Bluestem Strings Beginners Guide To Lap Steel Construction

INTRODUCTION

Thinking of building your first lap steel? Sometimes it can be a little overwhelming to think of gathering all the requisite information necessary to construct a basic instrument, especially if you have no prior experience with musical instrument construction. That's the bad news. The good news is the lap steel is one of the easiest instruments to build, with a basic instrument not much beyond stretching a rubber band over a cigar box and adding a Popsicle bridge. (Remember that first science fair project?) The lap steel in its most basic form is little more than tensioned strings played with a movable slide, so it is the perfect candidate to test out your desire to construct a musical instrument.

What follows is a very basic introduction to the construction of a simple lap steel. This guide is not meant to detail the "ultimate" six string lap steel, but serves to pass on enough basic information to create an instrument that can be built easily in the average home shop. You can use it to "dip your toe in the waters" of instrument construction, or use the measurements as a basis for something a little more advanced. It is recommended to the neophyte builder to complete a basic instrument first, and delay your dream vision until you have the basics mastered. The process of building is enjoyable on its own, and hopefully at the end of your quest you'll end up with an instrument that will produce many happy hours of making music. Enjoy!

SCALE LENGTH

The instrument shown in the basic plan (available below) has a scale length of 22-1/2". Scale lengths can range anywhere from 17" to 26", so this was chosen as a good middle of the road scale length. Different scale lengths can sound better with different tunings, string gauges, and string tensions. Scale length also affects playability of an instrument depending on playing styles and techniques such as bar slants.

STRING SPACING

I would generally suggest that you stick to the plan for a first lap steel, but to quickly summarize the string spacing issue I'll pass along the following information. You can find a more detailed discussion of string spacing on the "Just the FAQs" page.
I generally build my guitars with 3/8" string spacing at the NUT because that's what most folks seem to prefer although I personally prefer 11/32" spacing and have found it takes very little time to adjust to slightly narrower string spacing at the nut.
Most of my steels are built with 13/32" string spacing at the BRIDGE to accommodate commercial off-the-shelf pickups. The difference of 1/32" between the nut spacing and bridge bridge spacing is really quite imperceptible to most people, so these spacings really are a good basis for a standardized instrument.

A string spacing CHART to assist you in the layout of bridge and nut string center distances can be found by clicking HERE.
A string spacing LAYOUT GUIDE to assist you in the layout of bridge and nut string center distances can be found by clicking HERE.
Be sure to select "NONE" in the page scaling area of the print command box so the guide will print out full size.
BODY SHAPE

I have a strong prejudice toward body shapes that are loosely guitar based. I think the lap steel looks better and is more comfortable to play when it acknowledges its origins of design. Many early laps were guitar shaped because they were a natural extension from their acoustic predecessors. My personal belief is rectangular body shapes were primarily due to economics and the need to maximize profits for the companies that produced these instruments. The plan presented here features a body shape that attempts to strike a happy medium between the guitar-based and simpler to execute rectangular form. All of that said, do whatever your sense of style dictates.

HEADSTOCK SHAPE

What looks better, the "Classic" or "A" style headstock shape?
I have a preference for the "A" style, as it is easier to get a straight string path to the tuning post. The classic guitar shaped headstock can work also, but can be a little more difficult to implement. The shape indicated on the plan is a compromise that exhibits the right geometry to work smoothly, but also looks good.
Also, I'm sold on vertical posts, rather than vertical tuning buttons. It takes little time to adjust to tuning a conventional guitar style tuner and the ease of string changes makes up for the tuner posts not being mounted horizontally in a slotted headstock or tuner pan. My eyesight isn't what it used to be, and there's nothing like fumbling with a tuner post hole deep within a slotted headstock on a dark stage. Enough said.

FRET BOARD

I like frets. They are handsome and they make me feel good. You can try your hand at making a fret board, and the lap steel is a great way to experience the joys of learning to install frets. Since there is no requirement here to get it perfect, the pressure's off. A small Japanese pull-style saw that produces a kerf of about .024" is perfect for slotting. Frets can be glued in and filed flush. There are lots of web tutorials on fretting, so we won't dwell on it here. As far as wood selection, walnut is a good alternative to expensive wood for your first attempt at fretwork, and mother of pearl position markers can be easily installed in shallow holes drilled in the fret board surface. You may choose to indicate fret positions in some other manner and bypass frets altogether for a first instrument. It is perfectly acceptable to make a thin board and glue contrasting material in the slots where frets would normally go. Glue white plastic in slots cut in a walnut board and sand them flush. Anything goes here, as they only indicate position and will never be touched by the strings. The fret locations as well as all other dimensions are included on the instrument plan.

PICKUP

You could write a book on this subject. For a first instrument a standard Strat-style pickup is probably your best choice. They are easy to work with and can be obtained at a reasonable cost. An alternative to consider would be a P-90 style pickup. P-90s sound excellent in this application; factors that influence this would be the short scale length combined with proximity to the bridge and the use of heavier string gauges. There are many websites that preview the various types of pickups with sound files so you can preview what any given pickup choice will sound like. Building a basic lap steel is a great way to experiment with different pickup options. A short MP3 sound clip that demonstrates the different sounds produced by various pickup types is available at the end of this guide.

TUNERS
Grover cast back 18:1 ratio Sta-tites are shown on the plan; any other quality enclosed tuner would also be good. Cast tuners with bushings that screw in from the front are easier for the inexperienced builder to work with. A few extra dollars in the instrument budget is a good thing here. Quality tuners allow an instrument to be tuned accurately and stay that way.

BRIDGE AND STRING RETAINER
The strings can be anchored at the body end any number of ways. Popular setups with first time builders are tele-style bridge assemblies (with pickup) and stand alone bridges with the strings anchored by passing through the body. String ferrules are usually used in the back surface of the body to hold the string ball end on instruments where the bridge does not anchor the strings in some manner. E-bay can provide you with a source for many of these parts. Many of the businesses that specialize in musical instrument parts can also provide you with the basic components. The plan here shows a custom made stainless steel bridge plate with integral brass bridge. Any method can be used as long as the center of bridge dimension is kept at the same location.

ASSORTED HARDWARE
All of the other components are obtainable through the usual guitar supply shops and larger music stores. A complete list of all of the items necessary to complete the lap steel is shown on the plan.

STRING SELECTION AND TUNINGS
There are many options for string gauges and tunings depending on the type of music that you enjoy playing. I suggest the basic open E tuning as a beginning point of departure, especially if you intend to concentrate on playing rock or blues. Many fine players of the electric 6 string lap steel use open E almost exclusively, so it would seem to be an ideal first tuning. As far as string gauges go, it's OK to put a standard set of electric guitar strings on your instrument initially. Open E is tuned to the same standard pitch as a regular guitar and the third, fourth, and fifth strings are raised to the open E chord. The string gauges of a standard set are not ideal but they will certainly be acceptable. Ideally heavier gauges will be used due to the shorter scale of the lap steel vs. standard guitar scale length. The following tunings and recommended gauges are shown below to enable experimentation after your initial introduction to the lap steel. GHS strings produces a "standard" guitar set that is suitable for several of the tunings listed below. The set is labeled "DYM" and includes .013, .017, .026w, .036, .044, and .056 strings.

NOTE: All tunings displayed lowest on left (6th string) to highest on right (1st string)

OPEN E:
E / .056w ____ B / .044w ____ E / .036w ____ G#/.026w ____ B / .017 ____ E / .013

OPEN Em:
E / .054w ____ B / .038w ____ E / .030w ____ G / .024w ____ B / .020 ____ E / .015

C6 / Am7:
C / .036w ____ E / .030w ____ G / .024w ____ A / .020w ____ C / .017 ____ E / .015

OPEN G:
G / .052w ____ B / .042w ____ D / .032w ____ G / .024w ____ B / .017 ____ D / .015

G6:
G / .052w ____ B / .042w ____ E / .032w ____ G / .024w ____ B / .017 ____ D / .015

A6:
C# /.036w ____ E / .030w ____ F# /.026w ____ A / .020w ____ C# /.017 ____ E / .014

OBLIGITORY STANDARD DISCLAIMER

As always, I assume no responsibility for the use of this information, standard safety practices must be adhered to, and all personal protective equipment must be used where it is applicable. Please remember that woodworking is a potentially dangerous endeavor. The machines used to work with wood, metal, and other materials can be hazardous if used in an unsafe manner. Please read all machinery operation manuals and follow the safe working practices outlined within them.

SUGGESTED CONSTRUCTION SEQUENCE

Here's a suggested construction sequence that you can use as a guideline to produce the lap steel shown on the plan. Collect your materials, work safely, have a good time, and enjoy playing your new instrument!

MAKE BODY

1. Carefully edge join 1-1/2" thick stock to form body blank
2. Cut out basic body shape and sand edges smooth
3. Sand front and rear surfaces of instrument body blank to eliminate joint lines
4. Mark location of nut 6" from end on top and rear face of blank
5. Thin rear of headstock area to 9/16" within 1/2" of the line drawn 6" from the end
6. Taper the rear neck area of the blank
7. The neck should be 3/4" thick at the nut, tapering up to full thickness at the 10th fret location
8. Sand the rear surface of the neck
9. Blend the neck to headstock rear transition area with a 2" drum sander held in electric drill
10. Round over all front and rear body and neck edges, but leave headstock sides square
11. From this point onward, do not place instrument on unpadded surface

MAKE FRET BOARD

1. Cut fret board blank 17-1/2” by 1/4” thick
2. True one edge of fret board blank and rip to 2-1/4” width
3. Lay out fret locations on fret board blank and cut fret slots
4. Drill shallow 1/4” recesses to house the 1/4” position markers at 3rd, 5th, 7th, 9th, and 12th fret locations
5. Drill shallow 13/64” recesses for 5mm position markers at 15th, 17th, 19th, 21st, and 24th fret locations
6. Glue position markers into fret board recesses
7. Sand position markers level with fret board surface
8. Cut the fret board to its desired size and taper and sand the edges
9. Install frets and file/dress edges until they are flush with fretboard sides

ATTACH FRET BOARD

1. Position fretboard on top of body and clamp each end securely in position
2. Mask off body area adjacent to fret board, mask off edge of fret board
3. Remove the nut end clamp, apply glue to 15th fret and clamp in position up to 15th fret location
4. Remove clamp over 15-24 fret position, lift board slightly, knife in glue and re-clamp
5. Clean up excess glue and allow to dry overnight

ADD TUNING MACHINES

1. Transfer tuner locations to headstock area
2. Drill headstock area to accommodate selected tuners
3. Pilot drill for tuner mounting screws and temporarily install them using beeswax as thread lubricant

MAKE BRIDGE PLATE

1. Transfer bridge plate shape and hole locations from the plan to clear plastic template material
2. Cut template material to shape and drill 1/16” holes at all indicated positions
3. Transfer shape and cut bridge plate material to outline, edge sand on 120 grit disk to final shape
4. Transfer all hole locations to stainless steel bridge plate using plastic template’s 1/16” holes
5. Center punch all marked locations on the bridge blank
6. Drill 3/32” at end of slot locations, pilot drill 1/8” at all other locations
7. Enlarge holes for string ball ends, brass bridge mounting, and mounting screws to 7/32”
8. Cut string slots and round slot edges, especially top front edge that strings will bear against
9. Countersink the 3 mounting holes for #10 mounting screws
10. Sand and polish bridge plate

PREPARE BODY FOR BRIDGE PLATE

1. Draw a 2” long line perpendicular to centerline 22-1/2” from nut end of fret board (saddle position)
2. Position bridge on body by aligning the two brass bridge mounting holes directly over this line
3. Center outside string notches using two steel rules held against the sides of the fret board
4. Trace lightly around bridge directly on body with pencil
5. Mark all other bridge locations directly on the body
6. Pilot drill and countersink body for bridge plate mounting screws
7. Form 3/8” by 1/4” deep pockets for heads of bridge mounting screws
8. Form 1/4” by 3/16” deep recesses at string drop in locations
9. Duplicate this row of recesses under end of slot locations
10. Trim out area between the sets of holes with a narrow chisel
11. Do not mount bridge plate to body; wait until control cavity route is completed

MAKE BRASS BRIDGE

1. Make brass bridge 2-5/8” long by 3/4” tall from 3/8” thick stock
2. Round top corners and shape ends and top to semicircular profile
3. Draw line down the center of the brass bridge bottom
4. Hold the inverted bridge base plate over this line, center the bridge and mark screw locations
5. Drill two 5/32” by 9/16” deep holes for the mounting screws
6. Tap the previously drilled holes for the #10 X 24 by 3/8” mounting screws
7. Sand and polish the brass bridge
8. Attach bridge to mounting plate with two #10 X 24 by 3/8” machine screws

ADD NUT

1. Form 2” long by 5/8” nut from 1/4” thick blank material (brass may also be used)
2. Angle top of nut slightly toward headstock
3. Form string slots in the top as per drawing

4. Adjust slot depth so the TOP of all strings are at the same level
5. Contrasting color 3/32” headstock veneer may be used if desired, also serves to hold nut
6. Nut can be glued lightly in position

MAKE SCRATCH PLATE (PICK GUARD)

1. Transfer shape, pickup opening, and mounting screw locations from plan to clear template material
2. Cut template to shape and cut out the pickup shape
3. Drill 1/16” holes at the mounting screw locations
4. Transfer outer shape, pickup opening, and all mounting screw locations to the scratch plate material
5. Cut the scratch plate material to shape and cut out the pickup shape
6. Drill all 1/8” mounting holes and chamfer for #4 stainless steel screws
7. Drill volume and output jack locations with 3/8” drill bit
8. Insert pickup and mark mounting screw locations
9. Drill pickup mounting holes

10. Position scratch plate on body and mark outer shape on body lightly with pencil
11. Mark scratch plate pickup opening, volume control, and output jack locations on body
12. Draw shape of body route to accommodate all components and route body for components
13. Mount pickup, volume control, and output jack on scratch plate
14. Wire and solder all components plus extra 12” length of wire for grounding bridge plate

ADD SCRATCH PLATE TO BODY

1. Route body to accommodate scratch plate components
2. Drill pilot holes for mounting screws
3. Drill angled hole from beneath bridge plate and extending into control cavity route
4. Pass ground wire with 1” of insulation removed through hole so bridge plate will hold it in place
5. Mount scratch plate using beeswax lubed 1/2" by #4 oval Phillips head stainless steel screws

ATTACH BRIDGE PLATE TO BODY

1. Mount bridge plate using beeswax lubed 1-1/4” by #10 oval Phillips head stainless steel screws

FINAL STEPS

1. Add strings and check output to amplifier
2. Disassemble and finish sand entire instrument
3. Mask fret board if spray paint will be used
4. Apply finish
5. Re-assemble and play

A NOTE ON USING THE PDF PLAN

The plan is presented as a PDF file and has been drawn as a full size print. You may use the PDF directly, (PDFs can be zoomed with little loss of detail) or save the file to CDR or flash drive and take it to your local full service print shop and have a FULL SIZE 36" BY 28" plan printed for around $6. Make sure that the ACTUAL SIZE of the drawing borders printed measure 36” by 28” to ensure they have printed it out correctly for you. Your biggest obstacle in this process will be finding someone at the print shop that is familiar enough with their software to get the PDF to print out at the correct size. This will occasionally be a bit of a challenge for them, but that's their job. A full size drawing is nice to have, and eliminates the many steps involved in scaling up a drawing to actual size. A full size print also permits you to place semi-rigid plastic over specific areas and trace over it with a fine point permanent marker to create templates to transfer directly to your work. If you opt to work from the PDF, all of the dimensions are available, and the body is superimposed over a 1” grid to permit accurate scaling of your drawing to 1” grid paper.

The PDF plan for the Basic Lap Steel plan described in the text can be found HERE.

FREE BASIC OAHU TONEMASTER INSPIRED LAP STEEL CONSTRUCTION PRINT:
For those who feel a bit more adventurous, this PDF plan is loosely based on a vintage Oahu Tonemaster, but with the body shape modified slightly to accomodate the shorter scales that are popular with today's players. This plan will enable you to construct a basic lap steel with either a 22-1/2" OR 24" scale length with body joining the neck at the 12th fret for either choice of scale. Details for both scales are shown. Body "wings" are shown superimposed over a 1" grid that will allow you to scale the drawing of the wing portion up to full size templates if you wish. The fret positions are printed out to scale and there are full charts for accurate fret placement. The instrument can be modified as desired following the basic layout for critical measurements.
This PDF may be printed directly on 8-1/2" by 11" paper or viewed on your computer screen where details and text can be enlarged for viewing. PDFs can be zoomed with little loss of detail, so this size of drawing can be useful.
Click HERE for the PDF plan for a basic Oahu Tonemaster inspired lap steel.

PICKUP DEMONSTRATION sound samples found HERE include:

1. Overwound single coil at start of play
2. Split single humbucker at 13 seconds (See lap steel #6463 for an example of this pickup)
3. Series connected humbucker at 26 seconds
4. Parallel connected humbucker at 40 seconds
5. Coil cut humbucker at 54 seconds
6. P-90 at 1 minute 7 seconds

The sound samples were all recorded with the same maple-bodied 22-1/2" scale lap steel with each pickup located 2" in front of the bridge. All samples were recorded with an AKG C-1000 small diaphram condenser microphone positioned 6" in front of the 10" speaker of a Peavey 30 watt transistor amp. The microphone was also positioned half way between the center and outside edge. Amp volume was slightly above speaking level and bass, middle, and treble controls were positioned at their maximum values. This resulted in the least amount of coloration from the amp itself. An MP3 is certainly not the last word in fidelity, but the overall tonal coloration of the pickup options does come through. Different strokes for different folks!

If you desire to contact me about Bluestem Strings products:
Due to scoundrelous spammers actively mining sites for e-mail addresses, I'm forced to include the following text version of my e-mail address meant to confuse the automated robo-search of websites for e-mail addresses. Please e-mail me at:
rcordle (substitute the at symbol here) fastmail (substitute the dot here) fm
Please include "Bluestem Info Request" in the subject line, Thanks!