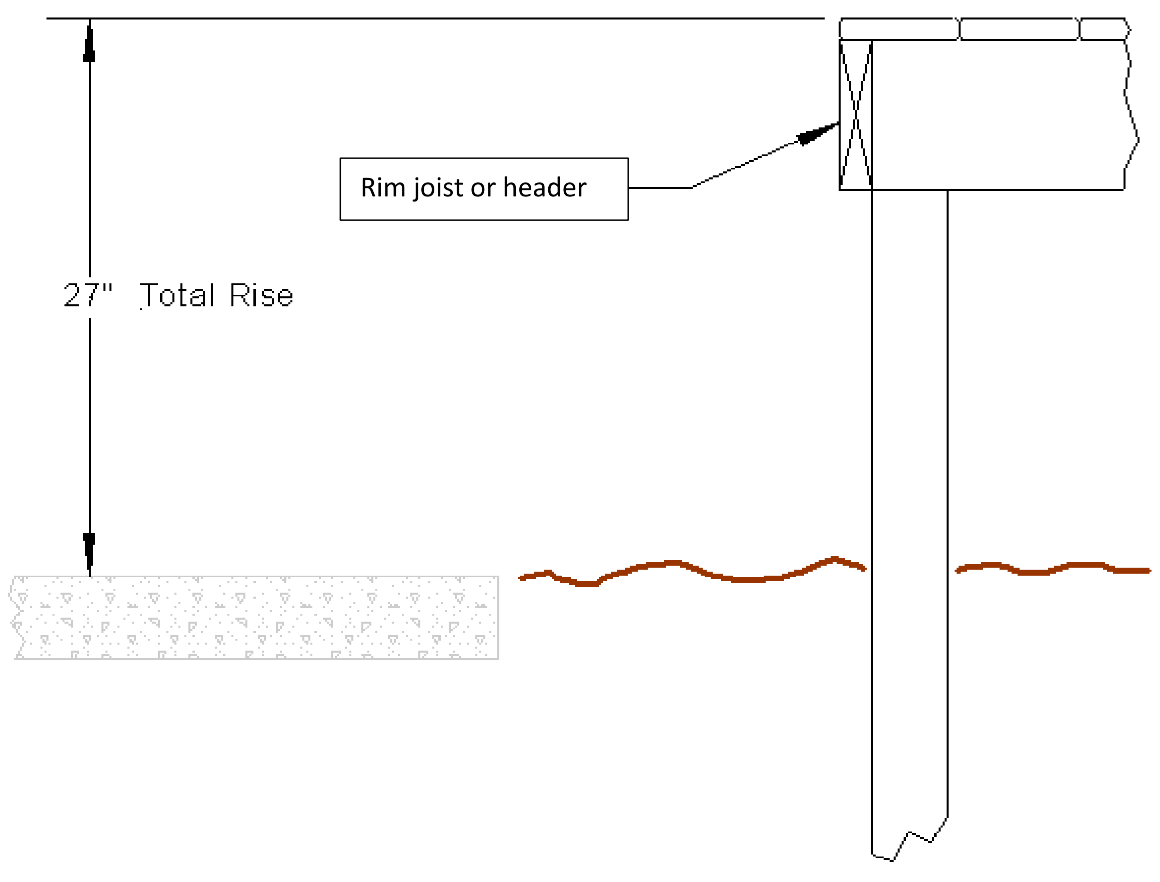
# COMMERCIAL STAIR CONSTRUCTION

Stair building is one of the most complex aspects of carpentry. My experience is that a good and accurate design is the only way to approach any complex geometry problem.

**1. Determine heights of finished floor, deck, or sidewalk surfaces. This determines the rise of each step.**

The distance from the upper walking surface to the floor, sidewalk or deck surface below is called the **total rise.**




Measuring Height From Deck To Sidewalk

Then some **math** must be performed. If a certain riser height is preferred (say 6 inches), then divide the total run by the preferred riser height. Or... use the riser height of the pre-cut stair treads, otherwise use a good starting number like 7 inches.

This gives the number of risers (steps) needed. Let's use an example of 27 inch total rise. 27" divided by 6" gives us 4½ steps. Oops... you can't have *half a step*. You can have either 4 or 5 risers.

27" divided by 4 gives a riser height of 6.75 inches.

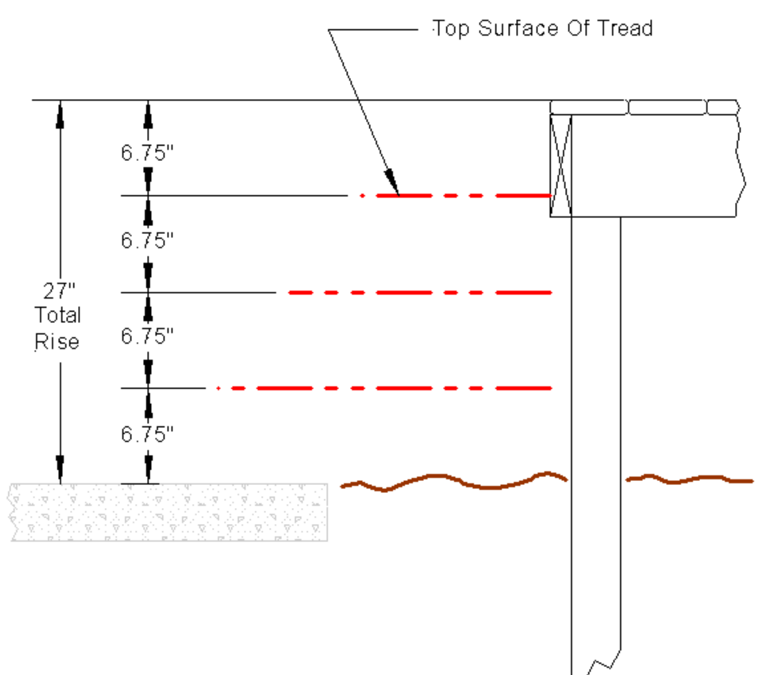
27" divided by 5 gives a riser height of 5.4 inches, which is a short step. So **4 risers** will be your choice.

**2. Determine the thickness of stair tread (run) material.**

Keep in mind any finish material on the upper landing (floor level), lower landing (floor level) and finish material on the stairs must be considered in the calculating the riser height.

**3. Lay out the heights of the UPPER FINISHED SURFACES of the stair treads (runs).**

These are the surfaces you walk on, and the surfaces that the building inspector measures from. Framing in code compliant stairs are usually made non-compliant when tile and carpet are afterthoughts. Plan the finish material into your project.



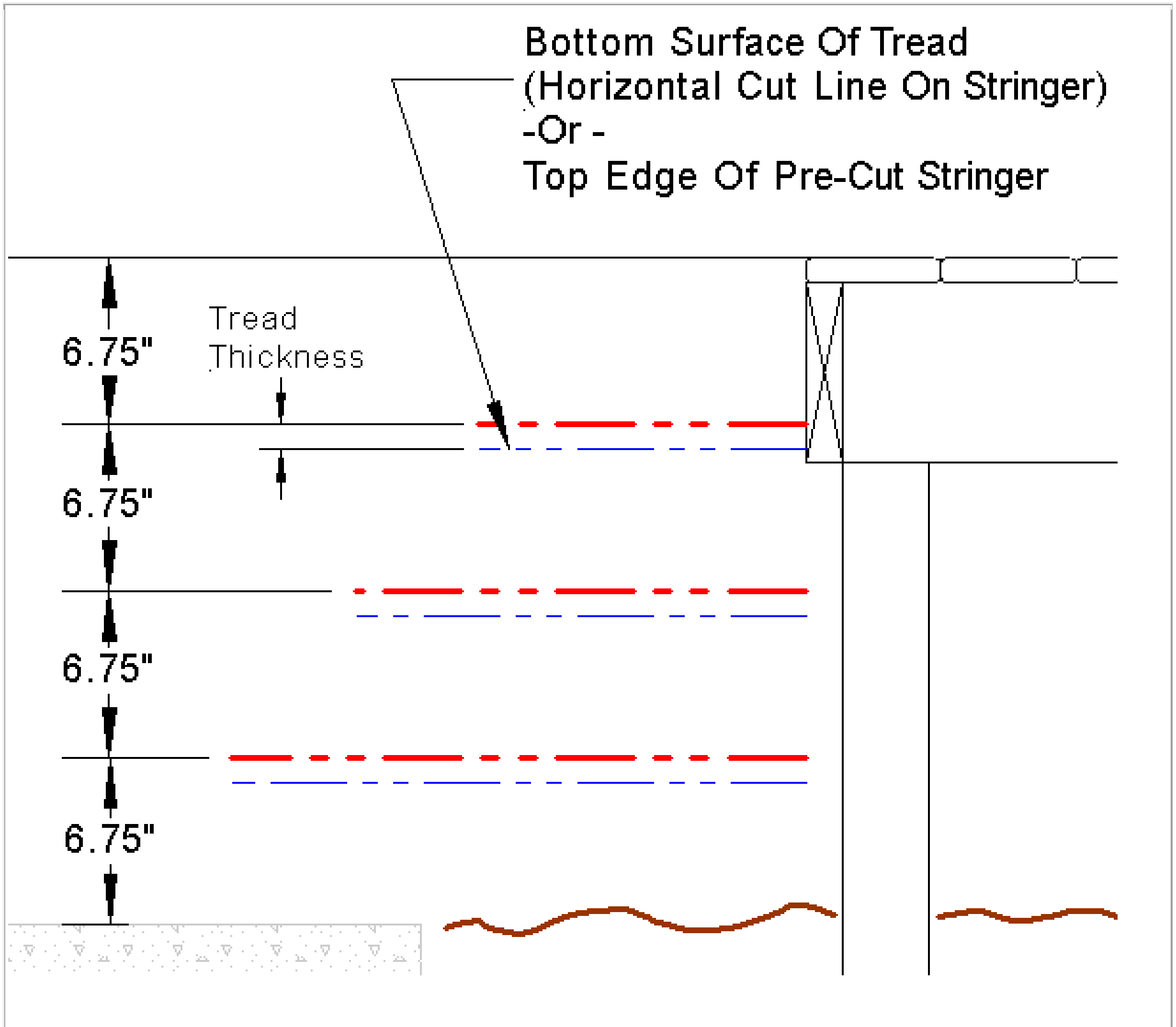

Lay Out The Locations Of The Upper Surfaces Of The Stair Treads

**First...** We **subtract the riser height** from the **finished deck surface**, which gives the location of the **top** of the upper tread.

**Then...** Then we **subtract the riser height again** from that **first line** (the top walking surface line) to get the **top** surface of the second tread. And so on...

**4. Subtract the thickness of the stair treads to determine the horizontal cut lines that will be marked on the stair stringers.**

If using pre-cut stringers, hold the stringers in a position so the **highest horizontal cut meets this line.** Of course, the stringer must be held with the horizontal cuts **level**.




Determine Horizontal Cut Lines
By Subtracting Thickness Of Stair Treads

## 5. Determine a starting point for the outer (front) surface of the risers.

On many decks and porches, the top riser will determine the starting point, because the top riser is often the outer joist of the deck structure.

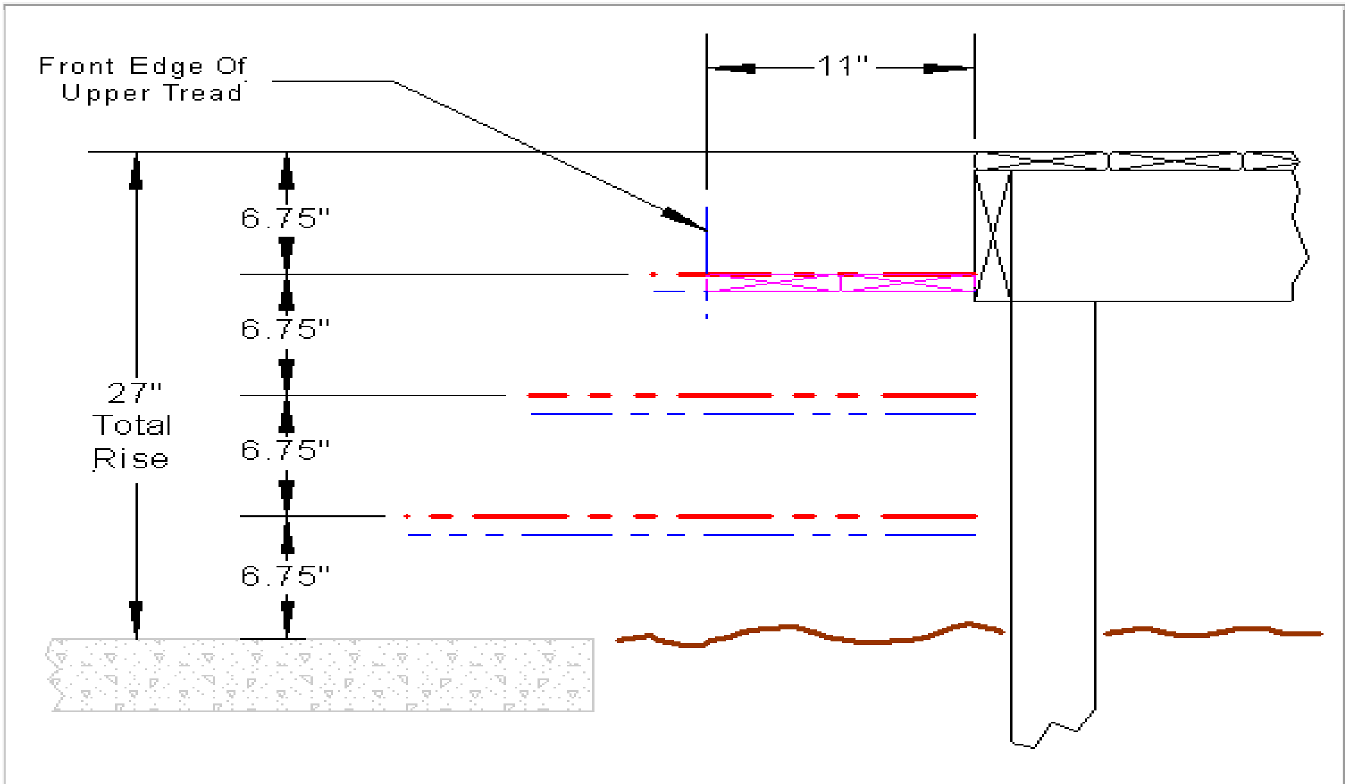
## 6. Determine the final position of the top tread:

The important geometry is the location of the **front edge** of the first tread.

Common tread materials for exterior decks are:

- Two 5/4x6 deck boards, which gives a tread width of about 11 inches.
- Two 2x6's which gives a tread width of about 11 inches.
- 2x12, which gives a tread width of about 11¼ inches.
- 2x10, which gives a tread width of about 9¼ inches. This certainly works for indoor treads but may not be acceptable for deck stairs.

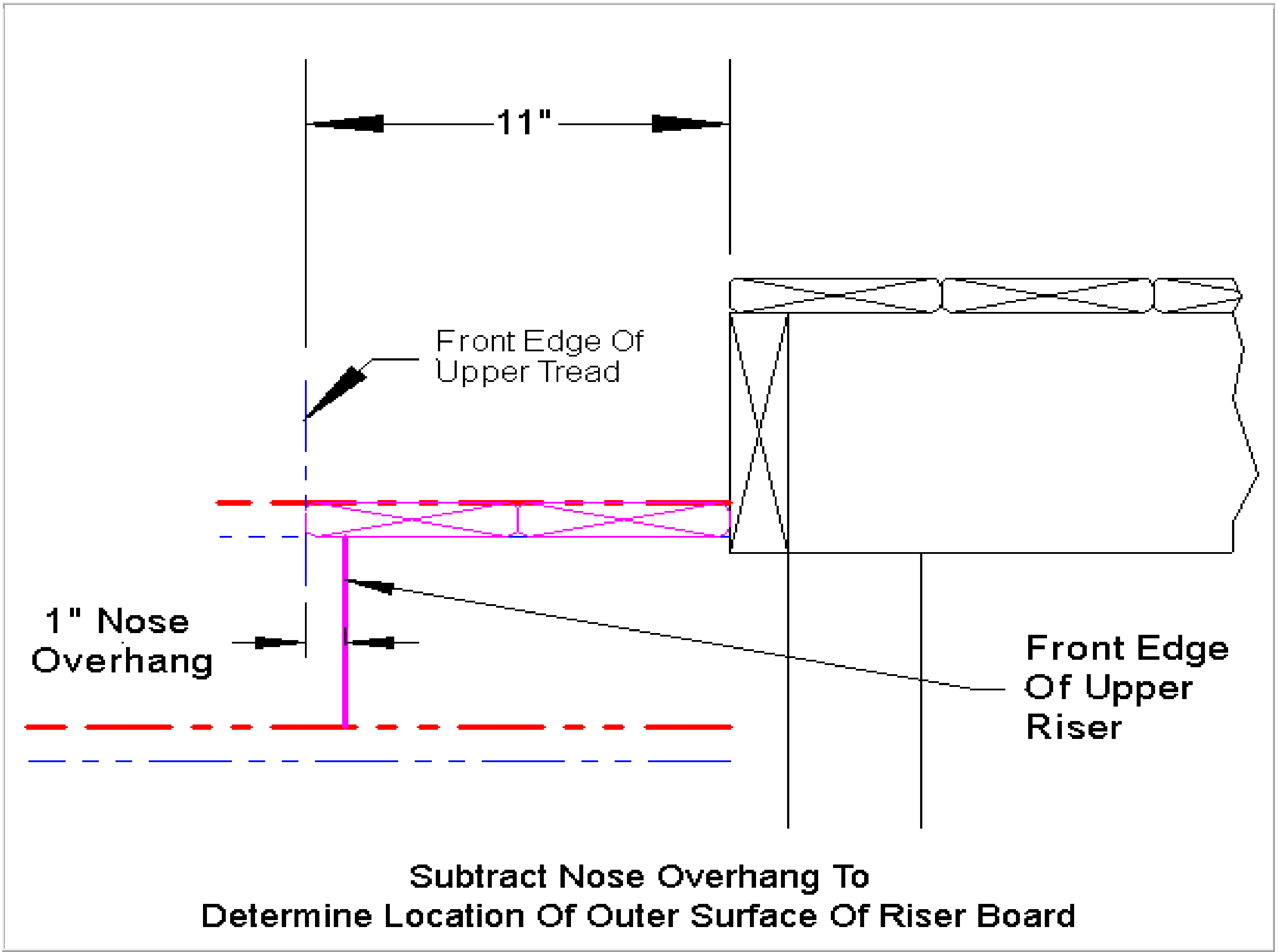
In this example we'll use a pair of 5/4x6 deck boards, which creates treads one inch thick and 11 inches wide.




Determine The Final Position Of Top Stair Tread

**7. Subtract the nose overhang distance to get the location of the front of the next riser.**

The nose is usually **one inch.** Nose distances of 3/4" to 1¼" are usually acceptable.




**8. Subtract the riser material thickness to get the vertical cut line for the stair stringers.**

Riser materials are usually:

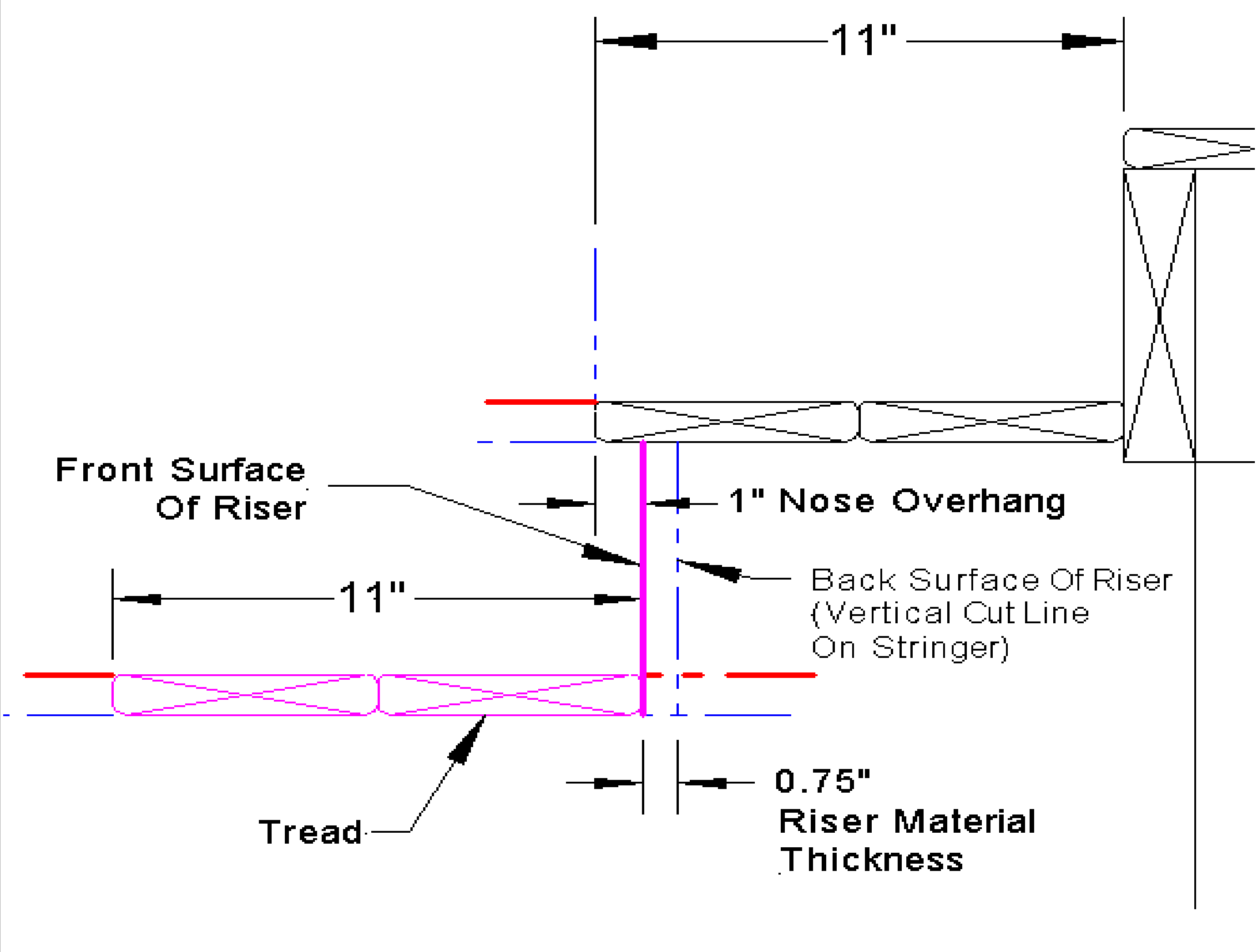
- 1x6 or double 1x4 treated wood (3/4" thick)
- 5/4x6 deck boards (1" thick or more)
- Sometimes 2x lumber is used (1½" thick)

See the next drawing for this...

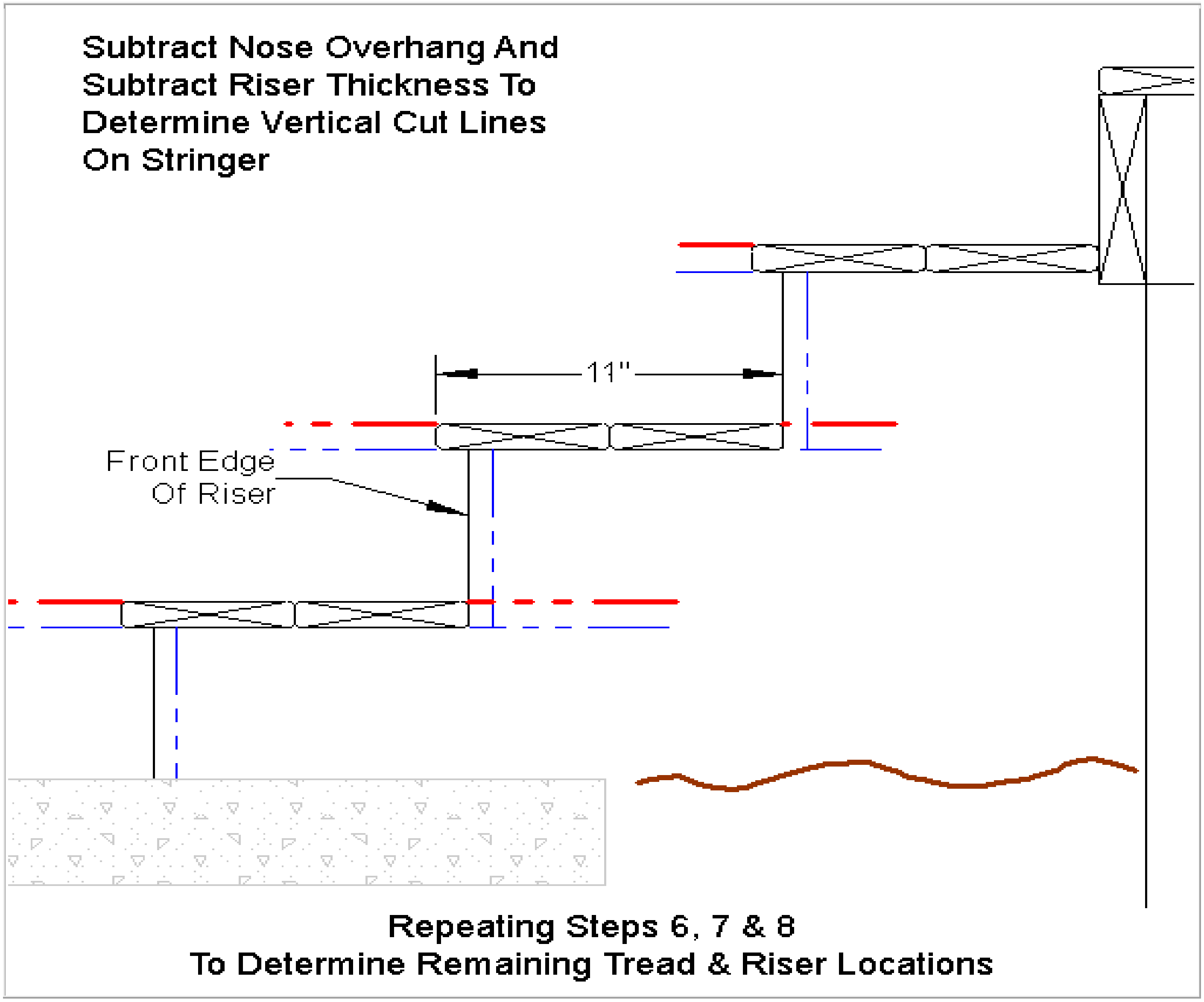
**9. Repeat steps 6, 7 and 8 for all the other treads.**

In other words, now that the first riser outer surface has been determined, the tread width can be laid out in front:

- This gives us the location of the front edge of the second tread.
- Back off the nose overhang to get the outer surface of the next riser
- Back off the riser thickness to get the vertical cut line on the stringer.



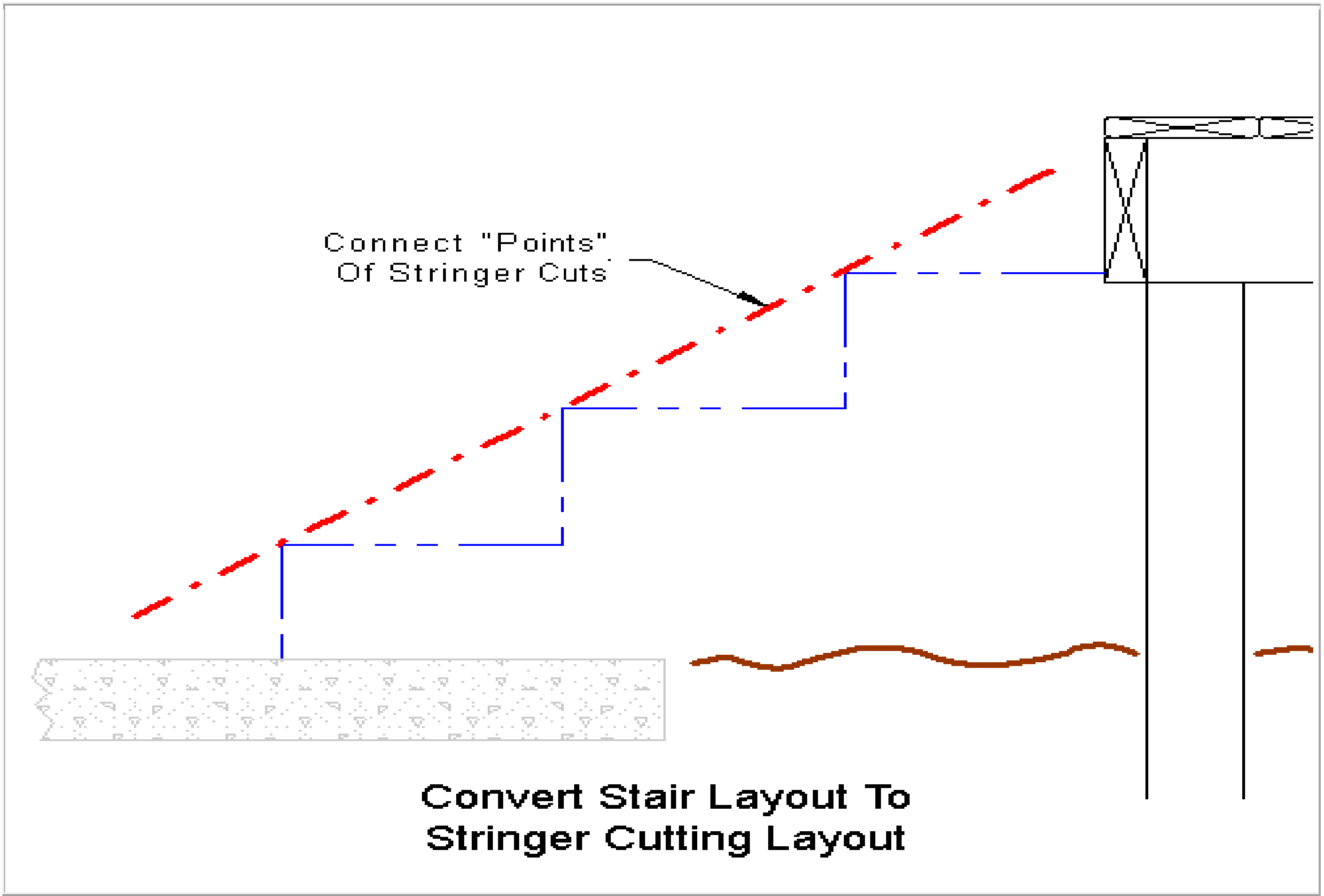

Determine Location Of Next Tread

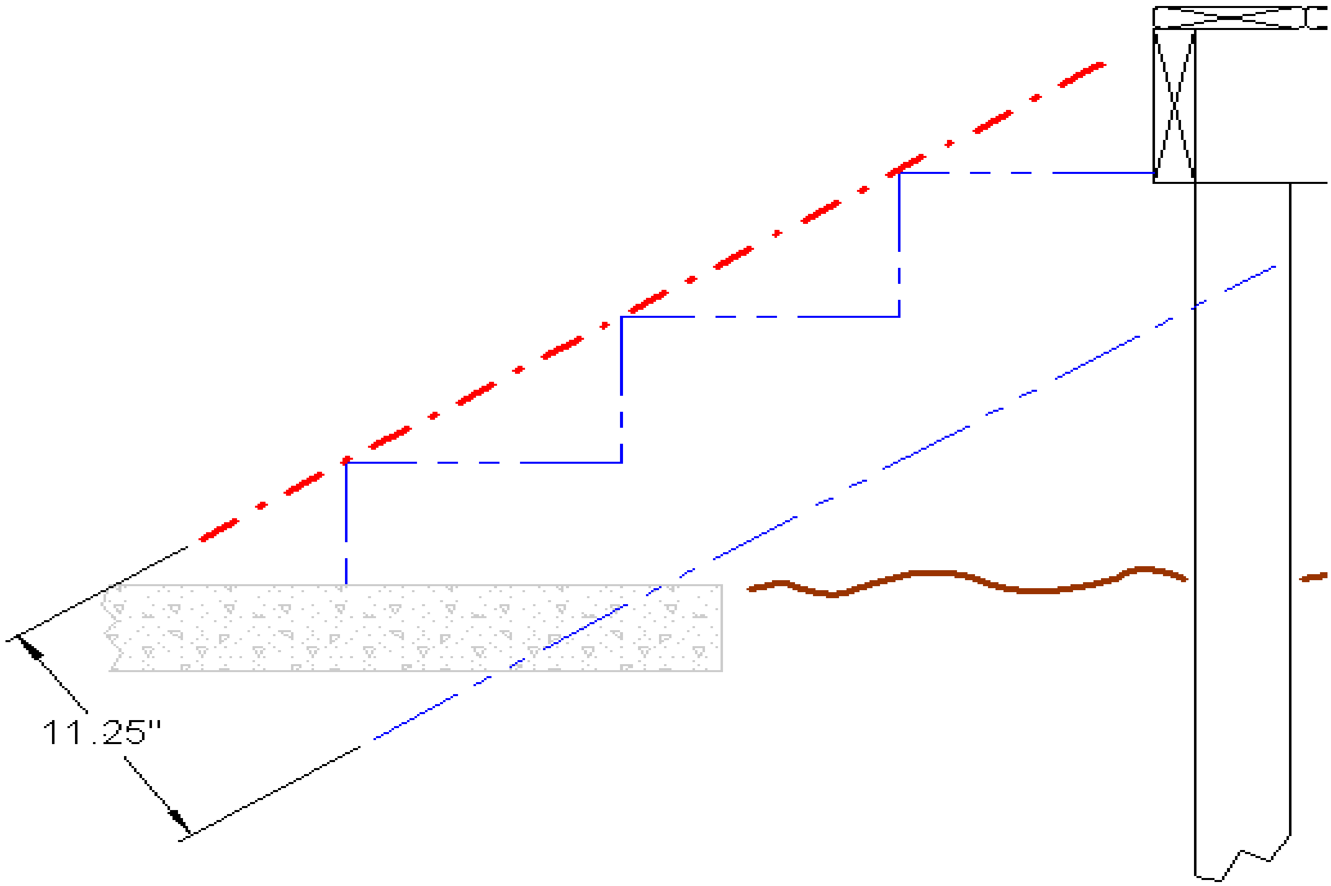



## 10. Convert stair layout to stringer cutting layout:

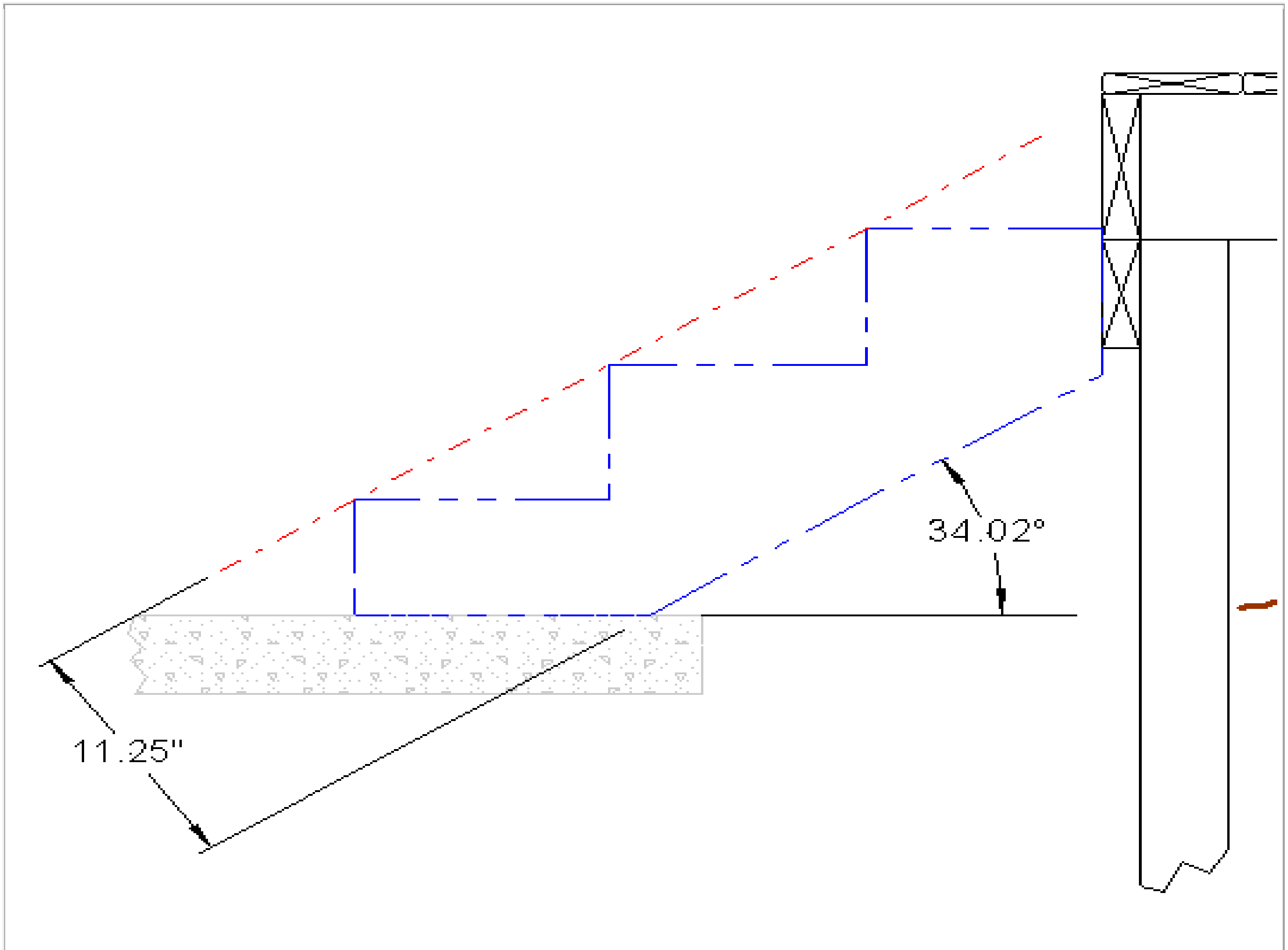
Draw a line to connect all the points on the stair stringers. Note that this is **parallel** to the "nose line" of the finished stairs, but is **not** the same as the nose line.

Make another line parallel to the first line, 11.25 inches apart. This denotes the width of a 2x12, the standard material used for stair stringers.


Connect "Points"
Of Stringer Cuts
Convert Stair Layout To
Stringer Cutting Layout



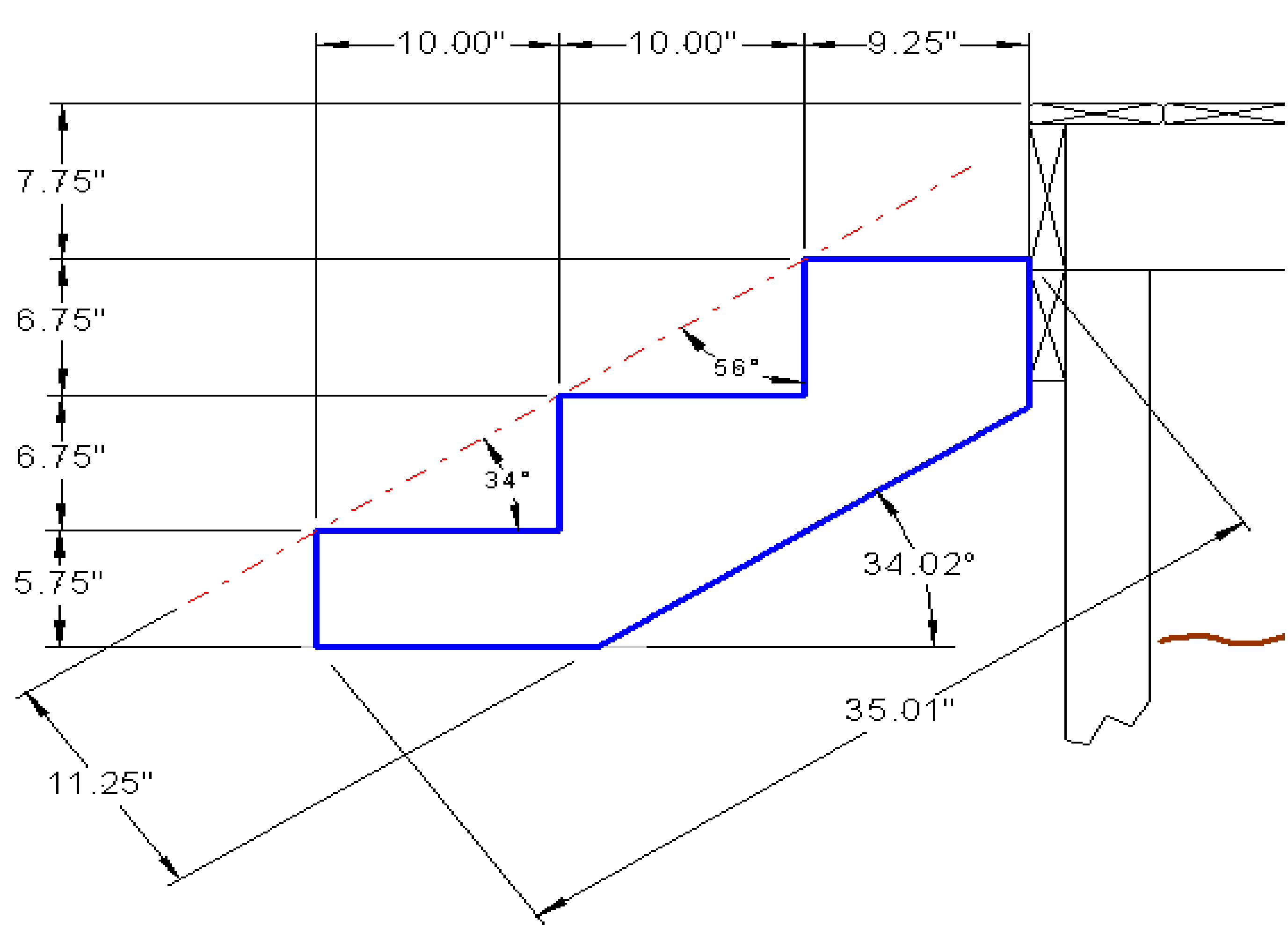

Draw Line Parallel To "Point Line",
11.25" Away



Create Outline Of Stair Stringer

In the drawing below, note some interesting patterns:

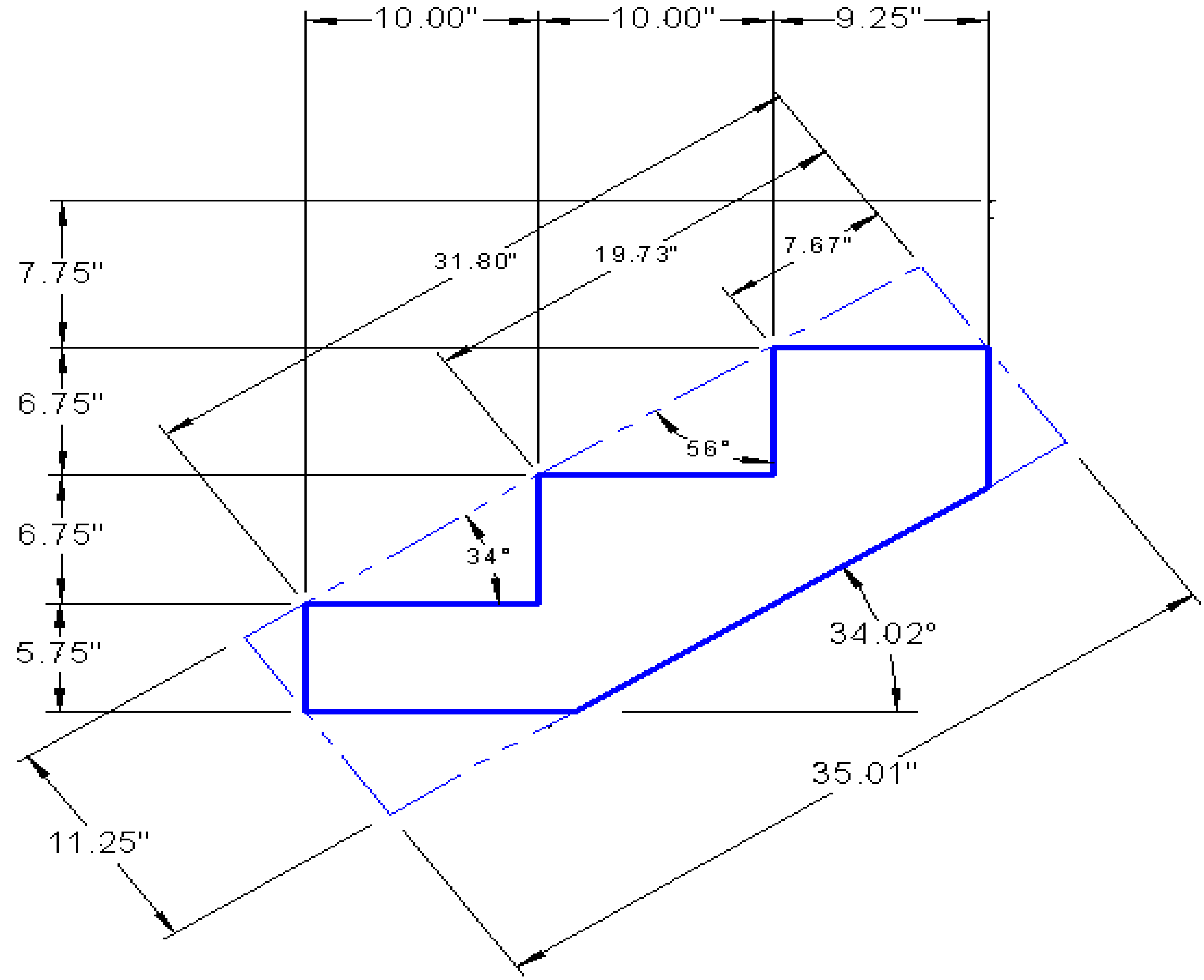
- The 7.75" top vertical dimension is **not** part of the stringer... this is a dimension that locates the position of the top of the stringer relative to the deck surface.
- The middle vertical dimensions (6.75") are the riser heights.
- The lower vertical dimension (5.75") is just the riser height **minus** the tread thickness.
- The 10.00" horizontal dimensions are the **"effective tread width"**. This is the actual tread width **minus** the nose overhang distance. If you took a "bird's eye view" of the steps from above, you would see only 10 inches of the 11 inch treads.
- The 9.25" horizontal dimension is the effective tread width **minus** the 0.75" thickness of the riser. When the risers are nailed onto the front edges, the effective tread width will return to 10 inches. And all the remaining tread supporting areas will simply "shift forward" by 0.75", if that makes any sense.




Layout Cuts On 2x12 Material

One benefit of a simple 2-dimensional CAD program is that you get easy (and very accurate) measurements of the overall length, and the angle between the stringer bottom and horizontal. Note that some of the tread cut-out angles are the same 34 degree angle, and the other lines are the **complement** of that angle, 56 degrees. You remember the **Complementary Angle Theorem** from high school math, don't you?

It's kinda intuitive... if a line is 34 degrees above horizontal, then the angle between *that* line and vertical is just 90-34, or 56 degrees.



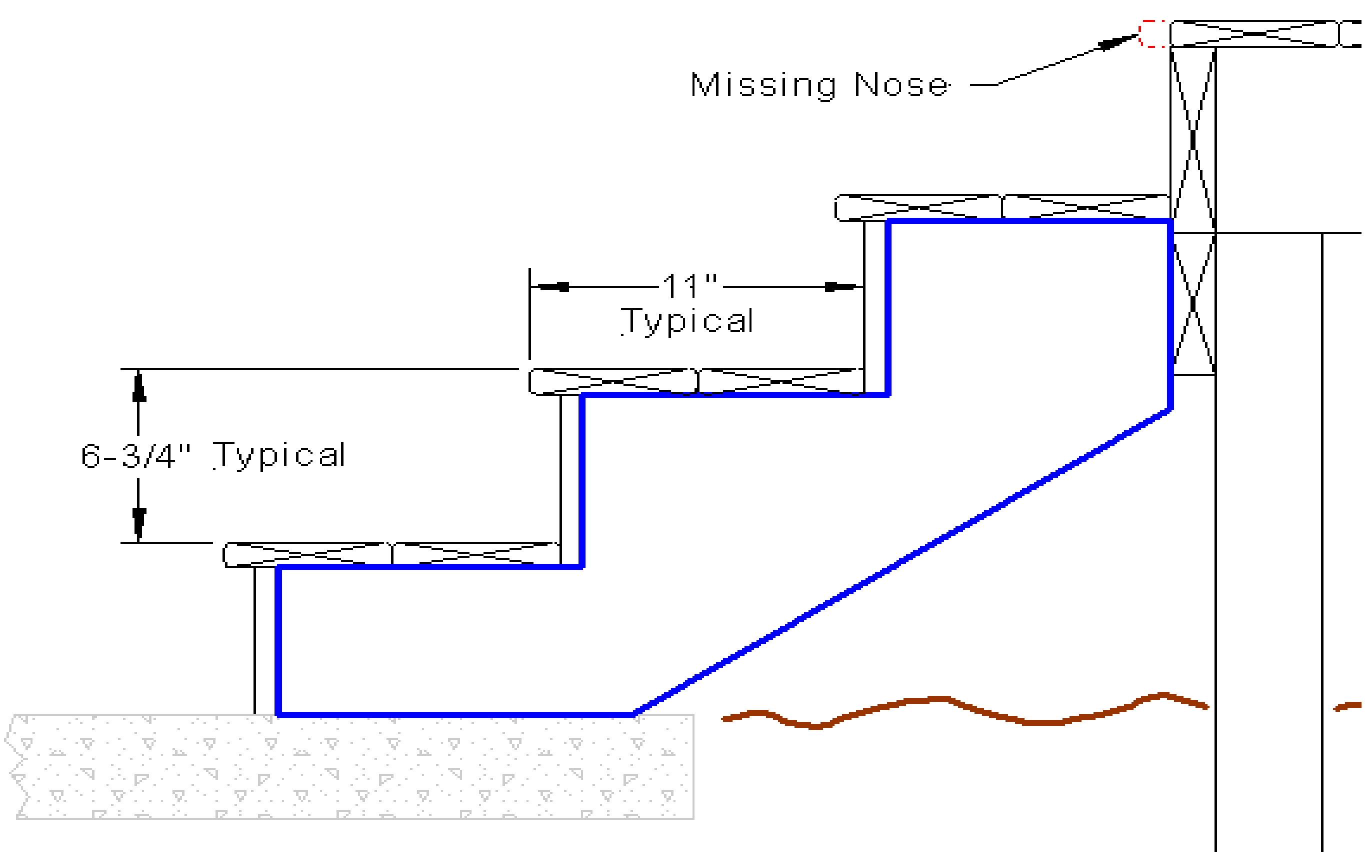

**CAD Software Provides Additional Layout Benefits**

A really powerful benefit of CAD software is the ability to quickly get distances from the end of the board to the stair "points" on the stringer. From these points the angled cuts can be laid out, and inaccuracies are held to a minimum.

This is NOT how most carpenters lay out stair stringers. The traditional practice has been to use a rafter framing square with little hexagonal brass buttons (sold separately) that are clamped onto the framing square to establish fixed dimensions. I'm not sure I can explain this process... you can read about it in the book Basic Stairbuilding by Scott Schuttner, from Taunton Press, which should be available at Home Depot.

## 11. Build Stairs

Note that many decks are **not** built with the decking overhanging the edge by one inch, so stairs built against such a deck may have a missing nose at the top. This is not normally a problem.




Completed Stairs With Treads And Enclosed Risers

The procedure for building stairs is typically:

- Install the stringers. Stringers would be fastened at the top, to the deck. It may also be desirable (or required by code) to fasten the lower end of the stringers to posts in the ground.
- Install the riser boards.
- Install the treads.