Bridges Placement Methods - Measurements and expected results

Blue Type = Clickable Link
(this one to original thread)

Contents:

Illustrate LtDave32’s method of bridge placement

Stewmac & other t-o-m placement

Stop Tail bridge quirks

Modified method optimized for stop tail bridge

Vintage Stop Tail bridge placement

Q: Why?

A: Mainly for a stop tail bridge placement method.

With a tune-o-matic style bridge, you have a stop tail or other anchor for the strings. As such, you can string up the guitar and check and adjust the bridge placement before drilling the holes for the studs / bushings. (see vid linked below)

Still, a method for marking a starting position helps.

Stop Tail Bridge Complication:

Placing a stop tail bridge without a separate anchor for the strings is a bit more difficult.

One could rig a temporary method of anchoring the strings, but the pull of the strings going through and over the top of the bridge to the nut has a significant effect on string alignment down the neck.

Here, a reliable method could be a big help.

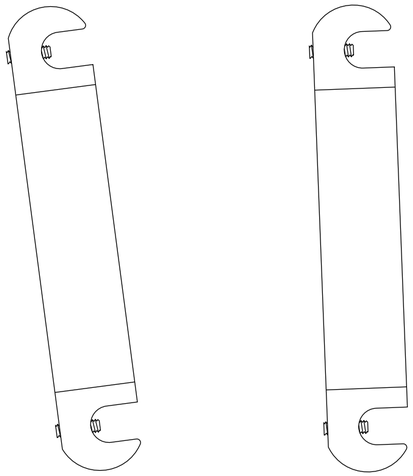
Speadsheet - Adjusting for Intonation

It’d be kind of useless to show a manner of placing a bridge without a means of evaluating whether it’s right for your application... or not.

The spreadsheet is dense with numbers, but it’s fairly simple.

Comments in the sheet explain what it’s doing and how it can be used.

Uncompensated Stoptail



50s Vintage Modern Angle

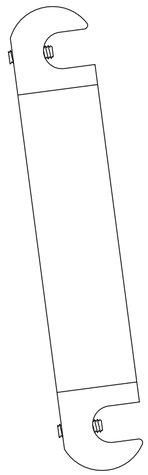
Just your standard stop tail bridge... that can be mounted at either a vintage or modern angle... more on that later.

Pigtail became a overwhelming favorite when they added some definition to the top ridge to eliminate the dreaded sitar buzzing some of the lesser bridges have. They’re cast aluminum instead of cheaper zinc... ground and polished by hand and have that vintage look to them. In other words, they have more going for them than just the defined ridge.

There are others, of course... choose wisely.

http://www.pigtailmusic.com/Products.php

Compensated Stoptail



50s Vintage Angle

Development to production... a good read.

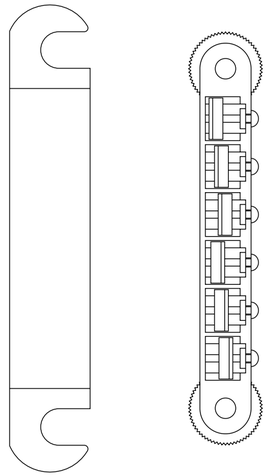
...or straight to the point...

Clearly, it’s designed as a drop-in replacement for a vintage bridge mounted at a vintage angle, but there’s no reason one couldn’t use it on a new build... at a vintage angle.

There are other companies that do something similar (not so elegantly, imo), but you have to be careful in reading the description to see if they compensate for a vintage angle or a lesser one (if they bother making that distinction at all in their description).

http://www.mojoaxe.com

Tune-o-matic style bridges



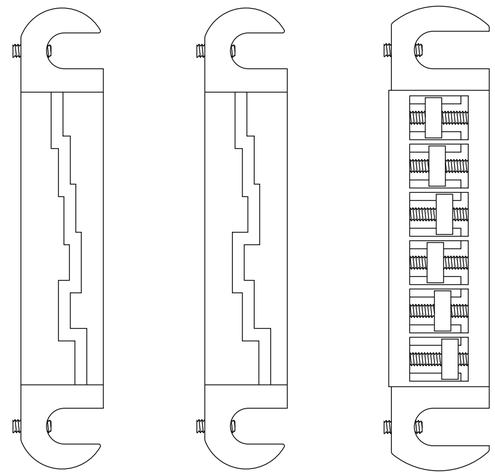
an Angle to Suit

Different tune-o-matic style bridges can have different ranges of saddle adjustment. i.e. a nashville bridge will have a greater range of adjustement both forward and back than an abr-1.

The best angle will depend on the setup... how much length needs to be added to the individual strings for proper intonation and the adjustment range of the bridge being used.

http://youtu.be/CUpLDgygD2g

“Combo” Bridges



Lightning Bar Adjustable

If you go this route, use the link below - fill in the scale, etc... and scroll to the bottom of the page for their recomendations.

i.e. - 24.625 scale - 22 fret - electric guitar

“Combo Bridge/Tailpieces

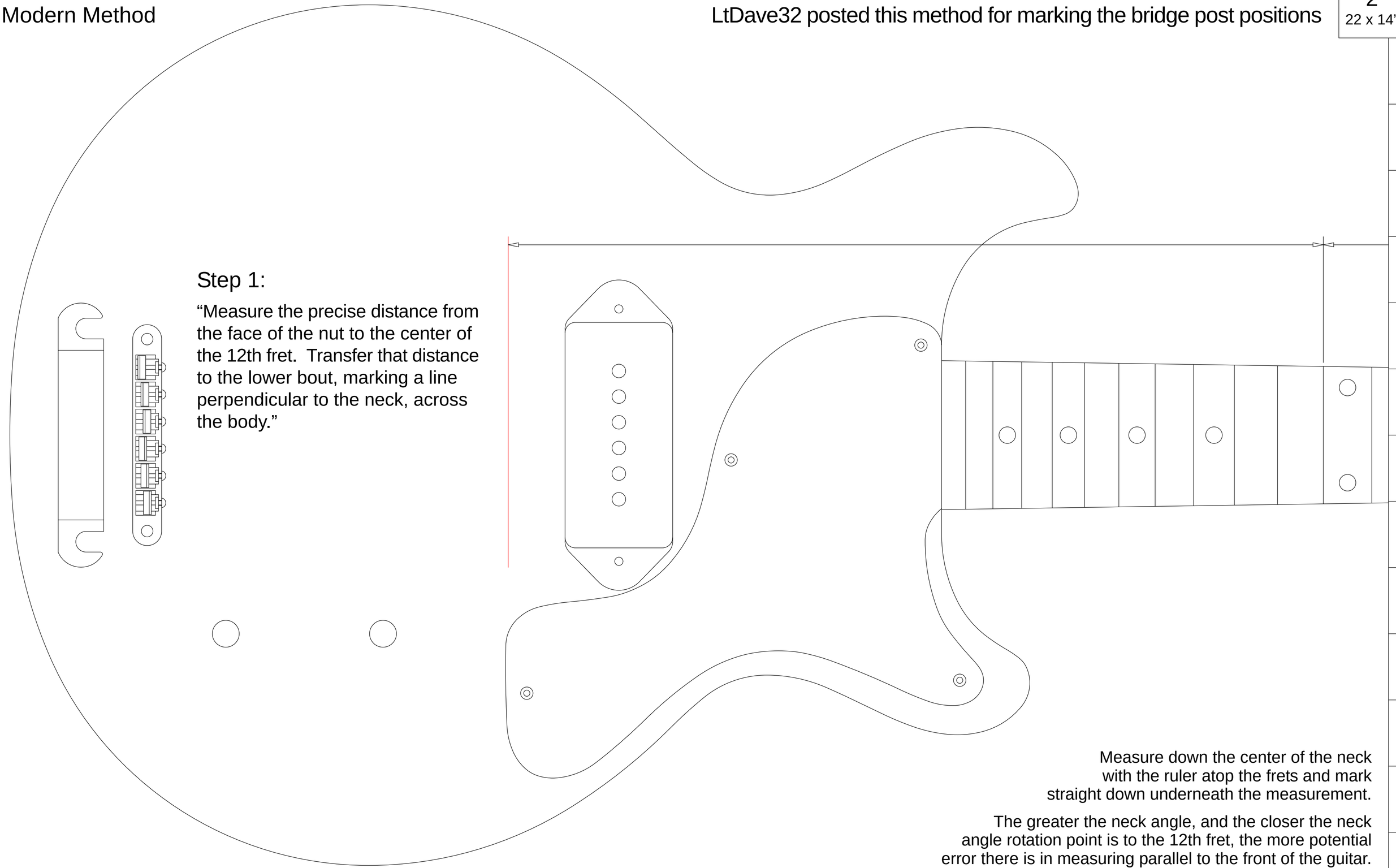
24.685" (± 0.030") from nut to center of treble-side post. Mount bass-side post 1/16"-1/8" further from the nut.”

We’re left to assume it should be centered?

Stewmac Fret Calculator

A Modern Method

LtDave32 posted this method for marking the bridge post positions

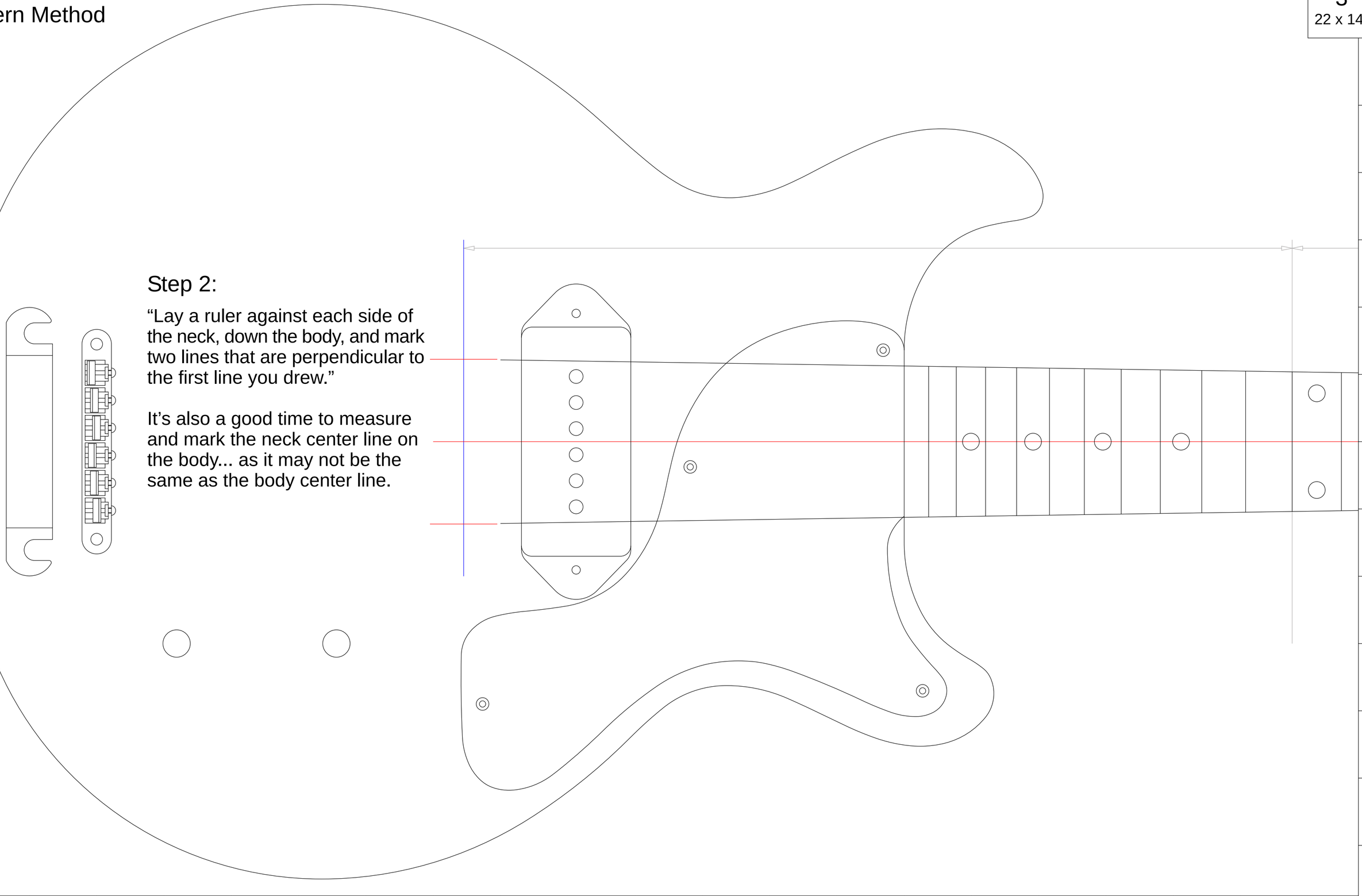


Step 1:

“Measure the precise distance from the face of the nut to the center of the 12th fret. Transfer that distance to the lower bout, marking a line perpendicular to the neck, across the body.”

Measure down the center of the neck with the ruler atop the frets and mark straight down underneath the measurement.

The greater the neck angle, and the closer the neck angle rotation point is to the 12th fret, the more potential error there is in measuring parallel to the front of the guitar.

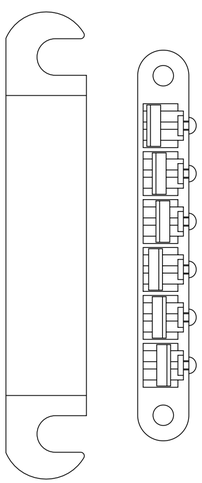


Step 2:

“Lay a ruler against each side of the neck, down the body, and mark two lines that are perpendicular to the first line you drew.”

It’s also a good time to measure and mark the neck center line on the body... as it may not be the same as the body center line.

A Modern Method



Step 3:

from the bass side intersection,
measure 5/32” away from the neck.

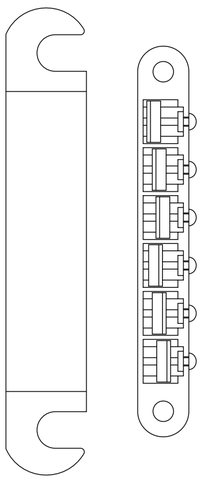
0.15625

from the treble side intersection,
measure 1/16” away from the neck.

0.0625

draw a line through these two points.

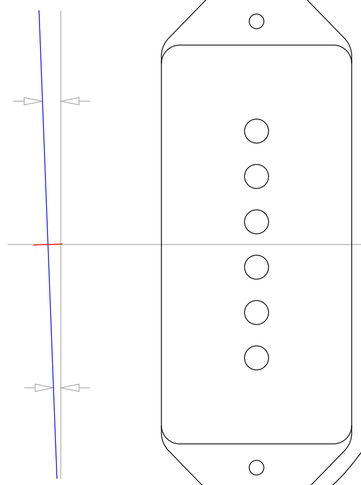
this is the bridge line.

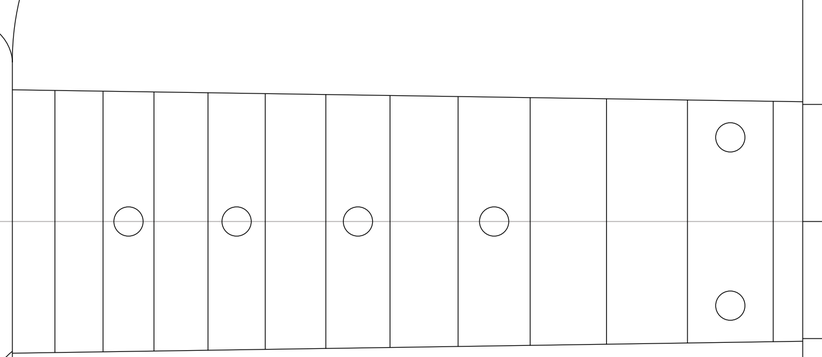


Step 4:

measure and mark the center of your bridge line.

Though, in this case, the center is on the neck center line

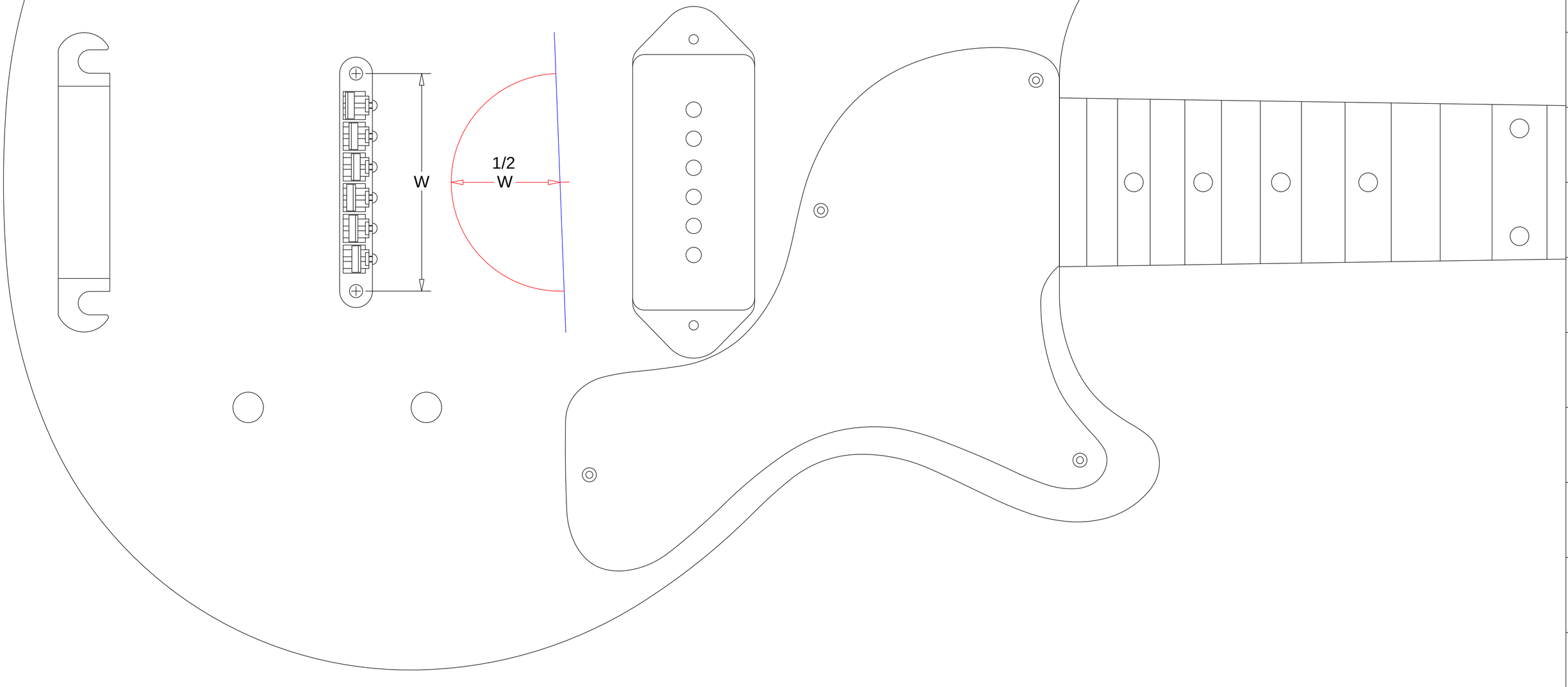




Tune-o-matic

Step 5 for Tune-o-matic style bridges:

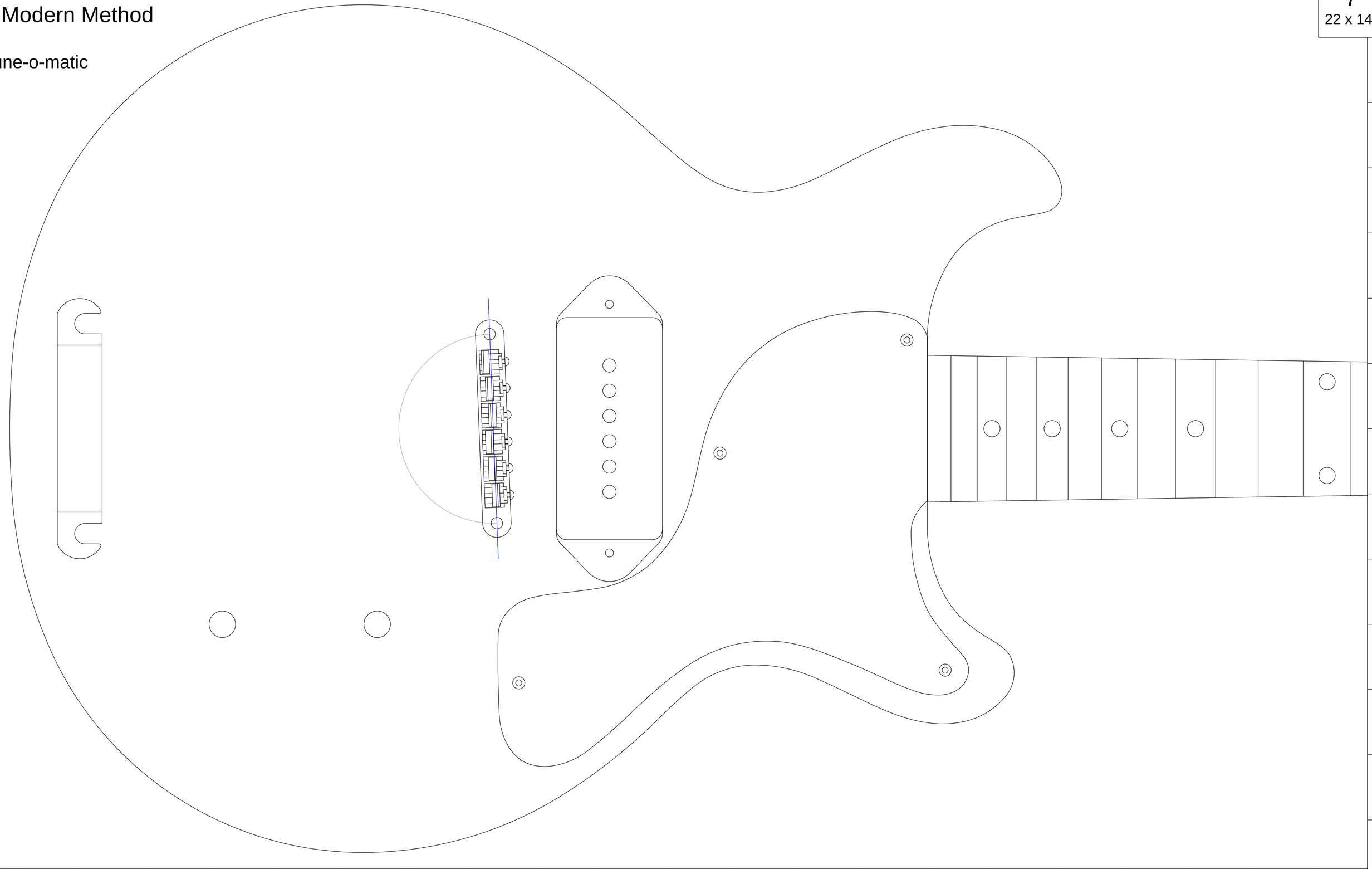
Measure the post spacing on the bridge and transfer that to the bridge line from the center point.



A Modern Method

Tune-o-matic

7
22 x 14”



A Modern Method

See Speadsheet - Adjusting for Intonation

Tune-o-matic

Angle = 2.19°

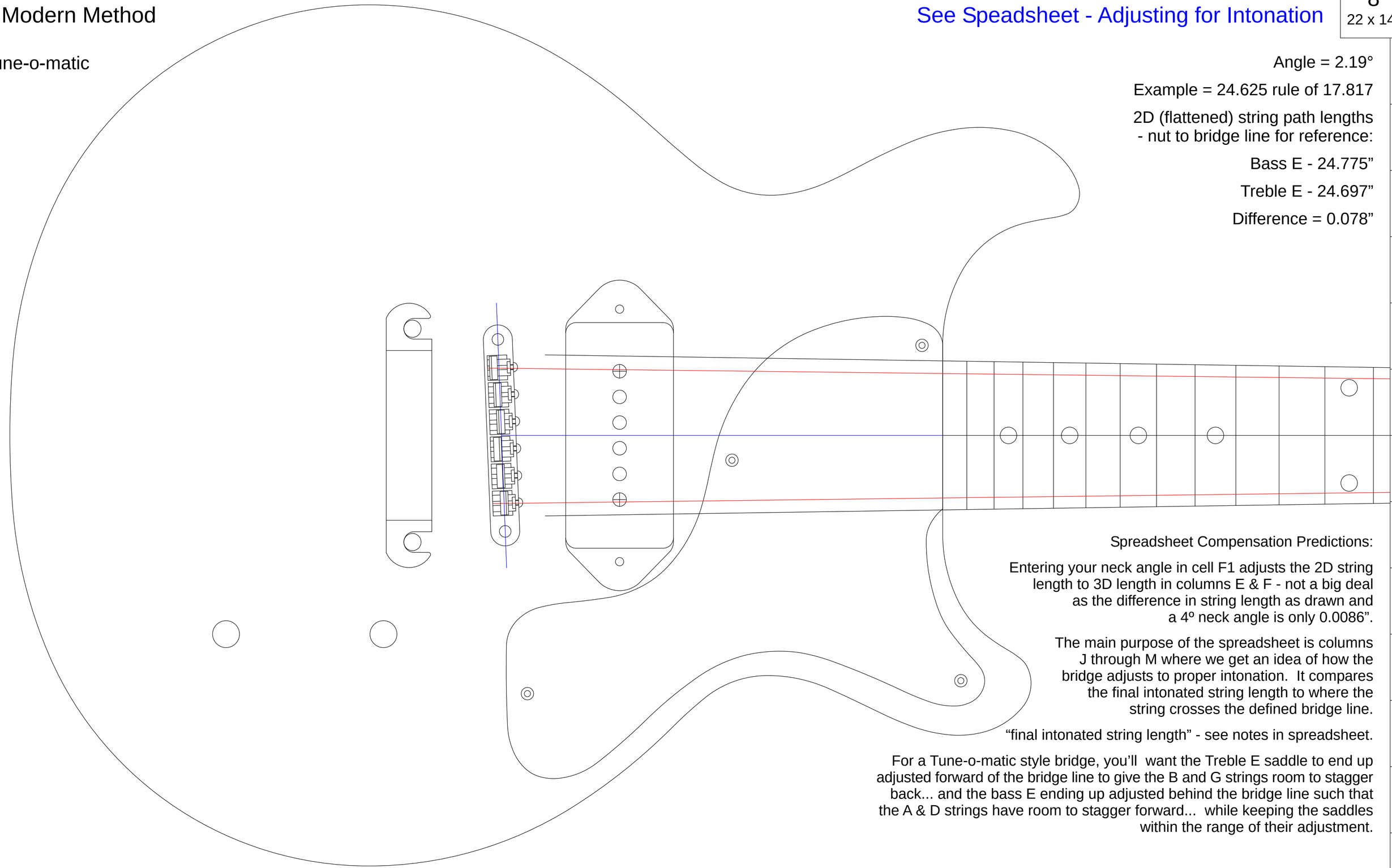
Example = 24.625 rule of 17.817

2D (flattened) string path lengths - nut to bridge line for reference:

Bass E - 24.775”

Treble E - 24.697”

Difference = 0.078”



Spreadsheet Compensation Predictions:

Entering your neck angle in cell F1 adjusts the 2D string length to 3D length in columns E & F - not a big deal as the difference in string length as drawn and a 4º neck angle is only 0.0086”.

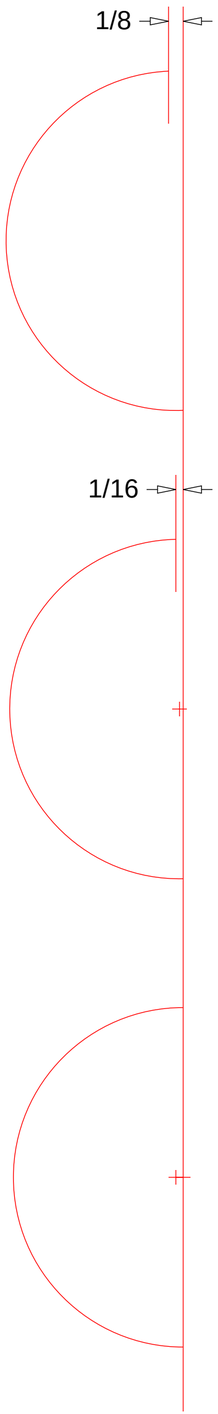
The main purpose of the spreadsheet is columns J through M where we get an idea of how the bridge adjusts to proper intonation. It compares the final intonated string length to where the string crosses the defined bridge line.

“final intonated string length” - see notes in spreadsheet.

For a Tune-o-matic style bridge, you’ll want the Treble E saddle to end up adjusted forward of the bridge line to give the B and G strings room to stagger back... and the bass E ending up adjusted behind the bridge line such that the A & D strings have room to stagger forward... while keeping the saddles within the range of their adjustment.

Stewmac’s recommendation for T-o-m style bridge for 24.625 relative scale:
“24.685" (± 0.030") from nut to center of treble-side post.
Mount bass-side post 1/16"-1/8" further from the nut.”

http://www.stewmac.com/FretCalculator



See Speadsheet - Adjusting for Intonation

24.685 - 24.625 = 0.060 back for treble E
24.810 - 24.625 = 0.185 back for bass E

Angle = 2.47°

Example = 24.625 rule of 17.817

2D (flattened) string path lengths -
nut to bridge line as a reference:

Bass E - 24.793”

Treble E - 24.705”

Difference: 0.088

24.685 - 24.625 = 0.060 back for treble E
24.7475 - 24.625 = 0.1225 back for bass E

Angle = 1.24°

Example = 24.625 rule of 17.817

2D (flattened) string path lengths -
nut to bridge line as a reference:

Bass E - 24.740”

Treble E - 24.969”

Difference: 0.044

Angle = 0°

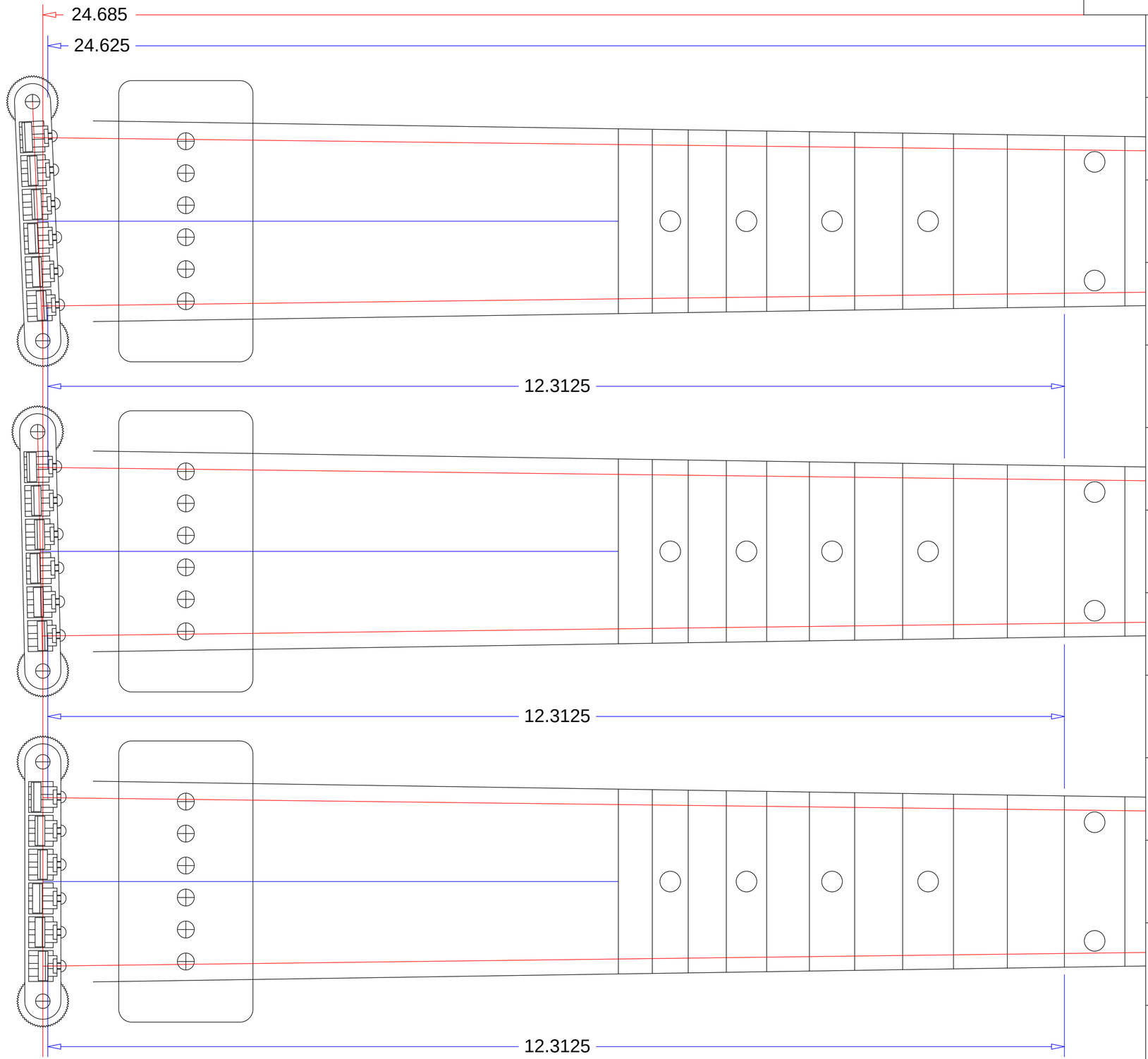
Example = 24.625 rule of 17.817

2D (flattened) string path lengths -
nut to bridge line as a reference:

Treble E - 24.687”

Bass E - 24.687”

Difference: 0



Modified Method

Tune-o-matic

Using the mm side of the ruler:

Step 3 values:

2mm = 0.078740157480315”

5mm = 0.196850393700787”
(or something like that)

ref: 5/64ths = 0.078125

See Speadsheet - Adjusting for Intonation

Angle = 2.75°

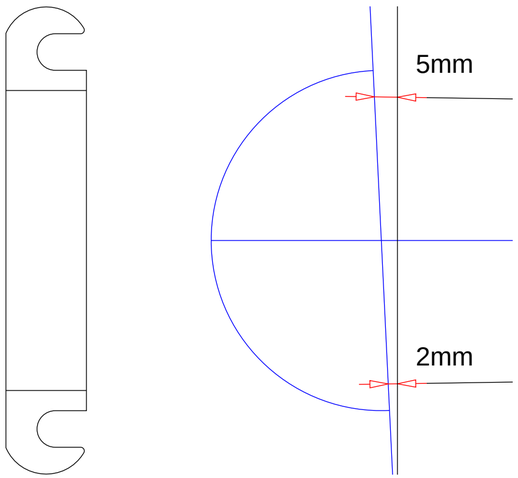
Example = 24.625 rule of 17.817

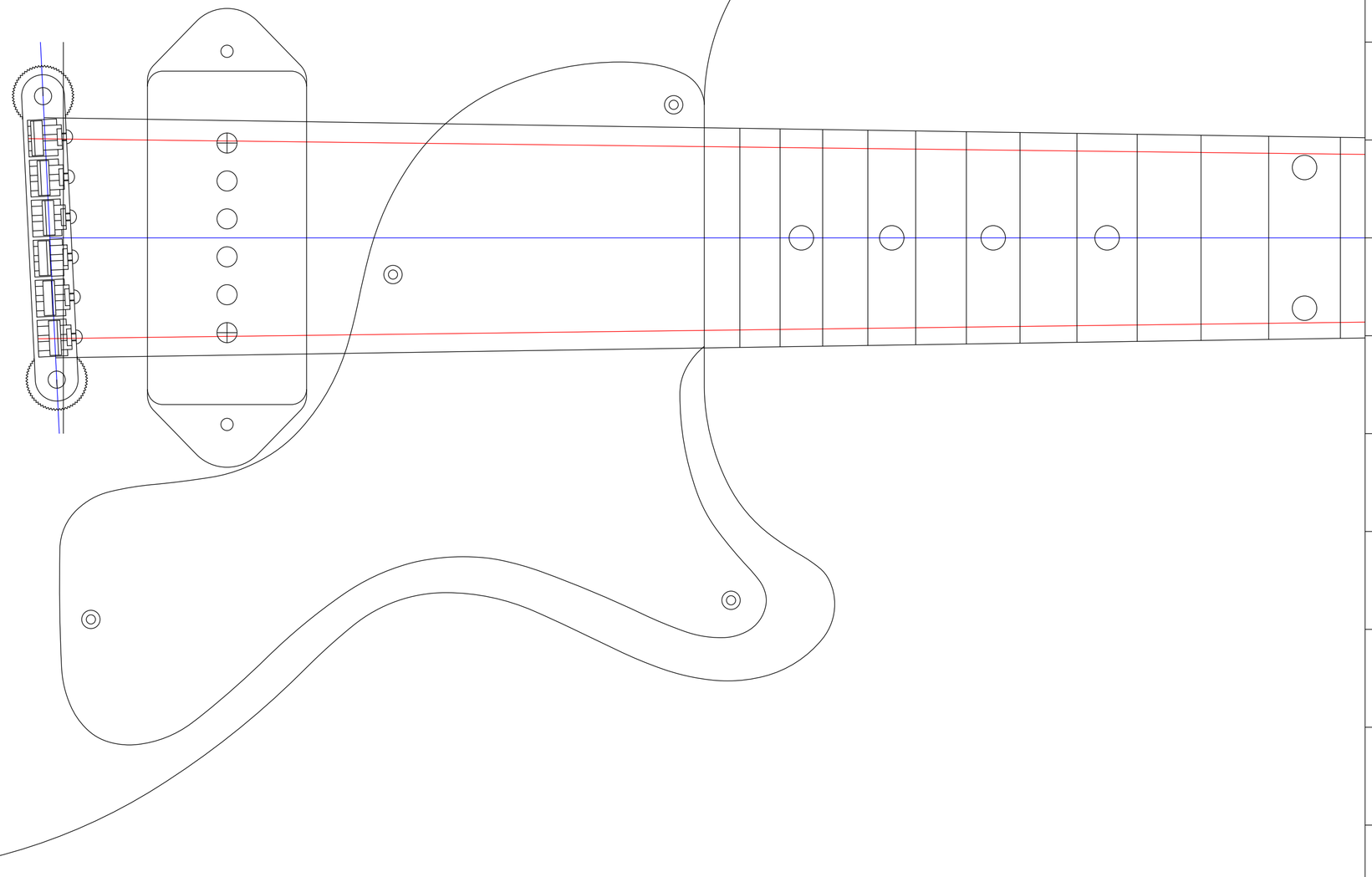
2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.715”

Treble E - 24.813”

Difference = 0.098”

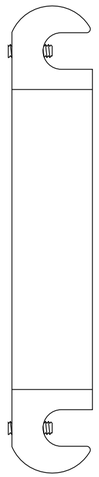


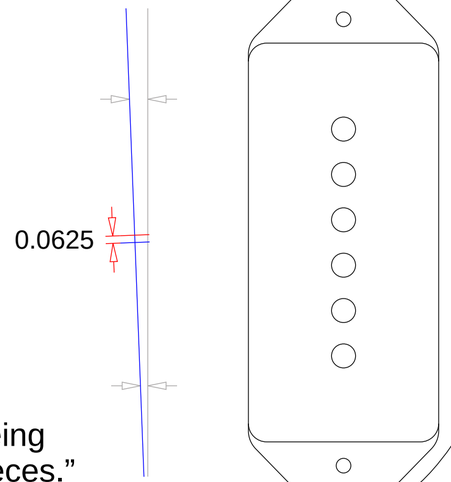


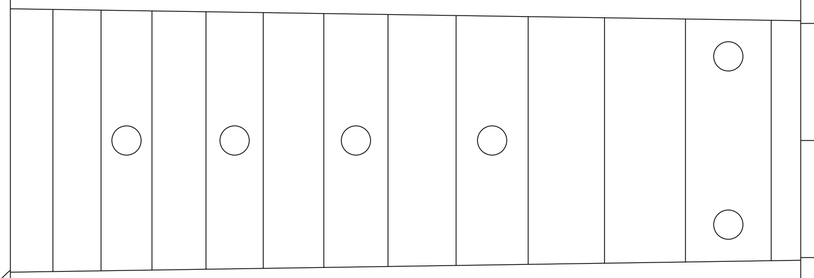
Stop Tail Bridge

Step 5: for Stop Tail bridges

Move the center of the bridge 1/16” toward the bass side.



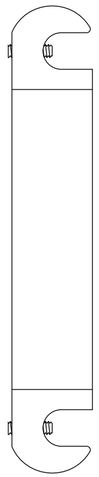




“This will result in the strings being perfectly aligned over the pole pieces.”

A Modern Method

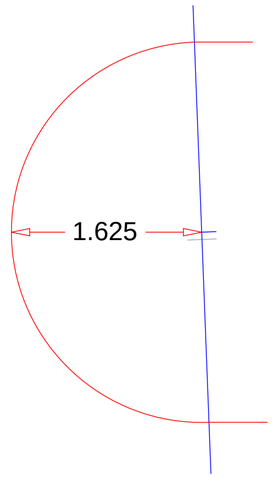
Stop Tail Bridge

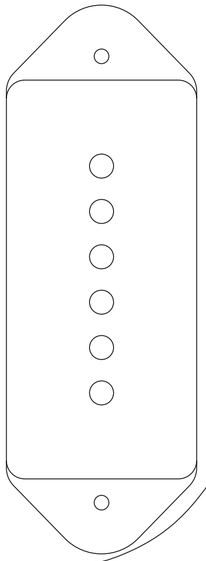


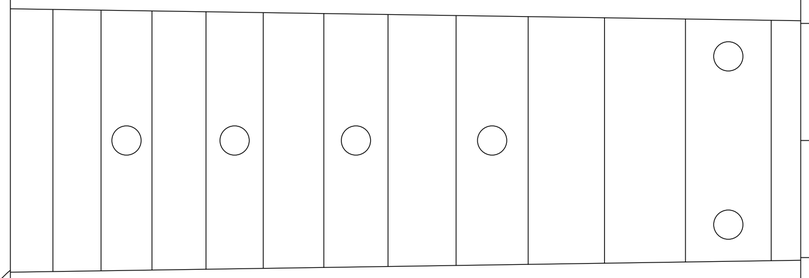
Step 6:

Mark the post spacing on the bridge line from the compensated center

3.25” spacing shown... see “how’s it hangin’?” on page 14.

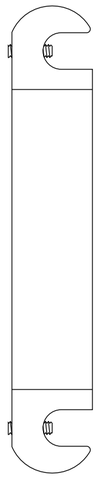






A Modern Method

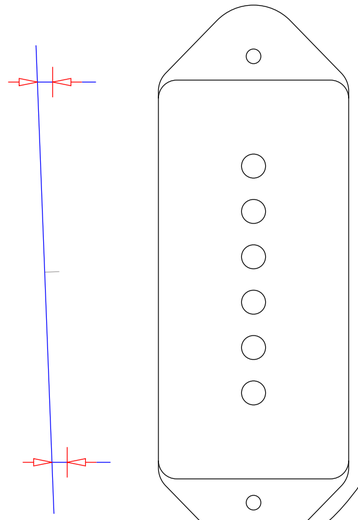
Stop Tail Bridge



Step 7:

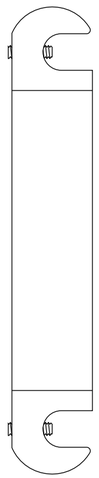
Measure the diameter of the stud at the point where the bridge makes contact. Divide by 2 for the radius and mark that distance toward the neck.

“This is where the drill point goes.”



A Modern Method

Stop Tail Bridge

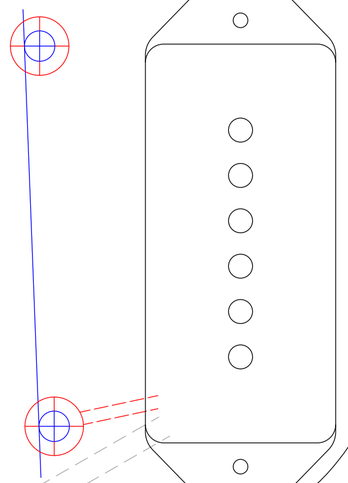


Step 8:

drill for your bushings

ps - don’t forget to also drill the hole for the ground wire

pss - don’t forget the wire before pressing in the bushings



A Modern Method

See Speadsheet - Adjusting for Intonation

Stop Tail Bridge

Angle = 2.19°

Post Spacing = 3.25
Post D = 0.260 Post R = 0.130

Alignment Compensation = 0.0625
shift toward bass along bridge line

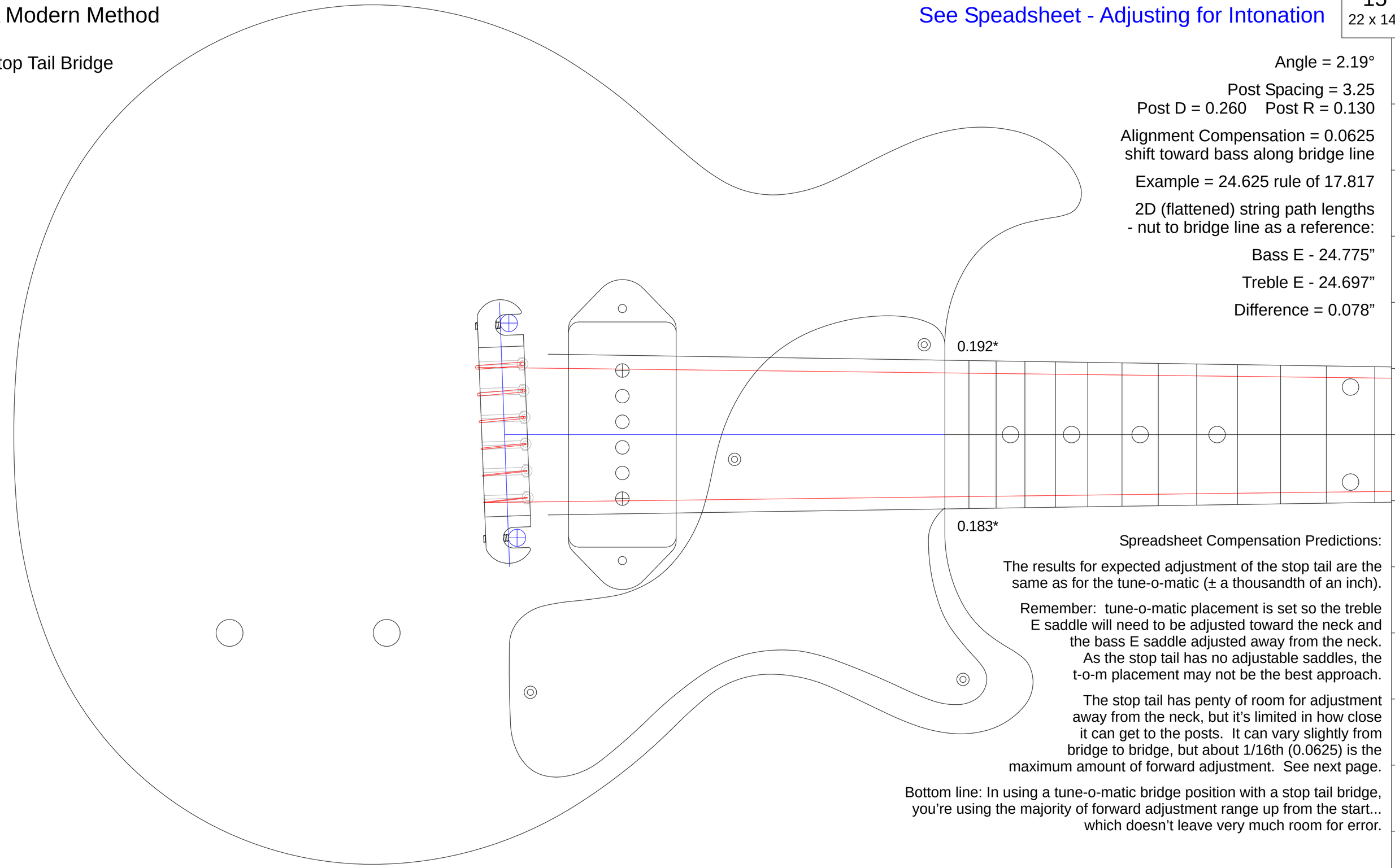
Example = 24.625 rule of 17.817

2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.775”

Treble E - 24.697”

Difference = 0.078”



Spreadsheet Compensation Predictions:

The results for expected adjustment of the stop tail are the same as for the tune-o-matic (± a thousandth of an inch).

Remember: tune-o-matic placement is set so the treble E saddle will need to be adjusted toward the neck and the bass E saddle adjusted away from the neck. As the stop tail has no adjustable saddles, the t-o-m placement may not be the best approach.

The stop tail has penty of room for adjustment away from the neck, but it’s limited in how close it can get to the posts. It can vary slightly from bridge to bridge, but about 1/16th (0.0625) is the maximum amount of forward adjustment. See next page.

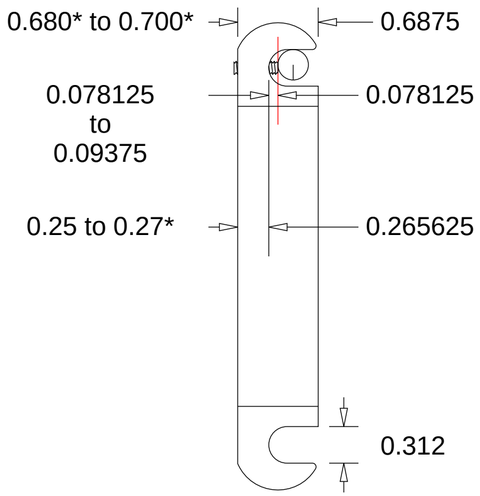
Bottom line: In using a tune-o-matic bridge position with a stop tail bridge, you’re using the majority of forward adjustment range up from the start... which doesn’t leave very much room for error.

Stop Tail Basics

Drilling Down

variation

example bridge

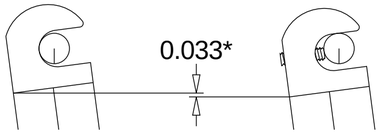


When the bridge is placed with the back of the ears on the bridge line, our example bridge will need to be adjusted out 7/64ths for the center of the bridge (the break point) to be on the bridge line. (possibly a 64th more - depending on the individual bridge)

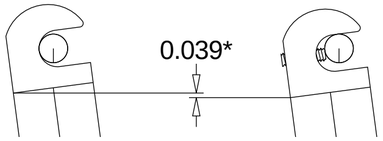
Having perfect intonation with the radiused back of the bridge ears (hooks) flush to the posts is not a very realistic (or even desirable) goal.

It’s better to have the posts set forward of where the bridge will intonate to avoid a noticeable shift in string alignment. When the bridge is adjusted out, the pull of the strings shifts the bridge down (strings and all) such that the outside of the bass ear (instead of the radiused back) is resting against the post .

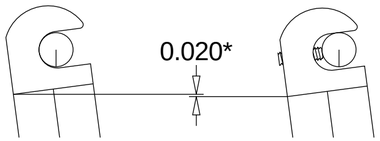
Post Diameter



0.26 D - 0.13 R - Vintage



0.245 D - 0.1225 R - Tonepros Locking



0.291 D - 0.1455 R - stewmac’s current metric set

With distance from the nut and/or 12th fret under control, let’s go crazy with string alignment.

How much the bridge shifts down depends on the diameter of the posts... as illustrated above.

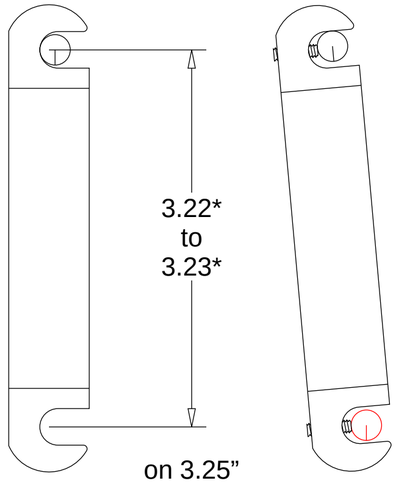
Except where noted, a vintage 0.260 diameter is used in all example drawings.

Smaller Radius - allows the bridge to shift more toward treble - potential need to compensate more toward bass when marking bridge post locations.

Larger Radius - bridge shifts less toward treble - potential need to compensate less toward bass

One might suspect that the larger diameter posts are meant for bridges set at a lesser angle...

How’s it Hangin’?



on 3.25”
post spacing

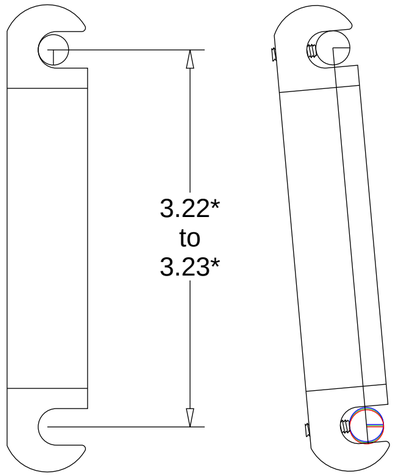
For posts up to, say 0.275 D, the body is drilled so that the inserts (and therefore the posts / studs) are 3.25” apart center to center eventhough the ears on the bridge are generally slightly less than that... 3.22 to 3.23.

If the ears were also 3.25” center to center...
and If you could drill holes exactly 3.2500” apart...
and If cross grain wood was as dimensionally stable as metal, then the bridge could very well bind on the posts if one of the sides (i.e. - the treble post) needs to be adjusted out more than the other .

see trouble free treble post in red above.

For posts approaching 0.2825 D (and larger), it’s a different story...

Hanging from a Thicker Branch



The 0.291 D post with bridge ears spaced 3.22...

if you zoom in on the treble post, the red is spaced 3.25 from the bass post.

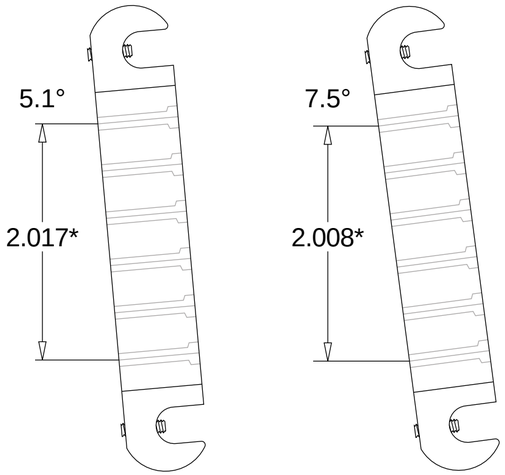
the green - spaced 3.24

the blue - spaced 3.23

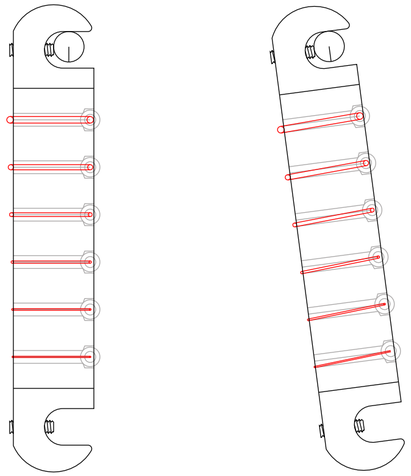
As mentioned previously, one gets the impression that the larger diameter posts are meant for bridges like the lightning bar or adjustable “combo” bridge (as stewmac calls it) where the bridge is set either square to the neck, or at a very slight angle. In such an application, the smaller shift of the larger diameter posts, the eveness of set screw adjustment and the notching of saddles makes the need to compensate toward the bass less of an issue.

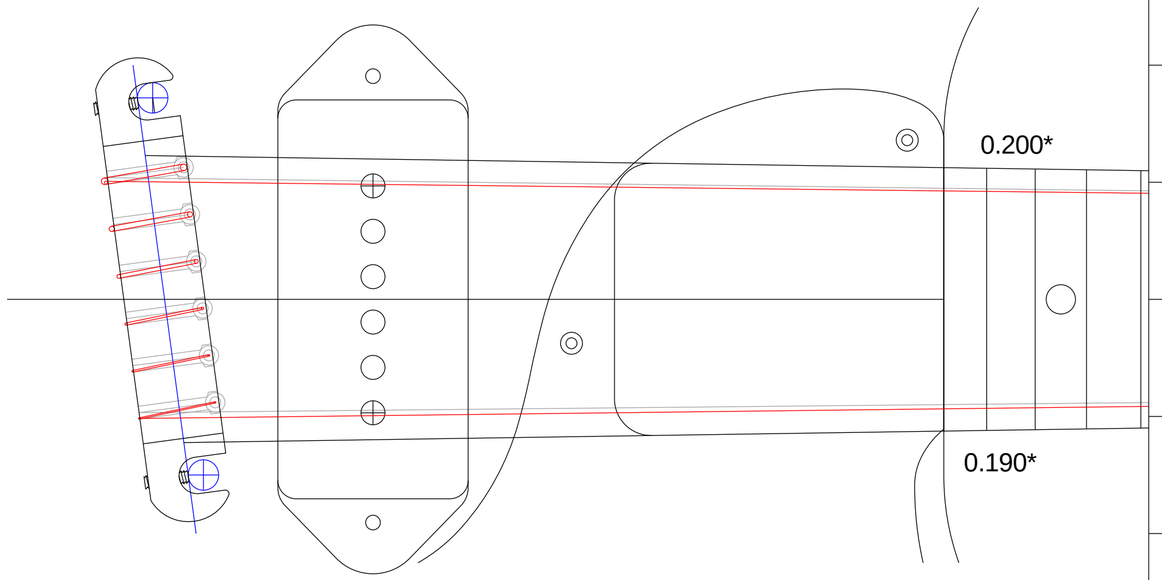
Pulling Strings

2.025 String Hole Spacing



String Alignment





When focussing on string alignment, it’s easy to get caught up in how they align over the poles... but make no mistake, it’s about the neck.

It’s always about the neck... in this case, how the strings align with the sides of the neck.

Depending on the design, the pickup route may have some room to shift the pickup for better pole alignment. If you’re designing yourself, bridge first - then pickup route.

When perfection is unobtainable, best to err on the side of having the high E closest to the center of its pole... the higher strings having less mass / metal to dissrupt the magnetic field.

Neck 1st... then poles.

Through holes... the angle pulls the strings until they’re resting on the treble side of the hole on exit.

The larger in diameter the hole, the more the strings will angle. Holes that are effectively widened at the exit by drilling and/or groove allow even more angle before the strings bend up and over the top.

pic posted by danelectro showing variation

if I’m not mistaken, Dan’s compensated bridge most closely resembles the pigtail in this regard.

Other bridges will vary.

The example bridge drawn here has through holes that are 7/64ths (0.109375) in diameter... no counter drilling or groove on exit. As such, it shows only a conservative amount of shift.

Gray line runs from the center of the exit to the nut

Red line is the center of a conservatively shifted string running to the nut. (centers of 0.011 - 0.056)

Of course, the low E is thicker than the high E, so the alignment should slightly favor the treble side of the board... suited to one’s own taste.

The following pages show a few ways to mark the positions of where to drill for the specific bushings and posts you’ll use. Compensation for string shift is included. That compensation may or may not be exaclty the best amount for the bridge you’ll use.

Before drilling to those marks, you may well want to run some string though the bridge and down the length of the neck to see how things line up while you position the bridge to the marks.

If you’re fanatical about it (I plead the 5th)... you could mock it up on a 2x6, drill and see if any alignment adjustments are called for. Plugging and redrilling expensive mahogany is disheartening, to say the least. Pencils and 2x6s are cheap. Pulling the bushings out of soft wood isn’t a problem.

Modified Method

Stop Tail Bridge optimized

~ as on page 13 ~

The method shown on pages 2 to 12 is optimized for tune-o-matic bridges

To adapt it to a stop tail bridge,

change Step 3:

Bass - 7/32nds away from neck

Treble - 1/32nd away from neck

change Step 5:

Compensate string alignment by shifting center 3/32nds up

See Speadsheet - Adjusting for Intonation

Angle = 4.38°

Post Spacing = 3.25
Post D = 0.260 Post R = 0.130

Alignment Compensation = 0.09375
shift toward bass along bridge line

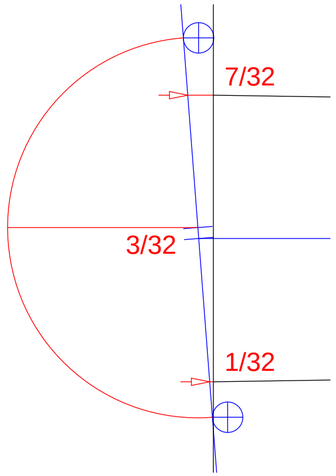
Example = 24.625 rule of 17.817

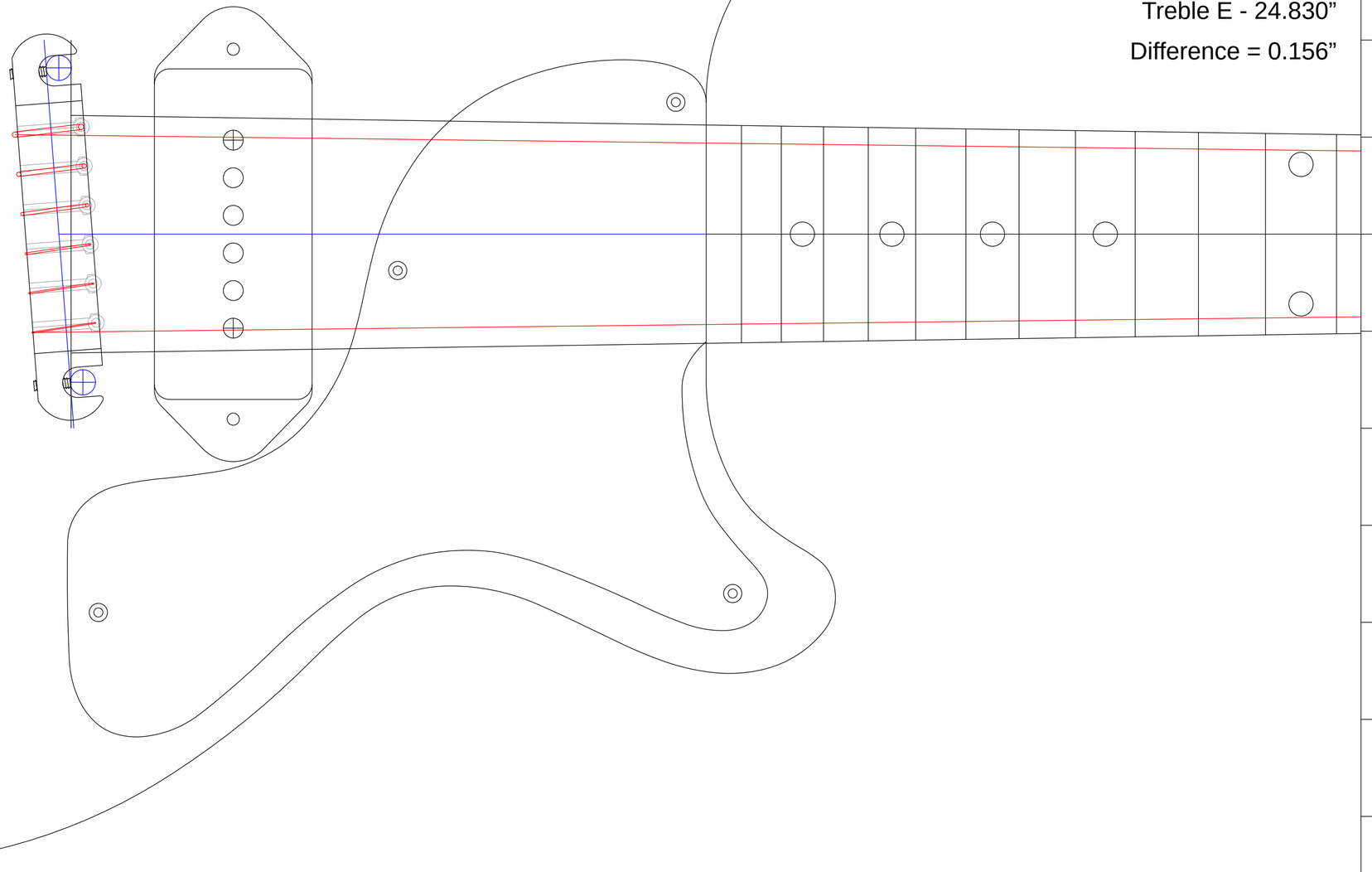
2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.674”

Treble E - 24.830”

Difference = 0.156”





Modified Method

Stop Tail Bridge
optimized
Metric

See Speadsheet - Adjusting for Intonation

Angle = 4.13°

Post Spacing = 3.25
Post D = 0.260 Post R = 0.130

Alignment Compensation = 0.098”
shift toward bass along bridge line

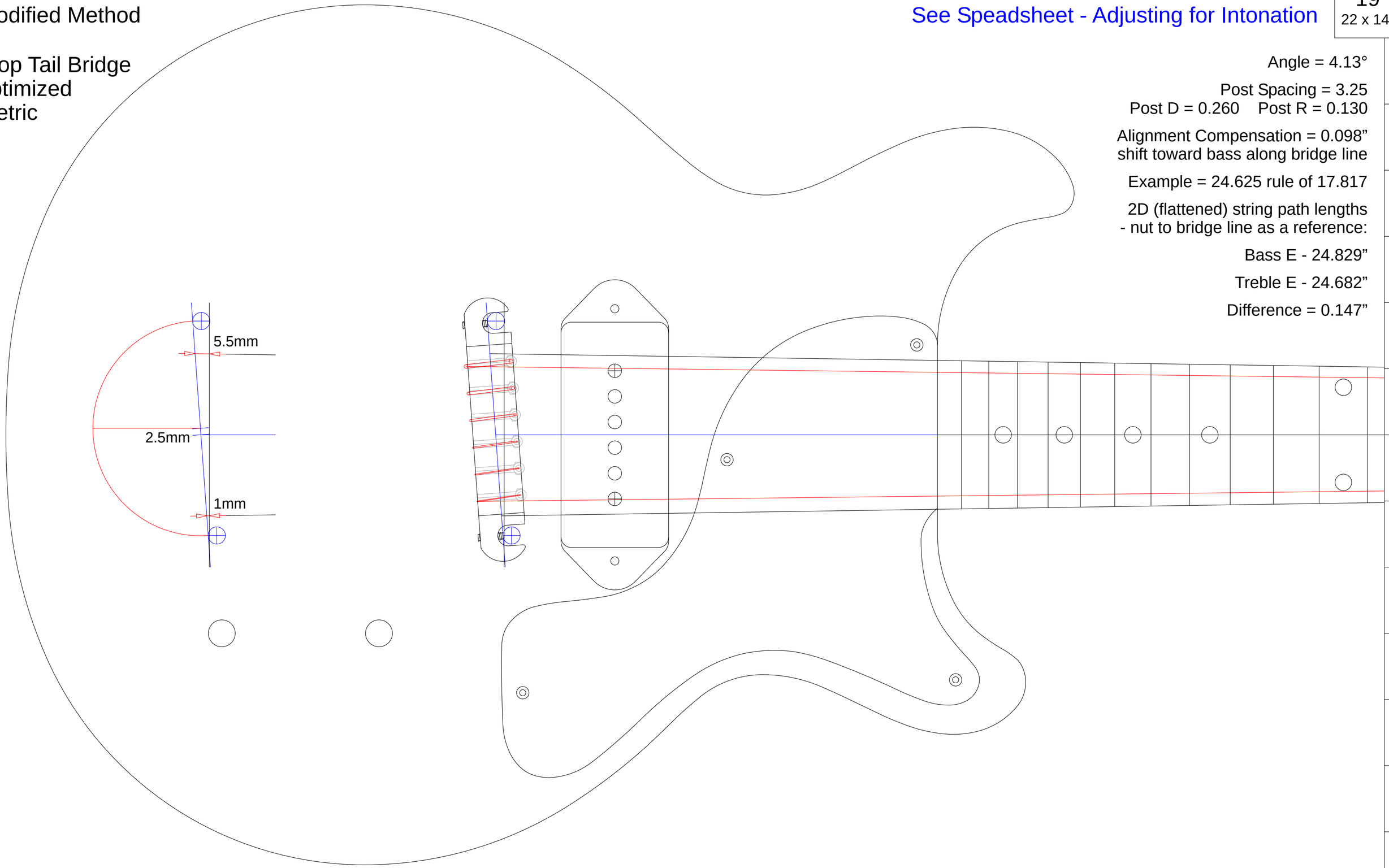
Example = 24.625 rule of 17.817

2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.829”

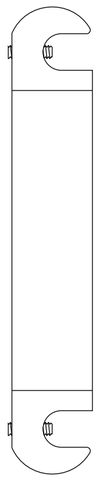
Treble E - 24.682”

Difference = 0.147”



Danelectro measured a 55 Single Cut Junior

20
22 x 14”

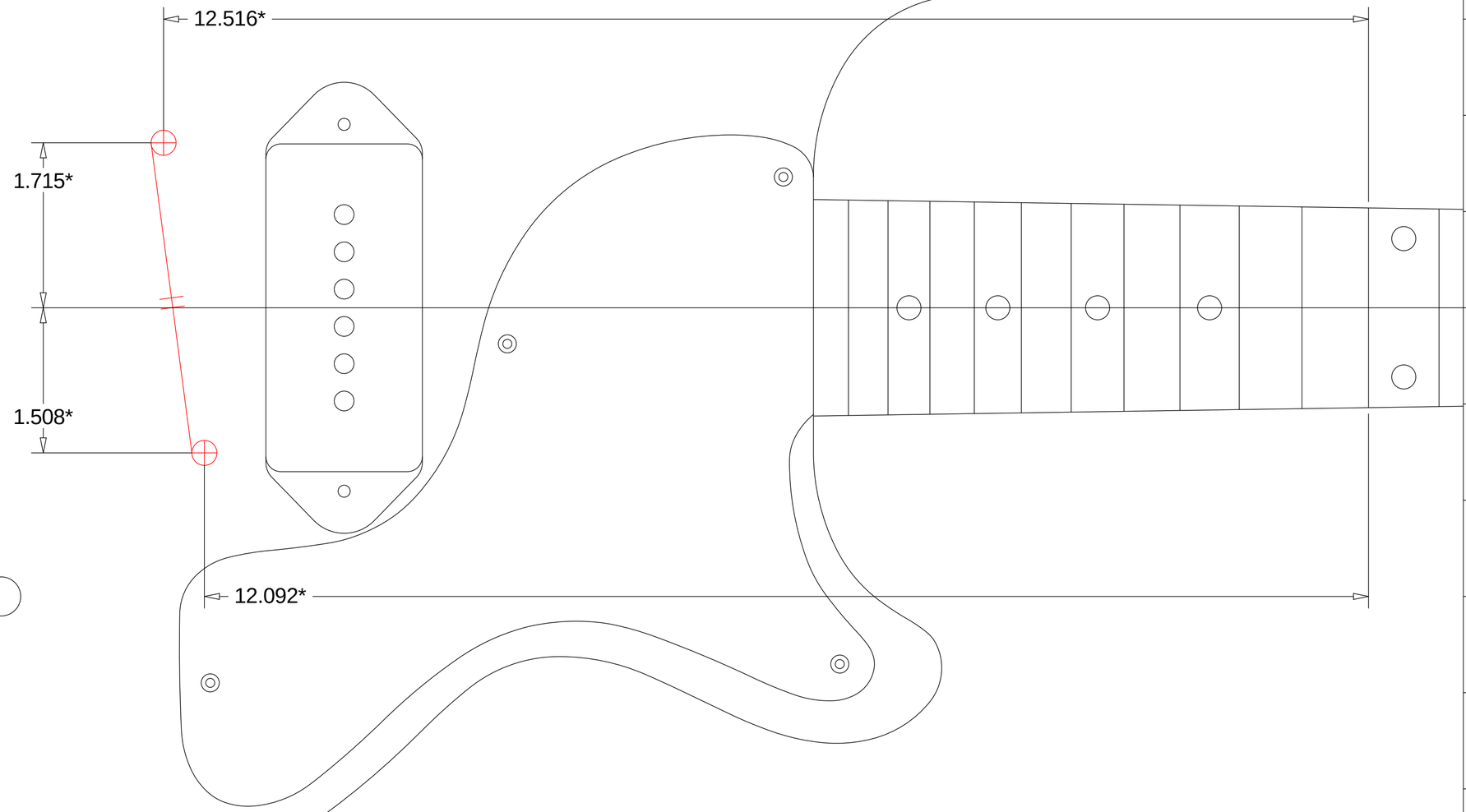


Vintage 50s placement

Angle = 7.49°

Post Spacing = 3.25
Post D = 0.260
Post R = 0.130

Alignment Compensation:
0.102 shift toward bass on bridge line



http://www.lespaulforum.com/forum/showthread.php?t=164035

The Vintage Stop Tail Puzzle

As a puzzle, it’s a good one to get you thinking in terms you may not be accustomed.

The jig (linked above) positions the bushings / studs in relation to / referencing the inside of the nut.

For convenience, Dan gave the measurements referencing the center of the 12th fret ...that he measured as 12.312 from the inside of the nut.

Because the modern Rule of 17.817 method of fret calculation places the 12th fret at exactly half the scale length, most people will mistakenly assume that the fret scale of this 55 Junior was calculated as 24.625 ...twice the nut to 12th fret distance.

At this point, an important distinction needs to be made between Base Scale and Relative Scale.

Base Scale is used to calculate fret positions.

Relative Scale is a direct result of the method used to calculate the fret positions. It’s twice the distance of the distance between the inside of the nut and the center of the 12th fret.

As mentioned above, the modern Rule of 17.817 method of calculating fret positions places the 12th fret at exactly half of the Base Scale, so the Base and Relative scales are identical.

When calculating fret positions by the older Rule of 18 method, the position of the 12th fret is not exaclty half of the Base Scale. It will have a Relative Scale slightly shorter than its Base Scale.

Using a 24.75 Base Scale to calculate fret positions by the older Rule of 18 method, we find that the 12th fret is positioned 12.285” from the inside of the nut... a Relative Scale of 24.57”.

Gibson claims they use a 24.75” scale.

But Dan measured the 12th fret of the 55 SC Junior as 12.312 from the inside of the nut (which I don’t doubt for a second), giving it a relative scale length of 24.624... not the 24.57 we would expect of a 24.75 Base scale calculated by the Rule of 18.

Precise fret measurements of later guitars (58 - 60 LP bursts and juniors) do conform to a Base scale of 24.75 - Rule of 18 - Relative scale of 24.57. (see far right of scale tab of spread sheet linked)

So what’s going on?

David Collins has spent a good deal of time researching the Base and Relative scales and shares what he’s found in his posts in this thread.

If we glean anything from Mr Collins, it’s that they used the rule of 18 to calculate fret positions... and that the 12th fret positions (and therefore relative scale) varied.

As a side note: if you use 24 -13/16ths (24.8125) as the Base scale for fret calculation with the Rule of 18, the 12th fret is 12.316 from the nut... which makes it just as easy to assume the measurement of 12.312 indicates a 24.8125 Rule of 18 scale as it is to assume it’s 24.625 Rule of 17.817 scale.

The only constant seems to be the position of the bridge... which, on good authority (Dan), did not change from the time it was introduced until the early 60s when it was replaced.

That could well be how Gibson defined their scale length... by the distance between nut and the center of the bridge.

(have a quick look at the next 2 pages)

Lost in Translation?

So... if, in fact, they meant 24.75 as the distance between the nut and the center of the bridge, then the base and relative scales could have been whatever. It may be possible that they experimented with a base scale of 24.8125 and used the Rule of 18 to position the frets ...and that the 24.312 relative scale that Dan measured reflects that. Only accurate measurements of all frets would support that theory.

For the purpose here, it just doesn’t matter. We could use the Vintage bridge position / bridge angle with a base scale of 24.8125 or 24.75 with fret positions calculated by the rule of 18... or similar relative scales of 24.625 or 24.5625 calculated by the more modern Rule of 17.817.

We could use that positioning as is... or adjust the position a 16th one way or the other to perhaps better suit a particular relative scale when intonation is considered.

Dan did mention that on the historic reissues, the treble side did not need to be adjusted out as far as it did on the 50s vintage guitars. He quantified that by saying by about a 16th. It could be that they moved the bridge so it didn’t have to be adjusted out so far with modern strings ... or it could be that they’ve settled on the 24.57 relative scale that results from a 24.75 base scale calculated by the rule of 18... a relative scale that’s about a 1/16th shorter than the 24.624 relative scale.

Bottom line: If you like the looks of the vintage angle and / or want to use a vintage looking solid aluminum bridge that compenstates that angle for perfect intonation, its position can be easily marked ...thanks to Dan’s measurements.

Vintage Stop Tail

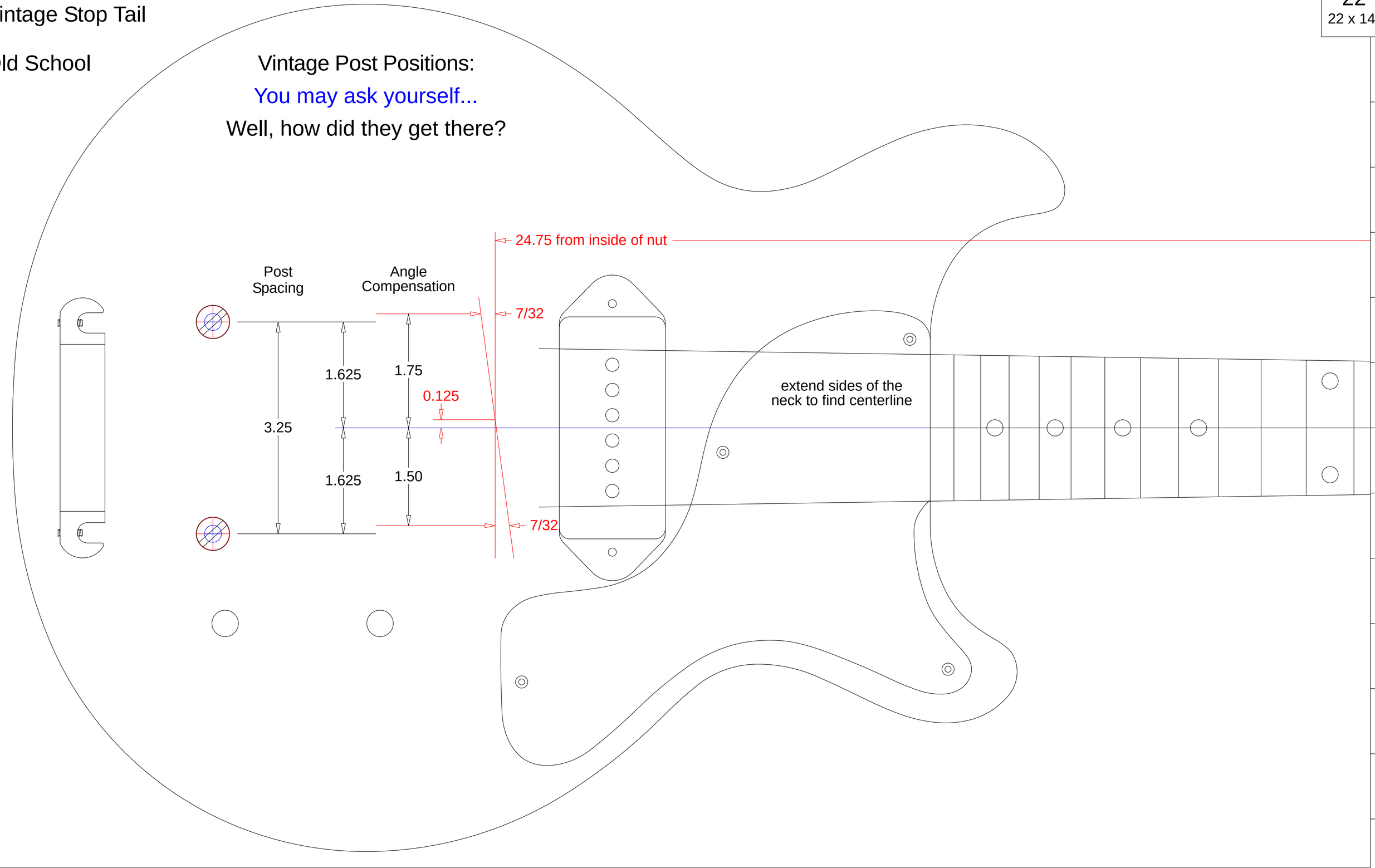
Old School

Vintage Post Positions:

You may ask yourself...

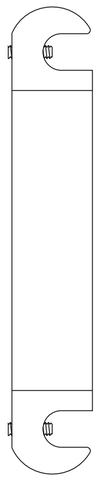
Well, how did they get there?

22
22 x 14”



Vintage Stop Tail

Old School



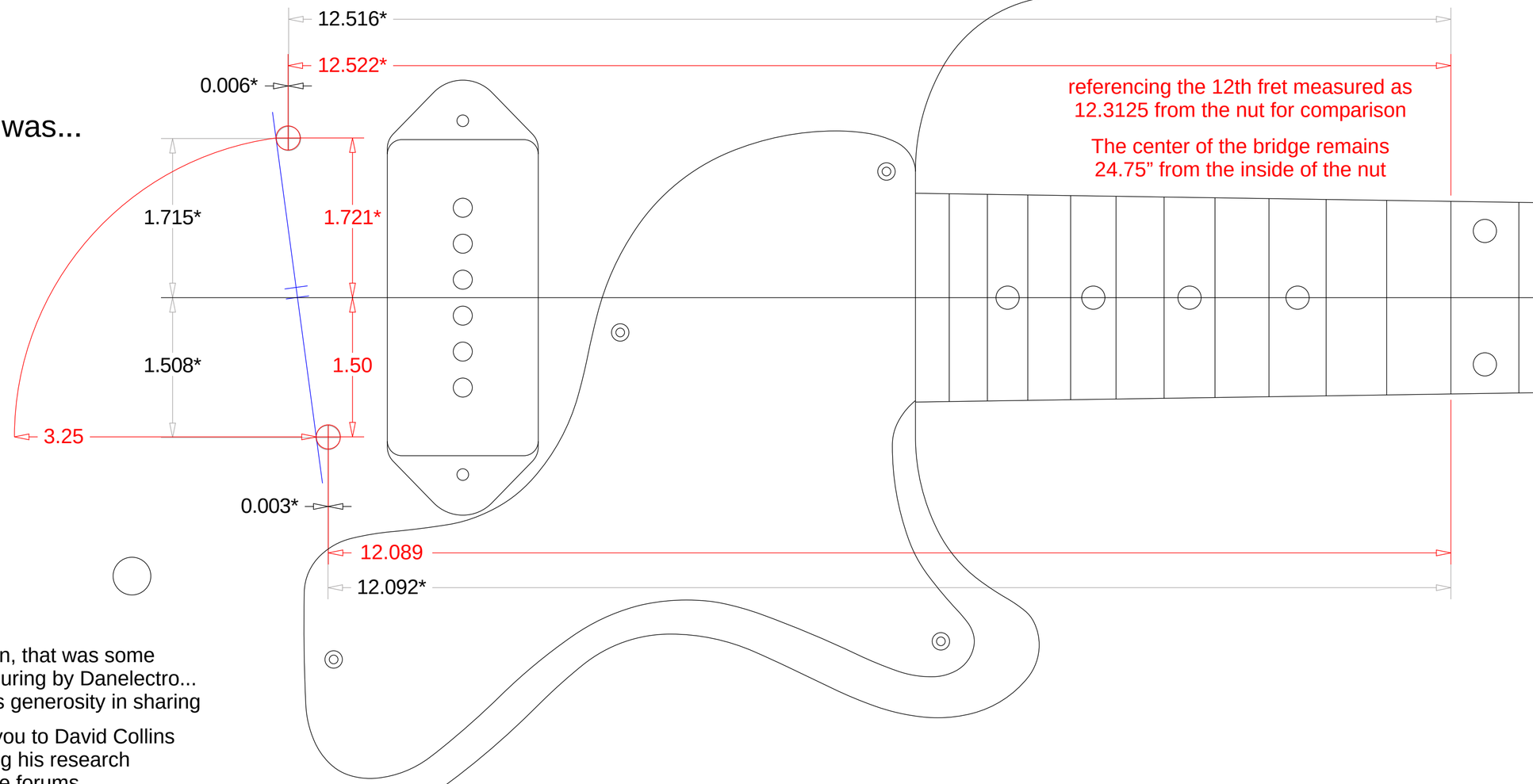
Same as it ever was...

Angle = 7.67°

Post Spacing = 3.25
Post D = 0.260
Post R = 0.130

Compensation:
0.109 shift toward bass
along bridge line

bass post spaced from
fixed treble mark.



in summation, that was some
meticulous measuring by Danelectro...
not to mention his generosity in sharing

also, a thank you to David Collins
for sharing his research
in the forums.

Vintage Stop Tail

Old School

See Speadsheet - Adjusting for Intonation

Angle = 7.67°

Post spacing = 3.25
Post D = 0.260 Post R = 0.130

Alignment Compensation = 0.109
shift toward bass along bridge line

Bridge position independent of fret scale

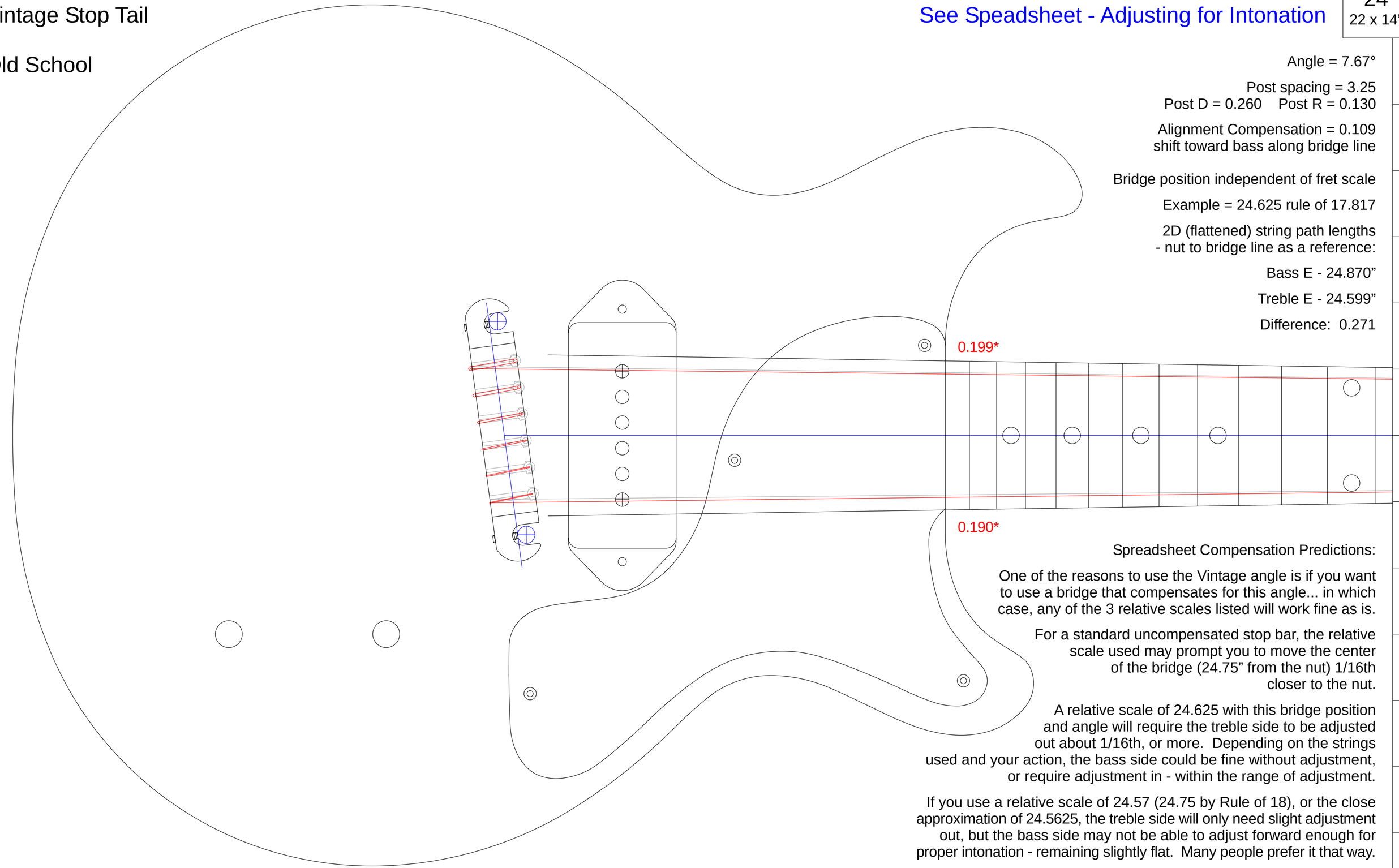
Example = 24.625 rule of 17.817

2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.870”

Treble E - 24.599”

Difference: 0.271



Spreadsheet Compensation Predictions:

One of the reasons to use the Vintage angle is if you want to use a bridge that compensates for this angle... in which case, any of the 3 relative scales listed will work fine as is.

For a standard uncompensated stop bar, the relative scale used may prompt you to move the center of the bridge (24.75” from the nut) 1/16th closer to the nut.

A relative scale of 24.625 with this bridge position and angle will require the treble side to be adjusted out about 1/16th, or more. Depending on the strings used and your action, the bass side could be fine without adjustment, or require adjustment in - within the range of adjustment.

If you use a relative scale of 24.57 (24.75 by Rule of 18), or the close approximation of 24.5625, the treble side will only need slight adjustment out, but the bass side may not be able to adjust forward enough for proper intonation - remaining slightly flat. Many people prefer it that way.

Old School Alternative 1

5/32B 5/32T

See Speadsheet - Adjusting for Intonation

Angle = 5.49°

Post spacing = 3.25
Post D = 0.260 Post R = 0.130

Alignment Compensation = 0.109
shift toward bass along bridge line

Bridge position independent of fret scale

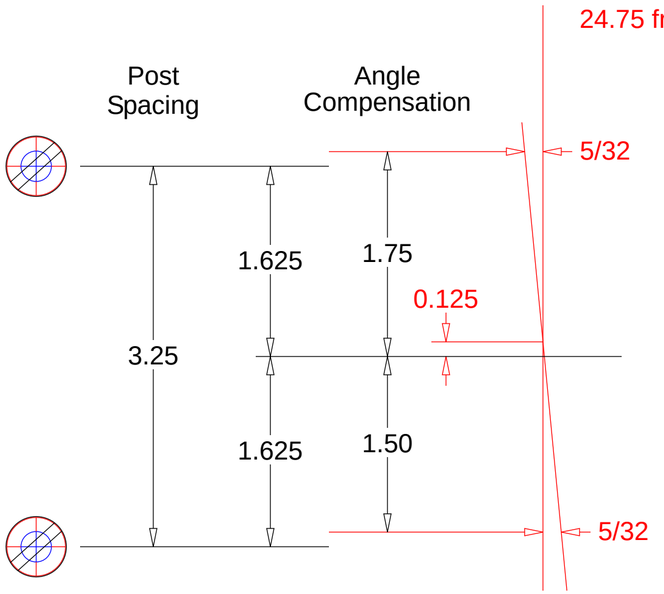
Example = 24.625 rule of 17.817

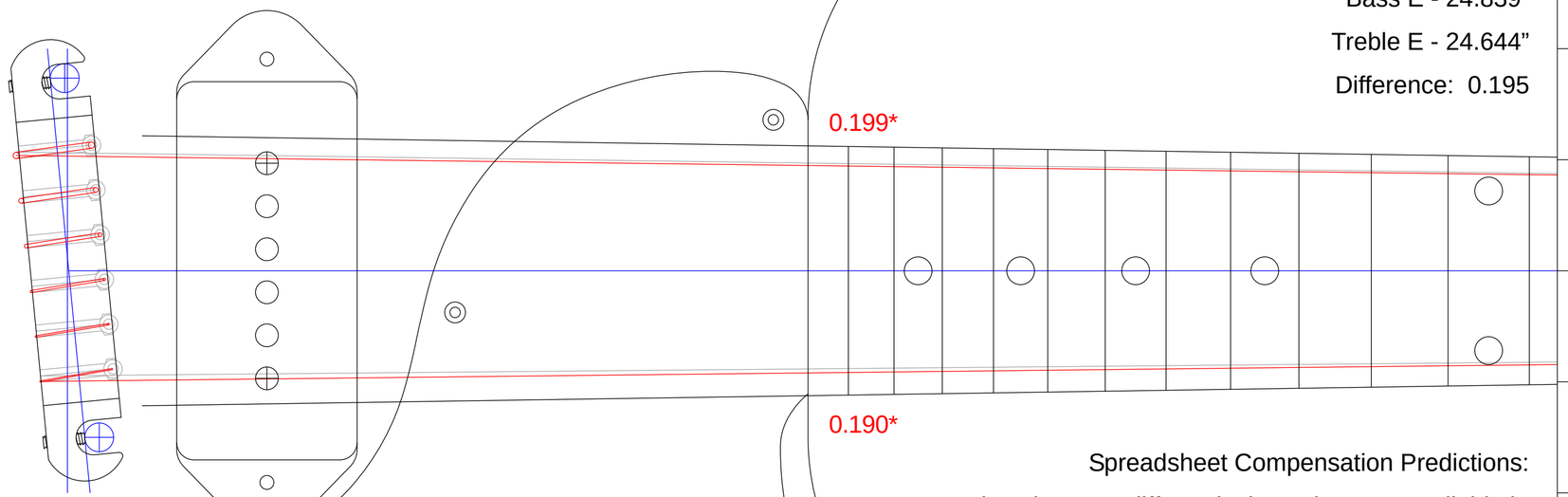
2D (flattened) string path lengths
- nut to bridge line as a reference:

Bass E - 24.839”

Treble E - 24.644”

Difference: 0.195





Spreadsheet Compensation Predictions:

New strings intonate differently than what was available in the 1950s... no surprise there. Dan mentioned that the high (treble) E needed to be adjusted out a 16th more than what may be considered ideal, so let’s consider a position with a 16th difference. In keeping with old school requirement of having the center of the bridge 24.75” from the nut, the treble and bass sides need to be positioned the same amount away from the line... in this case, 5/32nds - a 16th less than the original 7/32nds.

Moving the post back 1/16th makes the treble E string 0.0455” (about 3/64ths) longer from nut to bridge line. The results for the 24.625 relative scale look reasonable for both high and low Es. Remember, if you’re using a 24.5625 or 24.57 relative scale, you can get the same results showing for 24.625 by moving the center of the bridge 0.0625 or 0.055 (respectively) forward. (toward the nut)