

STAIR CALCULATIONS AND LAYOUT

I have wanted to write this ever since I made that statement in a nationally published website about most stairs being laid out wrong and some being off by 4 or 5". Let me tell you, when you write something to be read by over 2 million carpenters you had better have your stuff together, they will eat you alive, as they did me. I received some nasty emails and some replies on that website that would offend anyone, especially a timid person like myself.

I finally got my point across but now I am going to explain in detail the procedures of my stair calculations.

I am going to start this with some techniques used 5 or 6 thousand years ago, no calculators, just some hair stringline and some crude carpenter tools. Our current Chief Carpentry Advisor, Jesus Christ, probably used this procedure.

When we planned the alternator stair I just posted I showed the Indian carpenters that you did not have to have a calculator to find the number of risers in a stair.



I cut a string 64" long, the height of the stair landing, taped the ends together then folded 3 times and inserted some nails in the loops and marked at the center of the nails, of course it came out to 8". Everyone knew that.

So we had a 62" round Easter Basket we were building and I told them that we needed 16 increments to lay out the circular design drawn by our engineers and architects.

We wrapped a stringline around the circle, tight, cut it, taped it together and then did the same thing, folded it until we got 16 lengths, marked it at the nails and it came out just as accurate as we had used a calculator. After all, we used saws to cut the pieces for the basket and you know very well how accurate 50 saw cuts are.



I doubt if any carpenter could figure out this was laid out with a string line. I showed the workers how to do without a calculator.

If you are a stair builder you probably see a circular staircase layout here. 16 tread lay out with no calculator and each is within a 1/8". Good work in my books.



This is the Easter Basket the Indians built. 80" diameter, 80" high. Over 3000 parts. Absolutely amazing piece of work. We have no jointer, no planers, no routers, no band saw, nothing but a table saw, miter saws, one jigsaw and many hand tools. No Home Depots here in Camp Bucca, Iraq,

Like I said in Stair 102, it not what the carpenter, Frank Rochas, did when he built the Loretto Staircase, it is the fact that he had no modern tools, except for a stringline, handsaw, hammer, chisels and a headfull of knowledge. He most likely made most of his tools with a fire, hammer and an anvil. I shall never quit studying the history of carpentry.

Now back to modern carpentry, where most of us would be lost without our thousands of dollars worth of computers, calculators and truckloads of carpentry tools.

When the lights finally came on in my hard head about the layout of a stair stringer was when in 1983 we were building a gymnasium in Portales NM, USA, and a Baptist Volunteer went to layout a wall and took a framing square

and started marking the studs for a 16' wall. He marked the first stud, then slid his square down the plate and kept marking the studs on 16" centers. I went over and pulled a tape and he was off about 2" on the end stud, he got upset but we turned the studs over and marked them with a tape correctly. I know you have probably seen this and had the same thoughts I had that day.

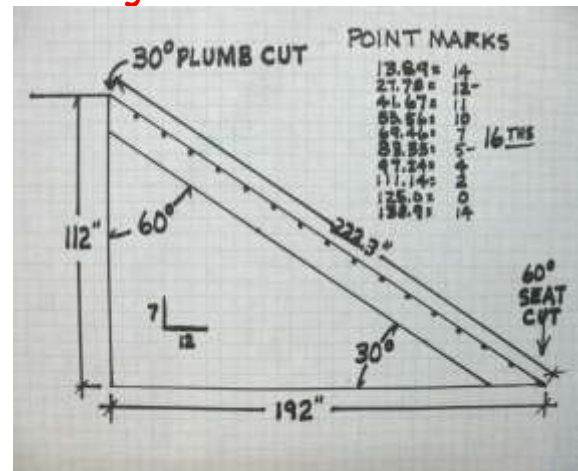
I started laying out one of the four staircases we had in the gym and, as I said, the lights finally came on.

I was marking the cutouts and realized I was doing the very same thing as the volunteer was doing. I went ahead and marked the stringer then I calculated the rake lengths of each cutout and the total rake length of the stringer and I was off a little over 2", about the same as the volunteer.

I immediately changed my procedure for laying out a stair.

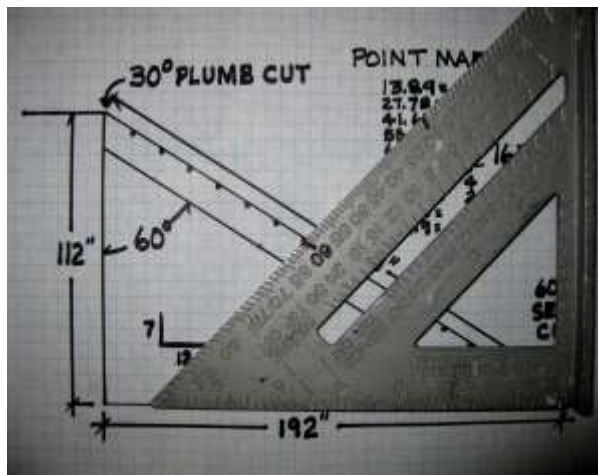
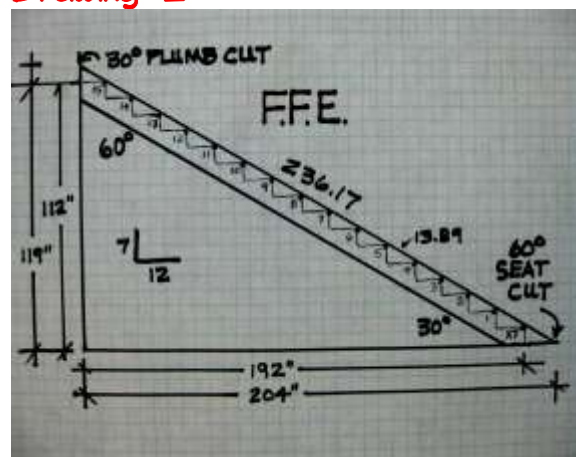
No wonder half of the stairs I was building had tread cuts, seat cuts that were out of level, plumb cuts that were out of plumb and I could not figure out why.

Drawing # 1

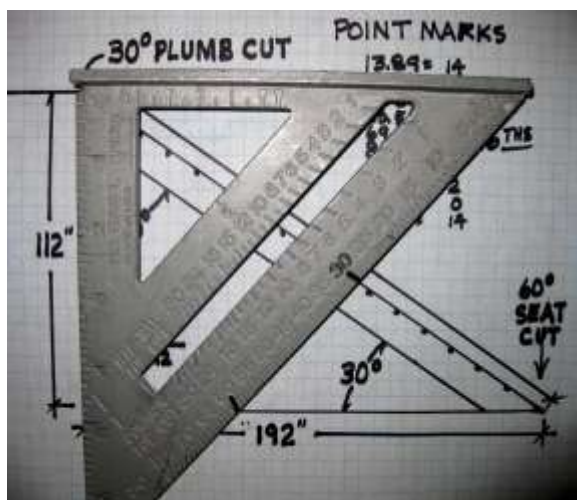


Study this closely; I will refer to it several times. Point mark calculations on the top right are the nose points of the stringer. Rake length of each cutout. If you remember calculations the formula is: **enter 1 9 2, push shift r-p, enter 1 1 2 then = gives you 222.3 then shift x-y gives you > 30.25°.**

Drawing #2



I have this speed square laying on the drawing exactly the same way I would lay it on the stringer to make the seat-floor cut. 60 degrees.



I now have it on the drawing as I would for the plumb cut, 30 degrees.

The difference between drawing 1 and 2 is simply that drawing 2 has an extra tread and the landing in drawing 1 has a finish floor riser, FFR, drawing 2 has a finish floor extension, FFE.

I have seen this many times where a carpenter will cut out drawing 1 stringer and decides to move drawing 1 stringer up and make a FFE out of it, it will work, but the treads and risers are out of level and out of plumb. Same thing with cutting out drawing 2 stringer and making an FFR stair out of it. Same problem. If you are not a stair builder this is going to get a little complicated, but after a few stairs I know very well you will understand what I and a whole bunch of other stair builders are talking about. I am not the only one who has figured this out, I just happen to be the poor individual that got caught writing about it on ContractorsTalk.com.

Today and for the past 23 years when I lay out a long stringer I mark the points of the tread/risers on the stringer and this keeps me, as on this stair, on a 13.89" layout for the cutouts.

I first calculate the length of the rake.
Drawing 1 stair;
Once again, on a **Casio fx-260** calculator push SHIFT, push R-P (plus button) then enter the run, 192, then EQUAL, and this gives me 222.3 which is the total rake length of the stringer. I mark the 20' stringer and make the plumb cut and the floor (seat) cut. I then mark the points of the cutouts.

Calculation:

You have 222.27 showing on you calculator. Push SHIFT and then push X-Y on the top table of the buttons, this will give you the angle, 60°, (rounded off) of the rise- rake. If you enter the run first and do the first calculation it will give you the run-rake angle 30° (rounded off).

Now for the stringer points of the cutouts (birdsmouth cuts).

We have a 7" rise and a 12" run for each step.

Calculation:

Enter 7, push SHIFT, push R-P, enter 12, then EQUAL, and you will see 13.89. This is the first mark you make from the floor cut point you made on the stringer. Hook your tape on this point and mark 13.89. Look closely at drawing #1 and see how I transferred these tenths into sixteenths.

Mark 13 7/8". 14/16's.

Now on the calculator, with 13.89 showing, push PLUS PLUS, this will give you 27.78 or 27 and 12 and half sixteenths, if you want to get that precise, most of us will just mark 27 3/4".

Now with 27.78 showing push EQUAL again and you will get 41.67 then EQUAL again and you will get 55.56 and keep pushing EQUAL until you get the total stringer marked.

Then you can take you frame square and gages and mark the cutouts.

Main thing is here that you have the correct stringer length. Sounds and looks complicated and time consuming. It's not; it takes about 10 minutes for me to do this. Very accurate layout, and why not do it, most carpenters would not even read this let alone do this 10 minute procedure, but I do.

I hope this has helped, I know it has helped me. Main thing is that with some of the lumber we have today and some of the 2x12 with the large rounded over corners it is very hard to accurately lay out you cutouts, at least it is for me. You don't have to use this but you have to admit you at least know how I learned some of the things I teach on my website. Most of them hard earned knowledge.

If you are a carpenter, you know all about hardheaded people.

Email me if you have any comments or questions. My email is on the website.

<http://carpenterbooks.com>

Bob Johnston, carpenter