

Learn How to Build Stairs

In order to advance your carpentry career you should learn how to build stairs. If you can cut a roof then learning how to cut and install steps should be fairly easy. The rise and run involved with step building are similar to roof framing in many ways. Even basic straight run steps are slightly different from one framing job to the next. There are strict guidelines that must be followed in order to construct a set of stairs that will be sturdy, safe to navigate, and satisfy the building inspector. The following information is the method I use for site building steps.

Local Building Codes

Long gone are the days of building stairs that are too steep, shoddily constructed, and with insufficient headroom. Most local building codes are very strict and have specific guidelines for building steps. In order to know how to build them you must be familiar with these local ordinances.

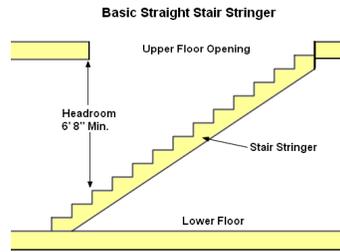
Most Common Building Codes

- **Headroom** minimum is almost always 6' 8" anywhere along the length of the stairway. This height is not only so people won't bump their heads easily but also for moving furniture.
- **Width** should not be less than 3' above the handrail and below the minimum required headroom.
- **Handrails** height should be between 34 and 38 inches measured vertically from the treads bull nose. A handrail should be provided on one side of every set with 4 risers or more. Handrails must not protrude into stairway path more than 4 1/2"
- **Riser** height shall not be more than 7 3/4" and not vary more than 3/8" from greatest to least. Be careful on this one, I've seen the riser height anywhere from 7 7/16" to 8 1/8" and not allowed to vary more than 1/8".
- **Tread** width minimum is 10" measured from bull nose to bull nose and should not vary more than 3/8".
- **Bull nose** or tread depth overhang should be between 3/4" and 1 1/4" and not vary more than 3/8".
- **Angle** of incline should be between 34 to 37 degrees.

Formula for Building Steps

It doesn't matter what type of staircase you are building, straight, L shaped with a landing, curved, complete turn around 180 degree, or winders. You must determine the overall rise and run of the staircase and divide it into comfortable increments.

In house framing this distance is usually from the first floor to the second or from the basement floor to the first floor.



Scenario for How to Build Stairs

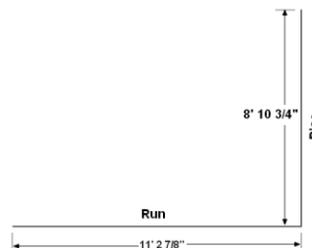
In this stair building tutorial we will be constructing a straight set using three 2 X 12 stringers, 2 X carpeted treads, and a 2 X 4 spacer board to allow drywall and a 3/4 finish stringer board to be inserted by the finish carpenter.

The overall rise is 8' 10 3/4" with a overall run of 11' 2 7/8".

I use a Construction Master calculator to figure my roofs and steps. A regular calculator can be used, but measurements should be taken in inches rather than feet and inches. Using a regular calculator has been discussed on the [carpentry math](#) page. There is also a free 30 day trial download on the [roof framing](#) page. Pick your poison, grab your regular calculator or the free download and lets see if you can learn how to build steps.

- **Determine Overall Rise and Run**

The overall rise and run of the steps is determined by measuring the space where the staircase is to fit. Keep in mind what type of floor covering is to be used when determining rise between floors. If ceramic tile or similar material is to be used it must be figured into the rise. Measure horizontally where the steps are to land with the understanding that you need a minimum of three feet of clear space before any obstructions to the direction of travel.



Find Rise of Each Step

- Using a regular calculator, convert feet and inches to inches only.
- With an overall stair rise of 8' 10 3/4" you should come up with 106 3/4 or 106.75.
- Since 7 1/2" is considered the perfect step, we divide 106.75 by 7.5 to find out how many steps are needed. 106.75 divided by 7.5 = 14.233 since we can't have .233 of a step we need to drop it and divide the overall rise by 14. 106.75 divided by 14 = 7.625 or 7 5/8".

- We now know that this set of steps requires 14 equal increments of $7\frac{5}{8}$ " to climb from one floor to the next. Write this number down, it is one of the keys to the step building tutorial.

Find Run of Each Step

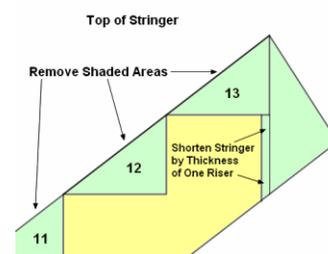
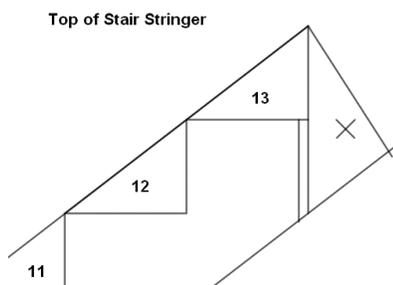
- When building this type of stairs there is one less tread than riser because the upper floor is the final step.
- We need to find 13 equal increments to add up to our overall run.
- Using a regular calculator convert $11' 2\frac{7}{8}"$ to 134.875.
- Divide 134.875 by 13 = 10.375 or $10\frac{3}{8}$ " run per stair tread. The actual run of the steps will be more due to the bottom step riser and the added bull nose of the tread. Make sure you will still have the three feet of required clear space at the bottom of the steps before laying out the stringers.

Rise and Run Using Construction Master

- The use of a [Construction Master](#) calculator is much faster and accurate than a regular calculator. To find the rise and run of each step we only need to enter $8' 10\frac{1}{2}"$ rise, $11' 2\frac{7}{8}"$ run, then press the stair key and it supplies us with the following information. Risers 14, riser size $7\frac{5}{8}"$, treads 13, tread size $10\frac{3}{8}"$, stringer length $13' 11\frac{1}{4}"$, and 36.24 degree of incline. Did you pick the proper poison?

Laying Out the Stringers

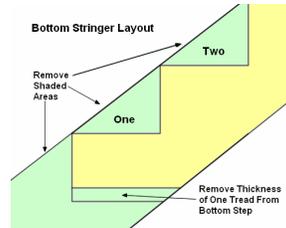
- Select straight 2 X 12 stock free of any cupping or large knots of the proper length. I know this is easier said than done, #1 stock is available, however most builders won't supply it due to the added cost.
- Place a set of lay out buttons on your [framing square](#), one on the tongue $7\frac{5}{8}"$ from the heel and the other on the body $10\frac{3}{8}"$ from the heel.
- Using the framing square and beginning at the top of the stringer layout the top plumb cut and the last tread. We now need to shorten the top cut by the thickness of one riser, in our case $\frac{3}{4}"$, so that the top tread will be the same as all the rest. Failure to do this will require the top tread to be $\frac{3}{4}"$ wider than the rest resulting in possible rejection by the building inspector, not a good story.



- Continue to lay out treads and risers by sliding the framing square down the stringer and marking them as you go just like you would mark a rafter using the [step off method](#). Write the number of treads

in the triangular part that will be cut out later until you have 13 treads marked out. These lay out marks are critical to success and accuracy is the key.

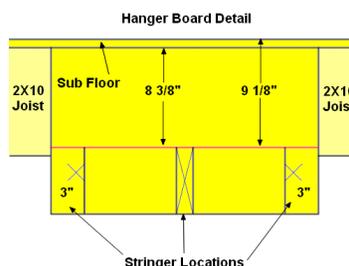
- Double check that you have the proper number of treads before laying out the bottom of the stringer.
- To properly lay out the bottom of the stringer you must shorten the bottom riser by the thickness of one tread, in our case 1 1/2". This will lower the entire stringer so when the bottom and top treads are attached to the stringer they will be the same rise as all the rest.



- Failure to drop the stringer the thickness of one tread will result in rejection by the building inspector, not to mention how happy the boss will be.
- Once you are satisfied that the stringer is properly marked out you can go ahead and cut the top plumb and tread marks as well as the bottom level and tread marks. We will test the stringer later and if it's wrong you can still get treads out of it and will not have wasted much material.

Attach Top of Stringers

- We need a way to securely attach the top of the stringers to the floor joist to which it will rest against. With 2 X 10 floor joists, a 3/4" subfloor, and 7 5/8" riser height dropped an inch and a half this means that the stringer will only bear against the joist 7/8 of an inch. Not safe at all and a recipe for disaster, over the years I have found a simple solution to this problem.
- There is always 3/4" sub flooring laying around, so I use it to create a hanger board as well as for stair risers.
- Cut a piece of sub flooring the same width as the staircase and rip it to 16 inches wide.
- We can now go ahead and lay out the hanger board to mark the location of the stringers. Remember that the top of the stringer has been dropped the thickness of a tread so hold it down accordingly. We can now go ahead and mount the hanger board. Make sure to glue and nail it securely.



Test the Stair Stringer

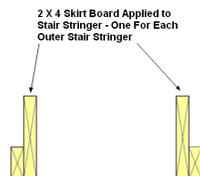
- You will need an assistant for this next step. Take the previously marked stringer which was cut on the top and bottom and hold it up to the alignment marks on the hanger board.
- With a torpedo level, check to be certain the tread and riser marks are plumb and level.
- Check to be certain you have the required three feet of clear space at the bottom of the steps. Remember that when the bottom riser and tread are installed the stairway will stick out another 1 3/4" than the stringer does now.
- Measuring from the stair tread marks check to see if you have the required headroom. Remember when the stair treads are installed they will be 1 1/2" higher than the marks.
- Once you are satisfied the stairway will meet all requirements you can go ahead and cut the stringers.

Cutting the Stair Stringers

- Take the stringer that you marked before and place it on top of another decent 2 X 12, flush them up on the bottom, and temporarily nail them together with 8 penny nails. One on each end should do it then mark the cut top and bottom ends on the board below.
- Set the skilsaw deeper than it needs to be and cut away, this will eliminate the need to mark the next stringer because the saw has marked it for you. With the stringers nailed together this reduces the chance of the pattern slipping and causing errors.
- Continue in this manner until all three stringers are cut.

Apply Spacer Boards to Stringers

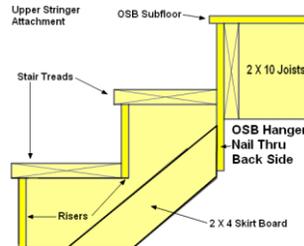
- So the drywall man doesn't have to cut the drywall around each individual step a spacer board should be applied to the two outermost stair stringers. If no finish stringer board is to be used then a 3/4" board is enough to slide the drywall behind. Since we will be using a finish stringer we will apply a 2 X 4.
- Hold a 2 X 4 flush along the bottom of the stringer, mark and cut it so it won't protrude past the stringer.
- Glue and nail the 2 X 4 securely to the stringer. We will need one for each side.



Stair Building Instructions

Until this point not much work seems to have been done, but without the proper planning and adherence to building codes we could never get to the next step. It is now time to set the stair stringers in place.

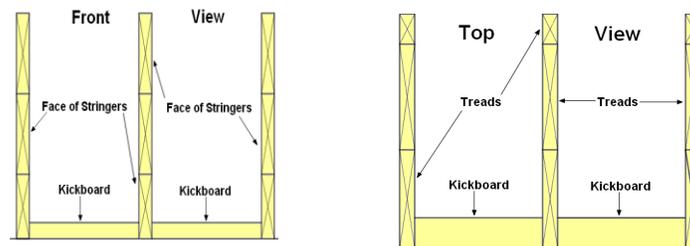
- Set the two outside ones first, glue and nail them securely thru the backside of the hanger board. Once the two outside ones are in place set the center one.



- This is the final chance to check for adequate headroom and bottom clear space.
- Using a straight edge make sure the cut outs for riser and stair treads line up. Slight variations of 1/8" or less are normal and allowable.
- After you are satisfied the set of will meet code set, glue, and nail the outside stringers into place. Place the middle one in the center of the two outer stringers.

Attach Bottom of Stringers

- Some carpenters cut the bottom stringer around a 2 X 4 kick board but I usually just glue and nail a 2 X 4 in between the stringers.



Cut the Risers

- One way to save money when building stairs that will have carpeted treads is to use scrap 3/4" orientated strand board for risers. There is always plenty of it laying around.
- Rip the risers at least 1/4" less than the actual rise of the steps, in this case we will go with 7 1/4". Which just happens to be the width of a 1 X 8 if you would rather use those.
- The bottom riser is different than the rest because of the dropping of the stringer. In this case it will need to be ripped to 6 1/8". So we need one at 6 1/8" and twelve at 7 1/4" for a total of thirteen.

Cut the Treads

- Since the run is $10 \frac{3}{8}$ ", and we are required to have a bull nose of $\frac{3}{4}$ " to $1 \frac{1}{4}$ ", our treads need to be between $11 \frac{1}{8}$ " and $11 \frac{5}{8}$ ". Lucky for us, a 2 X 12 just happens to be $11 \frac{1}{4}$ ", so we won't need to rip them. We need thirteen of them cut to the proper length.

Install Risers and Treads

- Use plenty of glue!
- Two nails for each riser at each stringer.
- Hold risers flush to the top.
- Three nails for each tread at each stringer.
- Glue and nail on the bottom riser.
- Glue and nail on the second riser.
- Glue and nail on the first tread.
- Glue and nail on the third riser.
- Glue and nail on the second tread.
- Continue in this fashion until all thirteen risers and treads are installed.

Tips on How to Build Stairs

Do not skimp on glue, a wasted tube of glue is better than a squeaky set of stairs. Glue everywhere wood touches wood.

Always check local building codes, most municipalities have strict guidelines.

Measure two or three times and cut once.

Don't be intimidated by this, many carpenters are, I even know a few with 20+ years experience that have never learned how to build stairs.

The easiest way to learn how to build steps is to start with something simpler like a set of three or four [step deck](#) stairs. The basic principle of building is the same only on a smaller scale.