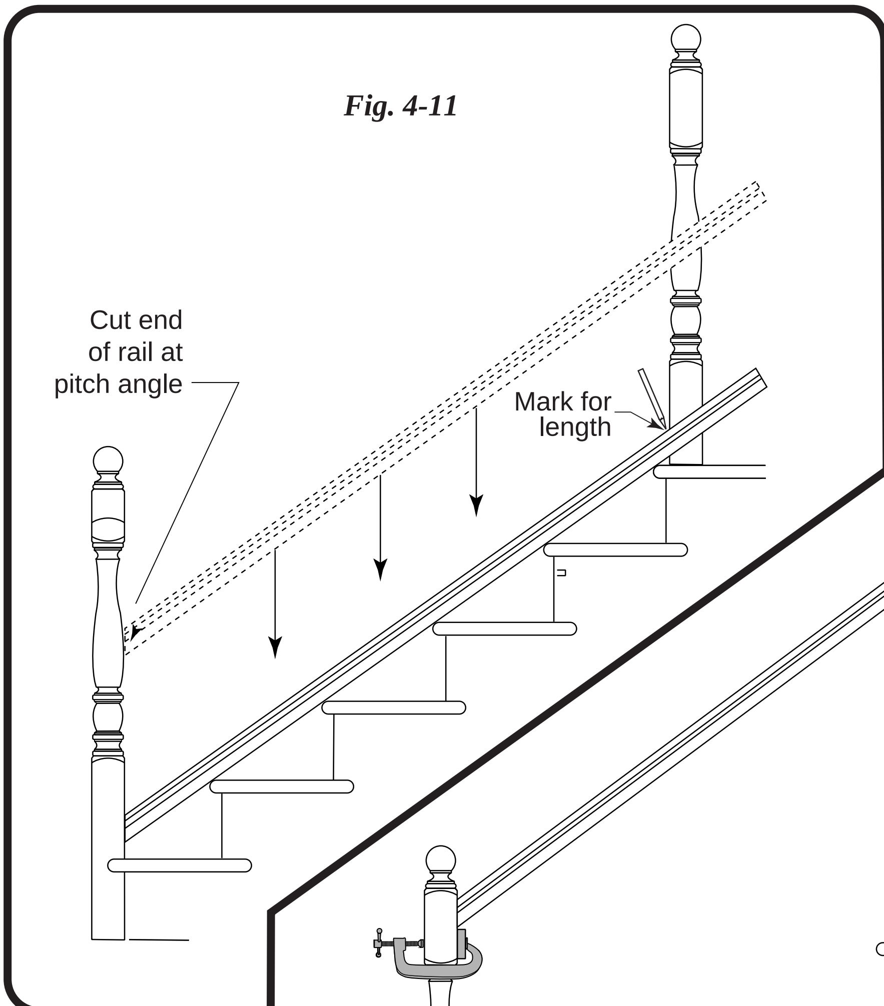
Post-to-Post Half Newels

1. Cut half newel to proper length. Bolt newel to wall using the appropriate hardware. Make sure that the centerlines match up with the center of the corresponding newel side.
2. Measure down from the top of each newel the desired reveal and scribe a line.
3. Cut rail sections to fit in between each newel and rail bolt into place. Make sure each rail section is on the reveal line marks.
4. Cut landing tread and fit the tread between newels.
5. Using nails and construction adhesive, secure landing tread to floor.

Installing Rake Rail Sections (Upper and Lower)

1. Select a piece of rail long enough to reach between the newels. On one end of the rail, make a cut at an angle equal to the pitch of the stair. ***Note: Use a pitch block to determine this angle; see instructions on making a pitch block in Chapter 3. The cut is made to fit the bottom newel.***
2. Lay the rail on the treads and let the angled end slide tightly against the lower newel. If it does not fit tightly, adjust the angle cut until it does. Please note Fig. 4-11 here.

Fig. 4-11



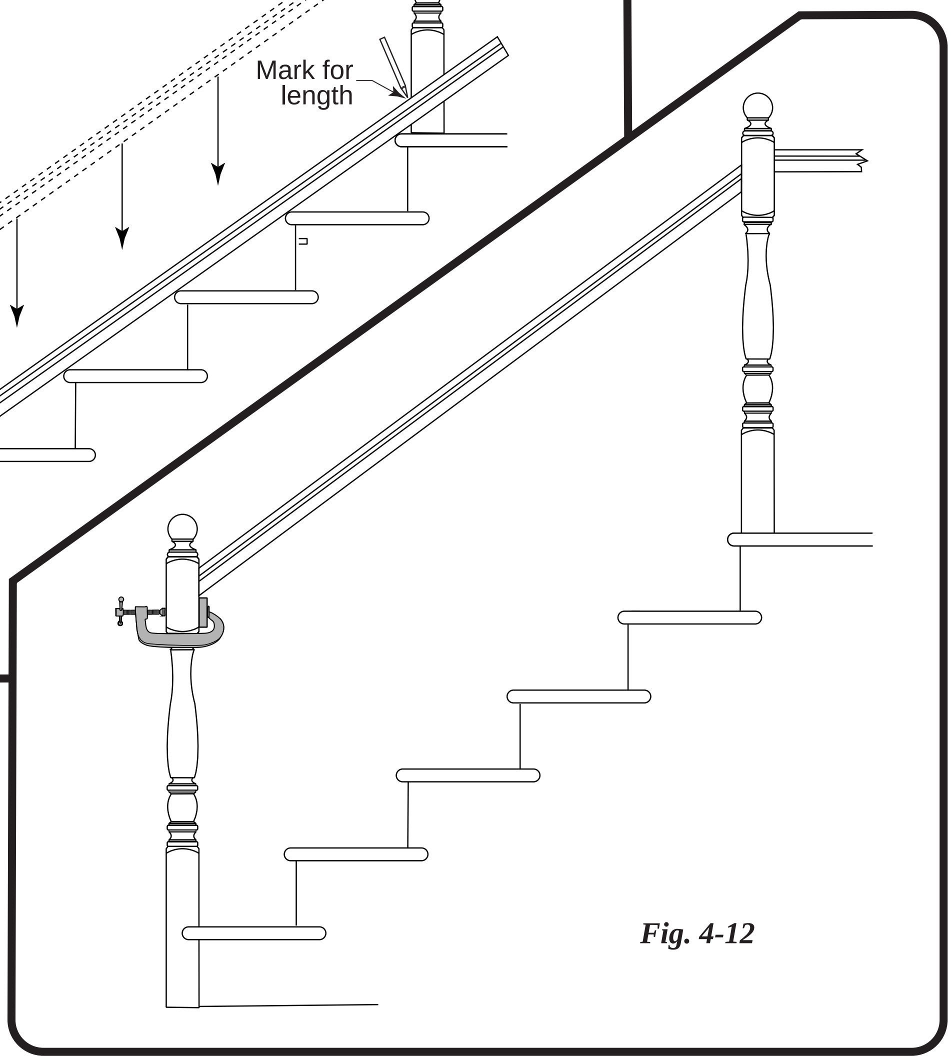


Fig. 4-12

3. Scribe a line where the rail intersects with the top newel. Cut the rail along the line.
4. Measure down the reveal plus the thickness of the rail (on the plumb) from the top of the bottom newel.
5. Clamp a block below the mark. Note Fig. 4-12 on previous page.
6. Set the rail into place and bolt as needed.
7. Attach appropriate trim.

Installing Post-to-Post Rail with Fittings

The post-to-post balustrade system with fittings is more complicated than the standard post-to-post system. The complexity yields a wider variety of applications than the standard post-to-post.

To install post-to post systems with fittings, cut and install newels as described in the standard post-to-post section (without fittings). The post-to-post with fittings system uses newels that have the same size top square. (Generally 5 - 7-inches.)

1. Make a square cut on the end of the handrail.
2. Attach an up easing to the end of the rail with a rail bolt.
3. Lay the rail on top of treads on the first run. Please note Fig. 4-13 here.

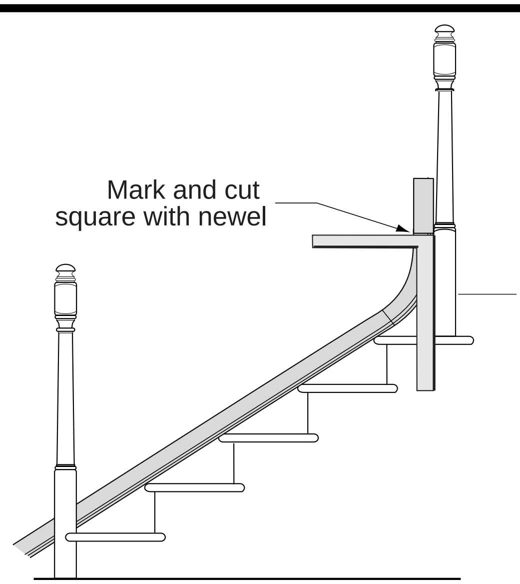


Fig. 4-13 *Adding fitting to upper newel post.*

4. Slide rail upwards until the fitting touches the face of the landing newel.

5. At the point where the fitting touches the face of the landing newel, scribe a line on the fitting perpendicular to the newel using a square.
6. Cut the up easing off on this line.
7. Lay rail back on to the treads and slide the rail up until the fitting is the desired distance away from the face of the newel.
8. At the face of the bottom newel, scribe a line with the pitch of the rail. Please note Fig. 4-14 here.

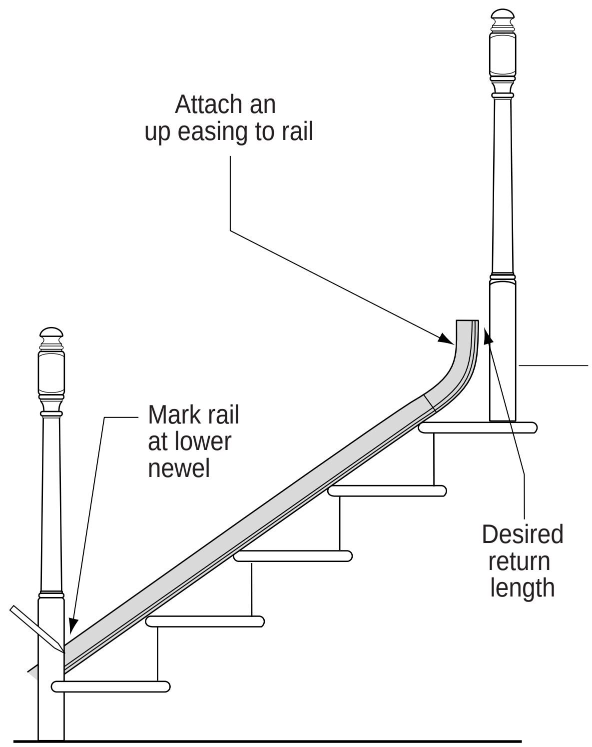


Fig. 4-14 *Marking rail at lower newel post.*

9. Cut off the bottom end of rail at this line.
10. Place rail back onto the treads with the bottom end fitted tightly against the face of the bottom newel.
11. Measure the distance from the back of the fitting to the face of the newel and add to this distance the thickness of the rail. This is your return length. Please note Fig. 4-15 here.

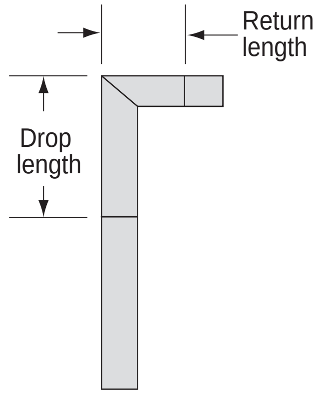


***Fig. 4-15** Determining return length.*

12. Measure the distance from the top of the rail to the top of the bottom newel. Please note Fig. 4-16 here.

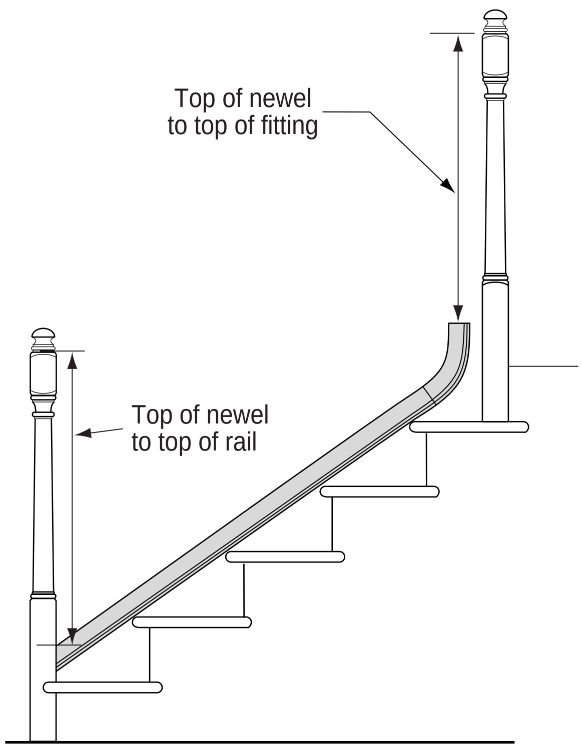


***Fig. 4-16** Determining the length of the drop.*

13. Measure the distance from the top of the fitting to the top of the upper newel.
14. Subtract the distance from the distance in Step 13. This is the length of your drop or neck.

15. Mark the gooseneck and make the cut.
16. Attach gooseneck to the fitting.
17. Raise rail up to the proper rail height and bolt each end to the newels. Please note Fig. 4-17 here.

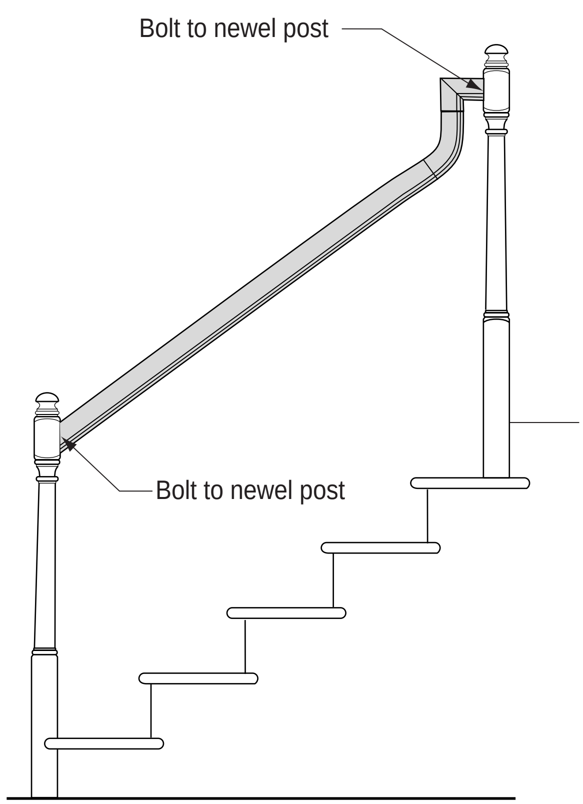


Fig. 4-17 *Bolting rail to newel posts.*

Chapter 4: Things to Remember

1. Always consult your local building codes before building a stair
2. Do not forget to add slope difference to post-to-post rake newels.
3. Layout rail centerline and newel placement prior to installation.
4. Turn laminated side of newel in the least visible direction.
5. Use the proper type newel for each location (i.e. 5-,7-,10- and 13-inch face newels).
6. Securely glue and bolt all newels to framing.
7. Make sure that all newels are plumb.
8. Place rail parallel to treads.
9. Always glue and bolt rail securely into place.

Chapter 5
Installing Balusters

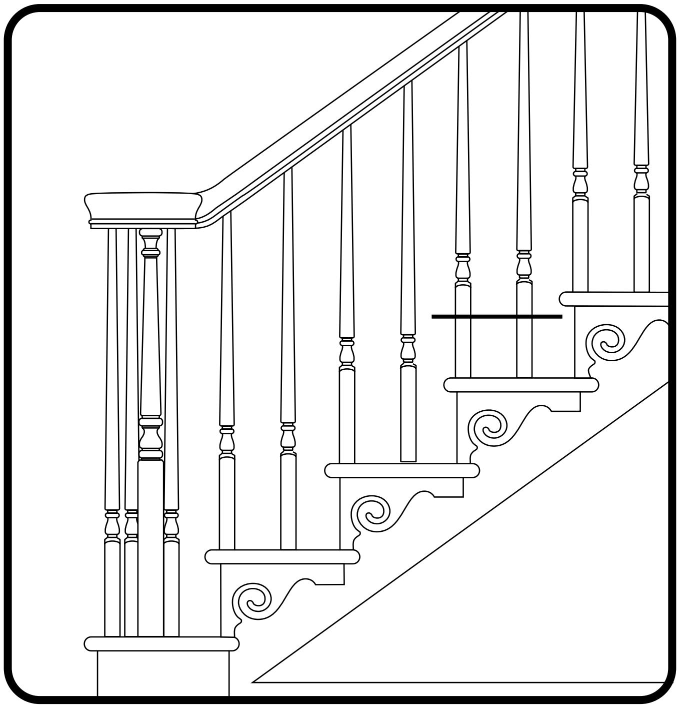
In this chapter:

Stair Balusters

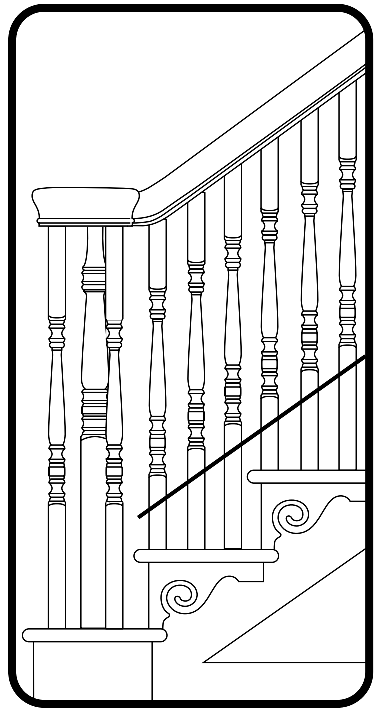
Balusters are the narrow, vertical sections of the staircase that help support the handrail. They are offered in a variety of sizes and designs and are usually selected to achieve aesthetical appeal. Due to safety reasons, baluster spacing is regulated by local building codes. The two most common types of balusters are square top and taper top.

This chapter will describe two types of baluster installations; tread-oriented baluster installation and rail-oriented baluster installation.

Traditional Tread Oriented



Rail Oriented



Tread-Oriented Balusters

Orienting the balusters to the treads is considered the more traditional installation method. With this type of installation, the bottom square on each of the balusters is the same length. Balusters are therefore oriented to correspond to the tread. Please note Fig. 5-1 here.

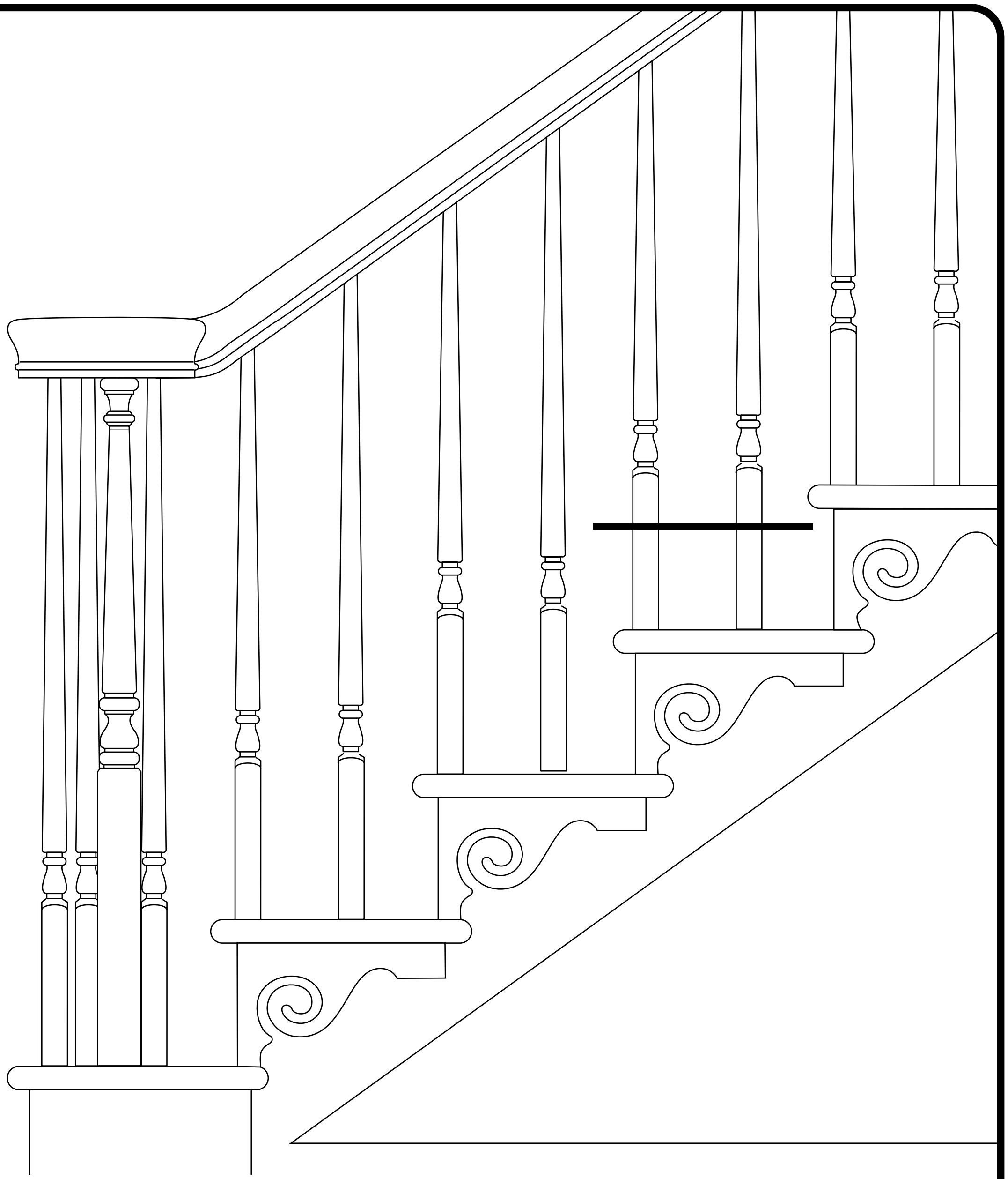


Fig. 5-1 *Traditional Tread Orientitation*

Installing Square Top Balusters

Laying Out the Treads

In the previous chapters you learned that when you set the newels and rail, you established a baluster or rail centerline for the staircase. You will use this centerline to determine the placement of the balusters on the treads. The face of the front or first baluster is usually even with the face of the riser.

The following steps describe the process:

1. From the face of the riser, measure back half the width of the baluster you are using and place a mark intersecting it with the rail centerline.

2. Space the second baluster evenly on the tread, so that all the balusters, up the rake (slope) are the same distance apart. On a "two baluster per step" installation, this is achieved by dividing the run of the stair by two. (This is the distance between adjacent risers.) Then measure back from the center mark of the first baluster and place a mark that intersects with the rail centerline. This will be the center mark of the second baluster. Please note Fig. 5-2 here.

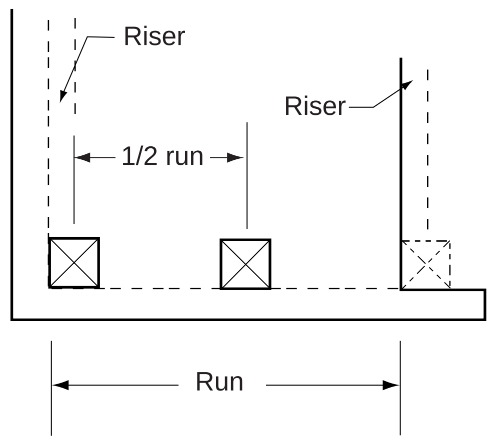


Fig. 5-2 *Determining placement of balusters on treads for "two baluster per step" installation.*

In the "three baluster per step installation" the placement is calculated the same way, except you must take the run and divide by three. Please note Fig. 5-3 here.

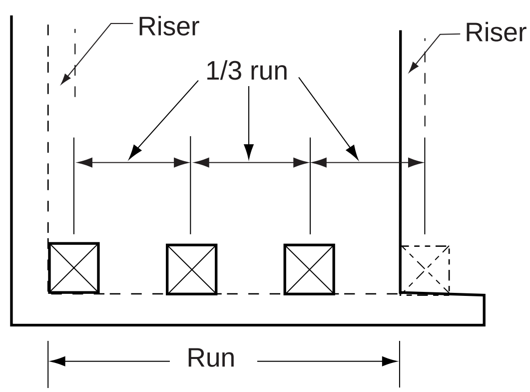


Fig. 5-3 *Determining placement of balusters on treads for "three baluster per step" installation.*

Note: Most building codes dictate that baluster placement must not allow a 4-inch sphere to pass through it. Consult local building codes for exact requirements.

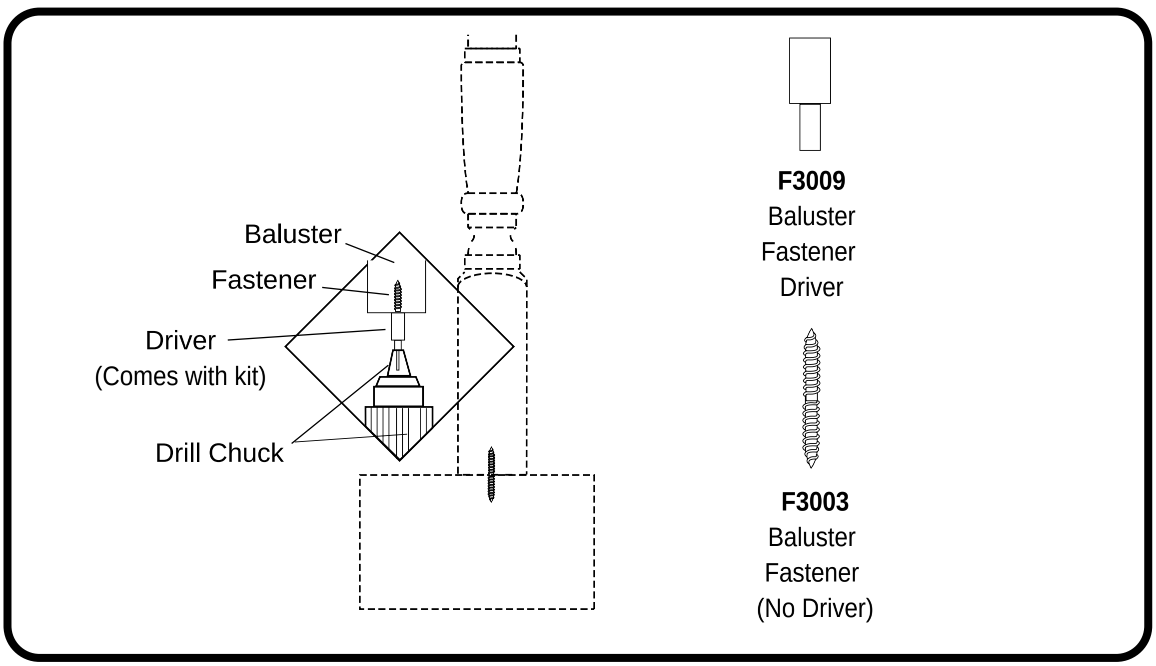
Boring the Treads

1. When installing manufactured balusters, drill the tread to accept the pre-made pins on the bottom of the baluster. If a factory turned dowel is not available, there are two basic types of dowels that may be added to your baluster: the wood dowel and the metal baluster screw.

   To install a wood dowel, drill a 1-inch hole in the bottom of the baluster (taking special care to match the correct diameter) and insert the dowel into the baluster. The dowel should be glued into the hole with at least 1/2-inch extending out from the bottom of the baluster.

Note: The dowel should be large enough to withstand the structural requirements.

The second dowel type is a double-ended dowel screw. (Dowel screws and dowel screwdrivers can be purchased through your local stair parts distributor.) Dowel screws are utilized by inserting one end into the bottom of the baluster and leaving half of the screw exposed to insert into the tread.



Note: This dowel should be large enough to withstand the structural requirements.

2. On the previously marked intersecting lines of the baluster, drill a hole about 1-inch deep with a brad point bit of the appropriate diameter. Make sure the hole is perpendicular to the top of the tread.

Cutting the Balusters

1. Measure the length of every baluster in place.
2. Hold the baluster in place with the dowel pushed firmly into the hole in the tread.
3. Use a level to plumb the baluster perfectly. Please note Fig. 5-4 here.

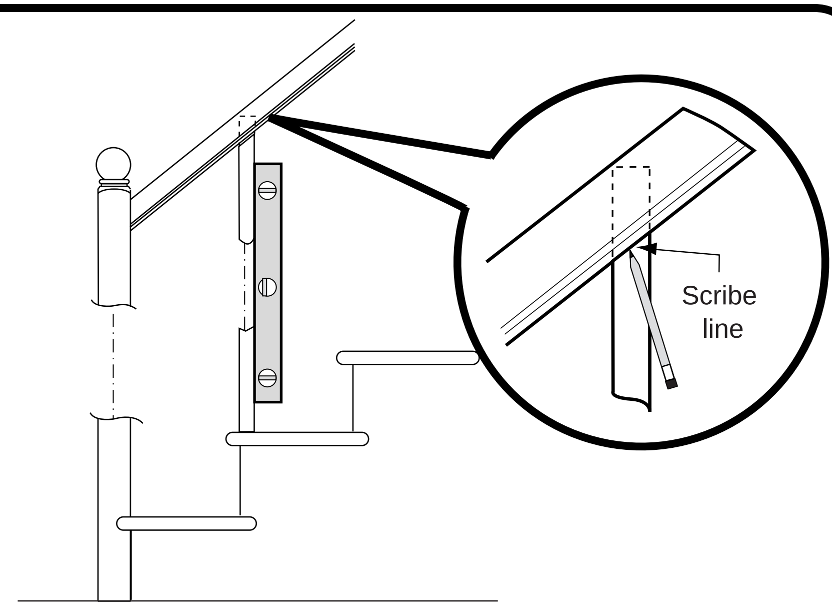


Fig. 5-4 *Cutting the square top baluster.*

4. Scribe a line even with the pitch of the rail.
5. Add the depth of the plow in the bottom of the rail to this length.
6. Using a miter-saw, cut the baluster at the proper angle.

Installing the Balusters

1. Place a small amount of glue into the hole in the tread and push the bottom dowel of the baluster firmly into the hole.
2. Next, place a small drop of glue on the top of the baluster and slide the angle cut of the baluster into the plowed portion of the rail.

3. Fasten the baluster to the rail with two small nails.
4. Use fillet to fill the plow between the balusters.
5. Measure the distance between the balusters and cut the fillet with the proper angles on each end.
6. Place two drops of glue on the bottom of the fillet and push it firmly into the plow.
7. Secure it with two small nails.

Installing Round Top Balusters

Boring the Treads

The instructions for this procedure are identical to the installation of square top balusters. Please note the prior section.

Boring the Rail

1. Using a level or a plumb bob, make a mark on the bottom of the rail directly above and corresponding with the baluster center on the tread.
2. Drill a hole of the appropriate diameter in the bottom of the rail. The hole size is determined by the diameter of the baluster top you have chosen.

Note: This hole must be drilled accurately.

There are several ways to bore the hole. One method is to use a jig made with a pitch block (see instructions in Chapter 3 on making a pitch block).

Drill a hole perpendicular to the run. The hole must be accurate and is best done on a drill press with the run side flat on the table. The drill bit should be the exact diameter of the baluster tops. This hole will guide your drill. Please note Fig. 5-5 here.

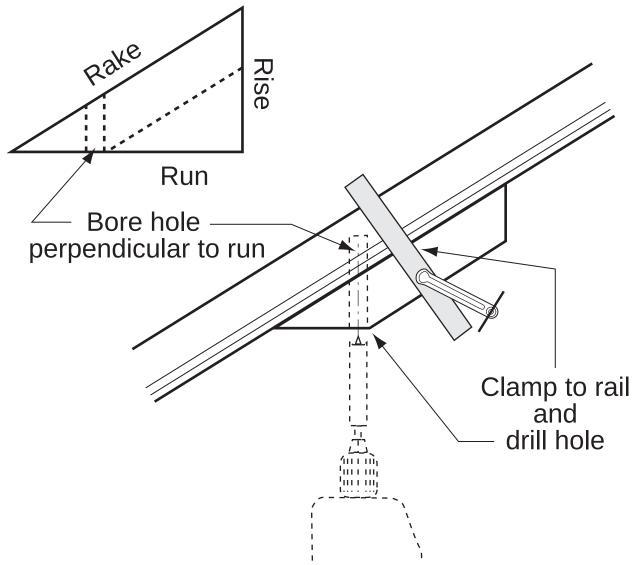


***Fig. 5-5** Using a jig to drill holes on a slope.*

3. Next, clamp the jig to the bottom of the rail with the run side parallel with the treads and the jig hole centered with the baluster mark on the bottom of the rail.
4. Drill the holes in the bottom of the rail about 1-1/2-inch deep. Place a piece of tape on the drill bit to make the holes uniform in depth and to prevent drilling too deep.

Cutting and Installing the Balusters

1. Measure the length of every baluster in place.
2. Hold the baluster in place with the dowel pushed firmly into the hole in the tread.
3. Line the center of the top of the baluster with the center of the hole in the bottom of the rail.

4. On the baluster, scribe a line equal to the pitch of the rail. Please note Fig. 5-6 here.

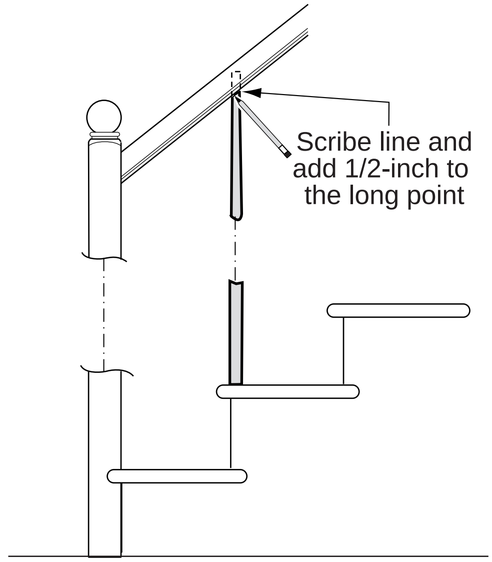


Fig. 5-6 *Alternative method for installing round top balusters.*

5. Add 1/2-inch to the longest point of this line and make a square cut on this mark with a miter saw.

6. Gently remove the rail.

7. Glue and nail the bottoms of each baluster into the tread. This will keep the balusters from spinning.

8. Push the rail down on top of the baluster, tapping it firmly with a rubber mallet.

9. Secure the rail to the newels.

10. Attach the baluster to the rail with a small nail.

Note: There is an alternate way to install round top balusters. When drilling the holes in the bottom of the rail, the holes should be 1-1/2-inches deep. Cut the balusters 1/2-inch longer than the length of the baluster as above. Next, push the top of the baluster up into the hole in the bottom of the rail. Then place glue in the hole in the tread and pull the baluster down, placing the dowel on the bottom of the baluster firmly into the hole. Secure each end with a small nail.

Rail-oriented or Raking the Balusters

The term "rail - oriented" generally applies to a baluster installation in which the bottom square and turning of the baluster is parallel to the handrail and not the tread. It is important in this method of installation that all the balusters have the same turning and top square lengths. Please note Fig. 5-7 here.

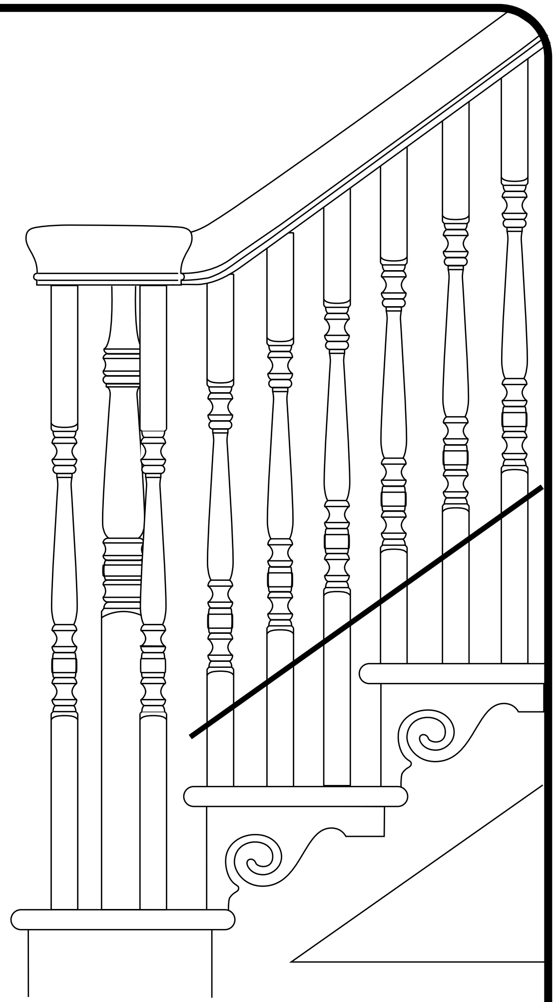


Fig. 5-7 *Rail Oriented balusters*

Installing Square Top Balusters

To install square top balusters, follow steps on laying out and boring tread as stated previously in the chapter. Then proceed as indicated below.

1. Cut the tops of each baluster at an angle equal to the pitch of the stair so that all the top squares are the same length. Please note Fig. 5-8 on the next page.
2. Turn the baluster upside down.
3. Center the top of the baluster with the hole in the tread and plumb it with a level.
4. Scribe a line with the bottom of the rail and add an amount equal to the depth of the plow in the rail.

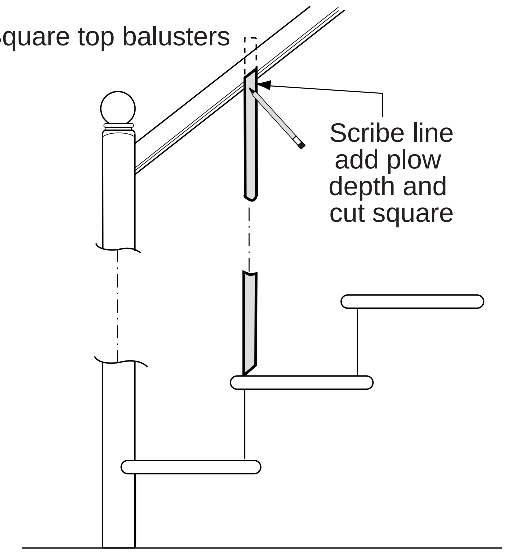


Fig. 5-8 *Raking the balusters using square top balusters.*

5. From this mark, cut the balusters square and add a dowel to the bottom as directed above.
6. Complete the installation as previously shown.

Installing Round Top Balusters

To install round top balusters, follow steps on laying out the tread, boring the tread and boring the rail in the round top baluster (Tread-Oriented) section described earlier in this chapter. Then proceed as indicated below.

1. Turn the baluster upside-down and line the top up with the hole in the tread. Make sure not to let the baluster slide into the hole.

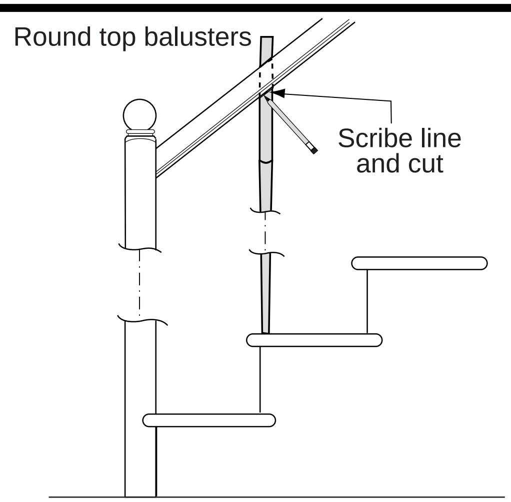


Fig. 5-9 *Raking the balusters using round top balusters.*

2. Center the bottom of the baluster with the hole in the bottom of the rail and scribe a line on the baluster along the pitch of the rail using the bottom of the rail as a guide. Please note Fig. 5-9 on the previous page.
3. Make a square cut on the bottom of the baluster at the long point of the line scribed.
4. Add a wooden dowel or metal dowel screw to the baluster. Complete the installation as previously shown.

Installing Balcony or Landing Balusters

Layout and Boring

1. Make sure that the baluster adjacent to the newel is close enough to meet local building code requirements.
2. Once you have determined this distance, measure from each newel and scribe a line.
3. Measure the distance between the two marks in a balcony section.
4. Divide this distance by the maximum spacing allowed by local building codes plus the thickness of the baluster at its narrowest point.

Baluster Spacing (Balcony or Landing)

__________ Distance

__________ ÷ Maximum baluster spacing + Thickness of narrowest part of baluster

---

__________ Round to the nearest whole number

__________ = Minimum number of baluster spacing

5. Round this number up to the nearest whole number. This number represents the minimum number of baluster spaces you must use.
6. Divide the distance between marks by the amount in step 5.
7. Mark the balusters out on the landing tread where they intersect with the rail centerline.
8. Plumb up to the rail and transfer these marks to the center of the rail above.
9. Bore lower landing tread and rail.
10. Cut and install balusters as shown in earlier sections. Make sure that the installation is consistent throughout the stair.

Volute Balusters

Laying out the balusters under the volute can be achieved by using the manufacturer-provided template inside the volute package.

One thing to keep in mind is that the size of the balusters you use determines the number of balusters you will need. For example, when using the 1-1/4-inch balusters, you will install five balusters under the volute. When using 1-3/4-inch balusters, you will need four balusters under the volute. These numbers can vary depending on the desired appearance.

Volute Baluster Layout Using Manufacturer-Provided Template

1. Place the template on the tread with the straight portion of the volute centered with the rail centerline.
2. Using a nail set, mark the holes that correspond to the desired baluster and newel layout.
3. Align the template with the bottom of the volute.
4. Using a nail set, mark the holes that you used to mark the tread.
5. Use these holes after the volute is installed to drill the appropriate diameter holes to accept the balusters.

Designing a Custom Volute Baluster Layout

1. Make a centerline on the bottom of the volute.

2. Measure the distance from the back of the third riser to the center of the back baluster. Please note Fig. 5-10 here.

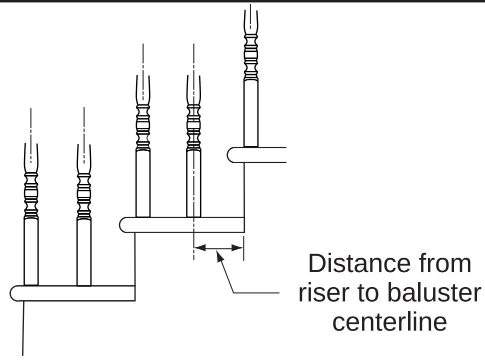


Fig. 5-10 *Custom layout*

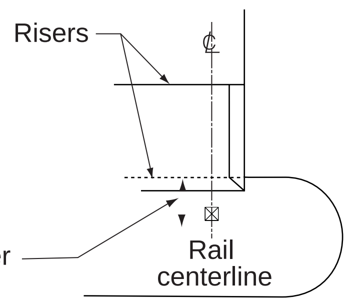


Fig. 5-11 *Custom layout*

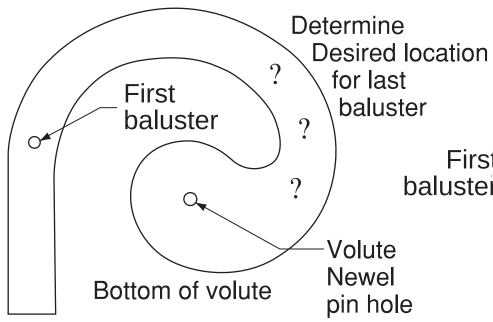


Fig. 5-12 *Custom layout*

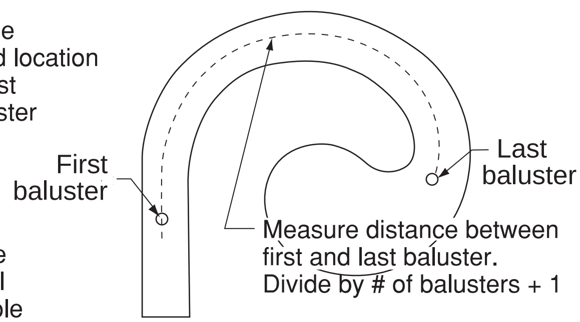


Fig. 5-13 *Custom layout*

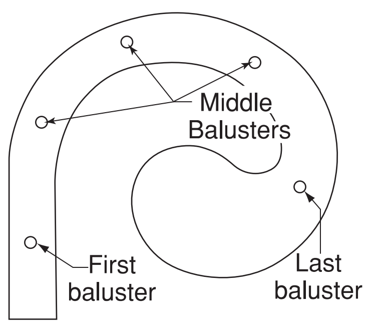


Fig. 5-14 *Custom layout*

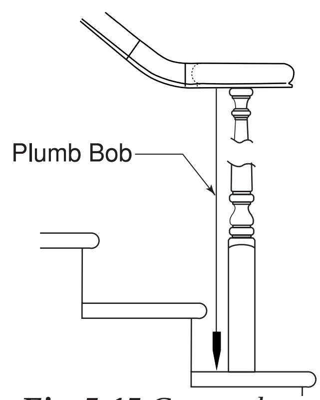


Fig. 5-15 *Custom layout*

3. From the face of the second riser, measure this distance and draw a line on the bullnose tread that intersects with the rail centerline. This will cause the back baluster of the volute to match the back baluster on the other treads. Please note Fig. 5-11 here.

4. Using a plumb bob, make a mark on the bottom of the volute that corresponds to the back baluster mark made in the previous step.
5. You must determine how far around the bottom of the volute the last baluster will be located. This is for aesthetical purposes only. Please note Fig. 5-12 here.
6. Divide the radial distance between these two baluster marks by the number of balusters you want between them and add one. This will give the necessary spacing.

Note: This can also be done through trial and error until you achieve the desired layout. Please note Fig. 5-13 here.

7. Using this spacing distance, start with the layout mark of the back baluster and mark intersecting lines on the centerline on the bottom of the volute for all of the desired balusters. Please note Fig. 5-14 here.
8. Using a plumb bob, mark a line on the tread that corresponds with the marks on the bottom of the volute. Please note Fig. 5-15 here.

Installing Volute Balusters

1. Bore holes in the tread. These holes should fit the appropriate dowel size (i.e., factory dowel, wood dowel or metal dowel in the bottom of the baluster).
2. Bore holes in the volute. Make sure that the holes are the appropriate diameter.

Note: When using square top balusters it will be necessary to mortise square holes in the bottom of the volute to accept the square top of the baluster. (It is also possible to insert dowels in the tops of the balusters).

3. Place the bottom dowels of the balusters into the holes in the tread.
4. Line the baluster up with the corresponding hole in the volute; scribe a line on the baluster 1/2-inch above the bottom of the volute.
5. Repeat the process for the other volute balusters.
6. Trim the balusters along the scribed lines.
7. Remove top rail and install each baluster into the tread with the other balusters on the rail. Place a small amount of wood glue into the hole where the baluster will be installed.
8. Gently push the rail back on the top of the newels and balusters and tap down firmly with a rubber mallet.

Large Turnout Baluster Layout
Using Manufacturer-Provided Template

1. Place the template on the tread with the straight portion of the tread centered with the rail centerline.
2. Using a nail set, mark the holes that correspond to the desired baluster and newel layout.
3. Align the template with the bottom of the turnout.
4. Using a nail set, mark the holes that you used to mark the tread.
5. Use these holes after the turnout is installed to drill the appropriate diameter holes to accept the balusters.

Designing a Custom Large Turnout Baluster Layout

1. Measure the distance on the tread from the back of the riser to the center of the back baluster. Please note Fig. 5-16 here.
2. From the face of the second riser, measure this distance and draw a line on the bullnose tread that intersects with the rail centerline. This will cause the back baluster of the large turnout to match the back baluster on the other treads. Please note Fig. 5-17 here.
3. Using a plumb bob, make a mark on the bottom of the large turnout that corresponds to the back baluster mark made in the previous step.

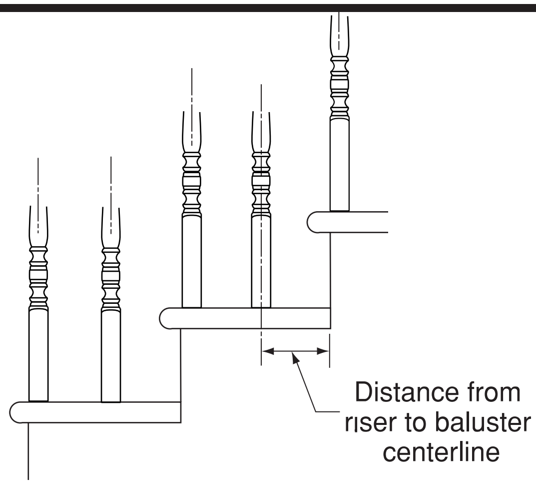


Fig. 5-16
Custom layout for Turnout

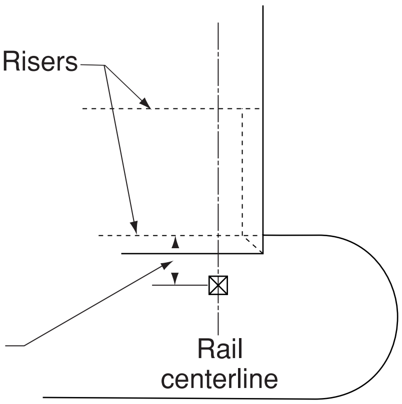


Fig. 5-17
Custom layout for Turnout

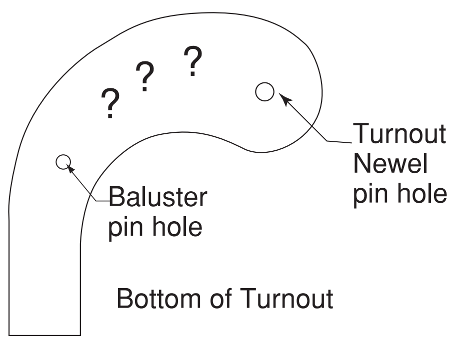


Fig. 5-18
Custom layout-Step 4, 5

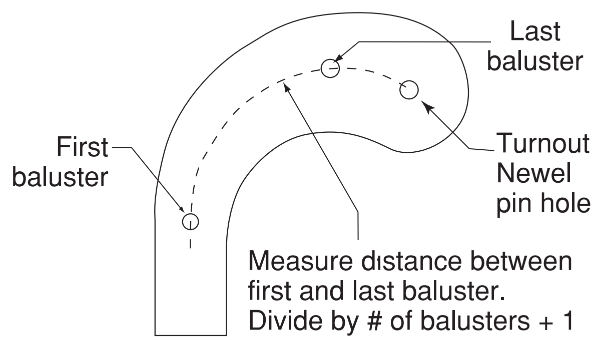


Fig. 5-19

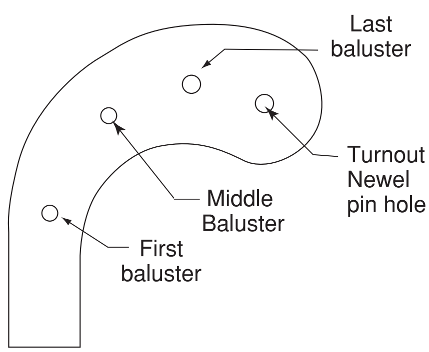


Fig. 5-20 *Large Turnout custom layout-step 7*

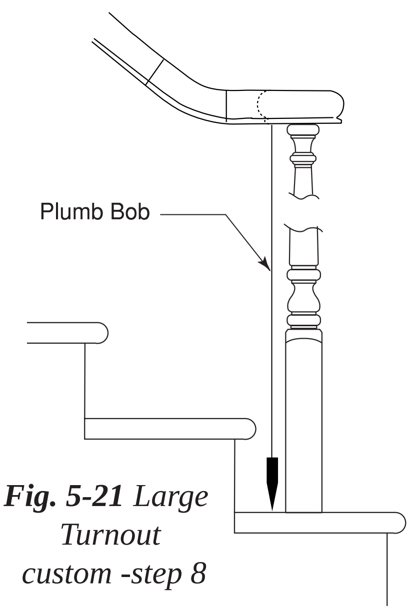


Fig. 5-21 *Large Turnout custom -step 8*

4. Determine how far around the bottom of the turnout the last baluster will be to achieve the desired look. Please note Fig. 5-18 here.
5. If using more than two balusters, divide the radial distance between these two baluster marks by one plus the number of balusters you want between them.

   Note: This can also be done through trial and error until you achieve the desired layout. This will give the necessary spacing. Please note Fig. 5-19 here.

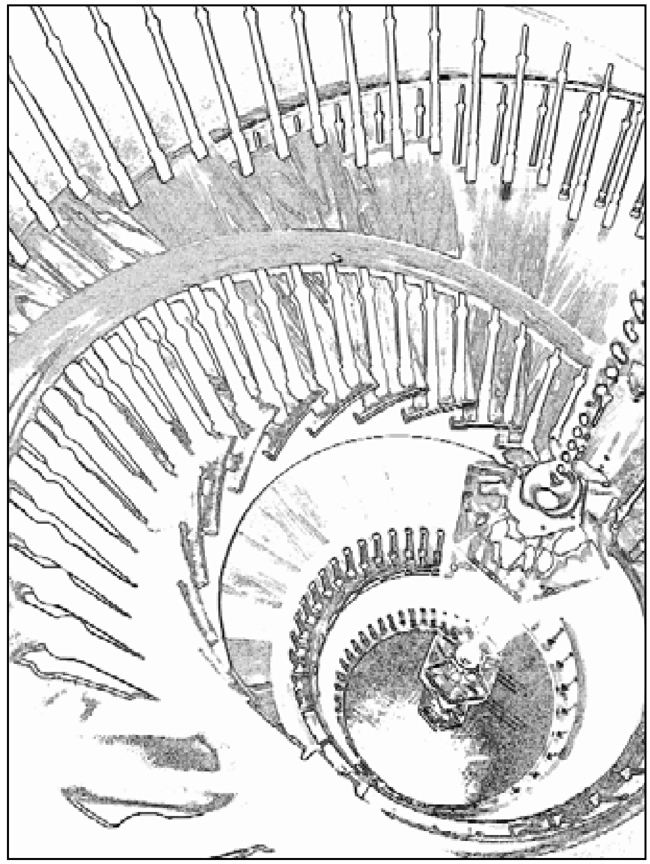
6. Make a centerline on the bottom of the large turnout.
7. Using the spacing distance from step 5 and starting from the layout mark of the back baluster, mark the intersecting lines on the bottom of the large turnout from the other balusters. Please note Fig. 5-20 here.
8. Using a plumb bob, mark a line on the tread that corresponds with the marks on the bottom of the large turnout. Please note Fig. 5-21 here.

Chapter 5: Things to Remember

1. Always consult your local building codes before building a stair.
2. Predetermine whether you will use a tread oriented or a rail oriented baluster layout.
3. When installing the balusters, take extra care to bore holes to the correct diameter. This will insure a proper fit.
4. Make sure dowel screws or non-factory dowel pins will meet necessary load requirements.
5. Pay close attention to baluster placement, (especially on balcony rails), so that you adhere to all building codes.
6. Glue and nail all baluster bases so that balusters will not “spin” in place.

Chapter 6
Bending Rail Installation

In this Chapter:



Bending Rail Installation

Bending or radius handrails are often considered one of the most technically challenging aspects of stair building. In actuality, the methods involved are no more difficult than those used in straight stair installation. With the proper tools and preparation, the job can be handled with minimal difficulty. The most frequent problems occur when materials, (i.e. bending rails & bending molds) are improperly stressed beyond their physical limits.

Note: It is important to note that due to variances in wood grain, it is possible that bending rail may fail if it is bent at a radius tighter than manufacturers recommended usage.

Fitts Industries, Inc. recommends, for successful use of its' bending handrails, that the radius not be tighter than 30-inches.

Bending Brackets

When bending handrail on site, the first step in the process is building a set of brackets. The brackets will act as a form for the rail, and can be made in several ways using a wide variety of materials. You will find our recommendations both cost effective and easy to build. The general design is a basic "L" bracket that is ridged enough to withstand the pressure placed on it by the bending rail. Please note Fig. 6-1 here.

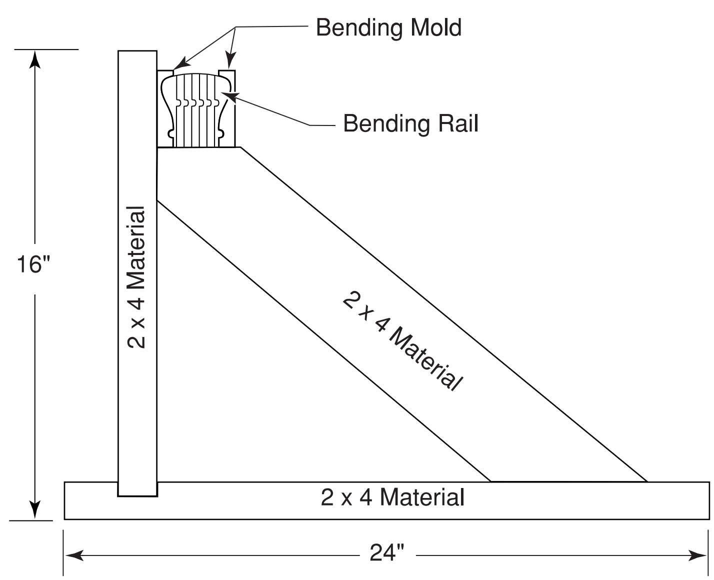


Fig. 6-1 *Bending Bracket*

This form allows the rail to be suspended above the treads, and will allow for easy inspection of the bottom of the rail during the bending process.

Bending Bracket Attachment and Layout

1. You must first determine the rail centerline. It is best to layout all of the centerlines and newel placements prior to construction. This will verify the proper length and placement of the material. ***Note: An important thing to consider is that the bending rail should extend past each end by at least 6-inches.***
2. Measure the width of the handrail including the bending mold. Divide this number by 2.
3. Measure over this distance from the rail centerline (Established in Step 1.)
4. Align the bending brackets on the tread so that when the rail is bent, it lies directly over the rail centerline and that the bracket is even with the front of the tread. Please note Fig. 6-2 here.

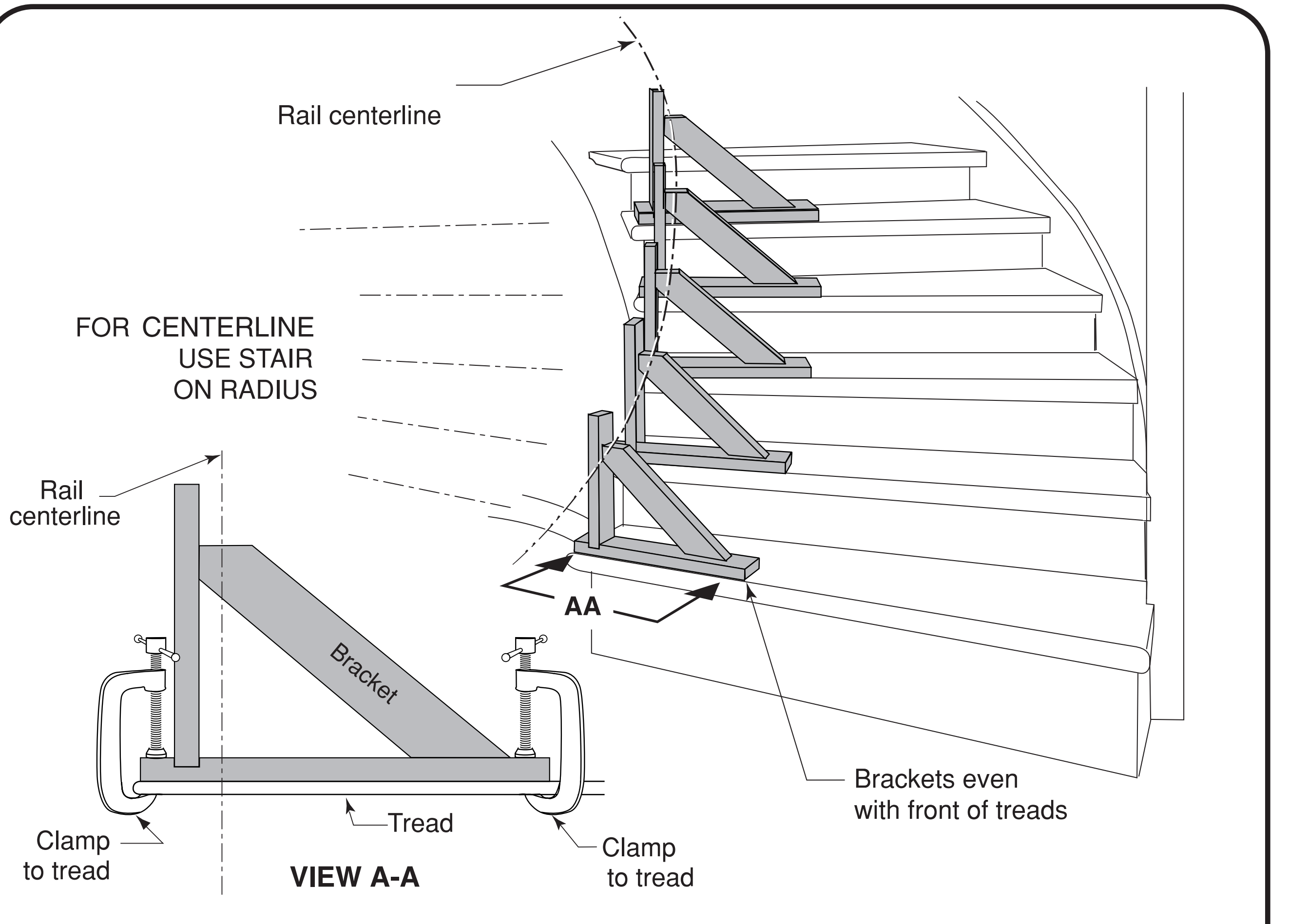


Fig 6-2 *Aligning Bending Brackets to Rail Centerline clamp to front of Tread*

5. Clamp the bending brackets to the treads. Cover the treads under the bending rail to catch any excess glue that may drip down. In a Post-to-Post system it may be necessary to place a bending bracket on the floor in front of the stair, as well as at the top level of the stair. This will assure the proper bending of the rail.

Level Balcony Rails

1. Repeat steps 1-3 above.
2. Lay the bending brackets around the balcony on 6-inch centers and positioned so the rail center will be directly over the rail centerline on the balcony.
3. The brackets and the rail should extend about 6-inches on each end.

Gluing the Rail

1. Prior to gluing, dry bend the rail on the stair or balcony to ensure proper length and placement.
2. It is very important to use the proper type of glue when bending a rail. There are many types of glues that will provide the proper strength. It is important that the glue have the proper bonding strength, allowing the user to manipulate and place the rail while it is still wet. Since there will be an excess of residual glue left on the rail after the drying process has occurred, it is important to take into consideration how easy the excess will be to sand and remove.

   If this is your first time bending handrail, it is suggested that you use glue with a slower set time. This will allow a longer period to manipulate the rail. When gluing handrail of a lighter variety (in terms of wood species), it is important to consider the color of the glue.
3. Using a glue applicator (such as a small paint roller), apply a thin layer of glue on all surfaces that will be bonded. Please note Fig. 6-3A here.
4. Cover the inside of the bending mold with wax paper, plastic wrap, or baby powder, to minimize the rail sticking to the molding. Please note Fig. 6-3B here.
5. As you glue the laminates, lay the rail into one side of the bending mold. Start with the first outside laminate, placing each layer on top of it. You will finish with the opposite outside ply. Please note Fig. 6-3C here.
6. Lay the other half of the bending mold on the bending rail and place tape around the entire form in three or four places to ensure the rail firmness during the bending process. Please note Fig. 6-3D here. You are now ready to bend the rail.

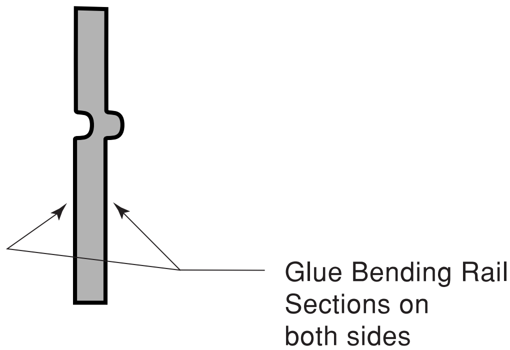


Fig. 6-3A

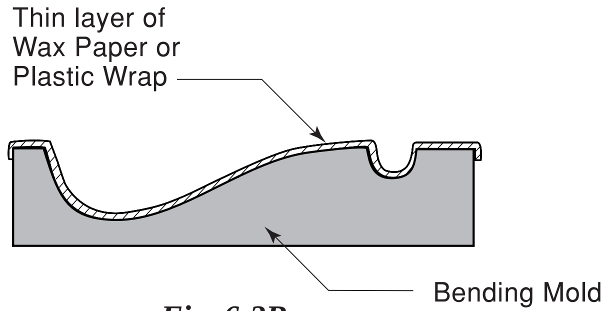


Fig. 6-3B

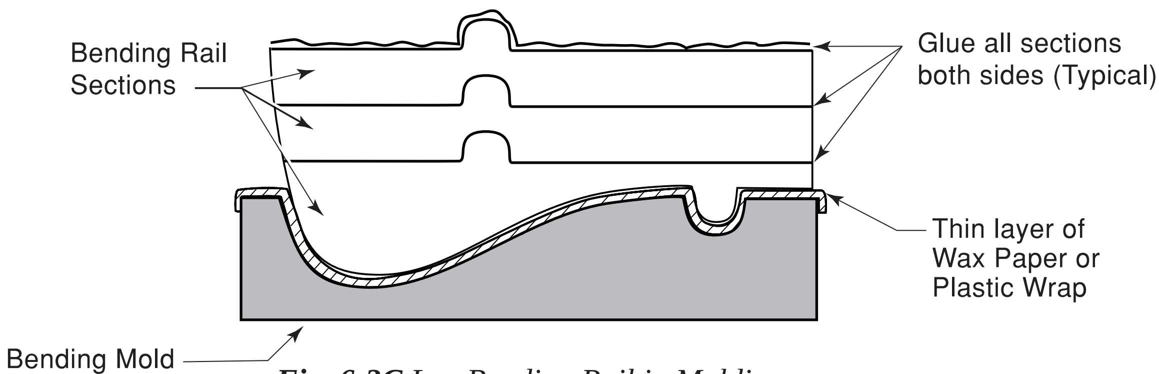


***Fig. 6-3C** Lay Bending Rail in Molding*

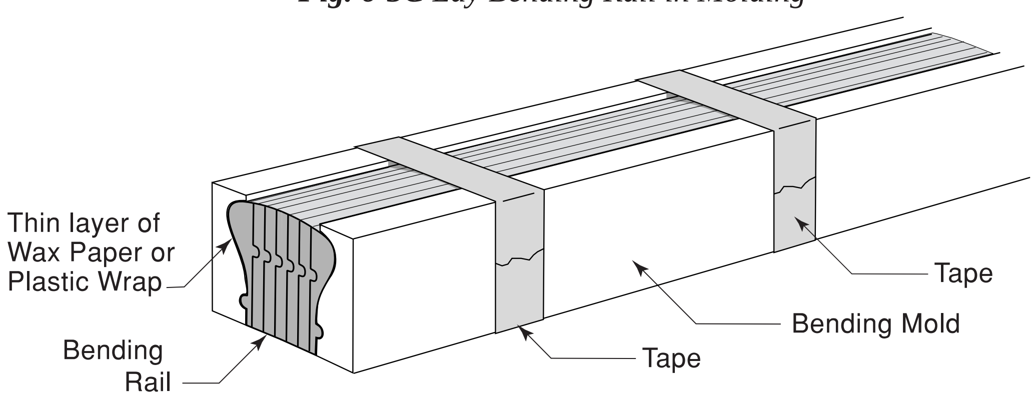


Fig. 6-3D

Note: When a required rail measures more than 16 feet, you may need to "lace" or "splice" two shorter sections of rail together. Please note Fig. 6-4. The splice is made by making a "butt-joint" between each laminate. A filament tape or a joint strap may be used to hold the joint together during bending. To make the best joint, it is suggested that you stagger the bending rail sections by two feet, so that the joint is "flatter" and stronger.

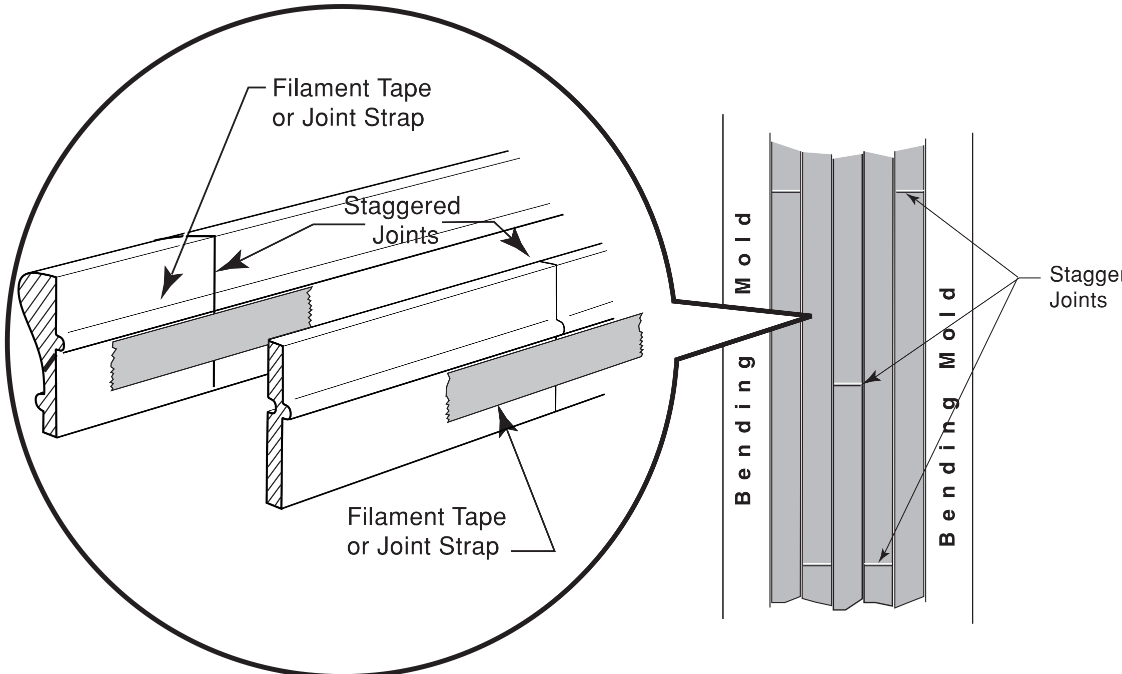


Fig. 6-4 *Joining Two Sections of Handrail*

Bending the Rail

1. Lay the rail on the bending brackets and loosely clamp into place.
2. Starting with the middle, pull the rail tightly to the brackets with a clamp.
3. Make sure that the bending mold is pushed down tightly against the rail, and that the rail is "square" inside the molding. This will ensure the proper twist on the rail. Please note Fig. 6-5 here.

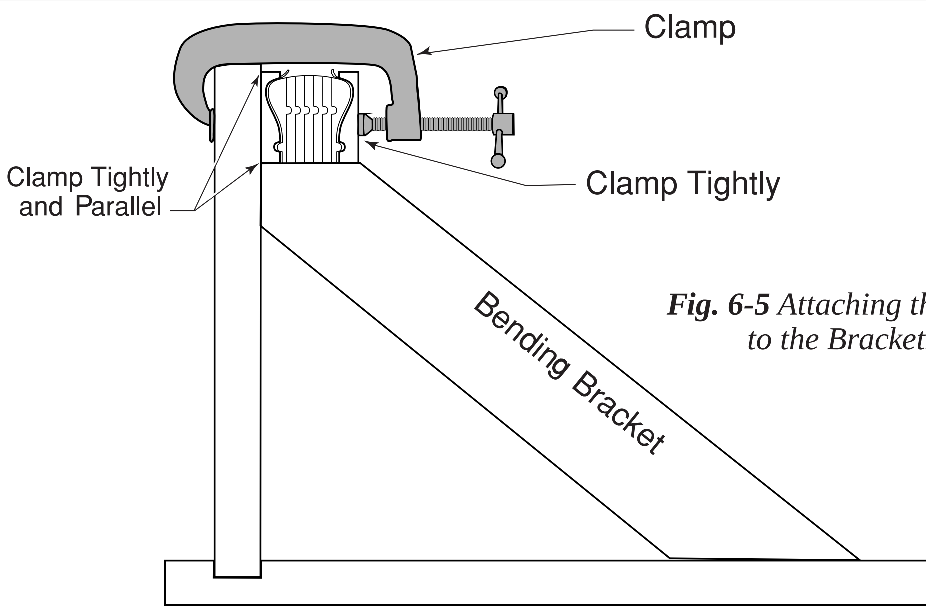


Fig. 6-5 *Attaching the Rail to the Brackets*

4. Place a clamp on each bracket, and one between each bracket. It is important to place the clamps close together so that the rail will achieve a good bond.
5. Since the outside laminates of most bending rail are thicker at the top than they are on the bottom, it is very important to check the bottom of the rail for gaps in the laminates. It may be necessary to add clamps to the bottom of the rail to close the gaps.
6. In most cases the rail can be removed within 24-48 hours. The temperature of the room, the humidity, and the tightness of the bend will affect the drying time. For the best results, plan to leave the rail in the mold for the full 48 hour time period.
7. Mark the rail with reference points so that you will be able to return the rail to the treads exactly where it was taken off.
8. Unclamp the dry rail and remove it from the stair.
9. Carefully remove the bending mold and any excess glue left on the rail with a sander or scraper.
10. Attach fittings, newels, and balusters using standard installation procedures.

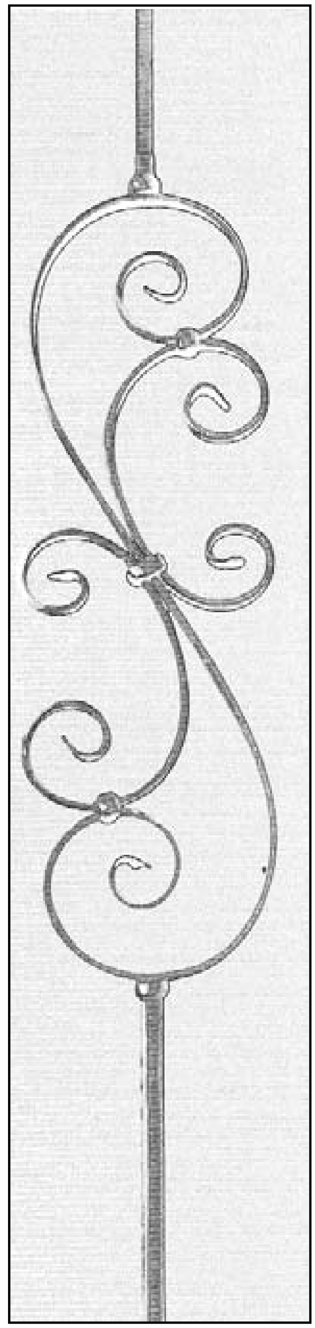
Note: When possible, leave the bending rail attached to the stair while working on other areas of the stair system.

Chapter 6: Things to Remember

1. Always consult your local building codes before building a stair.
2. Make sure to construct brackets that will withstand the pressure needed to bend handrail.
3. Make sure to clamp brackets to the tread so that the handrail sits directly on the rail centerline.
4. Bending rail should extend 6-inches past the beginning and ending of the stair. (This will ensure that the proper length material is used.)
5. Pay special attention to the bonding time and color of the glue.
6. It is important to check the bottom of the rail during the bending process to ensure that there are no gaps in the plies.
7. Make sure to apply wax paper or powder to the inside of the bending mold7 so that you do not glue the bending rail to the bending mold.
8. Make sure that the rail is clamped tightly and "squarely" to the bracket. This will ensure the proper "twist" to the rail.
9. For best results, let the glue set for 48 hours.
10. If at all possible, leave rail attached to the stair while working on other areas of the stair system.

Chapter 7
Wrought Iron Balustrade Installation

In this chapter:



Iron Balustrade Installation

Wrought Iron balusters are very unique because they offer the homeowner a great deal of flexibility and creativity during the selection process. It is rare to see an iron balustrade system using only one style of baluster. In many cases, as many as three styles of balusters are utilized. So, the difficulty comes with the layout of the balusters as opposed to the installation itself.

Layout and Drilling

As stated throughout this manual, it is important to keep local building codes in mind. Many areas have strict code compliance with regards to baluster placement and spacing.

Note: The main safety restriction deals with the 4-inch sphere code. It states that the baluster placement must prohibit a 4-inch spherical object to freely pass between the spacing.

Fitts Industries, Inc. has taken the necessary precautions to offer a select line of balusters that may be spaced close enough together to comply with these codes. It is also important to note that because the size and shape of the balusters vary greatly, it is not usually possible to lay out the treads and landing tread with constant spacing.

The following steps describe the process:

1. Lay the balusters on the floor or against the wall in the desired pattern. Please note Fig. 7-1 here.

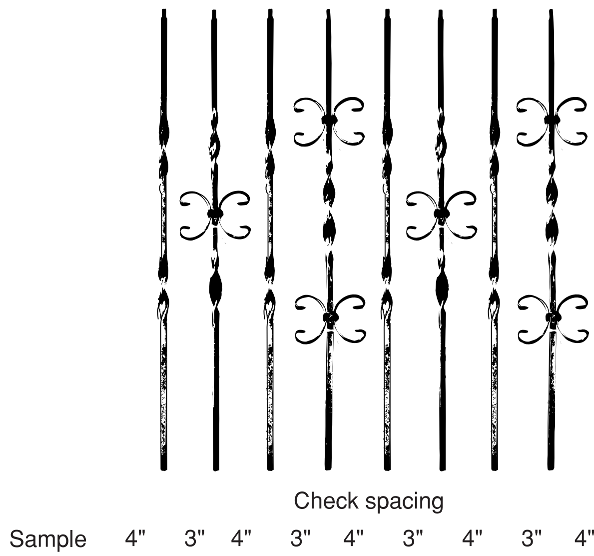


Fig. 7-1

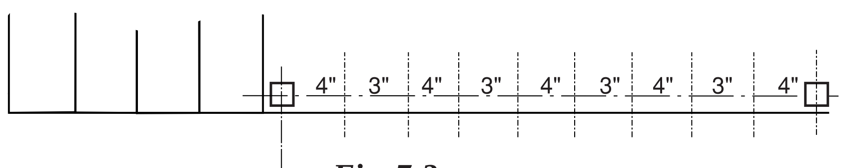


Fig. 7-2

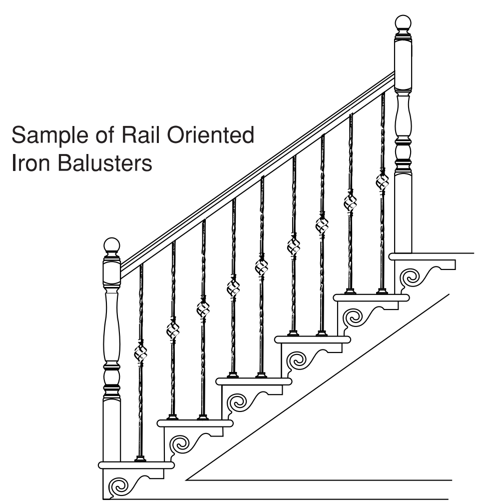


Fig. 7-3

2. Check the pattern layout for code compliance while spacing the balusters.
3. Measure the distances between the balusters.
4. Layout the rail centerline. Please note instructions in Chapter 3.
5. Mark your treads and/or landing tread to match your design. Repeat the design pattern to fill the necessary area under the rail.
6. Using a plum bob, transfer the marks for the balusters to the bottom of the rail. Please note Fig. 7-2 here.
7. On the previously made marks, drill a hole 5/8-inch in diameter, 1/2-inch deep into the tread or landing tread. (Copy step for all of the marks on the treads or landing tread. It is critical that these holes are consistent in depth. A variance in the depth of the holes could cause a problem with the installation of the handrail).
8. On the predetermined marks made on the handrail, drill a 1/2-inch diameter hole, 1-1/2-inch deep into the handrail. Follow this step for all of the predetermined marks on the handrail.

Cutting and Installing Balusters

All Fitts Industries, Inc. wrought iron balusters are designed using a rail-oriented baluster design. For review of this concept please note Chapter 5. Rail-oriented baluster placement cuts down on the number of baluster lengths needed and allows for greater flexibility in the selsction process, as well as any onsite adjustments that may occur during installation. Please note Fig. 7-3 here.

The following steps describe the process:

1. Turn the baluster upside down and place the end of the baluster into the hole in the tread. Please note Fig.7-4 here.

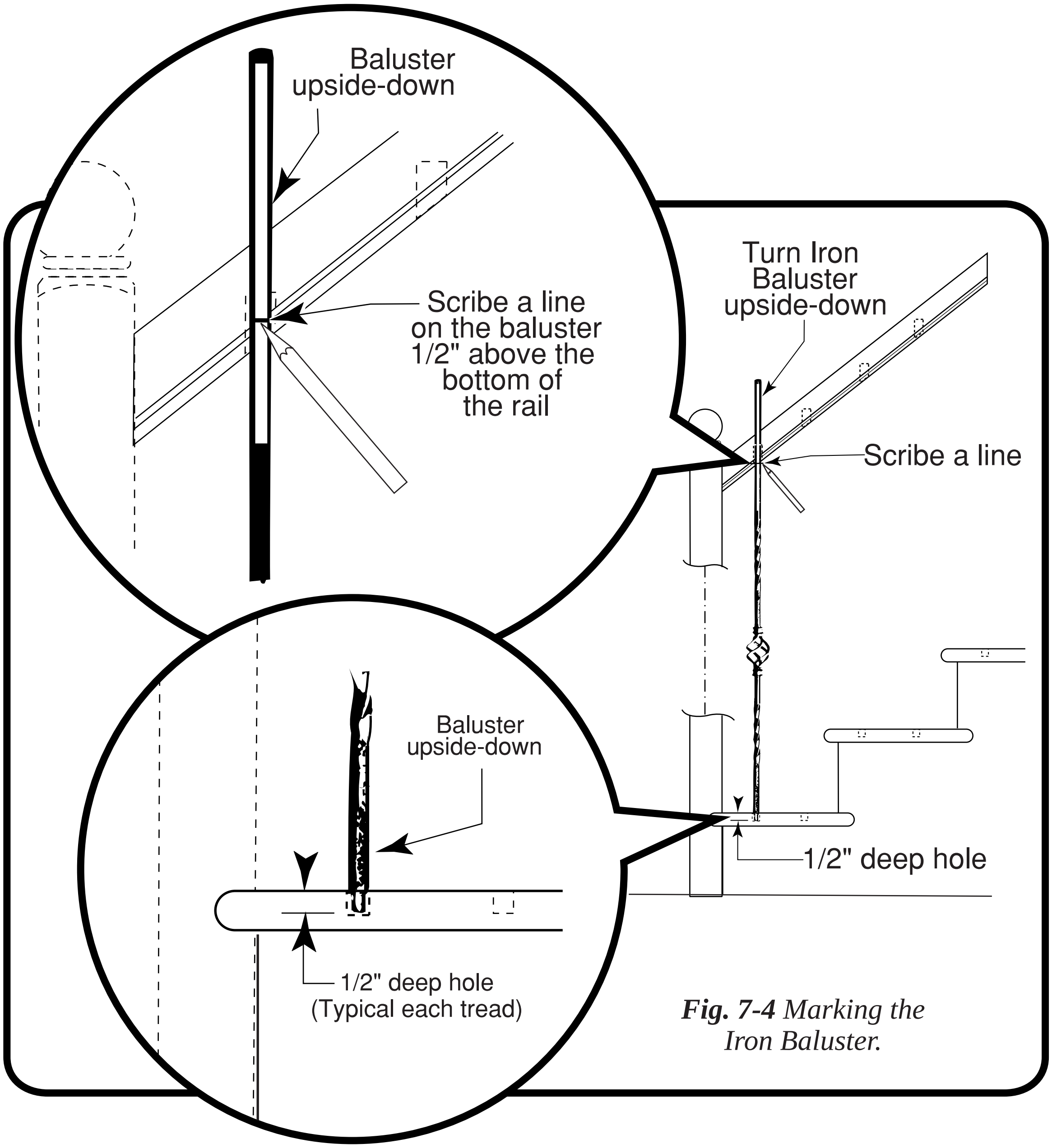


Fig. 7-4 *Marking the Iron Baluster.*

2. Line the bottom of the baluster up with the corresponding hole in the bottom of the rail. Scribe a line with the pitch of the rail even with the bottom of the rail. If the rail is a balcony rail, scribe the line even with the bottom of the handrail.

3. Add 1/2-inch to the longest point of the mark on the rake balusters, and 1-inch to the mark on the balcony balusters. Make a square cut.

Suggestion: A band saw with a metal cutting blade will work the best for trimming the balusters, but any metal cutting saw will work.

4. Repeat this process for all of the balusters. Remember to use the correct baluster to maintain a consistent design.

Installing Balusters

The following steps describe the process:

1. Remove the rails and carefully set to the side.
2. Using the proper adhesive (usually a fast cure epoxy), and place a small amount in each of the previously drilled holes in the tread or landing tread.
3. Slide the proper shoe onto the bottom of each baluster. Please note Fig 7-5 here.
4. Stand each baluster up, and place it into the predetermined hole (making sure to pay special attention to the pattern layout).

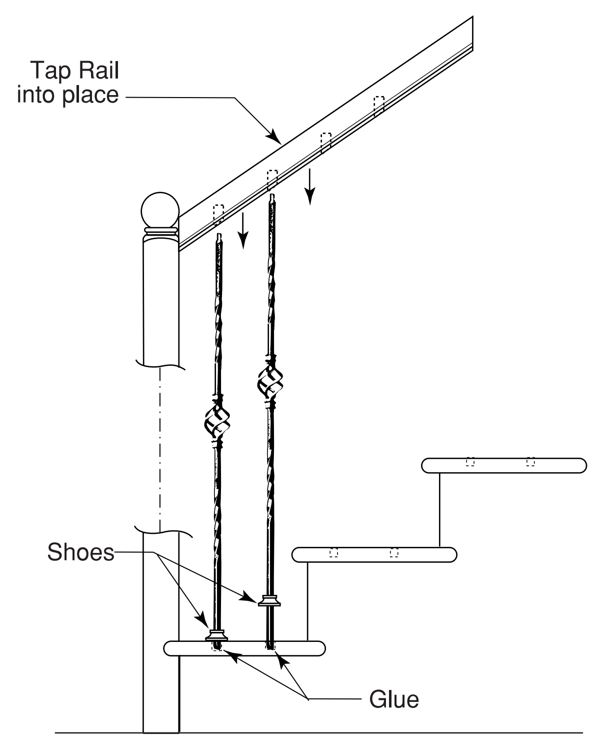


Fig. 7-5 *Fitting the Rail to Iron Balusters*

5. Place adhesive in the previously drilled holes in the bottom of the rail. Do not use a large amount of adhesive because it will have the tendency to run down the balusters.
6. Put the rail back into place and align the tops of the balusters with the hole in the bottom of the rail. Gently tap the rail down onto the balusters using a rubber mallet. (All Fitts Industries, Inc. wrought iron balusters come with a 1/2-inch diameter pin on the top. This allows for a snug fit into the rail).
7. Once the rail is back into place, securely attach it to the newels using the techniques described in the earlier chapters.

Stabilizing Long Rail Sections

It may be necessary, in certain applications, to add stability to a long section of handrail. Proper planning must be done before starting the installation process.

The following steps describe the process:

1. Make a rough baluster layout on the floor or treads.
2. Install a 4” x 4” or a 6” x 6” block approximately 8- to 10-inches long in the floor or on the side of the stringer. Please note Fig. 7-6 here.

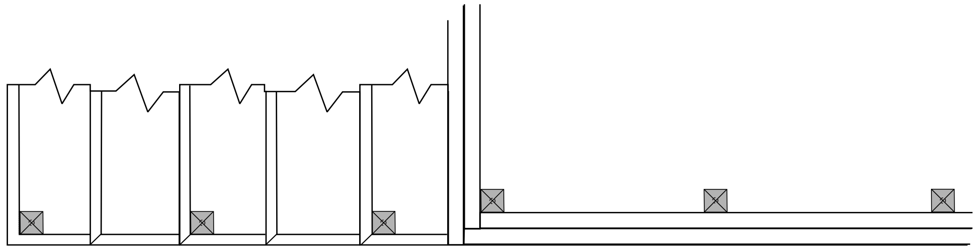


Fig. 7-6 *Add Blocking to Frame*

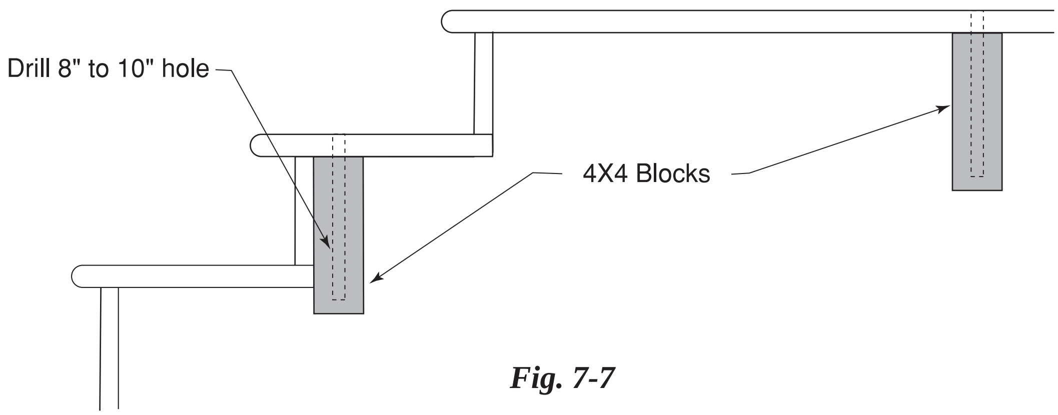


Fig. 7-7

It is very critical that the blocking is installed to match the baluster layout.

3. Repeat the process on every third or fourth tread, or every 3- to 4-feet on the balcony.
4. When drilling the treads or landing tread, drill the holes 6- to 8-inches deep in those areas with extra blocking. Please note Fig. 7-7 here.
5. When cutting the balusters that correspond to the extra deep holes, add the depth of the hole to the overall length of the baluster.
6. Install balusters as described in the previous section.

Chapter 7: Things to Remember

1. Always consult your local building codes before building a stair.
2. Most wrought iron systems will consist of more than one baluster style; pay special attention to baluster spacing and layout.
3. All Fitts Industries, Inc. wrought iron balusters are designed using a rail-oriented baluster design.
4. Wrought Iron balusters can be cut using either a band saw with a metal cutting blade or a metal cutting saw.
5. Make sure to check baluster layout before attaching any of the material.
6. On longer sections of rail, it is advised to mount the balusters into a piece of 4 x 4 blocking at various increments. This blocking should be mounted before installation.
7. If using the previously described mounting technique, it is important to predetermine which baluster will remain “uncut’ so that the appropriate baluster height is maintained.

Adjustable Base Box Newel Installation Instructions

Thank you for your purchase of Fitts' Adjustable Base Box Newel Posts. The instructions provided incorporate common and suggested installation practices and assume some general construction experience. Please note that the placement of the products on the stair are not specified. Always check local building codes before installation. Products are for interior use only.

Wood Storage Disclaimer

Box newel posts are partially constructed, unfinished wood products. Care is taken during and prior to the manufacturing process to dry lumber and maintain moisture content to stabilize the products during construction. The natural enemies of unfinished wood are moisture, temperature, and light. Recommended storage should be away from direct sunlight, free from dust, dirt and oil, and in a simulated environment that meets the condition of 55-85 degrees Fahrenheit and 40-55% relative humidity. Wood will shrink or swell due to variances in relative humidity. Products should be stored so that they have no direct contact with concrete – wood and or cardboard can absorb moisture from concrete and can cause product failure. Fitts Industries, Inc. assumes no responsibility for product failure that occurs outside of these storage parameters both in warehousing and jobsite storage. Products that are installed on a jobsite and unfinished must also meet these parameters.

Wood Finishing Disclaimer

All Fitts Industries, Inc. stair components are for interior use only. Careful steps must be taken after the product is unboxed. Products that are exposed to dust, dirt, oils, moisture, and heat can change the surface quality of the material and will create difficulty in the finishing process. Lightly sand stair components removing all dust from the sanded part. Vacuum or blow excess dust off of all stair components before finishing - It is important to follow safety warnings when dealing with wood dust. Always wear a dust respirator when sanding. *Note dust warning on Fitts packaging*. Make sure and follow the directions of the stain manufacturer to achieve desired results.

Surface Mounting Instructions

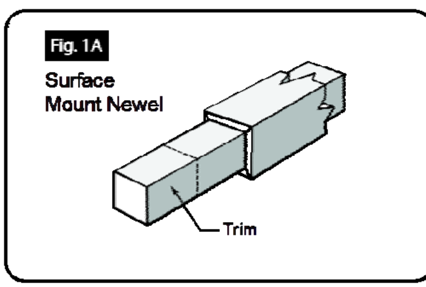
(For detailed instructions on Rail Centerlines | Post to Post Installations – Please note Chapter 4 of Fitts' Stair Installation Instruction Manual) Available at www.fitts.com/install.aspx

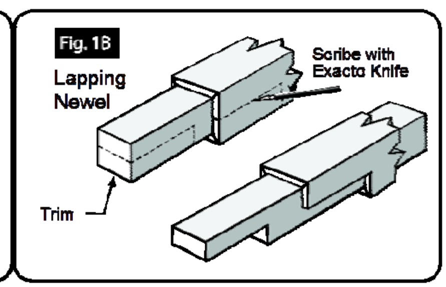
Important – Please READ: Fitts adjustable bases are manufactured out of plywood for optimal moisture stability. **NEVER pin nail through plywood as this will cause cracking. When applying the base ALWAYS use construction adhesive.**

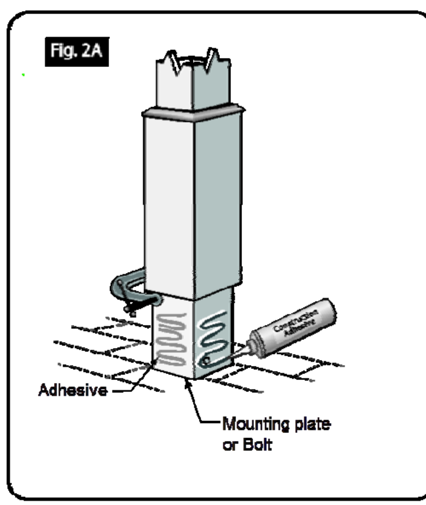
1. Measure the newel post and trim the bottom of the post to attain your desired rail height. Determine the desired height of the base sleeve and trim the bottom of the sleeve. The sleeve is manufactured out of a plywood substrate. Use a sharp saw blade and pre score the cut line with a razor knife to avoid tear out. (Fig. 1A). Please note that scoring is shown with the razor knife in 2B, but must also be used when making the flat horizontal cut on the adjustable base. This will alleviate tear out.

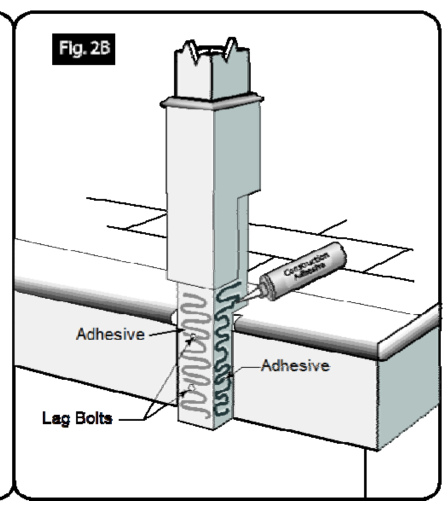
2. Clamp the base to the newel to free the bottom of the post for installation. For surface mounting applications choose your desired installation hardware and bolt and use construction adhesive for the connection. (Fig. 2A)

3. Apply construction adhesive to the base shaft and slide the base into place. It is important not to nail or screw the adjustable base into place. As homes adjust to seasonal change—movement in the wood can cause the base to crack. (Fig. 3A)







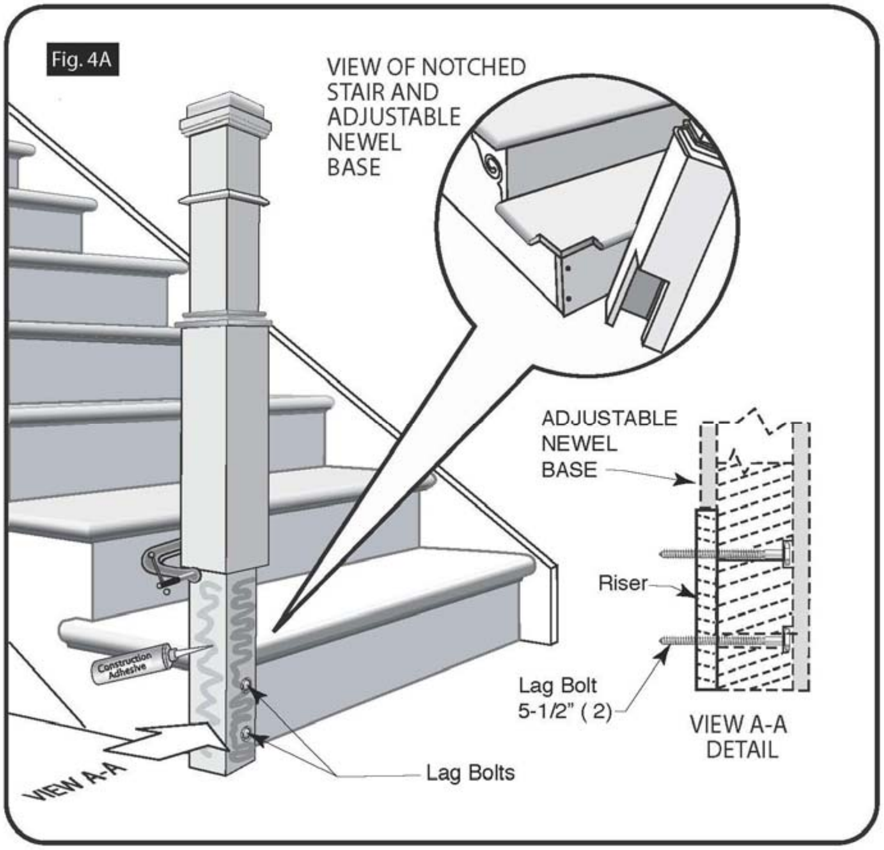


Face Mount Installation *(Starting \ Knee Wall \ Balcony)*

It is important to determine on a Face Mount installation if the adjustable base will be notched to mount to the front of the knee wall. If it is in fact notched use **Fig 1B** to make appropriate cut. Trim base to applicable height for your starting newel. Apply construction adhesive to the inside of the sleeve to fasten the adjustable base to the center shaft. **<u>(Do not nail or screw through the adjustable base. Climate change (expansion/contraction) will crack the plywood and will cause product failure over time.)</u>**

Starting Post | Knee Wall Face Mount | Balcony Mount

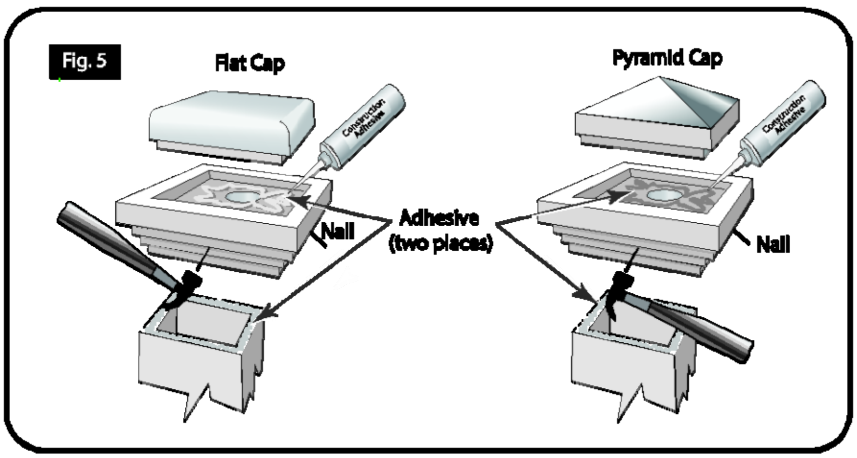
1. Locate and centerline and determine the newel height. Trim newel shaft to height. Notch the newel post to accept the first step or balcony). (Fig 1B) *On a knee wall installation it may not be necessary to notch the newel shaft.*
2. Notch adjustable base. Make sure score the adjustable base with a razor knife to avoid saw tear out. **(Fig.1B)**
3. Drill two pilot holes in front of newel base to accommodate two 5-1/2" lag bolts. Place base on newel and clamp in place allowing enough room work on the bottom of newel. **(Fig. 4A) (Fig. 2B)**
4. Lag bolt* newel into place. Place construction adhesive on the base of the center shaft, remove clamp and slide base into place.
5. On a balcony installation find moulding that has been used through out the home and trim/ finish the exposed base of the post.



*In addition to lag bolts—always use construction adhesive to give your newel the strongest connection.

Installing the Box Newel Cap

1. Determine whether you prefer the flat top or pyramid cap. Apply construction adhesive to the top of the newel center shaft.
2. Place decorative moulding on top of newel. Level and pin nail the cap in place through the side (bottom moulding) of cap.
3. Apply construction adhesive to base of the preferred flat or pyramid cap and apply into recessed channel



*Please consult local building codes before beginning any stair installation. Codes may very by State, City, Municipality, etc.

Thank you for your purchase of Fitts' Fixed Base Box Newel Posts. The instructions provided incorporate common and suggested installation practices and assume some general construction experience. Please note that the placement of the products on the stair are not specified. Always check local building codes before installation. Products are for interior use only.

Wood Storage Disclaimer

Box newel posts are partially constructed, unfinished wood products. Care is taken during and prior to the manufacturing process to dry lumber and maintain moisture contents to stabilize the products during construction. The natural enemies of unfinished wood are moisture, temperature, and light. Recommended storage should be away from direct sunlight, free from dust, dirt and oil and in a simulated environment that meets the condition of 55-85 degrees Fahrenheit and 40-55% relative humidity. Wood will shrink or swell due to variances in relative humidity. Products should be stored so that they have no direct contact with concrete – wood and or cardboard can absorb moisture from concrete and can cause product failure. Fitts Industries, Inc. assumes no responsibility for product failure that occur outside of these storage parameters both in warehousing and jobsite storage. Products that are installed on a jobsite and unfinished must also meet these parameters.

Wood Finishing Disclaimer

All Fitts Industries, Inc. stair components are for interior use only. Careful steps must be taken after the product is unboxed. Products that are exposed to dust, dirt, oils, moisture, and heat can change the surface quality of the material and will create difficulty in the finishing process. Lightly sand stair components removing all dust from the sanded part. Vacuum or blow excess dust off of all stair components before finishing - It is important to follow safety warnings when dealing with wood dust. Always wear a dust respirator when sanding. *Note dust warning on Fitts packaging*. Make sure and follow the directions of the stain manufacturer to achieve desired results.

Lapping a Box Newel

(For detailed instructions on Rail Centerlines | Post to Post Installations – Please note Chapter 4 of Fitts' Stair Installation Instruction Manual) Available at www.fitts.com/install.aspx

1. Determine the handrail centerline. Determine newel height and trim accordingly.
2. The box newel must be notched so that it may wrap around the riser and the skirt board.
   The center of the newel post should be aligned with the face of the riser. Please note Fig. 1 here.
3. Create blocking in the lower 7-8" of the newel post.
4. Glue and clamp in place. Nail material in for extra strength. Please note Fig. 2 here.
5. When blocking is dry, install newels using 5" lag bolts (unsupplied) and plug holes. Please note Fig. 3.

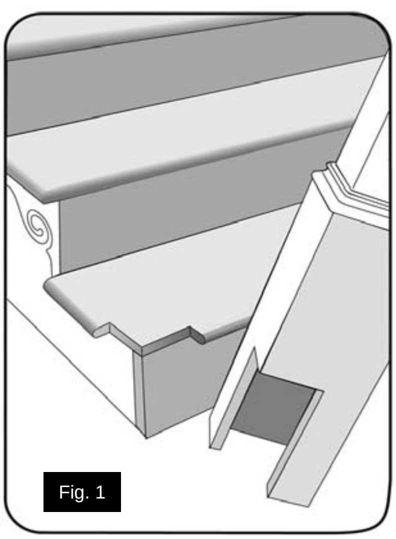


Fig. 1

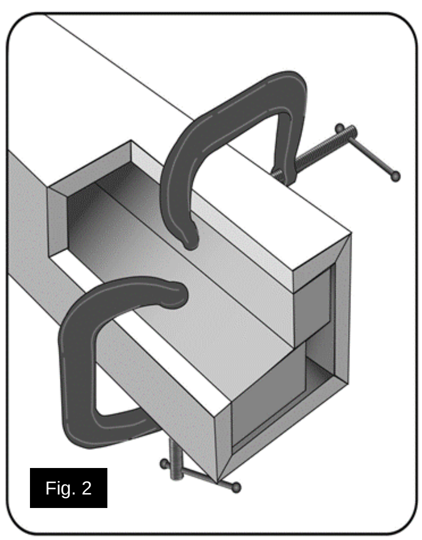


Fig. 2

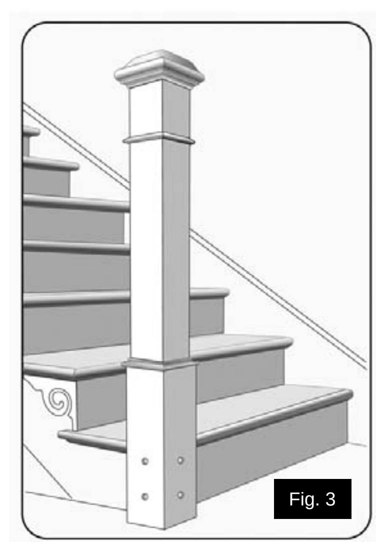
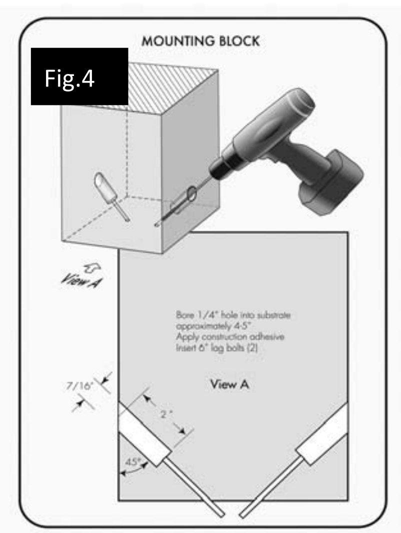


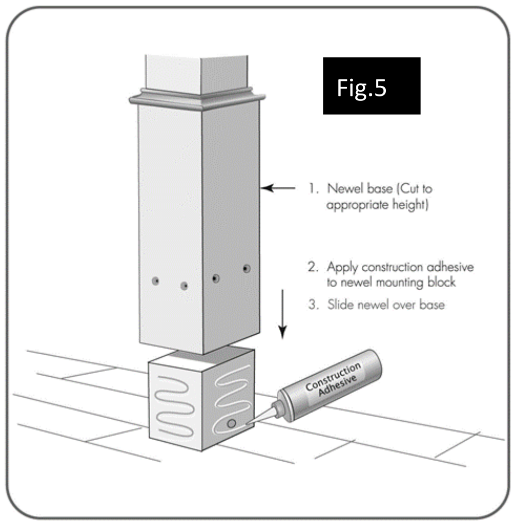
Fig. 3

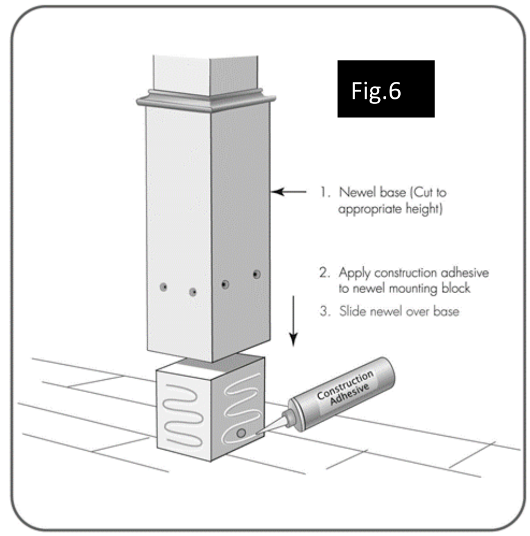
(See reverse for more information)

Surface Mounting a Box Newel Post

1. Remove false blocking provided in Fitts box newel – material is shipped loose inside the newel.
2. Measure roughly 3 inches from base of newel and mark. At a 45-degree angle bore a 1/4” hole through newel into substrate. Using prior hole as a guide bore 7-16” hole 1-1/2 -2” deep.
3. Repeat on opposing corner. Please note (Fig.4)
4. Find baluster centerline, measure and apply construction adhesive to base of newel. Lag newel base to subfloor. Using level check that mounting block is set square. Note that by boring at opposing corners you can loosen or tighten newel mounting block to level.
5. Apply construction adhesive to four sides of mounting block. Please note (Fig.5).



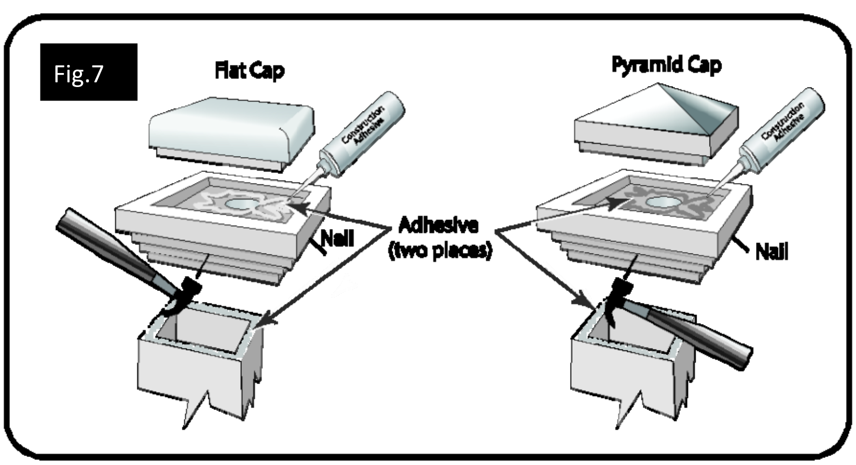




6. Slide newel over mounting block. Measure roughly 6 inches from the base of the newel. At that height measure 2 inches from the edge of the newel and mark. Pre bore for 3/16” -3” wood screws. Countersink screws, plug and sand. Please note (Fig 6).

Installing the Box Newel Cap

1. Determine whether you prefer the flat top or pyramid cap (*if this applies to your particular newel selection*). Apply construction adhesive to the top of the newel center shaft.
2. Find decorative moulding and place on top of newel. Level and pin nail the cap in place through the side (bottom moulding) of cap. (Fig.7)
3. Apply construction adhesive to base of the preferred flat or pyramid cap and apply into recessed channel.



*Please consult local building codes before beginning any stair installation. Codes may very by State, City, Municipality, etc.

Mathematical Conversions
Fraction conversion to Decimals

Fraction	Decimal
1/64	.0156
1/32	.0313
3/64	.0469
1/16	.0625
5/64	.0781
3/32	.0938
7/64	.1094
1/8	.1250
9/64	.1406
5/32	.1563
11/64	.1719
3/16	.1875
13/64	.2031
7/32	.2188
15/64	.2344
1/4	.2500
17/64	.2656
9/32	.2813
19/64	.2969
5/16	.3125
21/64	.3281
11/32	.3438
23/64	.3594
3/8	.3750
25/64	.3906
13/32	.4063
27/64	.4219
7/16	.4375
29/64	.45311
15/32	.4688
31/64	.4844
1/2	.5000

Fraction	Decimal
33/64	.5156
17/32	.5313
35/64	.5469
9/16	.5625
37/64	.5781
19/32	.5938
39/64	.6094
5/8	.6250
41/64	.6406
21/32	.6563
43/64	.6719
11/16	.6875
45/64	.7031
23/32	.7188
47/64	.7344
3/4	.7500
49/64	.7656
25/32	.7813
51/64	.7969
13/16	.8125
53/64	.8281
27/32	.8438
55/64	.8594
7/8	.8750
57/64	.8906
29/32	.9063
59/64	.9219
15/16	.9375
61/64	.9531
31/32	.9688
63/64	.9844
1	1

Run-Rise Chart

KEY: Number on Top = Angle of the Stair   Number on the Bottom = 90° - (minus) the Angle of the Stair

RUN

RISE

	9"	1/8	1/4	3/8	1/2	5/8	3/4	7/8	10"	1/8	1/4	3/8	1/2	5/8	3/4	7/8	11"	1/8	1/4	3/8	1/2	5/8	3/4	7/8	12"
6"	33.7	33.3	33.0	32.6	32.3	3.9	31.6	31.3	31.0	30.7	30.3	30.0	29.7	29.5	29.2	28.9	28.6	28.3	28.1	27.8	27.6	27.3	27.1	26.8	26.6
	56.3	56.7	57.0	57.4	57.7	58.1	58.3	58.7	59.0	59.3	59.7	60.0	60.3	60.5	60.8	61.1	61.4	61.7	61.9	62.2	62.4	62.7	62.9	63.2	63.4
1/8	34.2	33.9	33.5	33.2	32.8	32.5	32.1	31.8	31.5	31.2	30.9	30.6	30.3	30.0	29.7	32.4	29.1	28.8	28.6	28.3	28.0	27.8	27.5	27.3	27.0
	55.8	56.1	56.5	56.8	57.2	57.5	57.9	58.2	58.0	58.5	58.8	59.1	59.4	59.7	60.0	60.6	60.7	61.2	61.4	61.7	62.0	62.2	62.5	62.7	63.0
1/4	34.8	34.4	34.0	33.7	33.3	33.0	32.7	32.3	32.0	31.7	31.4	31.1	30.8	30.5	30.2	29.2	29.6	29.3	29.1	28.8	28.5	28.3	38.0	28.8	27.5
	55.2	55.6	56.0	56.3	56.7	57.0	57.3	57.7	58.0	58.3	58.6	58.9	59.2	59.5	59.8	60.1	60.4	60.7	60.9	61.2	61.5	61.7	62.0	62.2	62.5
3/8	35.3	34.9	34.6	34.2	33.9	33.5	33.2	32.8	32.5	32.2	31.9	31.6	31.3	31.0	30.7	30.4	30.1	29.8	29.5	29.3	29.0	28.7	28.5	28.2	28.0
	54.7	55.1	55.4	55.8	56.1	56.5	56.8	57.2	57.5	57.8	58.1	58.4	58.7	59.0	59.3	59.6	59.9	60.2	60.5	60.7	61.0	61.3	61.5	61.8	62.0
1/2	35.8	35.4	35.1	35.7	34.4	34.0	33.7	33.3	33.0	32.7	32.4	32.1	31.8	31.5	31.2	30.9	30.6	30.3	30.0	29.7	29.5	29.2	29.0	28.7	28.4
	54.2	54.6	54.9	55.3	55.6	56.0	56.3	56.7	57.0	57.3	57.6	57.9	58.2	58.5	58.8	59.1	59.4	59.7	60.0	60.3	60.5	60.8	61.0	61.3	61.6
5/8	36.4	36.0	35.6	35.2	34.9	34.5	34.2	33.9	33.5	33.2	32.9	32.6	32.3	31.9	31.6	31.3	31.1	30.8	30.5	30.2	30.0	29.7	29.4	29.2	28.9
	53.6	54.0	54.4	54.8	55.1	55.5	55.8	56.1	56.5	56.8	57.1	57.4	57.7	58.1	58.4	58.7	58.9	59.2	59.5	59.8	60.0	60.3	60.6	60.8	61.1
3/4	36.9	36.5	36.1	35.8	35.4	35.0	34.7	34.3	34.0	33.7	33.4	33.0	32.7	32.4	32.1	31.8	31.5	31.2	31.0	30.7	30.4	30.1	29.9	29.6	29.4
	53.1	53.5	53.9	54.2	54.6	55.0	55.3	55.7	56.0	56.3	56.6	57.0	57.3	57.6	57.9	58.2	58.5	58.8	59.0	59.3	59.6	59.9	60.1	60.4	60.6
7/8	37.4	37.0	36.6	36.3	35.9	35.5	35.2	34.8	34.5	34.2	33.9	33.5	33.2	32.9	32.6	32.3	32.0	31.7	31.4	31.1	30.9	30.6	30.3	30.1	29.8
	52.6	53.0	53.4	53.7	54.1	54.5	54.8	55.2	55.5	55.8	56.1	56.5	56.8	57.1	57.4	57.7	58.0	58.3	58.6	58.9	59.1	59.4	59.7	59.9	60.2
7"	37.9	37.5	37.1	36.7+	36.4	36.0	35.7	35.3	35.0	34.7	34.3	34.0	33.7	33.4	33.1	32.8	32.5	32.2	31.9	31.6	31.3	31.1	30.8	30.5	30.3
	52.1	52.5	52.9	53.3	53.6	54.0	54.3	54.7	55.0	55.3	55.7	56.0	56.3	56.6	56.9	57.2	57.5	57.8	58.1	58.4	58.7	58.9	59.1	59.5	59.7
1/8	38.4	38.0	37.6	37.2	36.9	36.5	36.2	35.8	35.5	35.1	34.8	34.6	34.2	33.8	33.5	33.2	32.9	32.6	32.3	32.1	31.8	31.5	31.2	31.0	30.7
	51.6	52.0	52.4	52.8	53.1	53.5	53.8	54.2	54.5	54.9	55.2	55.5	55.8	56.2	56.5	56.8	57.1	57.4	57.7	57.9	58.2	58.5	58.8	59.0	59.3
1/4	38.9	38.5	38.1	37.7	37.3	37.0	36.6	36.3	35.9	35.6	35.3	34.9	34.6	34.3	34.0	33.7	33.4	33.1	32.8	32.5	32.2	32.0	31.7	31.4	31.1
	51.1	51.5	51.9	52.3	52.7	53.0	53.4	53.7	54.1	54.4	54.7	55.1	55.4	55.7	56.0	56.3	56.6	56.9	57.2	57.5	57.8	58.0	58.3	58.6	58.9
3/8	39.3	39.0	38.6	38.2	37.8	37.5	37.1	36.8	36.4	36.1	35.7	35.4	35.1	34.8	34.5	34.1	33.8	33.5	33.2	33.0	32.7	32.4	32.1	31.8	31.6
	50.7	51.0	51.4	51.8	52.2	52.5	52.9	53.2	53.6	53.9	54.3	54.6	54.9	55.2	55.5	55.9	56.2	56.5	56.8	57.0	57.3	57.6	57.9	58.2	58.4
1/2	39.8	39.4	39.0	38.7	38.3	37.9	37.6	37.2	36.9	36.5	36.2	35.9	35.5	35.2	34.9	34.6	34.3	34.0	33.7	33.4	33.1	32.8	32.6	32.3	32.0
	50.2	50.6	51.0	51.3	51.7	52.1	52.4	52.8	53.1	53.5	53.8	54.1	54.5	54.8	55.1	55.4	55.7	56.0	56.3	56.6	56.9	57.2	57.4	57.7	58.0
5/8	40.3	39.9	39.5	39.1	38.8	38.4	38.0	37.7	37.3	37.0	36.6	36.3	36.0	35.7	35.3	35.0	34.7	34.4	34.1	33.8	33.5	33.3	33.0	32.7	32.4
	49.7	50.1	50.4	50.9	51.2	51.6	52.0	52.3	52.7	53.0	53.4	53.7	54.0	54.3	54.7	55.0	55.3	55.6	55.9	56.2	56.5	56.7	57.0	57.3	57.6
3/4	40.7	40.3	40.0	39.6	39.2	38.8	38.5	38.1	37.8	37.4	37.1	36.8	36.4	36.1	35.8	35.5	35.2	34.9	34.6	34.3	34.0	33.7	33.4	33.1	32.9
	49.3	49.7	50.0	50.4	50.8	51.2	51.5	51.9	52.2	52.6	52.9	53.2	53.6	53.9	54.2	54.5	54.8	55.1	55.4	55.7	56.0	56.3	56.6	56.9	57.1
7/8	41.2	40.8	40.4	40.0	39.7	39.3	38.9	38.6	38.2	37.9	37.5	37.2	36.9	36.5	36.2	35.9	35.6	35.3	35.0	34.7	34.4	34.1	33.8	33.6	33.3
	48.8	49.2	49.6	50.0	50.3	50.7	51.1	51.4	51.8	52.1	52.5	52.8	53.1	53.5	53.8	54.1	54.4	54.7	55.0	55.3	55.6	55.9	56.2	56.4	56.7
8"	41.6	41.2	40.9	40.5	40.1	39.7	39.4	39.0	38.7	38.3	38.0	37.6	37.3	37.0	36.7	36.3	36.0	35.7	35.4	35.1	34.8	34.5	34.2	34.0	33.7
	48.4	48.8	49.1	49.5	49.9	50.3	50.6	51.0	51.3	51.7	52.0	52.4	52.7	53.0	53.3	53.7	54.0	54.3	54.6	54.9	55.2	55.5	55.8	56.0	56.3
1/8	42.1	41.7	41.3	40.9	40.5	40.2	39.8	39.4	39.1	38.7	38.4	38.1	37.7	37.4	37.1	36.8	36.5	36.1	35.8	35.5	35.2	35.0	34.7	34.4	34.1
	47.9	48.3	48.7	49.1	49.5	49.8	50.2	50.6	50.9	51.3	51.6	51.9	52.3	52.6	52.9	53.2	53.5	53.9	54.2	54.5	54.8	55.0	55.3	55.6	55.9
1/4	42.5	42.1	41.7	41.3	41.0	40.6	40.2	39.9	39.5	39.2	38.8	38.5	38.2	37.8	37.5	37.2	36.9	36.6	36.3	36.0	35.7	35.4	35.1	34.8	34.5
	47.5	47.9	48.3	48.7	49.0	49.4	49.8	50.1	50.5	50.8	51.2	51.5	51.8	52.2	52.5	52.8	53.1	53.4	53.7	54.0	54.3	54.6	54.9	55.2	55.5
3/8	42.9	42.5	42.2	41.8	41.4	41.0	40.7	40.3	39.9	39.6	39.3	38.9	38.6	38.2	37.9	37.6	37.3	37.0	36.7	36.4	36.1	35.8	35.5	35.2	34.9
	47.1	47.5	47.8	48.2	48.6	49.0	49.3	49.7	50.1	50.4	50.7	51.1	51.4	51.8	52.1	52.4	52.7	53.0	53.3	53.6	53.9	54.2	54.5	54.8	55.1
1/2	43.4	43.0	42.6	42.2	41.8	41.4	41.1	40.7	40.4	40.0	39.7	39.3	39.0	38.7	38.3	38.0	37.7	37.4	37.1	36.8	36.5	36.2	35.9	35.6	35.3
	46.6	47.0	47.4	47.8	48.2	48.6	48.9	49.3	49.6	50.0	50.3	50.7	51.0	51.3	51.7	52.0	52.3	52.6	52.9	53.2	53.5	53.8	54.1	54.4	54.7

Useful Calculations
Chapter 1

Total Rise

___________ Total distance from rough floor to rough floor

___________ + Thickness of upper finished floor

___________ - Thickness of lower finished floor

___________ = Thickness rise (Finished floor to floor)

Number of Risers

___________ Total rise (Finished floor to floor)

___________ + Maximum unit rise

___________ = Number of risers

(Rounded to the next highest whole number)

Unit Rise

___________ Total rise (Finished floor to floor)

___________ ÷ Number of risers

___________ = Unit rise

Number of Treads

___________	Number of risers
___________	- One
___________	= Number of treads

Minimum Total Run

___________	Number of treads
___________	(x) Maximum unit run
___________	= Maximum total run

Unit Run

___________	Desired total run
___________	÷ Number of treads
___________	= Unit Run

Calculations
Chapter 2

Stringer Lengths - Pythagorean theorem

$(\text{Run})^2 + (\text{Rise})^2 = (\text{Rake})^2$

$(\_\_\_\_\_)^2 + (\_\_\_\_\_)^2 = (\_\_\_\_\_)^2$

$(\text{Rake})^2 = \_\_\_\_\_$

$(\quad\quad)^2 = \_\_\_\_\_$

_____ ÷ 12" = _____

- or the length of the stringer. Round this to the next highest "even" number. The rounded number will give you the necessary 2 x 12" length you will need.

Calculating First Riser Heights

__________ First unit rise

__________ - Tread thickness

__________ + Finished floor thickness

__________ = First Riser height

Checking the Fit of the Stringer

__________	Unit Rise Height
__________	+ Tread thickness
__________	= Finished floor thickness
__________	= Distance of the stringer below rough cut

Calculations
Chapter 3

Starting Newel Height

__________ Distance from the bottom of the fitting to the tread

__________ + Desired rail height

__________ - Depth of the handrail

__________ = Starting newel height

Newel Height

__________ Desired rail height

__________ - Rail thickness

__________ = Newel height

Calculations
Chapter 4

Starting Newel Height

__________ Distance from the bottom of the fitting to the tread

__________ + Desired rail height

__________ - Depth of the handrail

__________ = Starting newel height

Rake-to-Rake Newel Length

__________ Reveal

__________ + Rail Height

__________ + Slope difference

__________ + Tread height

__________ = Rake-to-rake newel length (TOP MOUNT SYSTEM)

__________ + Tale or drop down length

__________ Rake-to-rake newel length (HALF LAP SYSTEM)

Rake-to-Balcony Newel Length

__________	Reveal
__________	+ Rail Height
__________	+ Tread height
__________	= Newel Length (TOP MOUNT SYSTEM)
__________	+ Tale or drop down length
__________	Newel length (HALF LAP SYSTEM)

Balcony Newel Length

__________	Reveal
__________	+ Rail Height
__________	+ Thickness of the finished floor
__________	= Newel Length (TOP MOUNT SYSTEM)
__________	+ Tale or drop down length
__________	Newel length (HALF LAP SYSTEM)

Calculations
Chapter 5

Baluster Spacing (Balcony or Landing)

__________ Distance

__________ ÷ Maximum baluster spacing + Thickness of narrowest part of baluster

---

__________ Round to the nearest whole number

__________ = Minimum number of baluster spacing