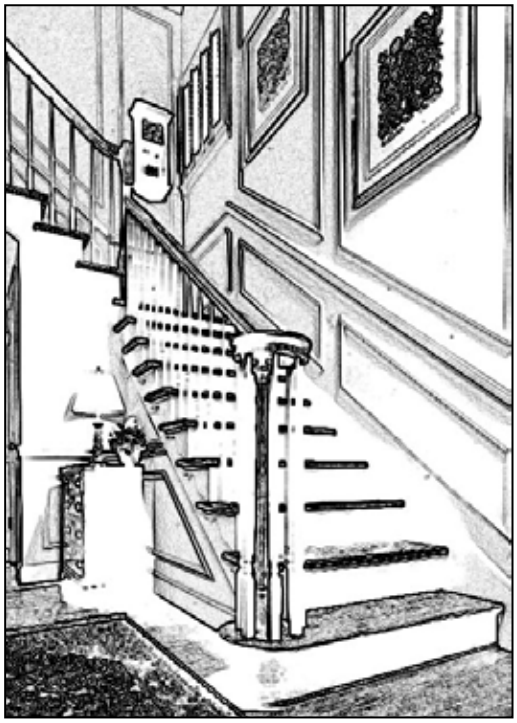
Chapter 3
Installing Over-the-Post Railing on an L-Shaped Stair

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.

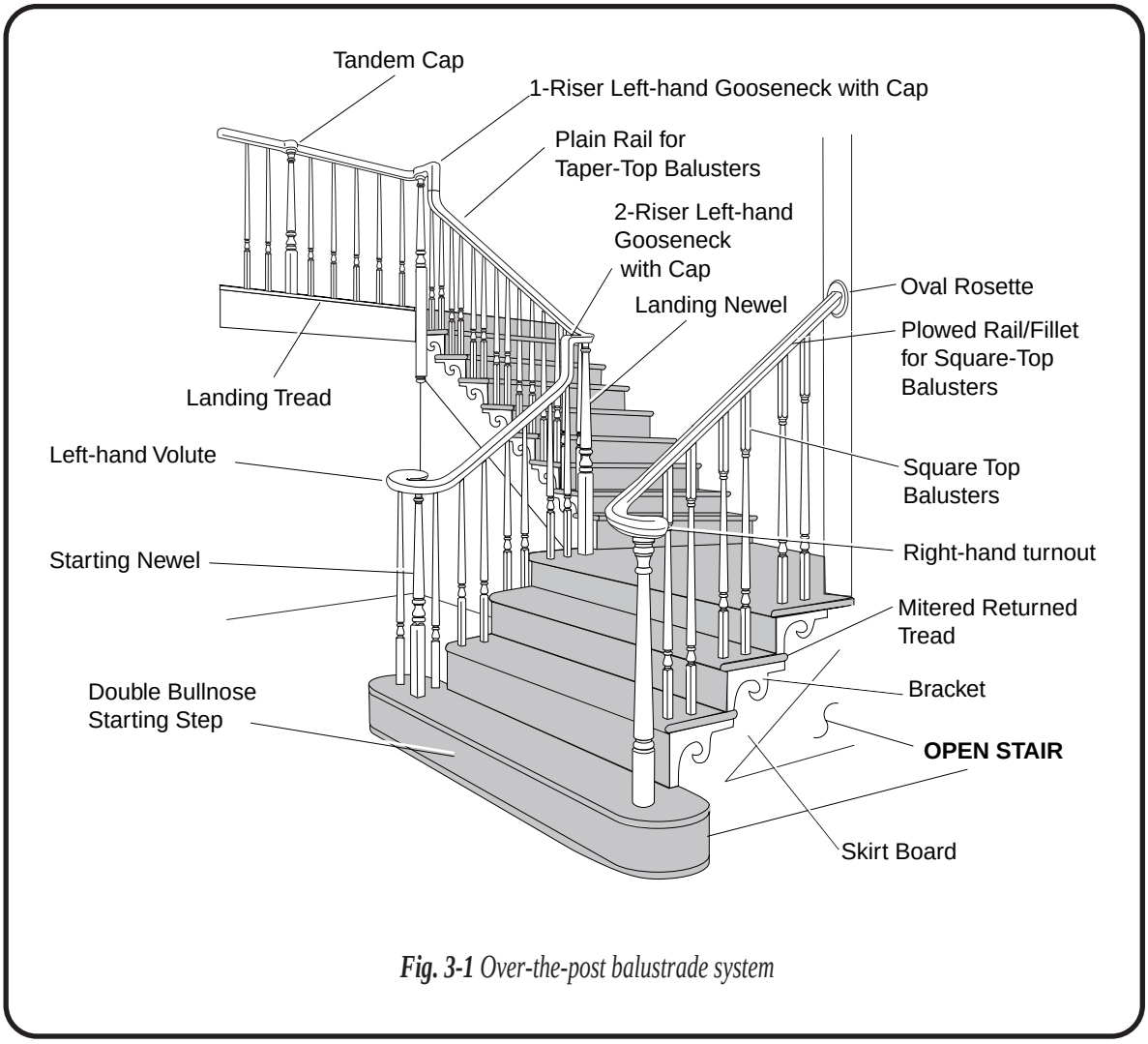


Fig. 3-1 *Over-the-post balustrade system*

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.

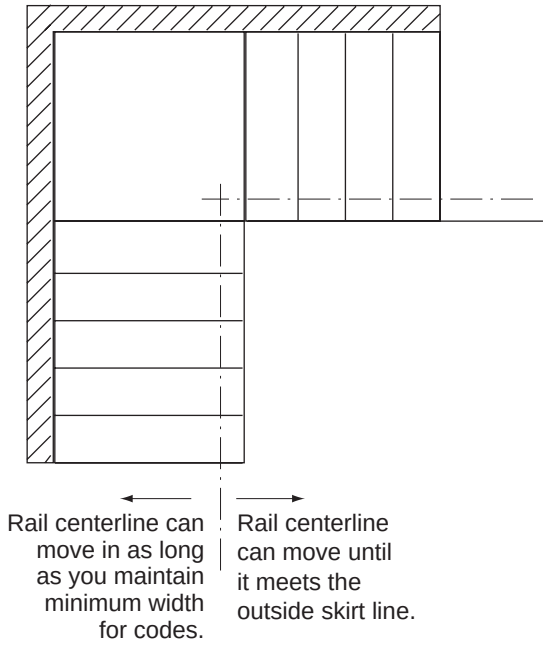


Fig. 3-2 *Variations on placement of rail centerlines*

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.

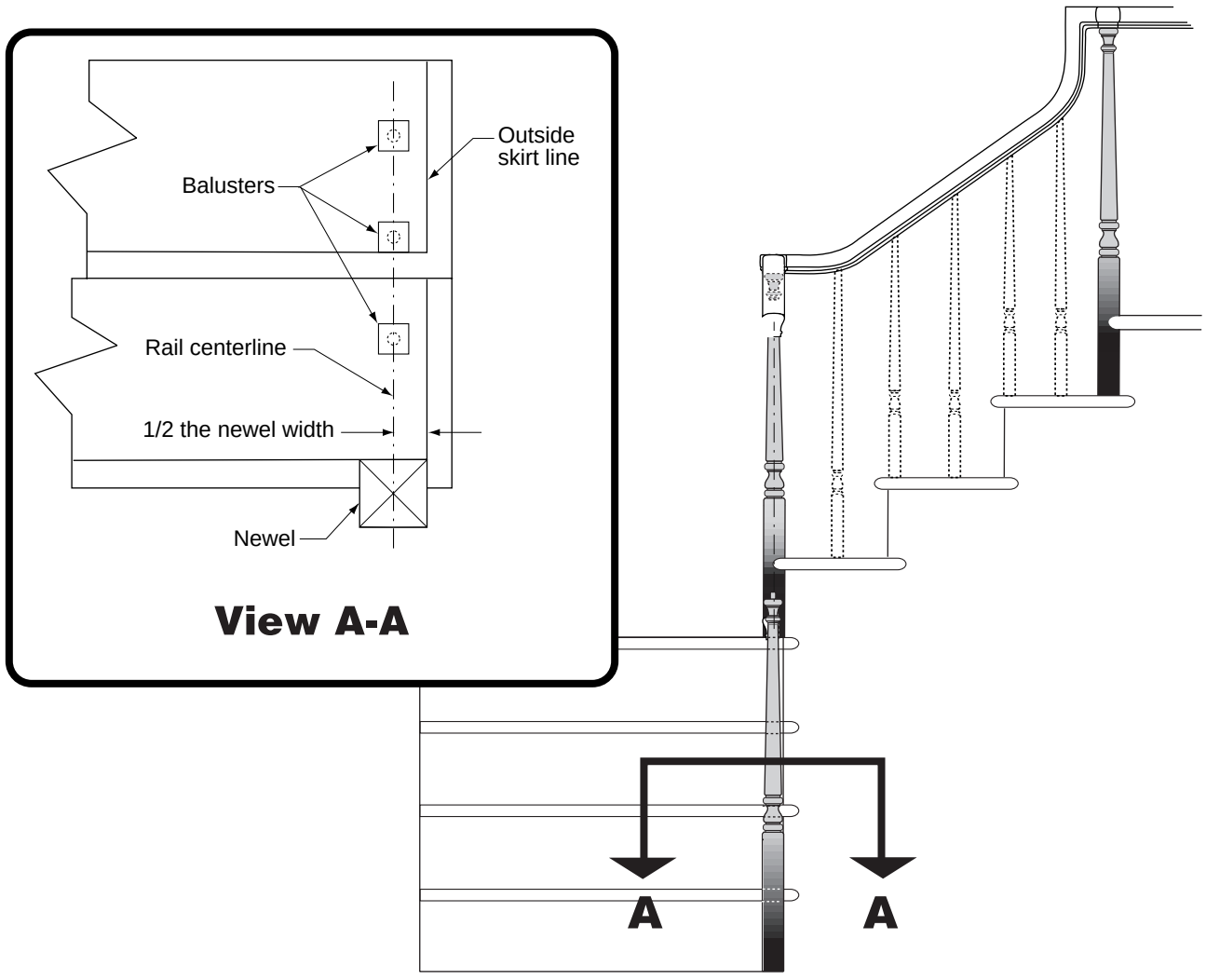


Fig. 3-3 *Top mount rail system*

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.

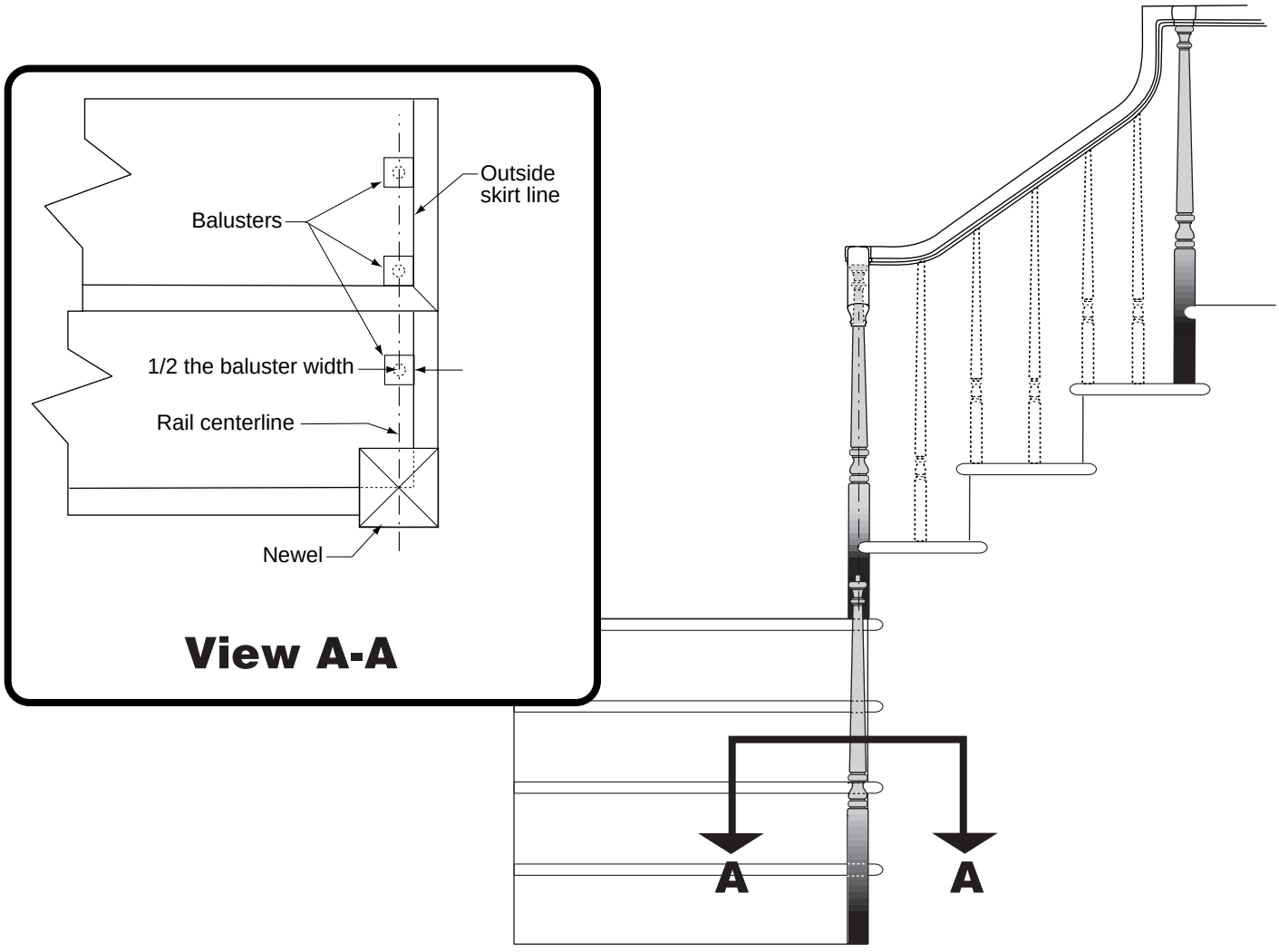


Fig. 3-4 Half lap rail system

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.

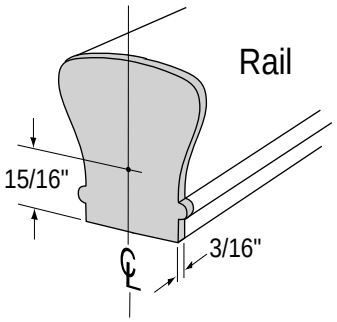


Fig. 3-5 *Preparing a template from handrail.*

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.

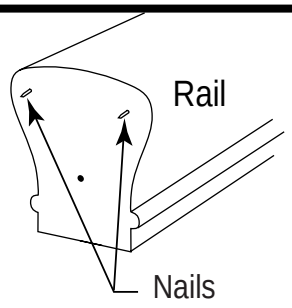


Fig. 3-6 *Stabilizing rail and fitting with use of small finishing nails.*

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.

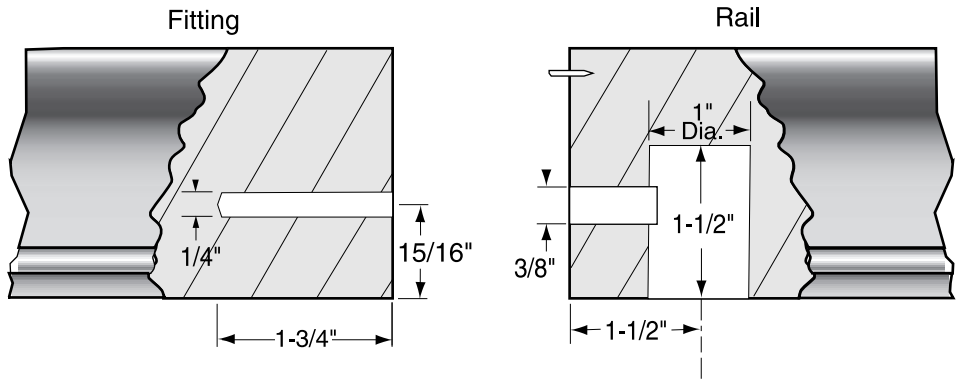


Fig. 3-7 *Drilling holes in fitting and rail for joining*

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.

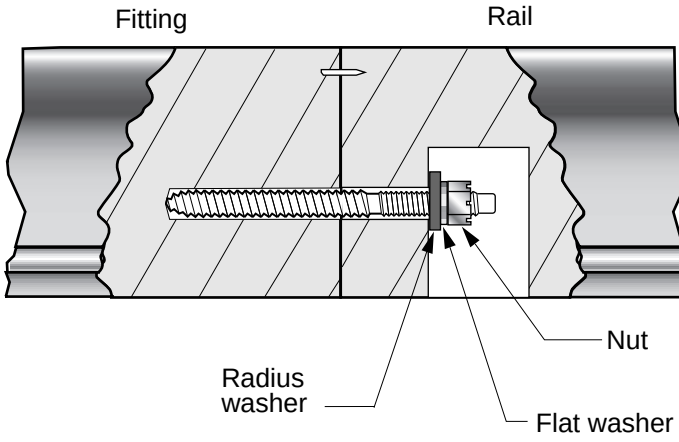


Fig. 3-8 *Assembling fitting and rail using rail bolt and accessories.*

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.

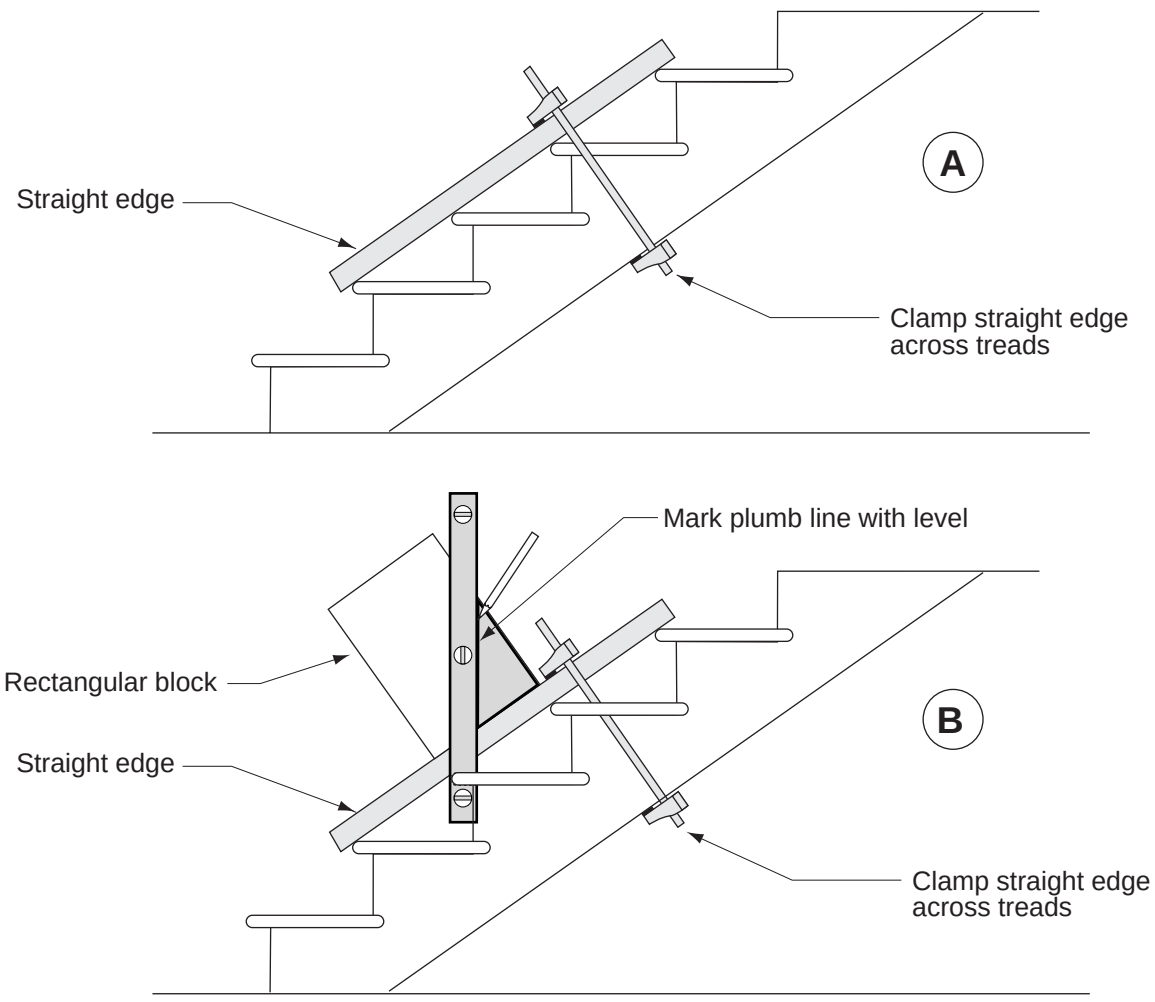


Fig. 3-9 *Determining angles on pitch block.*

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.

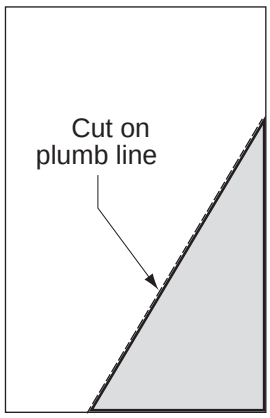


Fig. 3-10 *Cutting pitch block.*

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.

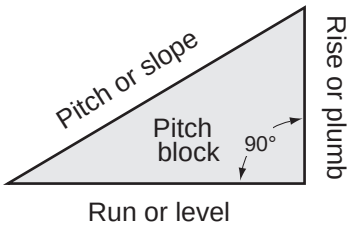


Fig. 3-11 *Finished pitch block showing rise, run, and slope of stair.*

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.

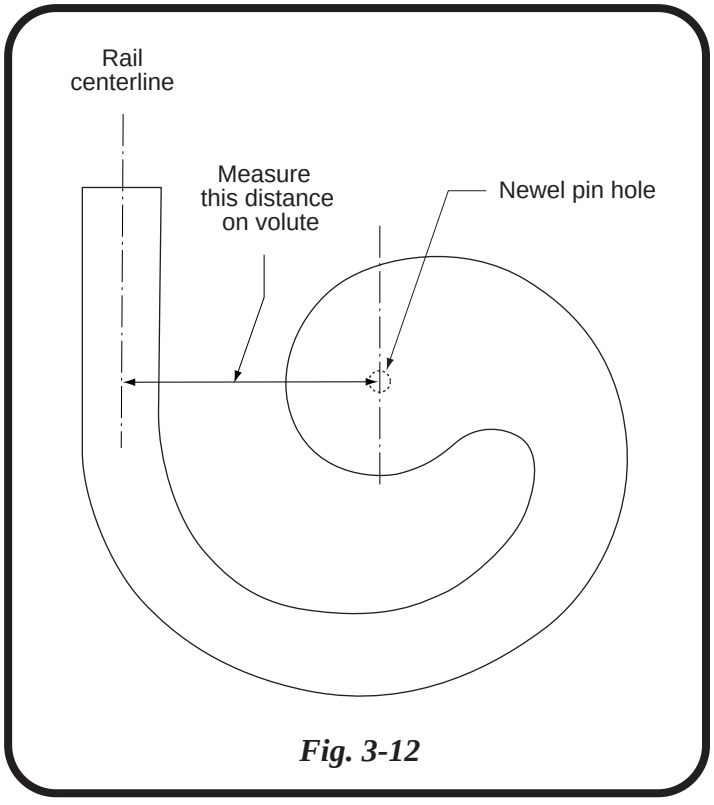


Fig. 3-12

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

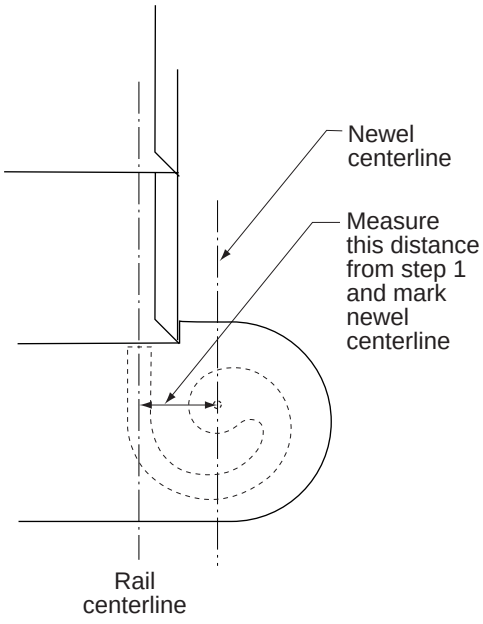


Fig. 3-13

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.

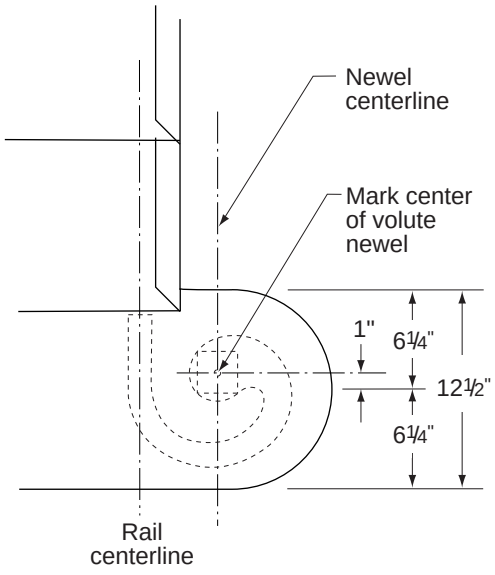
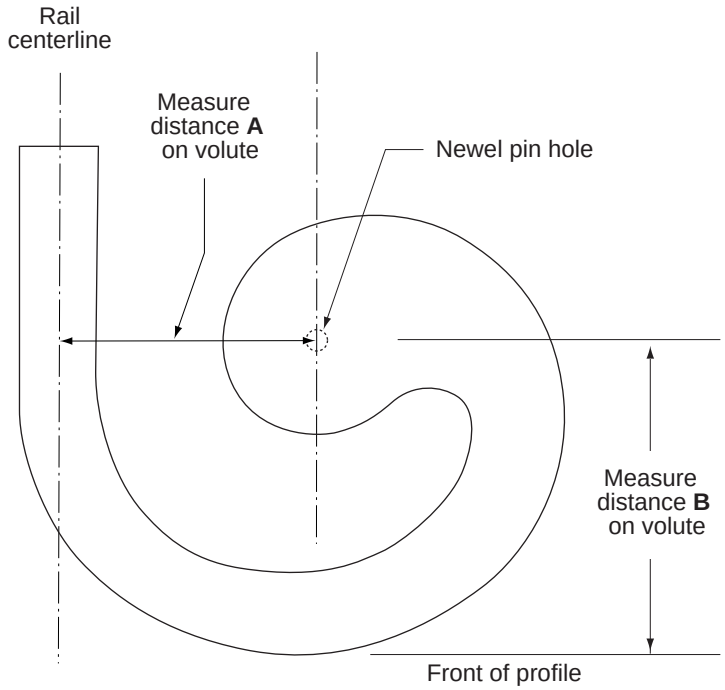
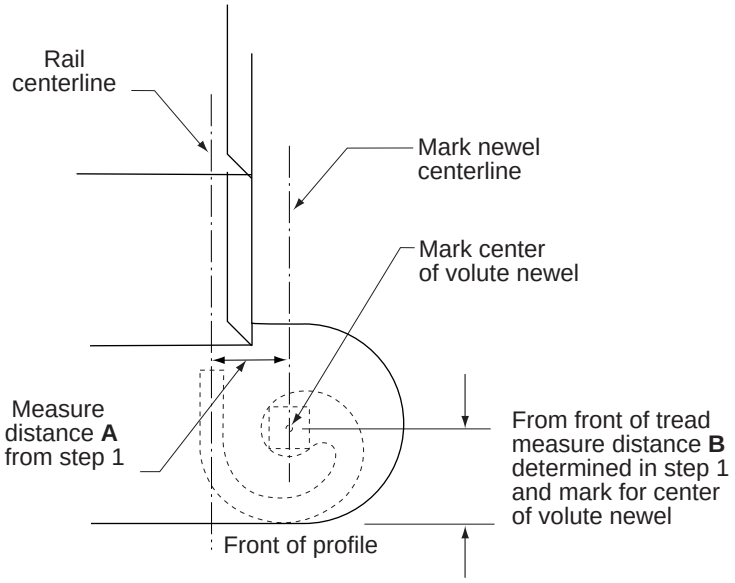


Fig. 3-14

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.

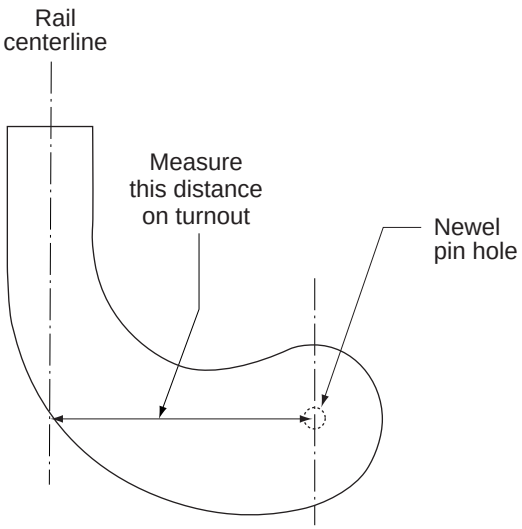


Fig. 3-16

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

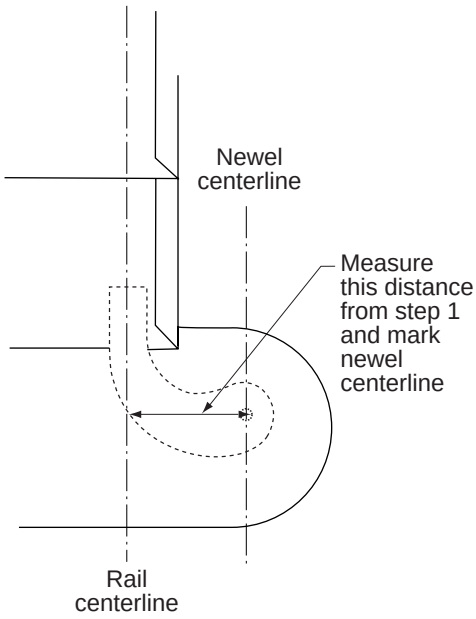


Fig. 3-17

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.

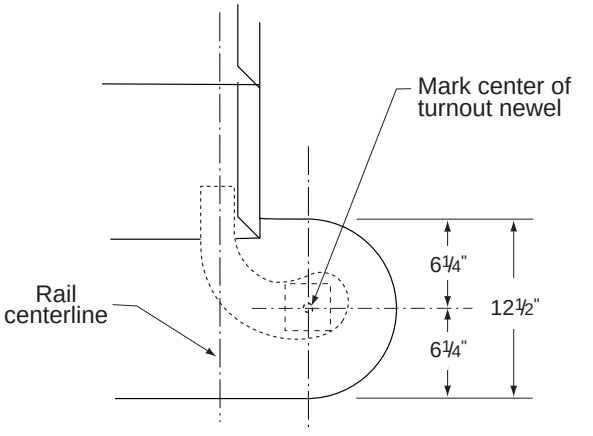


Fig. 3-18

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-

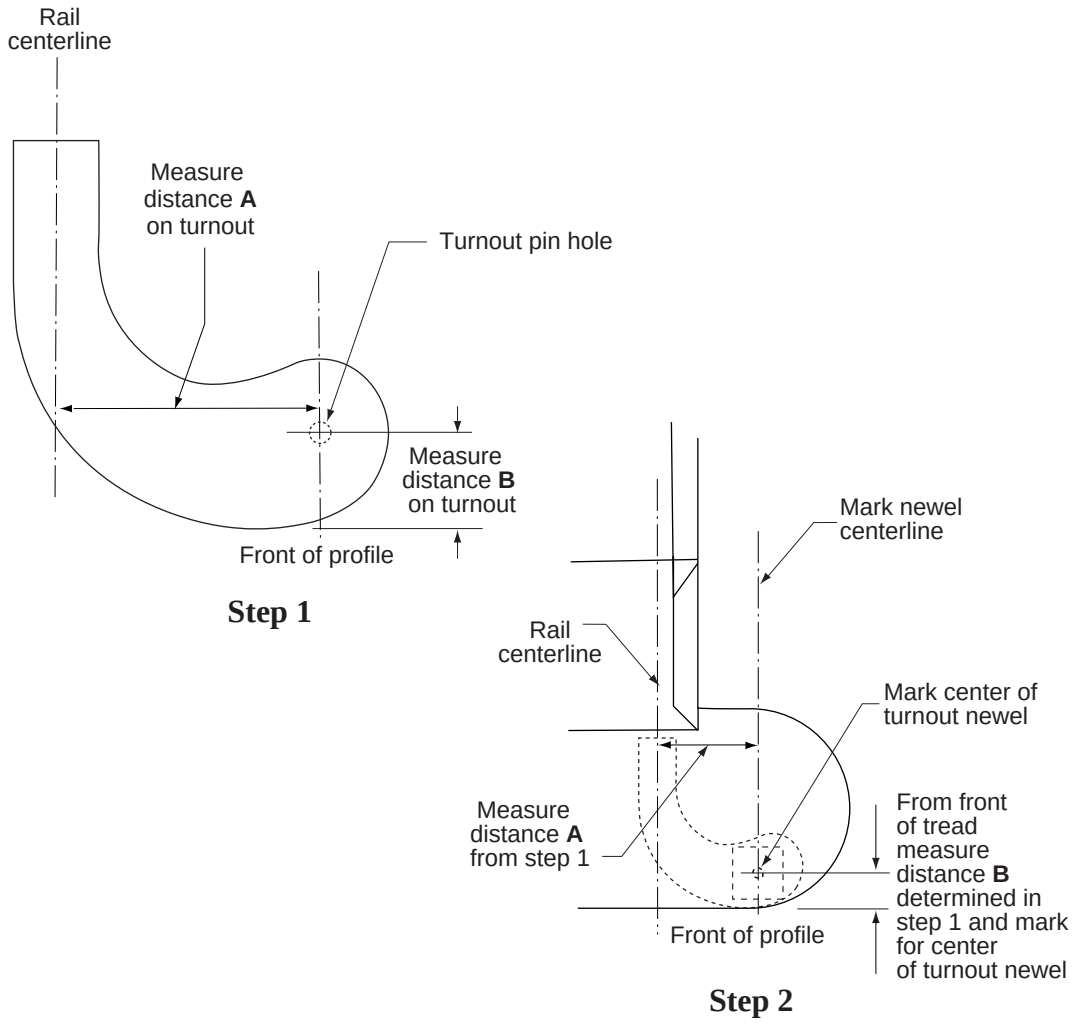


Fig. 3-19 *Layout of the large turnout for code exception*

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.

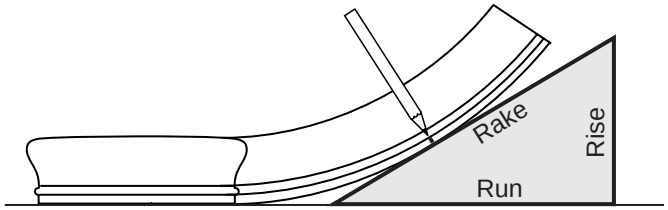


Fig. 3-20 *Marking location of cut line on up easing of starting fitting.*

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.

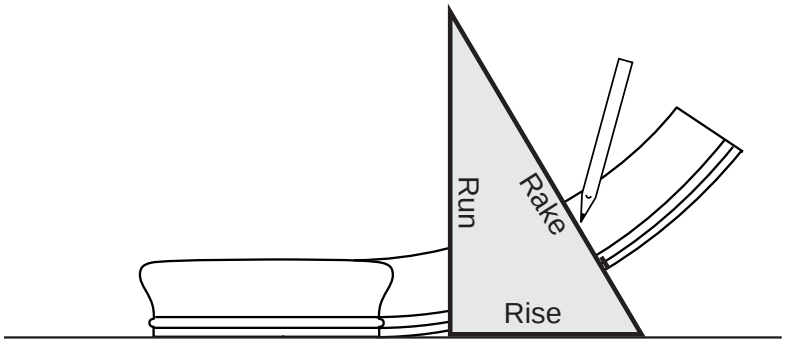


Fig. 3-21 *Marking cut line on up easing of starting fitting.*

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.

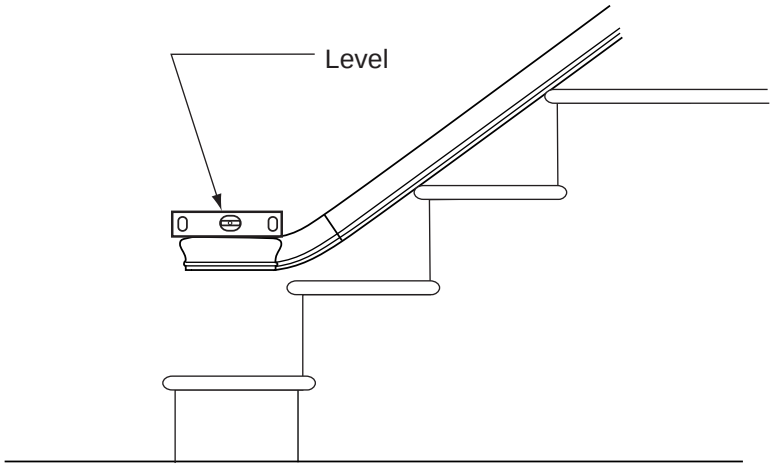


Fig. 3-22 *Make sure starting fitting (volute, turnout, starting easing) is level.*

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.

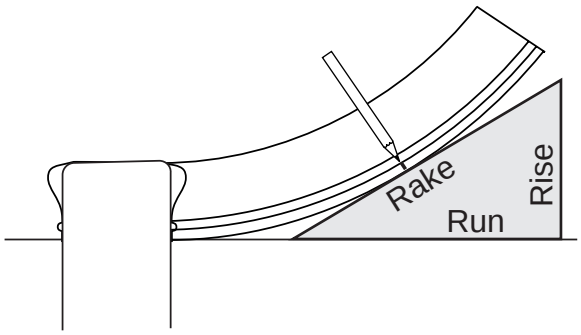


Fig. 3-23 *Marking location of cut line on two-rise gooseneck*

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.

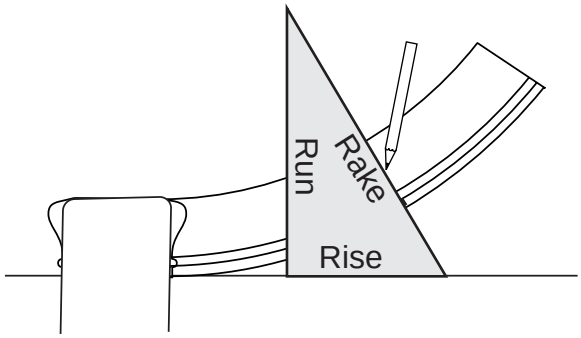


Fig. 3-24 *Marking cut line on two-rise gooseneck*

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.

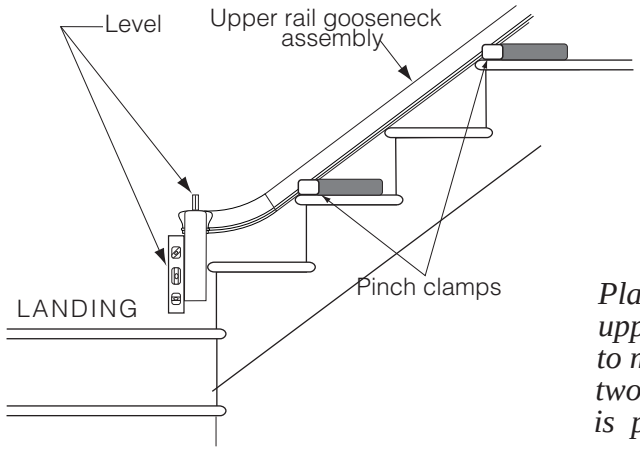
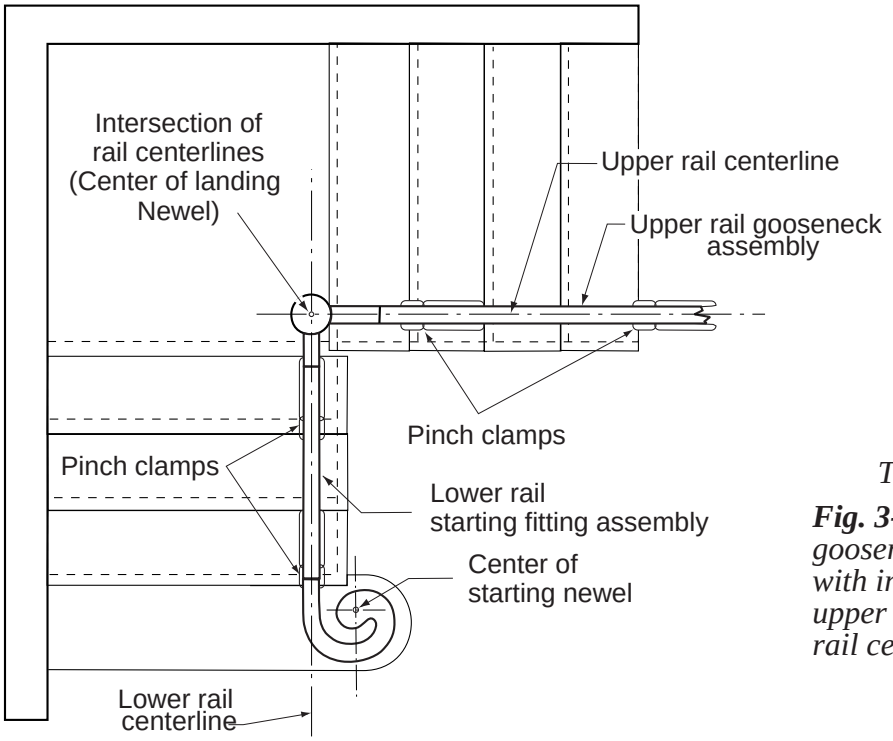


Fig. 3-25
Placing assembly on upper rail centerline to make sure two-rise gooseneck is plumb and level.

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.

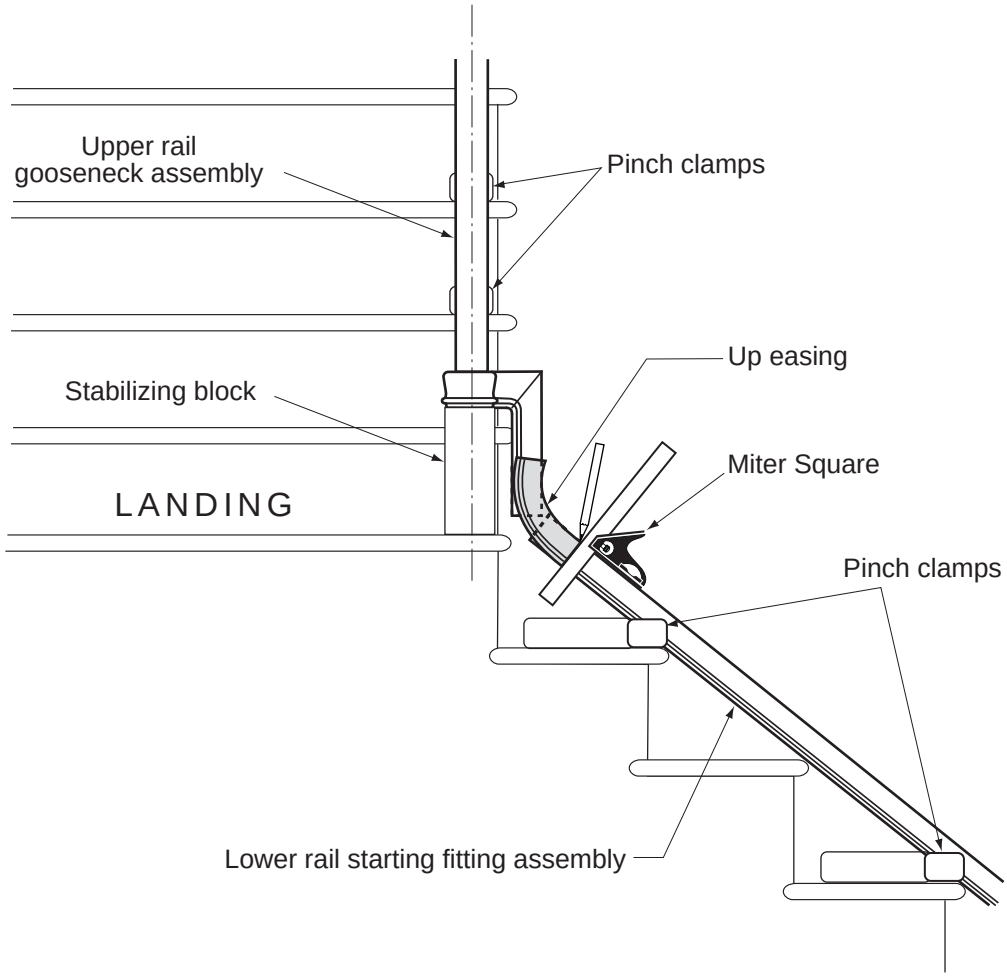


Fig. 3-27 *Mark lower rail at bottom end of up easing for square cut on lower rail.*

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.

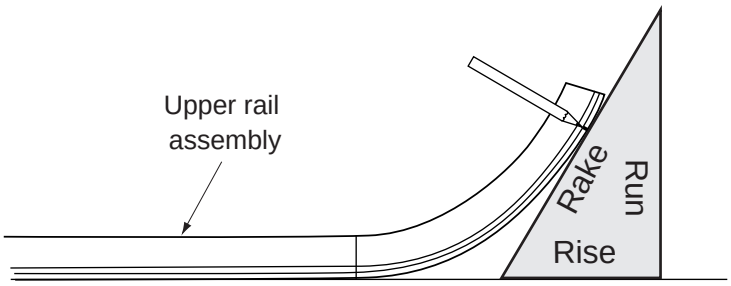


Fig. 3-28 *Marking location of cut on gooseneck up easing connected to upper rail assembly*

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.

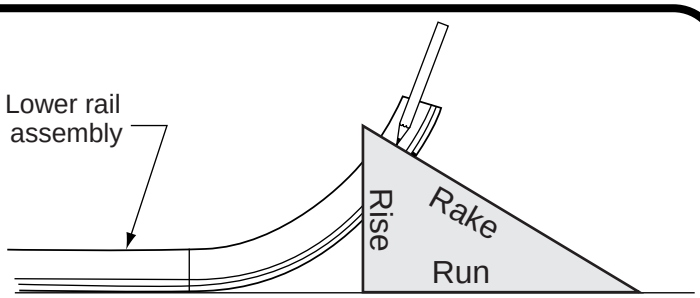


Fig. 3-29 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

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.

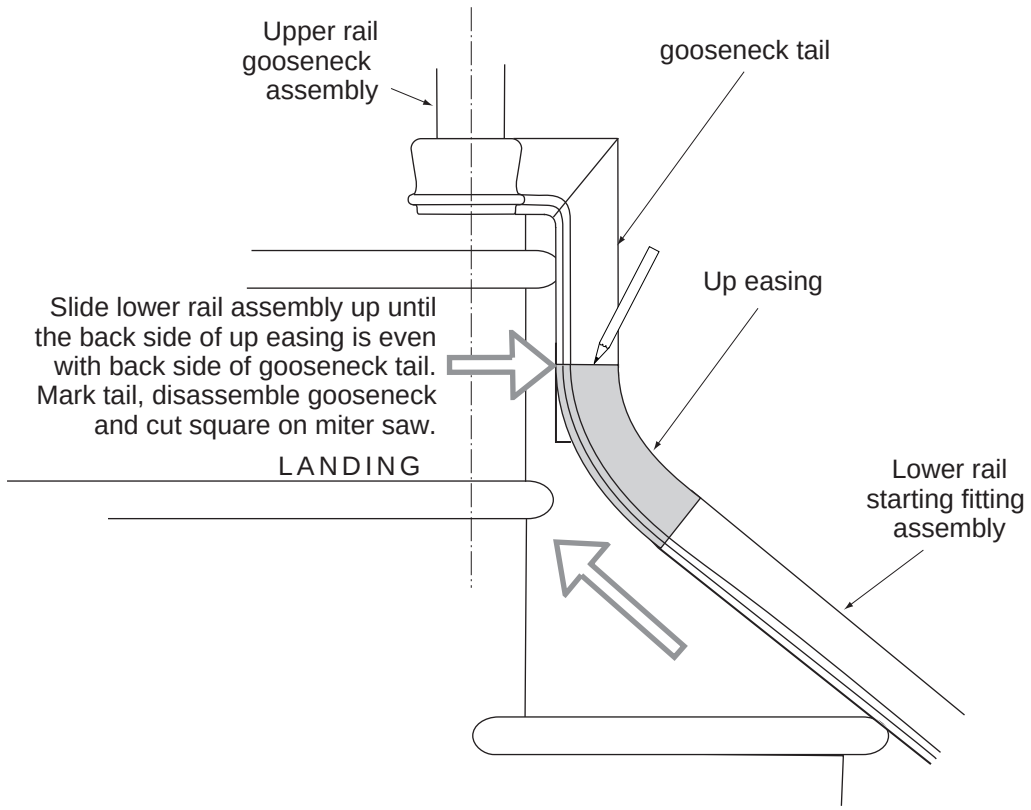


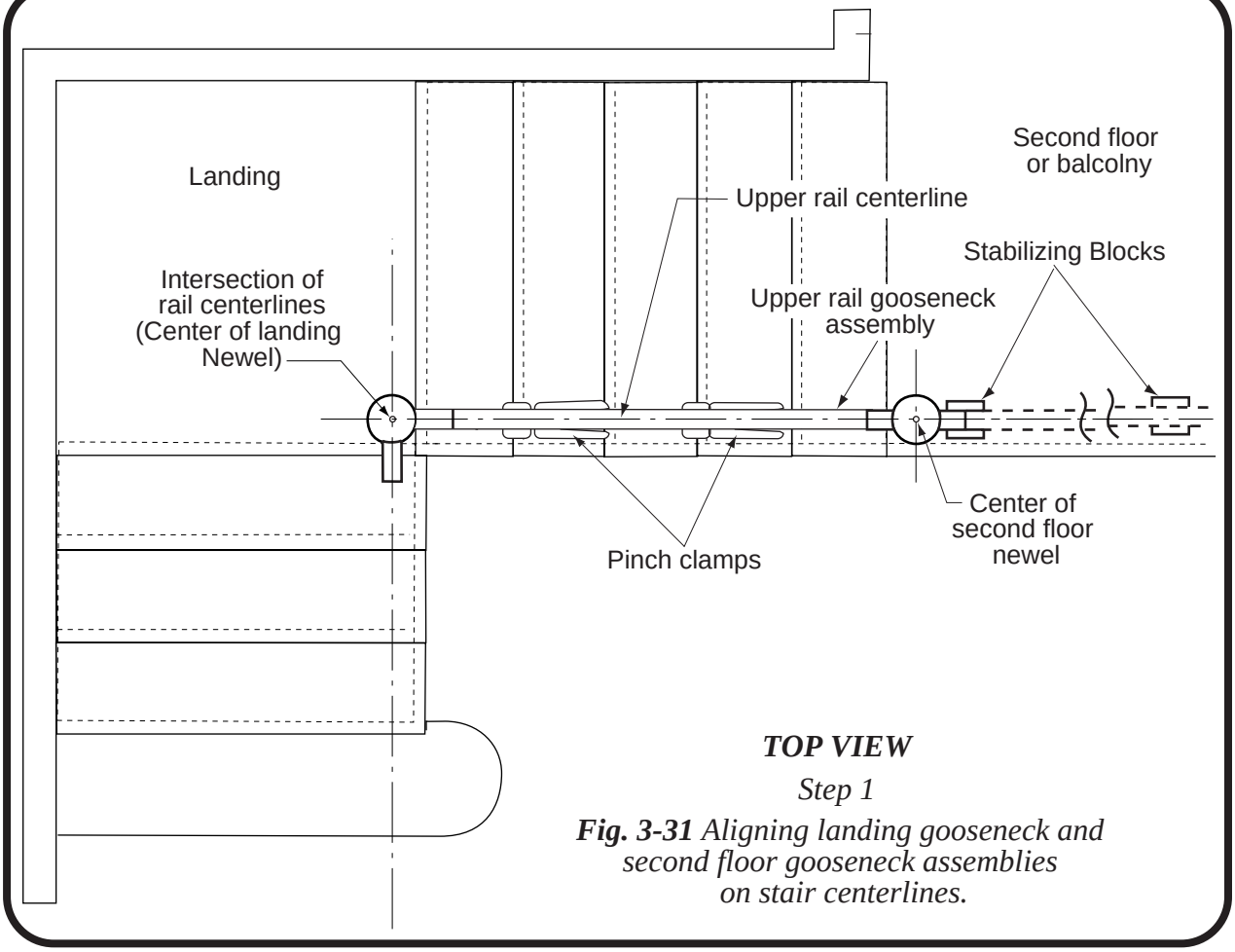
Fig. 3-30 *Marking landing Gooseneck tail for square cut.*

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).

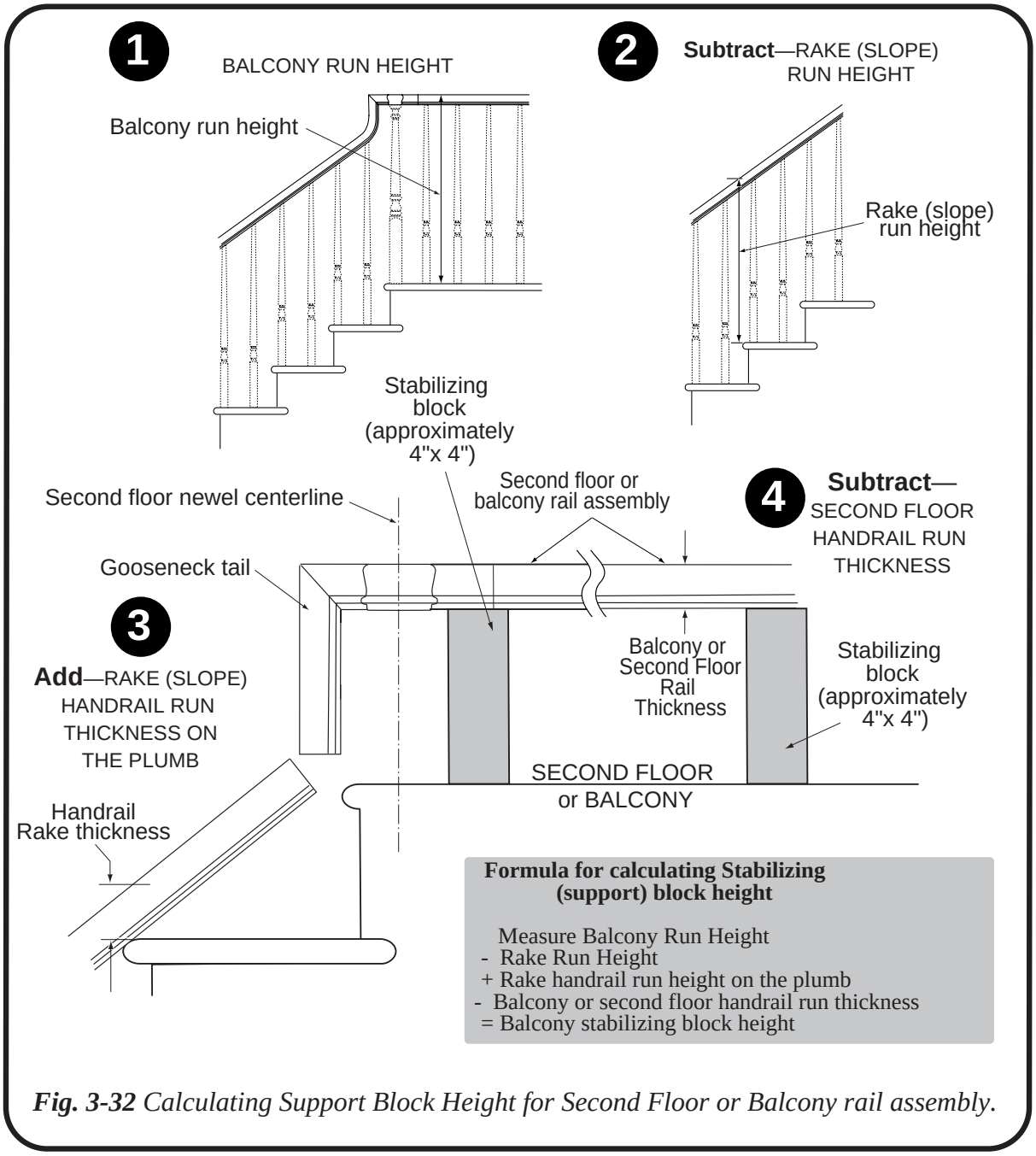


Fig. 3-32 *Calculating Support Block Height for Second Floor or Balcony rail assembly.*

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.

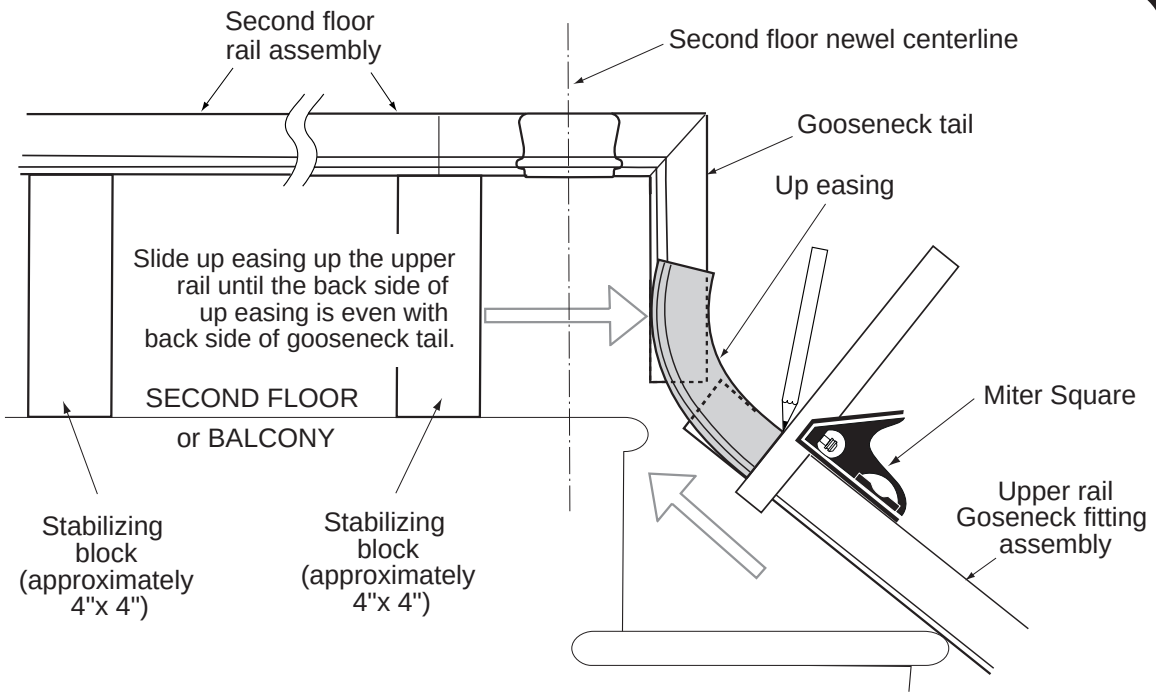


Fig. 3-33 *Marking top of upper rail gooseneck assembly for square cut*

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.

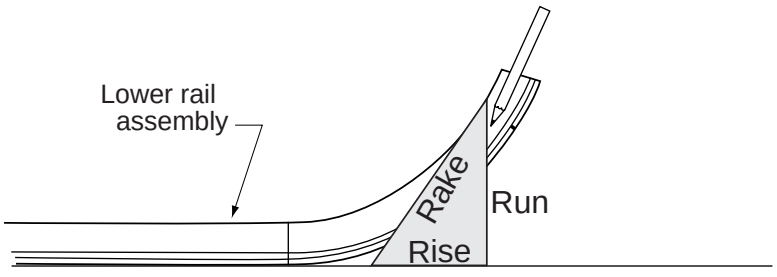


Fig. 3-34 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

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.

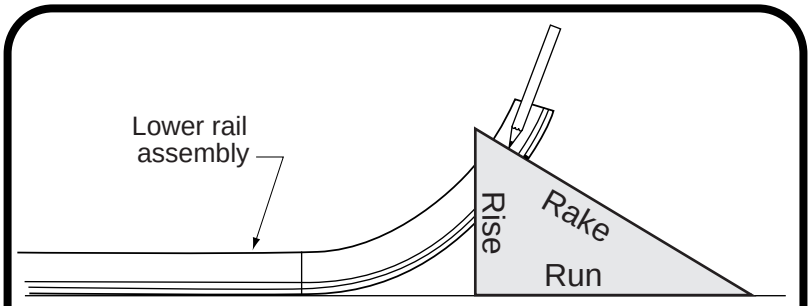


Fig. 3-35 *Marking cut line on gooseneck up easing connected to lower rail assembly.*

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.

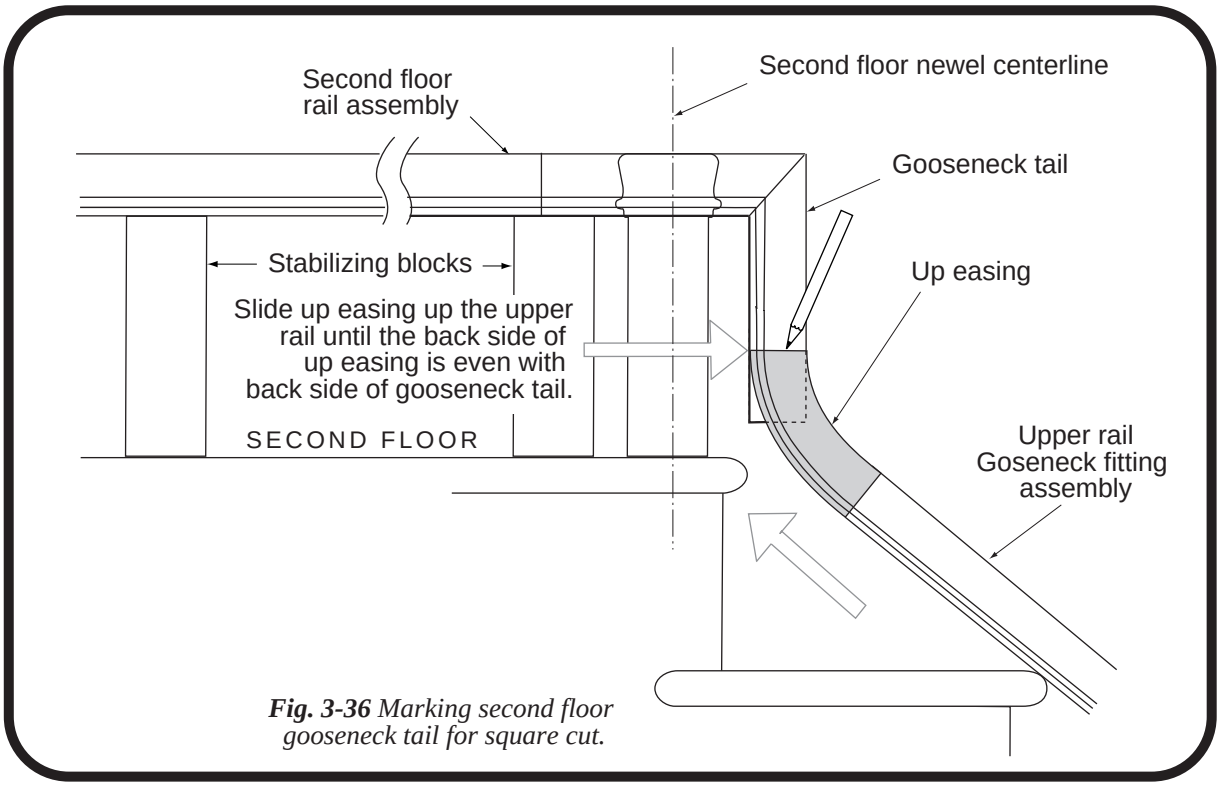


Fig. 3-36 *Marking second floor gooseneck tail for square cut.*

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.

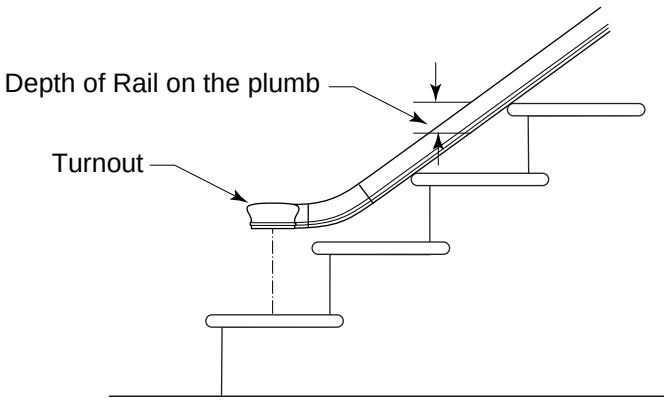


Fig. 3-37 *Determining starting newel height.*

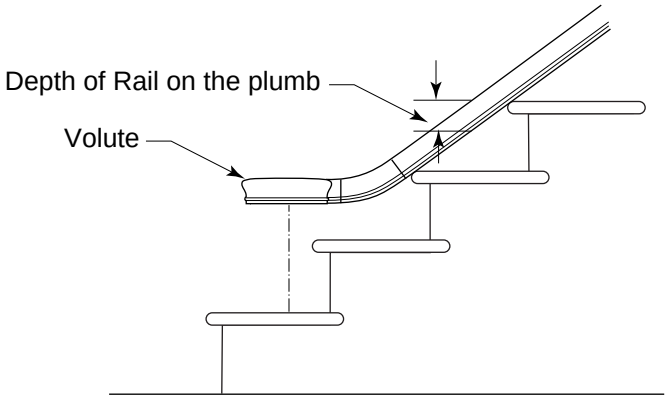


Fig. 3-38 *Determining starting newel height.*

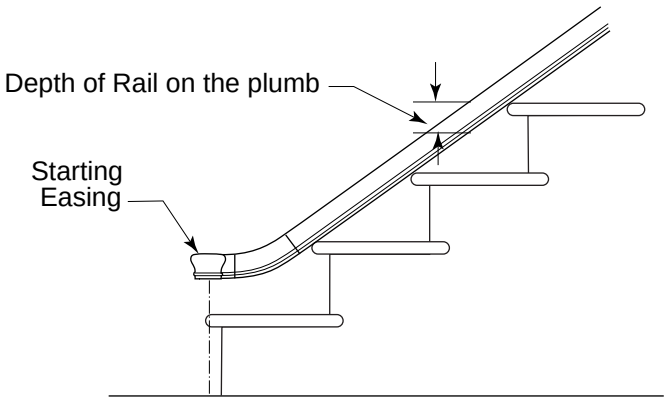


Fig. 3-39 *Determining starting newel height.*

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.

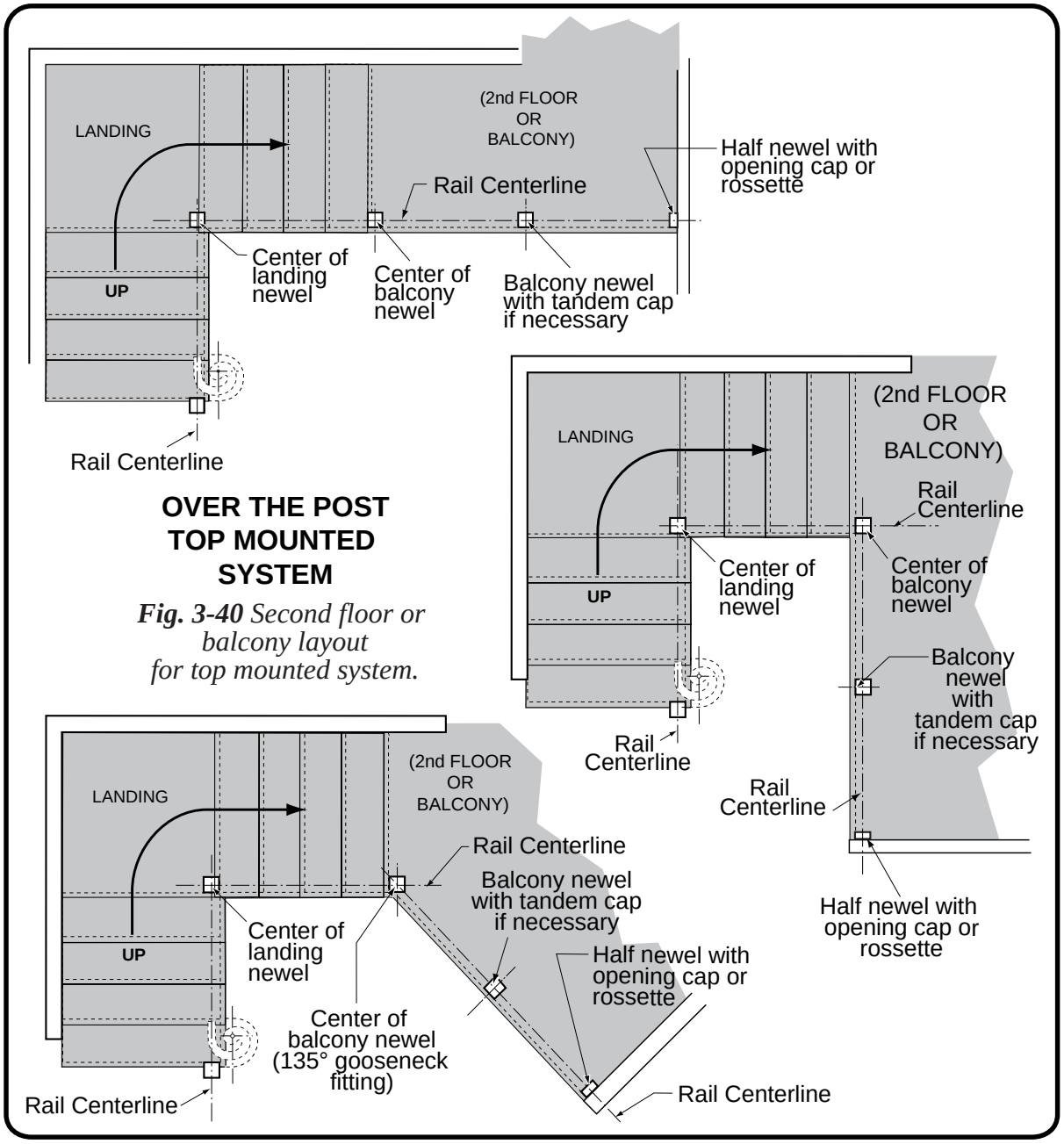


Fig. 3-40 *Second floor or balcony layout for top mounted system.*

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.

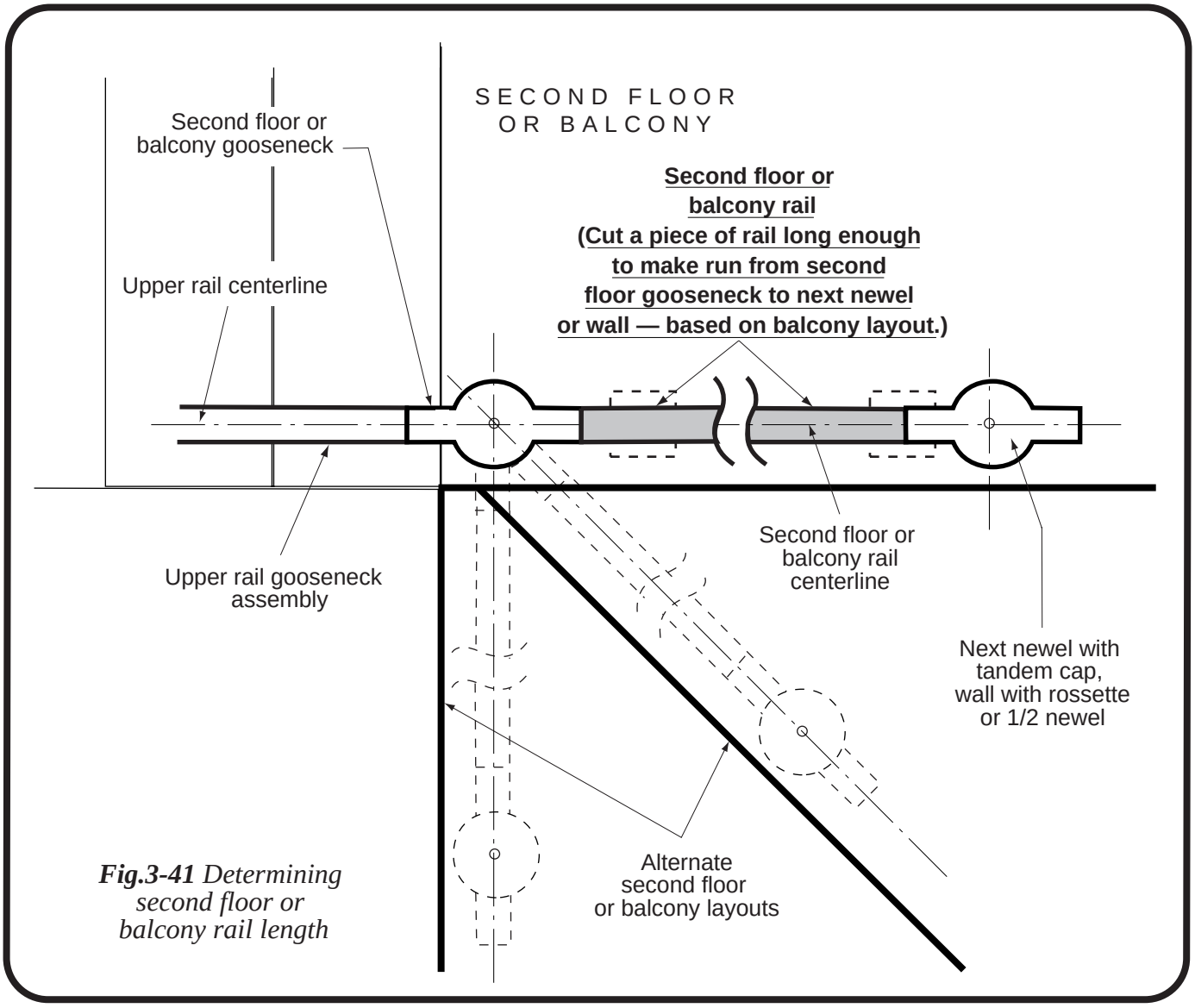


***Fig.3-41** Determining second floor or balcony rail length*

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.

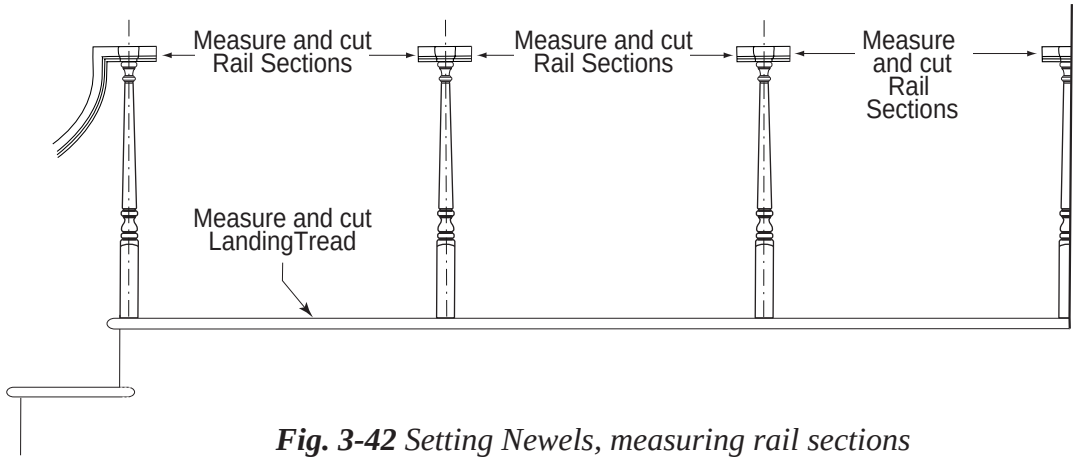


Fig. 3-42 *Setting Newels, measuring rail sections*

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.

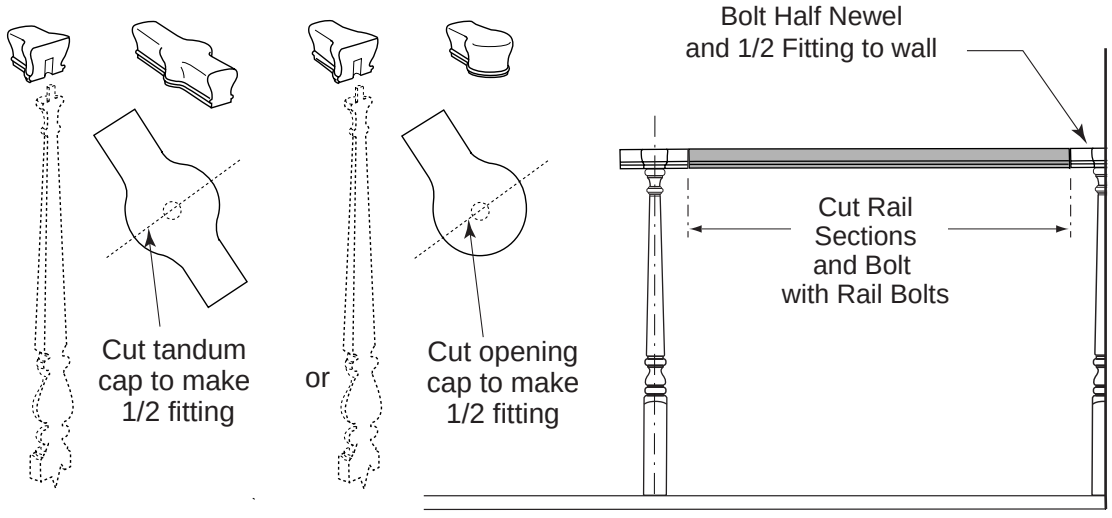


Fig. 3-43

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.

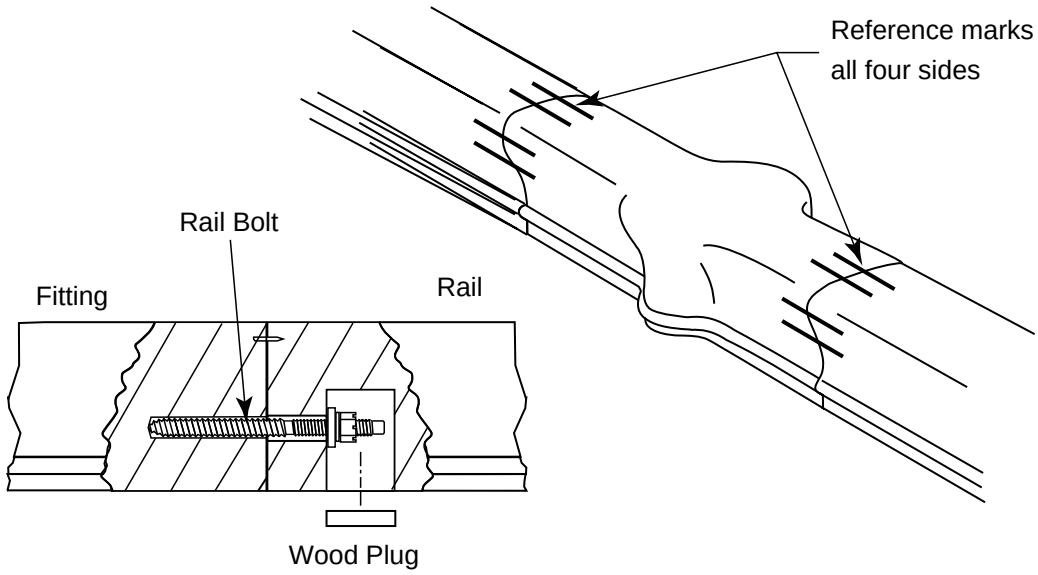


Fig. 3-44 *Installing Final Rail and Newel*

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.