Shay Tender Sill

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It's been nearly a year since the tender frame was constructed. I've now started to paint the tender and decided that it'd be nice to finish the end sill so that all the structural parts could be painted.

Cass 5 Sill: This photo shows the tender sill on Cass 5. Most the shays I've seen use the same basic design with some variation in the details. I decided to copy the Cass 5 design shown here.

This and other Cass photos on this page were taken in the spring of 2003 shortly after I finished the frames. One of the purposes of that visit was to obtain more detail on the sills.

Oak Sills: The sills are made of oak. This photo shows some new sills in the Cass Shops. I'm not sure whether these pieces are for a shay or for the Heisler they were overhauling.

The finished sills for the model need to be about 1.125" thick and 3" high. Oak has a pretty course grain so I decided to find a closer grained hardwood such as maple or cherry. These are common hardwoods that are being actively logged in the area. However, the local lumber company didn't have any pieces in stock that would have a finished thickness of over an inch. So, put the sills on hold pending a visit to one of the local sawmills.

How About Mahogany?: I was doing some volunteer electronics training in Ghana (West Africa) in June, 2003, a short time after I started looking for suitable sill hardwood. I often walked by a furniture shop down the street from my hotel. The shop had a roof but otherwise was open air. Only hand tools were used. Typical products were beds, chests, tables and chairs. One time I stopped and asked if they would sell me a couple pieces of the wood they were using. I selected a ~2x6 and told the guys I wanted two pieces about 60 centimeters long. They got out the ruler and measured off ~ 21 inches. I started to laugh and explained that I wanted about 20 inches and mentally converted to metric since the country is metric. The guy said "when your ruler says inches, you use inches". And yes, they always use the saw that way.

The local lumber yard planed the rough cut boards to 1.125" thickness and finished one edge with a jointer. I then used my radial arm saw to cut the board to the correct length and width. The photo shows the back side of the sill. I don't have a router so I cut the recess with the mill.

Polling Pockets: The bars and straps looked fairly straightforward to fabricate but the poling pockets looked to be a challenge. I checked several suppliers of 1.5" scale castings and didn't find any that looked like the ones on the Cass shays. This shows the pockets to be 8" square (scales to 1")

The recess is 6" --- scales to 3/4"

The inner side is about 3.5" high.

I had some 1.25" square aluminum bar so I milled a short length down to 1" square and mounted it in the 4-jaw check. The photo shows making the fourth pocket, the first three had been machined and then sawed off the bar. The first step was to turn a 10 degree taper to the outside using tool with a 0.14" radius ---- a bit I had ground for some long forgotten project. The length of the tapered cut was 0.25" and the depth of the cut was such that the end of the bar is round and about 0.975" diameter

The end was drilled with a #33 drill and then a 3/4" drill with the tip of the drill going in 1/4" The outer edge of the drill barely entered the rod.

The inside was then drilled to a depth of 1/4" using a 1/2" diameter end mill as shown in the photo.

The hole was then finished to a 3/4" diameter with the the other side of that 0.14" radius tool.

The first threes pieces were cut off the bar. The last piece including the remaining bar was removed from the chuck and the bottom of all pieces milled such that the base was 3/32" thick

The top of the pieces was then milled using a fly cutter set at a 10 degree angle.

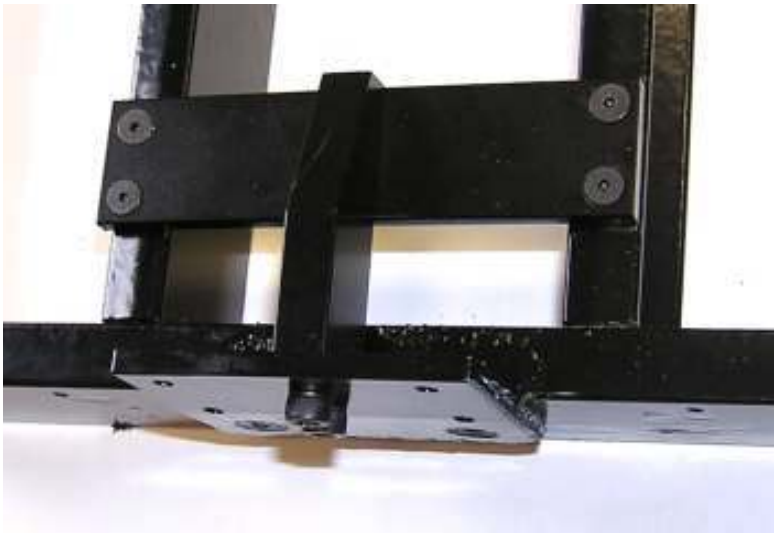
The outer edge of shorter side is thicker than the longer side because of the tapers. The photo shows a piece after the 10 degree cut on the right and a finished piece on the left.

The thicker sides were thinned using a ball end mill in the drill press. The piece was moved into the mill by hand. Another way to do this is by using a ball end cutter in the Dremel --- I didn't have a ball end cutter.

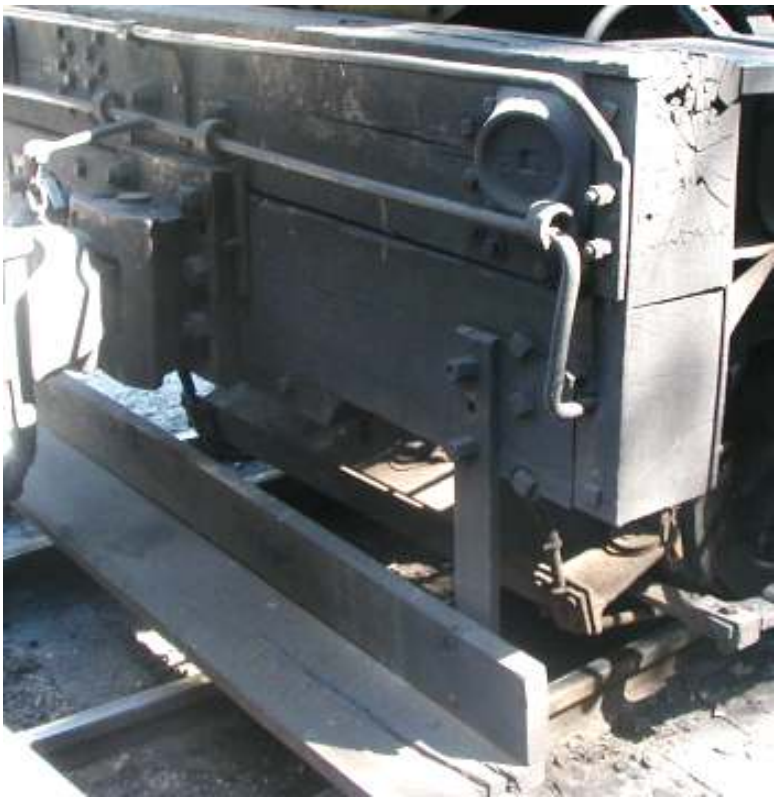
This shows one pocket with the sides thinned and one without the sides thinned.

The sharp corners were then rounded using a straight sided cutter in the Mototool and then all edges rounded and smoothed with 80 grit sand paper.

Next, the end of 4-40 fillister head screws were squared on the grinder and driven into a 5/32 diameter recess in bottom of the pockets. The last step was to bead blast the pockets. Aluminum is tough to paint but powder coating sticks very well and will be used on the pockets.



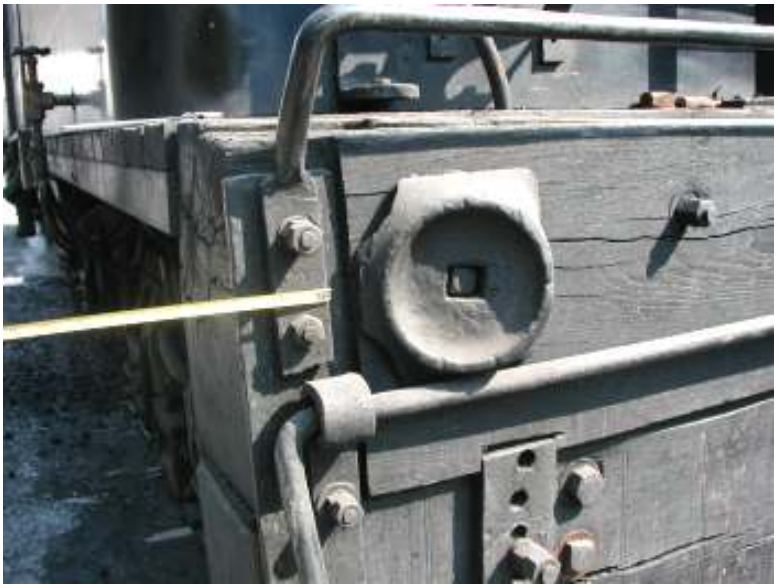
Support: The support shown in the photo was added to the plate to which the coupler pocket connects to prevent it from twisting under load. This seemed prudent but it might be overkill. The black paint is powder coating.



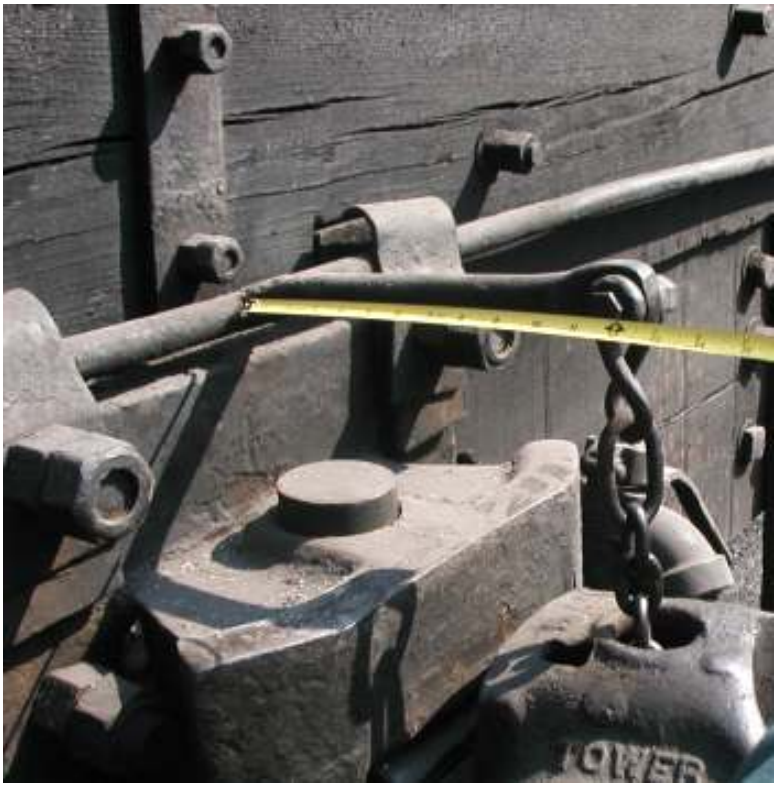
More Measurements: This is a good point to look at some more photos and measurements of the hand bar, coupler release bar and foot boards. The photo on right shows the left end of the front sill --- the front and back sills are nearly identical. I wanted to get a better view of the steel tie straps along the edges.

This is the tender sill again. Note the extra holes in the footboard hanger. I think I'll skip those.

This is the left end of the front sill again. The metal tie straps look to be about 1/2" thick. I think I'll go overboard and make my scale straps 1/8" thick.



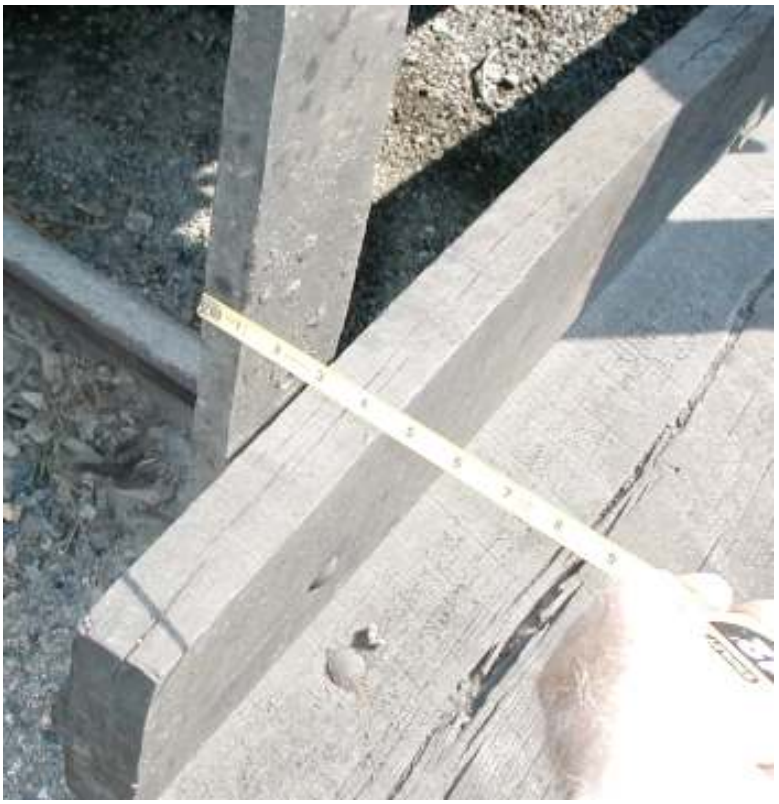
This is back to the tender sill again. The strap holding the hand bar is 2" wide (I can read the rule on the full size uncompressed photo). The 2 inches scales to 1/4". The tie strap underneath looks to be about 4" wide scaling to 1/2"



This photo shows the lift bar on the coupler release bar to be about 12" long, which scales to about 1.5". The photo also shows the brackets that retain the release bar. The rods look to be about 1" diameter which will scale to 1/8"

This shows the footboard hanger to be 4" wide (scale 1/2")

The hanger is 1" thick (scale 1/8") and the foot board and back board are about 2" thick (scale 1/4") I'll make the back board 1/2" high and the footboard 1.25" wide.



Hand Bar: The hand bar was made from 1/8" diameter rod solver soldered to pieces of 1/8" X 1/4" bar. The photo shows the fixture used to hold everything during the soldering operation.

Coupler Release Bar: The coupler release bar was also made from 1/8" diameter rod. The photo shows the little lift bar that hangs over the coupler after it had been soldered to the main bar. The end of the lift bar was turned to 1/16" and inserted in a mating hole in the main bar to keep it positioned during the soldering operation.

This shows the end of the lift bar pivot brackets. These bracket

on Cass 5 had an oversize hole that probably allowed the bracket to be threaded over the bend ends of the rod. These holes would have been way out of scale on the model so I made a bracket with the back open. The bar is held in the correct position at the front of the bracket by a 4-40 screw as shown in the photo.

(Nearly) Finished Sill: The photo shows the sill ready for paint. Everything will be disassembled for painting. The correct screws will be used when it is reassembled. Some scale chain is also needed to link the lift bar to the coupler release pin.

This part of the project required much more effort than anticipated including the ~8000 mile trip to get the wood.

Update: During the first test run at the track i found that the foot boards dragged on something so I raised then 1/2" on both the tender and the mainframe. This adjustment was don by cutting 1/2" off the top of the hanger and then using the remaining hole in each bracket as the top hole. A second lower hole was then drilled in each bracket.

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