

16/15 Santoor Construction - James Jones

Frame

- Laminate Maple pin block (3 ply) 3 1/8" (finished height) X 24" rough with exact length with 15 degree angles 23 3/8" with a thickness of 26/32"
- Cut poplar hitch pin block 3 1/8" (finished) X 24" rough with same 15 degree angles and a length of 23 3/8" and thickness of 26.32"
- Cut front and back rails 1/2" X 3 1/8" X 12" (front) 1/2" X 3 1/8" X 24" (back) 40" total length for both. Cut 15 degree angle on one end. Place pin blocks into glue up jig and then cut front and back rails to fit. Mark pin blocks with rails and cut out material to assemble and glue frame.
- Center and drill 1/12" hole in back rail before assembly
- Drill all tuning and hitch pin blocks prior to assembly using jigs. Mark hitch pins with #53 bit with marking jig taped to hitch pin block. Remove marking jig. Using angle platform drill all hitch pins at a slant with the drill press. Drill #26 for 1" hitch pins not all the way through. Double stick tape drilling jig to pin block blank. Drill #15 for tuning pins at right angle all the way through. 91 hitch and tuning pins
- Assemble frame using frame glue up jig once all elements are created.
- Custom shape from 1/2" X 1/2" poplar corner reinforcement pieces and glue in.
- Using router and 1/2" bit create thin 1/8" + lip to support center scalloped brace on sound board side. Size to make flush and round ends to fit. Once dry, rout for lips on front and back railing and center scalloped brace. Shape and glue in 1/2" X 1/2" braces

Soundboard and Back

- Edge glue quarter sawn Spruce rough to 75% of pattern as complete soundboard will not pass through thickness sander. Rough thickness would be 6/32". Thickness the two pieces to a final thickness of 5/32" Joint and glue to full size. Do the same with quarter sawn spruce for the back. Assemble from pieces 2 1/4" wide for stability of back. Finished thickness also 5/32. Other woods besides Spruce could be used such as Mahogany, Redwood or Cedar.

Soundboard Bracing and Center Beam

- Create 1/2" X 1/2" quartered sawn spruce bracing (7) 13" rough pieces.
- Create quartered sawn scalloped center board 5/8" thick X 1" high length rough 17 1/2"
- Cut scallops with scroll saw to pattern
- Using router and 1/2" bit create thin 1/8" + lip to support center scalloped beam on sound board side. Size to make flush and round ends to fit. Once dry, rout for lips on front and back railing and center scalloped beam.
- Cut to length, round ends and glue in 1/2" X 1/2" braces

Back Support Brace

- Create quarter sawn center back brace 3/4" X 3/4" X 24"
- Using router and 1/2" bit create thin 1/8" + lip to support back brace
- Size to make flush and round ends to fit.
- Glue onto back of frame
- Create sound post 1/2" X 1/2" X 4" to extend from back brace to under side of scalloped soundboard brace

Frame and Brace Assembly

- Once all braces are glued to center beam and front and back rails, sand assembly flush on both sides with large belt sander
- Install label on inside of front rail
- Once flush, cut sound board and back to fit and glue on
- Finish inside of instrument
- Glue on spruce back.

Side and Interior bridges

- Create Poplar side bridges based on sample and drawing.

- (2) 3/4" X 25/32" X 26" stock
- Rout top 1/8" groove centered
- Rout side 1/8" groove up 1/8" from bottom of side bridge
- Using jointer and angled fence, create flat face between and just up to each 1/8" groove.
- Round over inside of side bridge with medium size Dewalt router in vise
- Glue on sanded body using wedges leaving some overhand on both sides
- Saddles are 1/8" stainless steel on top side and black acetal on sides of bridges
- Interior continuous bridges are of stock 3/4" X 1 3/4" high material with 1/8" groove in center. Finished bridges would have 1" holes, 1 1/2" high at bass end, 1 3/8" treble end. (see bridge patterns)

Stringing and Tuning

- Shown is the fundamental Pandit Shiv Kumar Sharma tuning in both Western and Indian notation. The abbreviations S,R,G,M,P,D,N, and S stand for Shadaj, Rishabh, Gandhar, Madhayam, Pancham, Dhaiwat, Nishad and then again Shadaj. A horizontal line underneath the note means the note is Kormal (flat). A vertical line on the top of the note means it is Tivra (sharp). Higher octaves are shown with a dot on the top of the note and lower octaves with a dot on the bottom of the note. There are 3 strings per course except the Chikari which has 4 strings and the wound string courses which have 2; for a total of 91 strings. The string spacing center to center is 1 3/8". On the Chikari the top two strings are tuned in unison to SA with the bottom two tuned to the two dominant tones of the particular raga you want to play.

Indian notation is very primitive because Indian classical music is primarily an oral tradition.

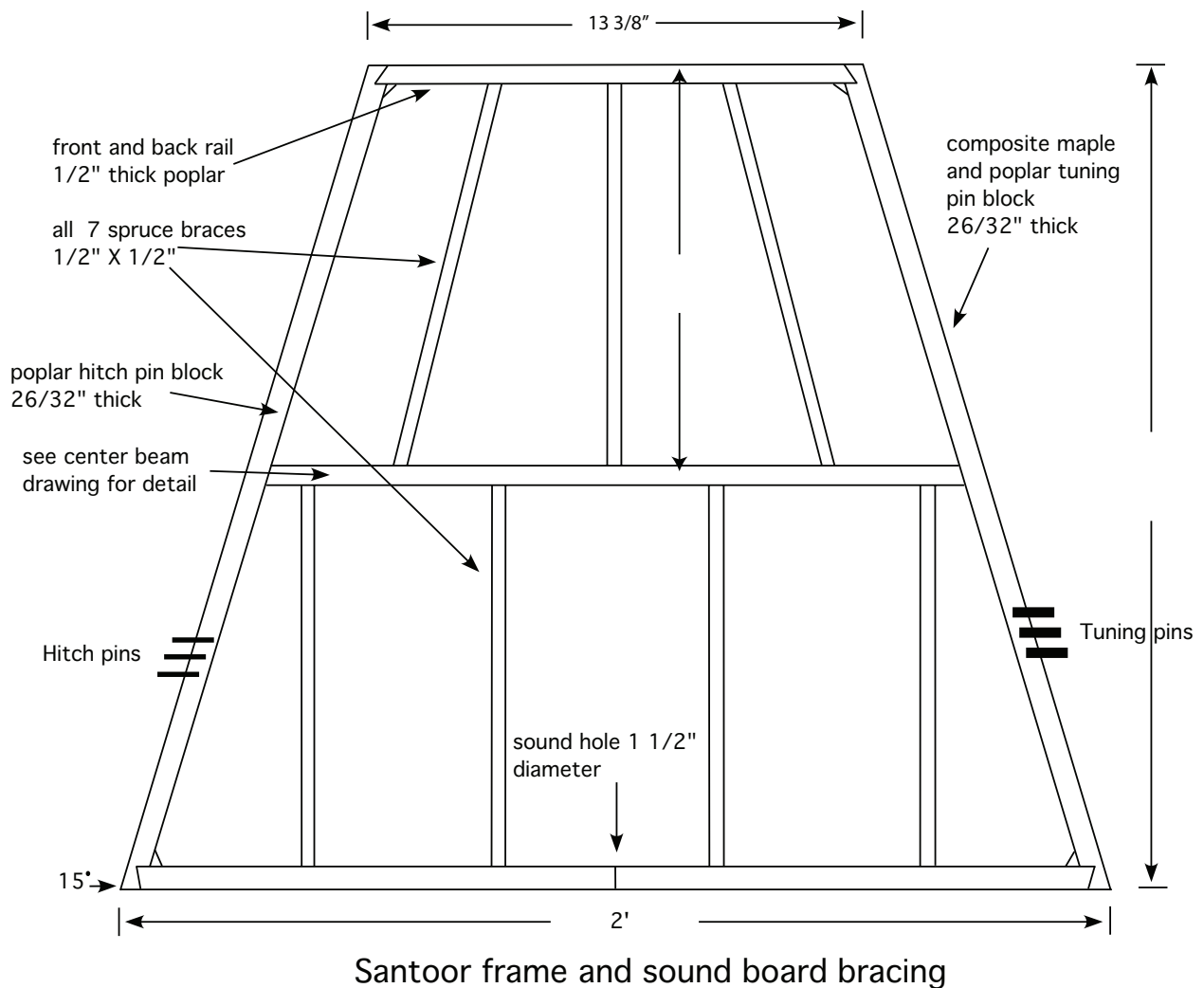
Chessman Style Bridges

- Glue up blanks of Poplar 1 1/2" X 22/32" X 42". Grain would be running top to bottom.
- Rout 1/8" groove in top for acetal saddle
- Plane to triangle and then shape with drum sander like regular hammered dulcimer bridges

- Using pattern mark and cut all 31 bridges on small band saw. Cut out to size using pattern and sand with drum sander. Approx. $7/32$ " width of center.

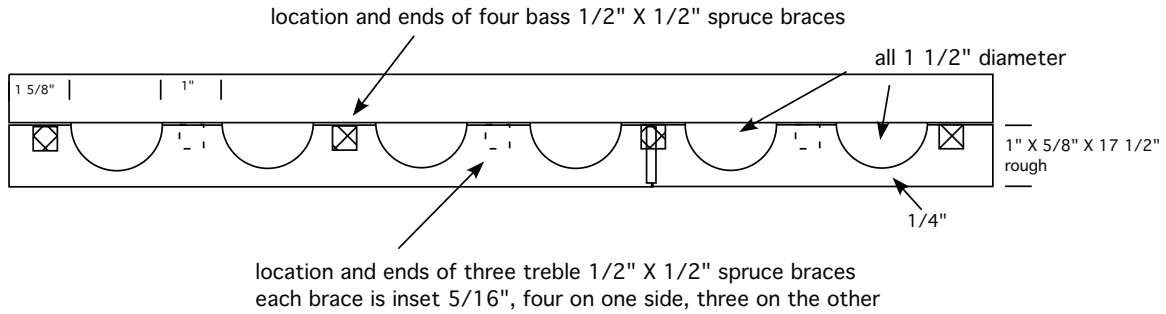
Options

- To decrease sustain, use a softer wood (walnut, poplar), make bridges small as possible, use acetal for bridge saddle and side bridges. For slightly more sustain and brightness use stainless steel side saddle.

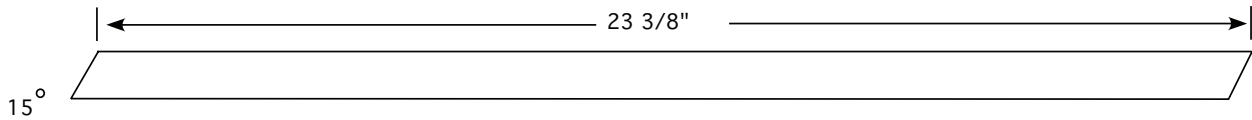


- For chessman style bridges design consider size, shape, material/wood, saddle material and what it sits on. Traditional specs are $1\frac{3}{8}$ " high with bone saddle with side bridges $\frac{7}{8}$ " high.

Spruce Center Beam

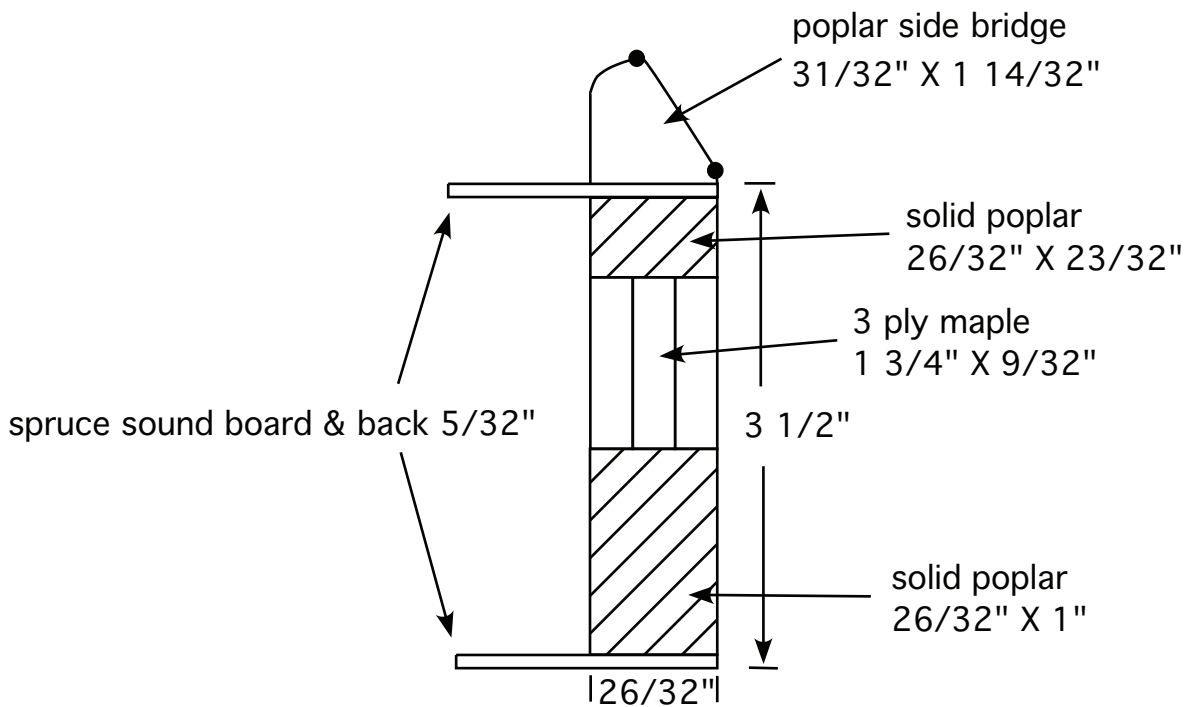


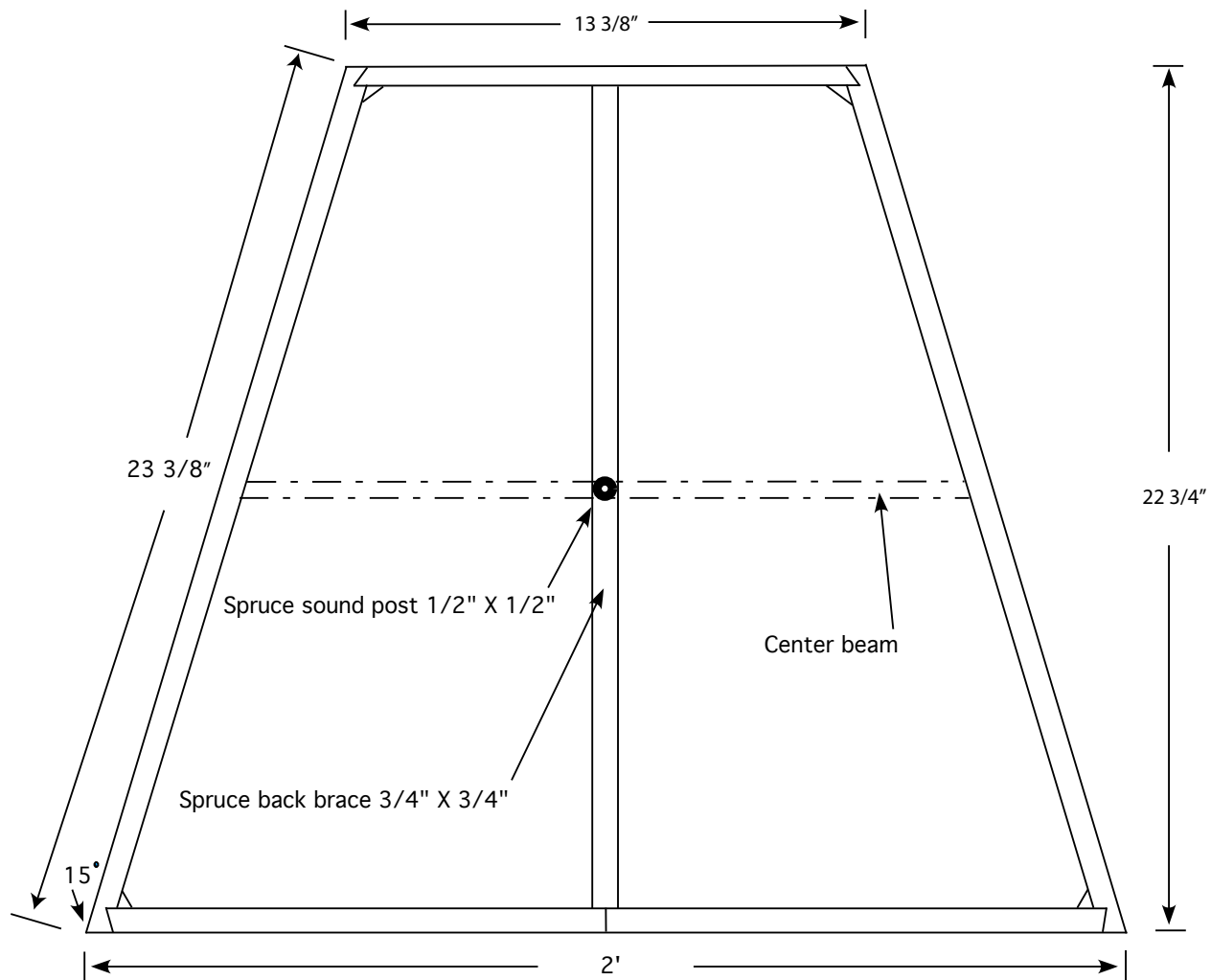
Tuning Pin and Hitch Pin Block Length



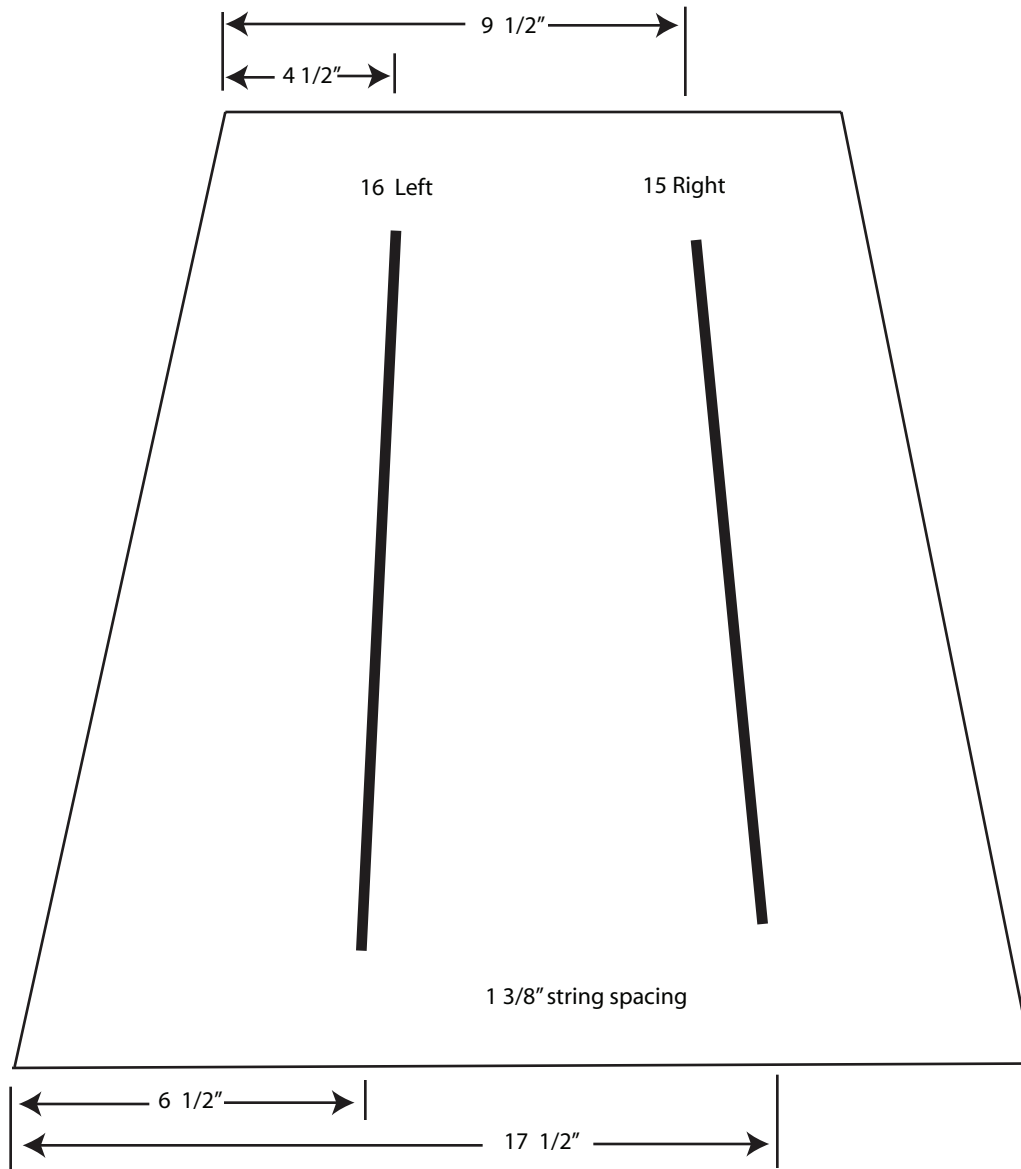
Tuning Pin Block and Side Bridge

(end view, not to scale)





Santoor frame and back brace



Chessman Style Bridges (location above)

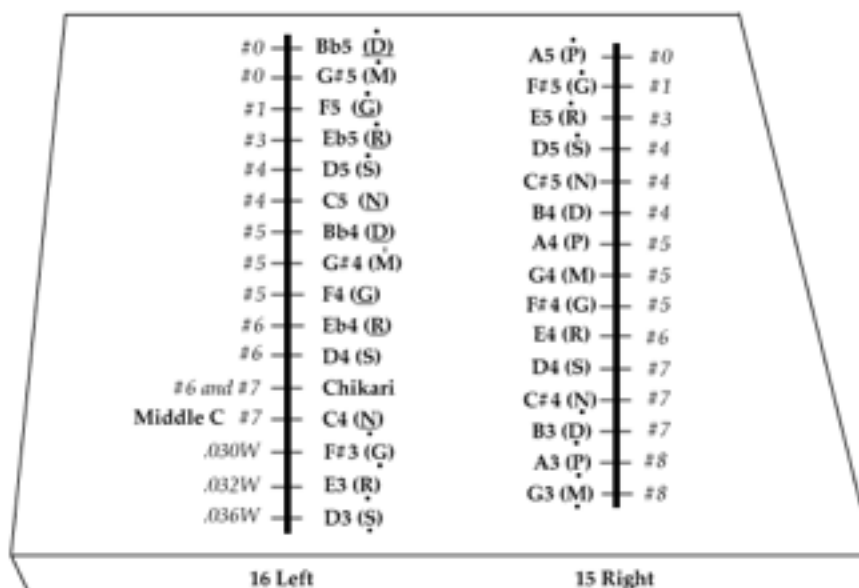
- Glue up $22 \frac{32}{32}$ " X $1 \frac{1}{2}$ " poplar blanks out with grain running top to bottom. Need at least 42" of length to get 31 bridges using pattern below.
- Rout $\frac{1}{8}$ " groove centered in top
- Shape
- Cut out to size using pattern and sand. Approx. $\frac{7}{32}$ " width of center. Santoor Chessman Style Bridges

- Glue up 22/32" X 1 1/2" poplar blanks out with grain running top to bottom. Need at least 42" of length to get 31 bridges using pattern below.
- Rout 1/8" groove centered in top
- Shape
- Cut out to size using pattern and sand. Approx. 7/32" width of center.

Tuning Chart and String Gauges

James Jones

16/15 Indian Santoor



Shown is the fundamental Pandit Shiv Kumar Sharma tuning in both Western and Indian notation. The abbreviations S,R,G,M,P,D,N, and S stand for Shadaj, Rishabh, Gandhar, Madhayam, Pancham, Dhaiwat, Nishad and then again Shadaj. A horizontal line underneath the note means the note is Kormal (flat). A vertical line on the top of the note means it is Tivra (sharp). Higher octaves are shown with a dot on the top of the note and lower octaves with a dot on the bottom of the note. There are 3 strings per course except the Chikari which has 4 strings and the wound string courses which have 2; a total of 91 strings. The string spacing center to center is 1 3/8". On the Chikari the top two strings are tuned in unison to SA with the bottom two tuned to the two dominant tones of the particular raga you want to play.

Note: The numbers next to the Western note designations represent the octave with C4 being 261.6 Hz

I use number designations for wire sizes. Their actual diameters are as follows. W for Wound

#0 = .009 = 0/23mm	To order replacements contact me
#1 = .010 = 0/25mm	by phone or mail indicating the
#2 = .011 = 0/27mm	gauge and number desired and if
#3 = .012 = 0/30mm	you need loop ends. I will ship
#4 = .013 = 0/33mm	immediately and bill you for the
#5 = .014 = 0/35mm	strings.
#6 = .016 = 0/40mm	
#7 = .018 = 0/45mm	
#8 = .020 = 0/50mm	

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