The Table Project: much ado about that not much

This project started in May of 2016 when a large branch fell from a massive mahogany tree, that grew in front of Jackson Memorial Hospital. The powers that be decided the entire tree should be cut and discarded. One day, on my morning walk from the parking garage to my office, I saw the destruction under way and after a quick internet search found Mike Tisdale in Homestead Florida who had a portable saw mill and a strong interest in recovering valuable wood from urban areas. I called Mike who drove to Jackson Memorial and with cooperation from the tree cutters loaded the main trunk of the tree on his trailer and departed back to his mahogany orchard and wood lot. Before he left he asked me if I would like a slice and I not wanting to impose and assuming the wood needed drying before milling said maybe so. This was the first mistake of many.

One year later in July 2017 I called Mike to ask about the tree and a slice and he informed me that he had cut that long ago and had no idea where the pieces were. Anyone who is familiar with sawing lumber, not me at the time, knows that green wood easier to mill. Oh well, so much for a souvenir of the Jackson mahogany tree. Nevertheless, Daphne and I visited Mike at his Homestead property. It was acres of mahogany trees damaged by Hurricane Andrew and acres of rough sawn lumber of every type imaginable, from French oak to Ebony, all stickered and covered and waiting for someone to put it to use. Mike had traveled abroad cutting and shipping wood back to Homestead..

Figure 1: Jackson Memorial Hospital Mahogany

Figure 2: Mahogany trunk leaving Jackson on Mike's trailer

Figure 3. Mike Tisdale's saw mill in Homestead.

Before leaving, Daphne asked for some slices of a tree trunk sitting near the portable mill and Mike was happy to fire it up and cut slices for her, despite it starting to rain just as the sawing began. We loaded the slices into the car and brought them back to Micanopy Avenue. Mahogany, I “think: but am not sure”. Daphne paid Mike $25 but he was reluctant to take it as I think he wanted to just give us the wood, that anyway was rife with hollows and knots, probably in appreciation of the tree from Jackson. For the next four years the slices sat on the back porch stickered and drying while we shared ideas for their use, ranging from a headboard to stepping stones in the garden. Finally, we agreed that with some effort, a table could be made and the story of that construction follows below.

Starting in August of 2021, the first step was to arrange the slices to a rectangular shape of a size appropriate for a dining table. I quickly realized that moving these slabs of wood as if they were pieces of a jigsaw puzzle was not fun. Using a tripod, I photographed each slice, separately with the same distance and 90 degree camera angle. After importing each to Photoshop, I trimmed the photos to the outline of the slice and scaled their image size to their actual size. Thus, these individual shapes could be moved around in Adobe illustrator to find an arrangement that was mostly symmetrical with respect to size and shape distribution and filled a rectangle for a table top.

Figure 4: An example of a declined arrangement of slices.

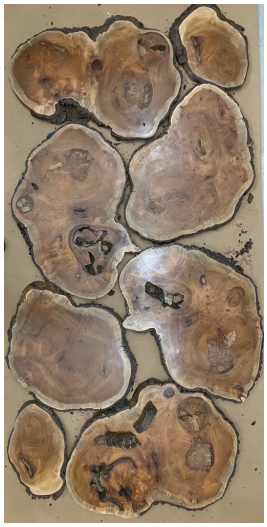

Figure 5: Final arrangement arrayed on a paper to represent the glass top.

In all 12 different arrangements were considered and the slices were placed on the dining room floor for visualization before settling on a final form that was aesthetically pleasing and fit the shape requirements. Consideration was made for size to allow two chairs per side and one chair on each end. The final size was 42 inches by 84 inches with the wood slices filling the width but short about six inches in length.

The chain saw mill yielded slices that varied from 1½ - 2½ to inches thick and each varied in thickness across the width.

So one of the first jobs was to flatten and plane to a fixed thickness. After a bit of reading in late 2021, it was clear the best method for flattening largish end grain wood was by router sled.

All the pieces were measured for thickness to gauge how high to make the sled. I trimmed two scrap 2 x 4 ‘s to about 2 in and planed both edges to flat and identical thickness using the Shopsmith 12” planer. Four three foot iron angles ¼ x 1½ x 1½ inch from Homedepot were used to create the sled. Two attached to the 2 x 4’s and two for the brand new Makita router (courtesy of Corrie’s ex) to slide over the wood. Since the iron angles have a curved inside corner, a plywood plate was made to guide the router base over the curve and prevent the base from riding up the curve rather than sliding completely flat between the two angle iron rails. The plastic router base was attached over the plywood guide to provide a smooth flat surface to ride the rails. Next a left-over Ikea shelf provided a flat surface for the sled and a large enough surface for most of the slices. The side rails were clamped to the Ikea shelf and the sled placed on top.

In March of 2022, I ordered a Whiteside™ (cat#1304), 1¼ inch, mortising bit with 2 1/8 inch overall length to allow the needed reach from the top of the router sled to the final surface. Flattening each element took about one to two hours and as a weekend warrior the effort was spread over several months. The top surface of each piece was sanded to 220 grit, waxed and returned to the array. During flattening, constant attention had to be paid to crumbles of bark, that if trapped under the slab, could change the height of the slice off the table surface. Each slice was flattened on one side and then the thickness was keyed to the previous slice by a small cut at full thickness before raising the router up to take 1/16 inch off on each pass. When slices were too thick for the sled, the sled rails were raised using quarter inch aluminum bars. Finally, some slices were larger than the extent of the rails and the ends of those slices required repositioning to allow access to the full surface. This was a tedious and unbelievably messy process. Despite using a vacuum attachment to the router which collected dust and small chips, the flattening turned the shop into a disaster. I eventually strung plastic sheeting to restrict the debris to a smaller area.

Interestingly, the slices, that had dried and been stored inside for arrangement began to swell in the humidity gaining a concave and convex side. After returning to low humidity in the house they re-flattened. For this reason I decided to finish the surfaces. Top surfaces were sanded with 180 and 220 grit. First one-part polyurethane was tried but unacceptably darkened the wood probably because the end-grain allowed deep penetration. Then Bona sealer was tried, it also darkened the color but to a lesser extent. Finally Daphne and I settled on a wax finish which preserved the color of the wood. Since a glass top will cover the wood we deemed wax to be sufficient protection.

Figure 6. Bar clamps at the back hold slide rails to the surface. Waxing the angle irons between each slice kept the sled easy to move and the only resistance that of the cutter bit.

After all were flattened to nearly identical thickness and returned to the array, painter's tape with cardboard supports was applied to each contact point between slices and cut to allow the slices to be flipped over to be face down for design of a metal support that would be minimally visible from the top of the table. The tape allowed realignment of the pieces into the chosen arrangement. Turning the flattened slices into a table was the next challenge and one that I had been considering for a while. My initial idea was to use steel flat bar welded to form a frame under each contact point and to be narrow enough to not be visible from the top of the table. This contiguous frame would be screwed to the bottom of the wood. The next step being to place the top on a standard Parsons type table frame that would be hidden under the wood. All finally to be covered with glass. This idea had numerous problems, including how to attached the top to the Parson's base and what strength of the steel under-support would be needed. Contacting several metal shops found little interest in working on the project. Finally in May of 2022 I made contact with Art Ballard, a master metalwork craftsman, who was willing and interested in working with me. Art made the excellent suggestion of using water jet cutting to make a continuous support from a single sheet of steel. I abandoned the idea of

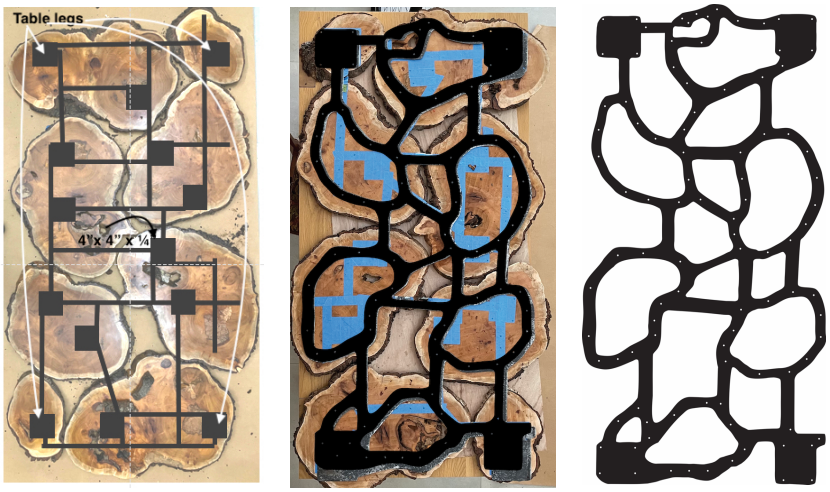

Figure 6 Left panel, original design of welded bars for the under-frame. Middle panel, the first template superimposed on the wood and the changed final template shown in Right panel.

using a premade Parson table and decided on an aluminum base with four supporting legs at the corners that would be attached to the steel under support. Actually multiple designs were considered for the base and created in Google Sketchup, hoping to find a form that would

emphasize the wood top floating with no support. The final format accounted for not only aesthetics but also the difficulty in fabrication and stability and strength considerations.

This still left the question of strength or more accurately resistance to deflection under the weight of the wood and steel. The ideal is to have a flat surface with direct contact between wood and covering glass top. Deflection calculations can only give approximate deflections since the system is really a combination beam, with the wood firmly attached to the steel support. Nevertheless using online beam deflection calculators, assuming pinned ends and modeling only one straight bar suggested that quarter inch steel would give deflection about ¼ inch at the middle carrying weight of the wood unattached. This is greater than the calculated deflection of a glass top ½" in thickness and thus would leave a gap between glass and wood. Based on these calculations I decide to bore the wood slices at the point of contact and embed steel rods in epoxy cement to increase bending resistance, in addition to the screw attachment of the wood to the steel frame. The latter would concentrate all of the bending stress on the steel at the junctions of the wood pieces. I felt that the pins would transfer more of the stress to the wood. In February of 2023, the edges of the wooden cookies were mated. Two rods were inserted at each contact point between slices to limit twisting. Using the Shopsmith in horizontal boring mode, holes were drilled in mating pieces.

Figure 7: Alignment of pins before setting in epoxy

Figure 8: Close up of pins

The slices were 1 1/8 inch thick and the drill table was set to center the bit 5/8" inch from the top surface. A wood jig was made to maintain position over the table, exact spacing and parallelism of the holes. The jig had two 3/8 inch holes to align the second hole relative to the first. Tape that had been placed at the contact points was scribed with lines on the tape for linear drill alignment to separate pieces.

Pin length varied depending on drill bit access to the edge as some contact points were angled in the plane of the slice. Wood slices were returned now to the top of the current dining table that had a nearly flat surface. Pins were 3/8" threaded rod and were cut to length and dry fit to ensure that all could be glued at one time. Threaded rod was chosen to increase the epoxy cement grip on the metal. The close fit of pins to holes required several pins to be reduced to 5/16" for easy assembly and several holes need enlarging to 7/16 inch. Daphne and I mixed epoxy and set all the pins in a single glue-up. After full cure, it was clear that

these pins were sufficient to support the width of the table but were insufficient to hold the wood in a plane over the long axis. The wood slices in aggregate weighed 56 pounds.

Meanwhile, a drawing file was needed for water jet cutting the steel under-frame. A photo of the final wood arrangement was imported to Adobe Illustrator adjusted for dimensional accuracy and the under-frame drawn over the array to cross slices at their attachments. Holes were added that would accommodate #14 screws for attachment of the steel to the wood while staying clear of the glued pins. The area of the support was calculated from the drawing using an Illustrator script and, with thickness and steel density, used to estimate weight of the frame. The wood slices totaled 56 lb, ¼" steel support 56 lb., aluminum base 68 lb. and 3/8" glass top 120 lb., for a total of about 300 lb. Moving the table would require separating the glass top, so the assembled wood and base would weigh 180 lbs much easier to manage. For comparison, a 2 in thick slab of Cuban mahogany, 36" x70" weighs 120 lb. with no base or top.

The drawing was keyed to a thick paper cut to the projected glass dimensions 42" x 84". Slices were placed on the paper in the final arrangement and then centered relative to the paper to make sure that wood was distributed evenly on the glass top. Next, the expected positions of the aluminum base were marked with tape on the bottom of the slices to ensure that the table would be centered on the base. Attachment of the base to the under-frame would require welding vertical supports to the steel frame to go inside the legs and to secure the base and top with a threaded bolt in each leg.

After extraction of the drawing as a DXF for CAD/CAM use, Art sent the drawing for water jet cutting of a trial pattern out of sheet metal. Having horizontally drilled and pinned the slices since the drawing was made, slight adjustments were needed to correct alignment with the pins, avoidance of holes in some wood slices and positioning for the table base attachment. One more test of the pattern was made and checked before sending for cutting of the ¼" steel frame on April 15, 2023. I picked up the final frame from Artswork on April 19 and brought it home for cleaning burrs from the edges, alignment to the underside of the table, marking of base legs for welding the inserts, and drilling the 103 holes into the wood for screwing to the frame. A jig was made to allow vertical and centered drilling. Finally the wood was taped to limit mess during application of 3M 5200 (rapid set) adhesive between the wood and the steel frame.

On May 4, the assembly day at Artswork, we placed the wood, top down, on top of construction paper outlining the planned glass top all on a flat steel table. Finally the steel frame was placed and keyed to the holes drilled into the wood. I checked the placement of the steel inserts for each being square to the other corners and for being equidistant to each other. The inserts were then checked for symmetry with the glass top template. Bryan, the expert welder, attached the inserts he made previously to closely fit the inside of the 4 X 4 aluminum legs. The inserts were made using 3 x 3 x ¼" steel tube each with a welded bar to

make a close but not too tight fit to the aluminum legs. To construct the base, all four legs were placed over their respective inserts (each numbered for best fit

Figure 9: Steel insert for leg

Figure 10: Assembly of legs onto the steel frame at Artswork's shop

and to match the tapped holes for bolts). Legs were marked for cutting to length measuring not from the steel frame but from the top of the table using a level and square. After cutting the legs to length, the legs were fit to the inserts, checked for bolt hole alignment and used to measure and cut the braces for the table base. Cross braces were clamped square and welded and the center brace assembled similarly. Finally 1/8" aluminum plates were cut using the metal break to make pads for the bottoms of the legs. After welding to the bottoms, all

Figure 11 Bryan cuts base plates on the metal break

Figure 12. Insert to leg bolt

welds (oops except one) were ground to be not visible from the inverted base. The final step was to mate the steel frame to the wood. We picked up the frame with an overhead lift by attaching the lift to the leg inserts. I then coated the wood with 3M 5200 between the taped outline and the steel frame was place on the wood and secured with screws (#14 x ½") in the predrilled holes.

The following day, I met Art at the shop, placed scuff pads on each leg base, stripped the tape outline and trimmed excess adhesive. The table top was transported top down with leg inserts up for minimal stress on bumpy roads as we transported the table top and base to 1780 Micanopy. With the help of Daphne, neighbor Roni Medvin, and the Rosenkcrantz' who were visiting her, we placed the base in the house. The top was picked up, carried to the door, flipped and then placed on the base making certain the numbered legs went to the correct sleeve. The top slipped into the legs with no effort! which was a credit to Bryan at Artswork.

Screws interfered with mating two of the legs and had to be removed. After seating on the legs, the bolts went directly into the threaded holes of two legs at one end, but the other legs were not lined up. I placed my bottle jack under the frame and found a spot where very slight lift lined up one of the remaining bolt holes. The last bolt hole required grinding to make the opening large enough to insert a bolt.

Now the pins holding the wood slabs together needed covering with bark. Fragments of bark had been collected each time pieces fell off during handling. These pieces were then fragmented when necessary and judiciously glued at the slab joints to mimic contiguous bark and to cover any part of the pins holding the slabs together.

Figure 13. Pins before covering

Figure 14. Pins after covering

The weld on one base plate was showing as it had not been ground. I propped up the base and used a 60 grit disk on the 4”grinder to clean the weld from view. Next the base, that was bare aluminum, showed a fair amount of scratches and needed finishing. Sanding was problematic. Orbital sanding or hand sanding with 180 grit looked terrible. It was nonuniform and of variable intensity. After numerous attempts with different grit papers and different approaches, Daphne and I settled on unidirectional sanding by hand with 180 and then 220 grit that gave a brushed look and hid most of the scratches. Final waxing made the finish appear more uniform.

The last step was the glass top. Measurements were made to cover the top with some overhang of the widest and longest dimension of the wood while not being extremely larger than the smallest dimension. Low iron glass (Starfire™) was chosen to not filter the color of the wood and on May 25 a piece was ordered for tempering. The 3/8” x 43” x 78” top was delivered on June 9 2023 to finish the project.

Post mortem: The project was a learning experience and several parts of the process could be improved. A larger and completely flat table for assembling the glue up of pins would have improved the flatness of the wood surface. The dining table used for this purpose had edges that were out of plane and disturbed the final surface. A larger and more robust router sled that could be used to re-flatten the entire glued up array would be preferable. Finally finishing the base with blasting to provide even finish before assembly would have been superior.

All’s well that ends well, and we love the look of the table in our dining room.