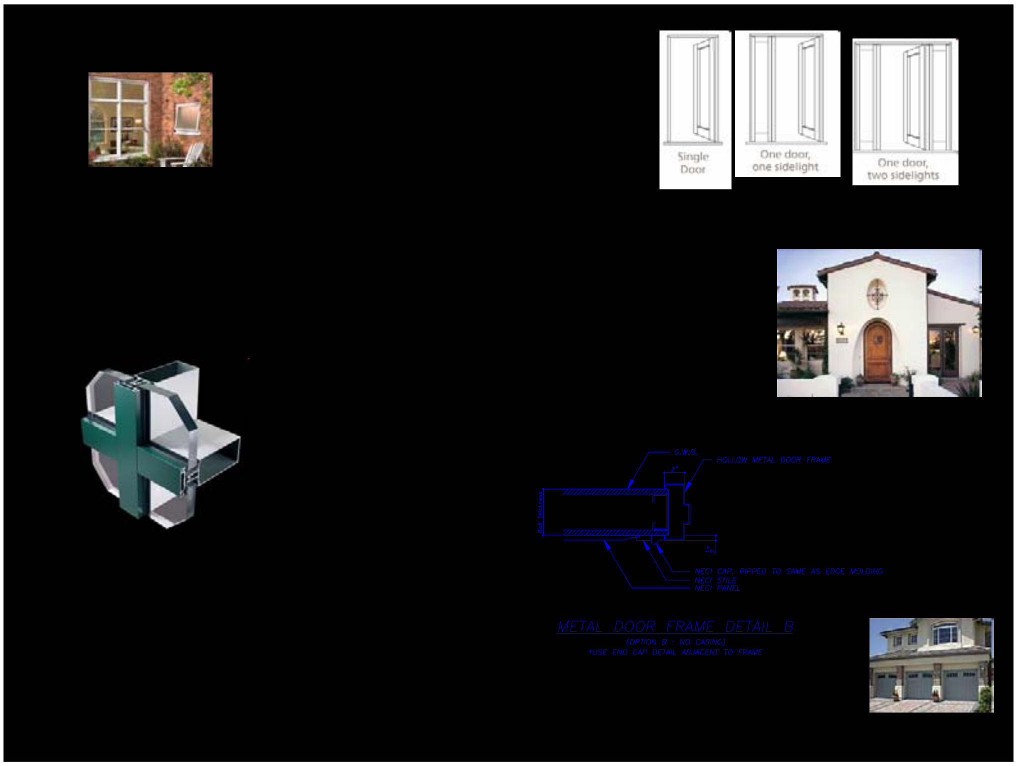
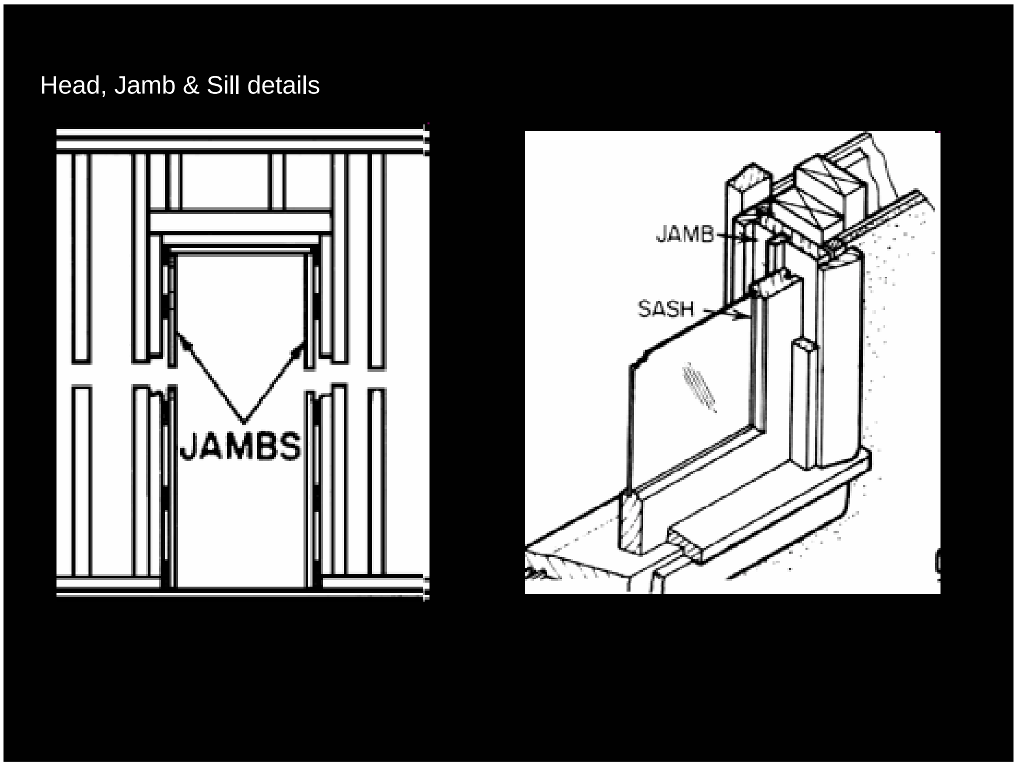
Door

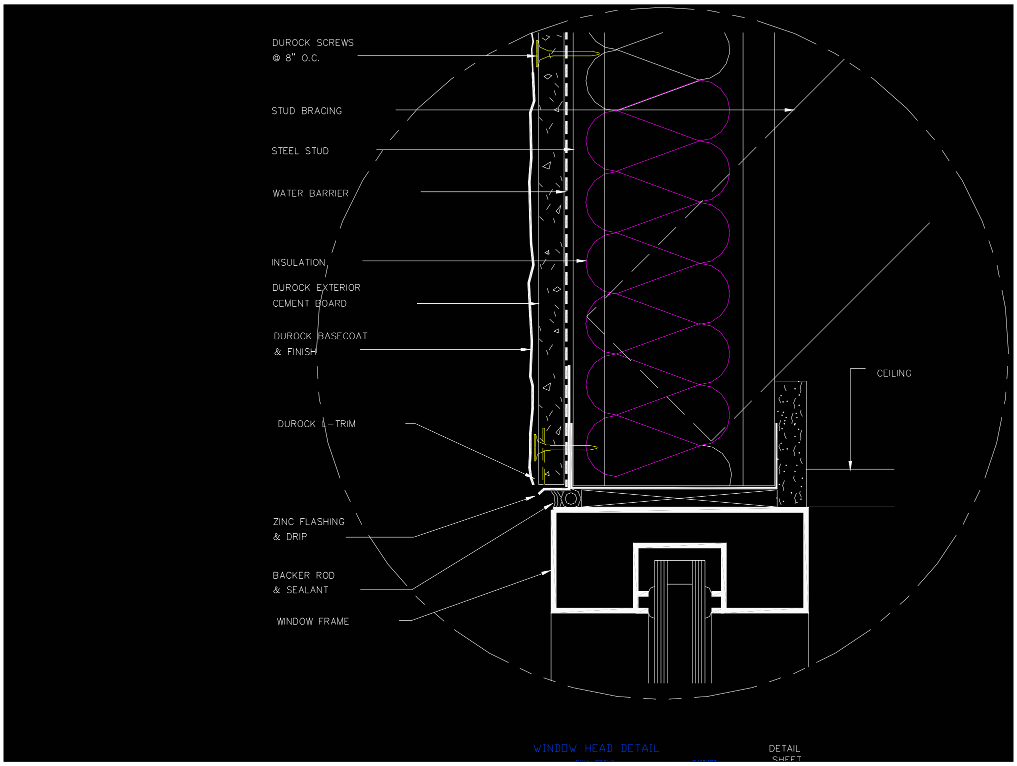
Door A brief look at door concept and then a look at adapting concepts to achieve a design intent.



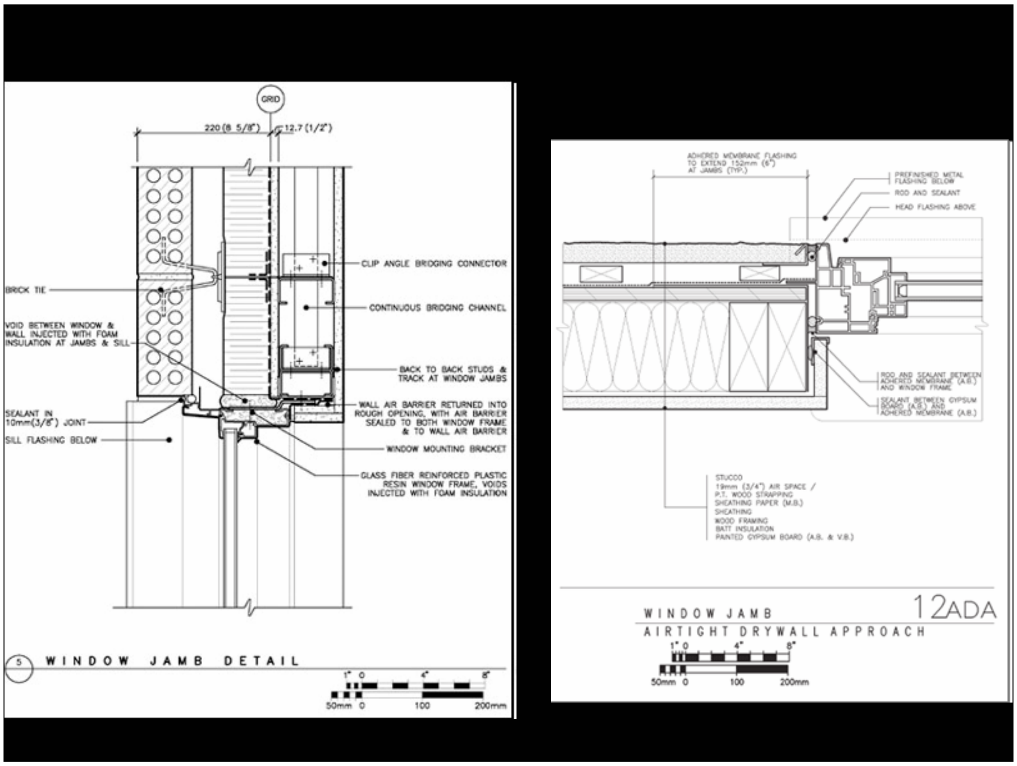
Standard doors and windows. Choices are generally limited to a single design on the “residential” and “commercial markets. Windows typically are prefabricated units which are inserted into a “rough opening” and shimmed and trimmed to fit. Doors swing at one edge and are either right hand (rh), lh, and either inswing or outswing, hinges on one side and standard hardware, latch and optional lock on the other. Taken as a concept, a hinge or pivot point somewhere to allow it to open + a way to keep it closed (and/or open) + security.



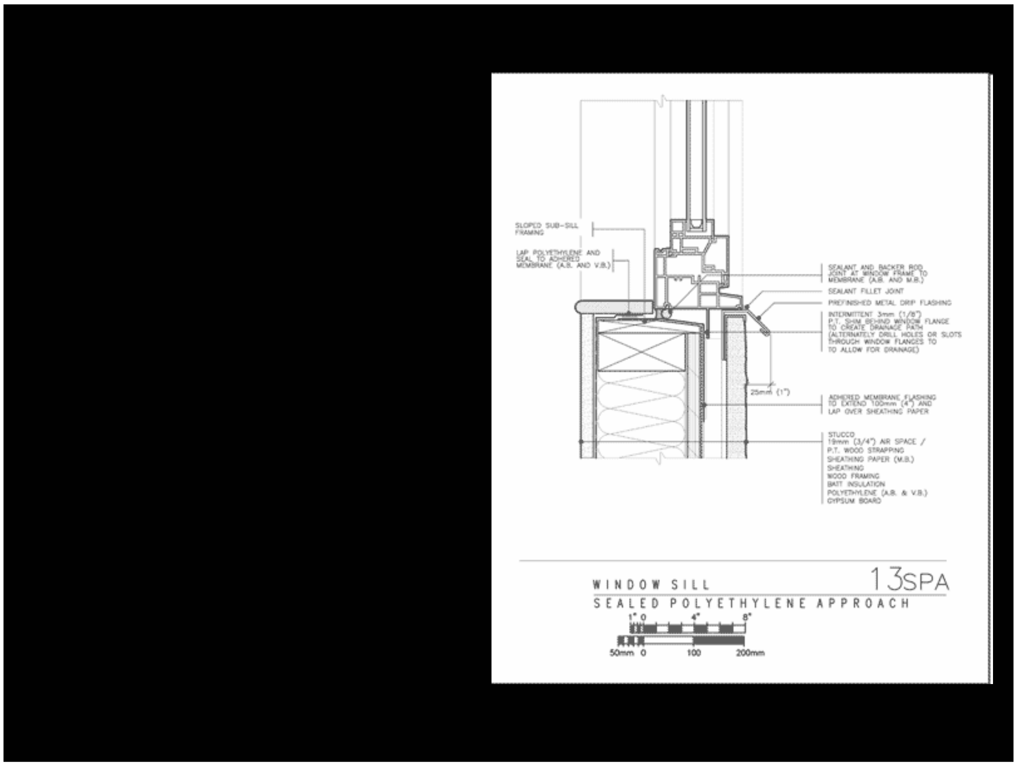
Doors and windows are defined by a designer in drawings, elevation mostly, then more specifically by details known as head, jamb, and sill details.



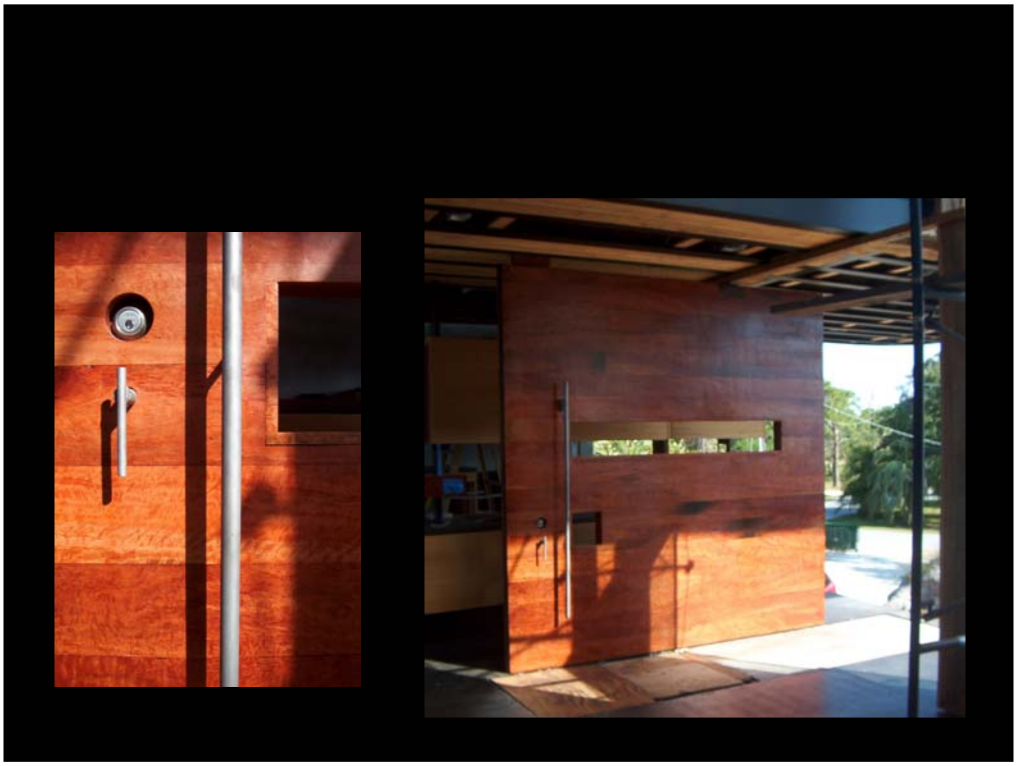
A head detail of an aluminum framed, double pane glass window set in a light gauge metal famed wall with a std. Gwb interior, fiberglass batts insulation, vapor barrier at exterior a hardboard (either fiberglass coated gypsum panel or fiberglass mesh reinforced cement based board, coated with cementitious finish coating (stucco). Special notice to the flashing with drip edge above the aluminum frame and the shim to create a reveal for the backer rod and sealant.



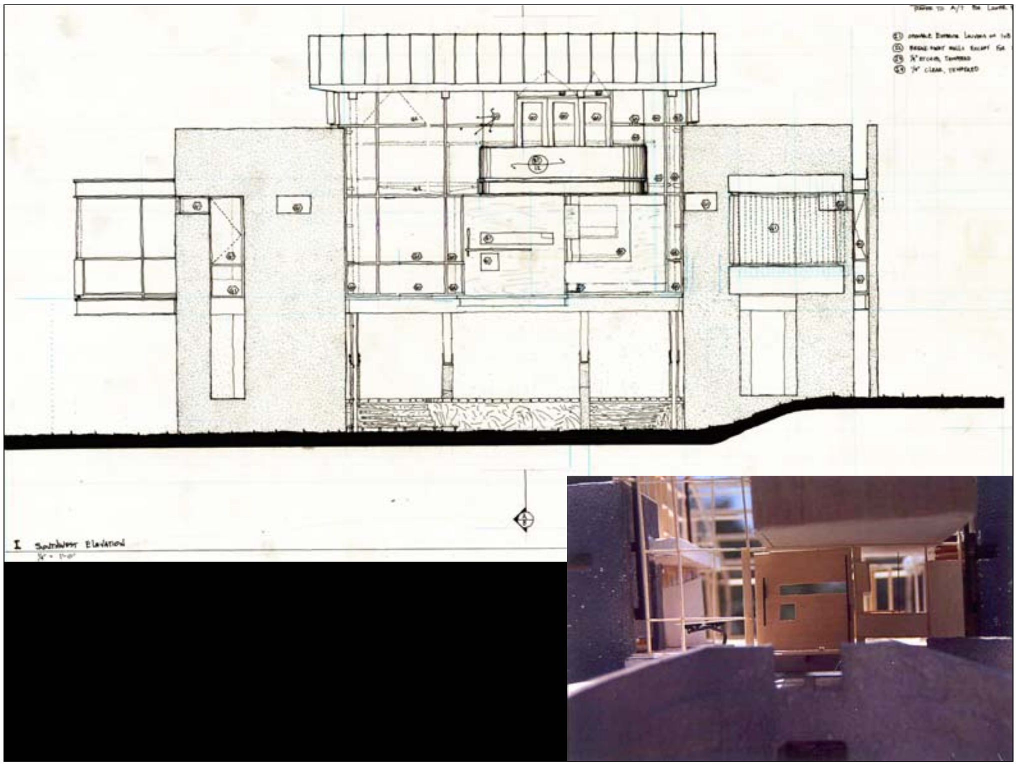
Jamb details, one in brick veneer wall, the other in a stucco over hardboard sheathing wall.



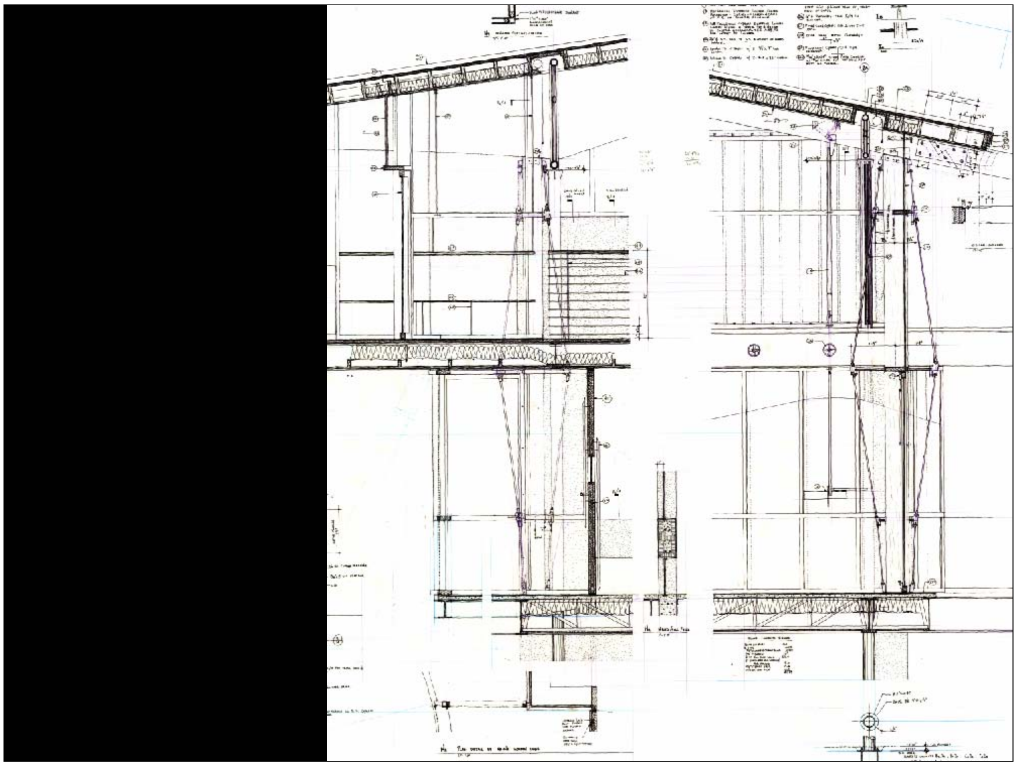
Sill detail of extruded aluminum frame window.



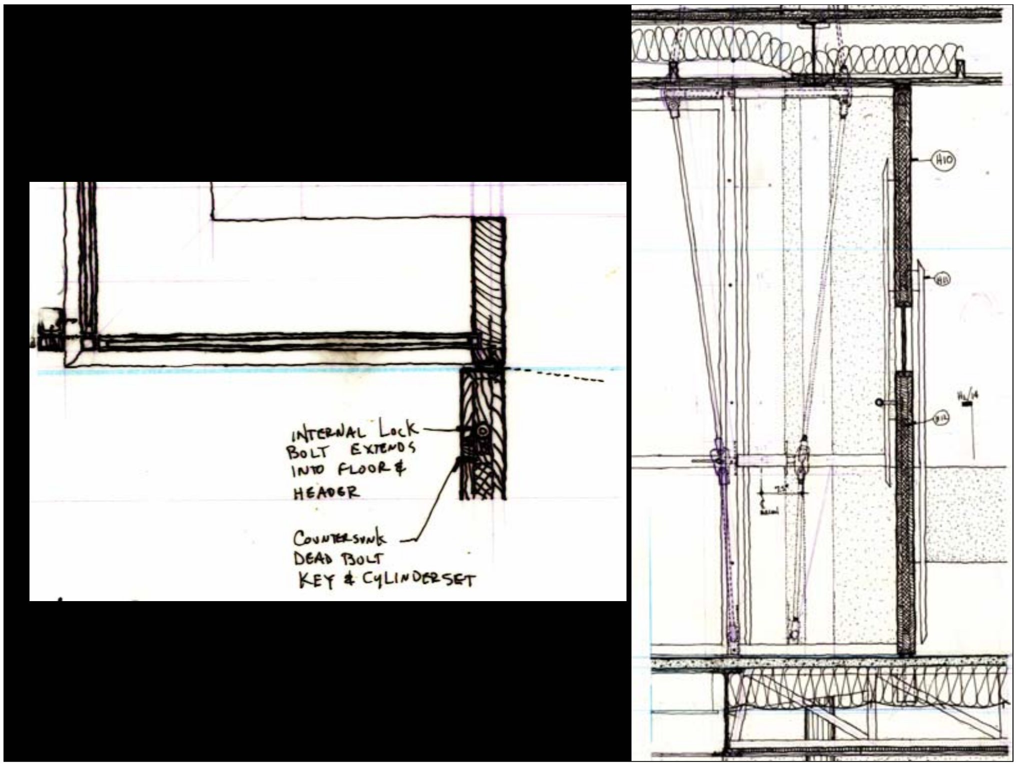
Taking the concept of a door, define an opening to allow passage. Pivot point, handle, weather seal (vinyl/foam insert), water protection (overhang + vinyl sweep), latch and lock.



The idea for this door is that it becomes a regulator for passage of breezes, space and people. The door is thought of as a panel that pivots and can be pinned in two different locations, one perpendicular to passage, preventing it; and other parallel to passage, encouraging and directing it. The panel was developed into a 9’ square with an offset pivot point at 3’ from the east edge. This provides a space (rather than an opening) of 3’ wide on the east side of the panel and 6’ on the west side of the panel and 9’x9’ overall allowing the Florida breezes to flow through the house and out toward the bay.

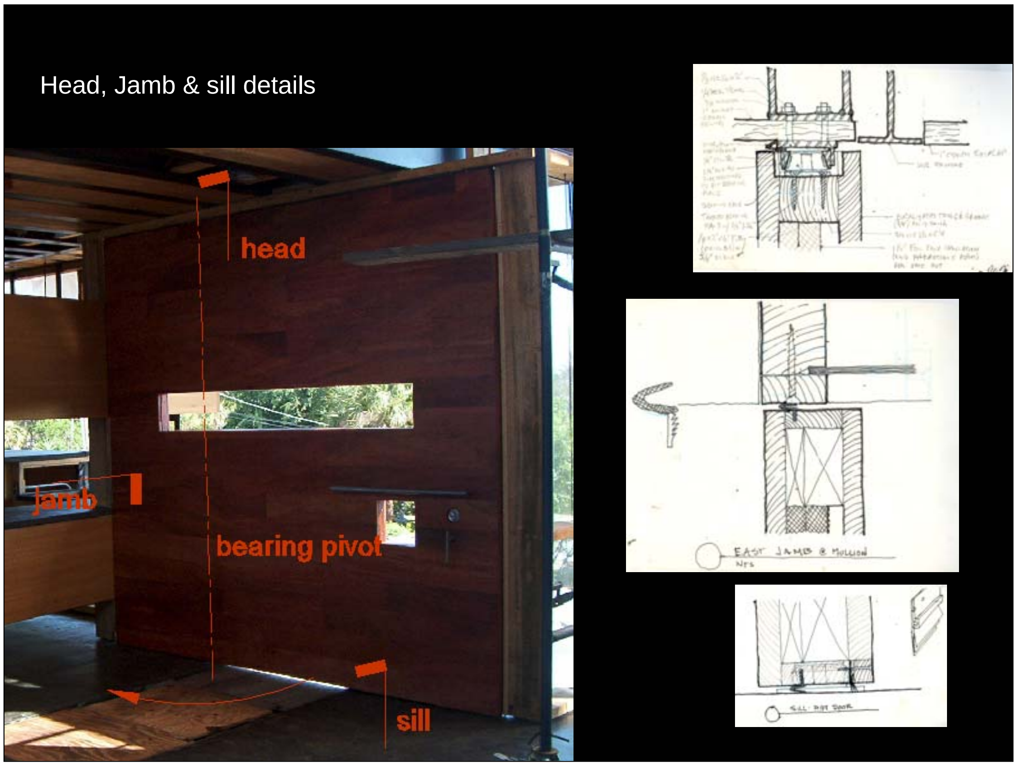


Wall Sections define generally how the exterior surfaces are assembled including the relationships between floor/wall/roof planes. The wall sections generally reference more detailed drawings specifying exactly how each joint is made. In the above drawing, the 9’ square door is seen at the left/lower. The head, jamb and sill details are then referenced from there. At right is the north glass wall with the tension rods reinforcing the cypress curtainwall.

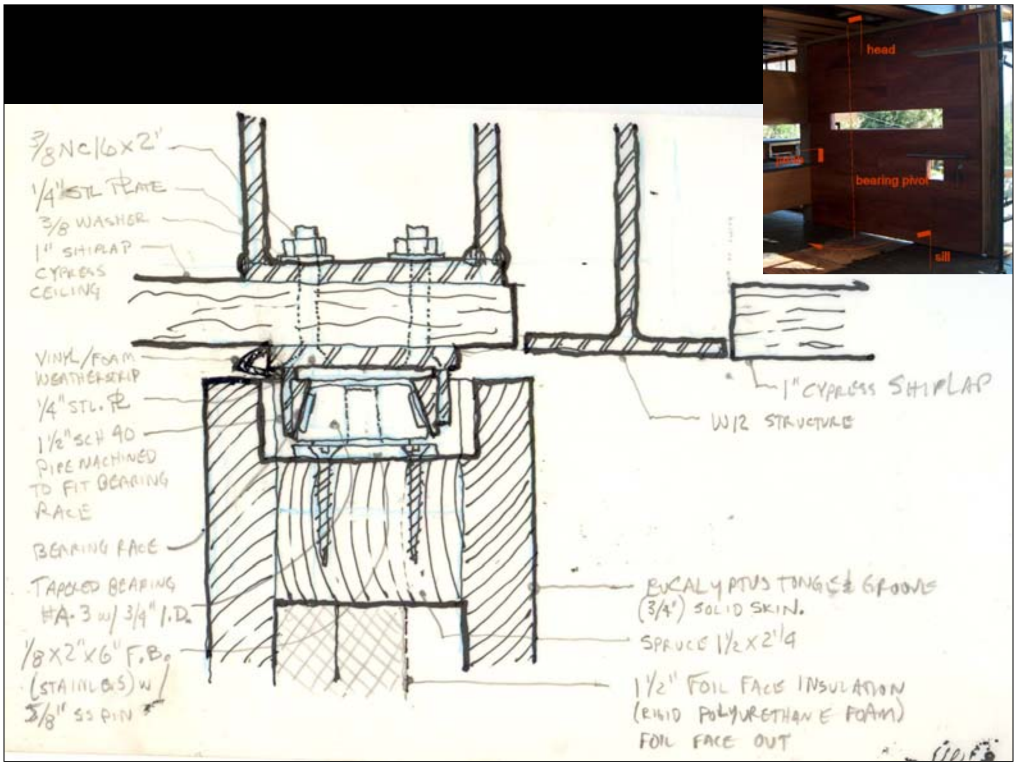


At left is the Jamb detail at the east side of the pivot panel. This jamb is the extent of the detail that was shown on the construction drawings and was fine tuned and modified slightly to accommodate the specific requirements of the materials eventually used. At right, a close-up of the wall section showing the pivot panel.

Photo showing the "rough opening". The rough opening is the dimension of the opening framed out in the wall for the door (or window . . . Or pivot panel) The rough opening includes space for spacers, seals, etc as required by the head, jamb, and sill assemblies. In the foreground can be seen the tension rods for the curtainwall reinforcement. The varying jamb condition can be seen opposite the opening, cypress mullion, cypress plywood cabinet, ditto – moving bottom to top.



Examples of head, jamb, and sill details and their respective locations on the opening. At the sill of the door in this photo is a temporary plywood floor filler where etched glass will eventually flush out the underside and eliminate the gap that can be seen at present.



Head detail of the pivot panel. At top is the ¼” plate header which is welded beyond and behind to the W12 wide flange beam structure of the loft above. Then the Ceiling boards are sandwiched between the header and the bearing plate. The bearing plate has a machined pipe section welded to it which accepts the bearing race and the door top has a steel plate with a ¾” solid steel pin which the bearing slides over. The door is made up of a spruce 2x4 frame with a ‘skin’ of ¾” tongue and groove boards made of lumber milled from a local, fallen Eucalyptus tree. The door also is insulated with (2) ¾” layers of foil faced polyurethane foam insulation with the foil face outward facing a ¾” air space to reduce radiant heat gain.

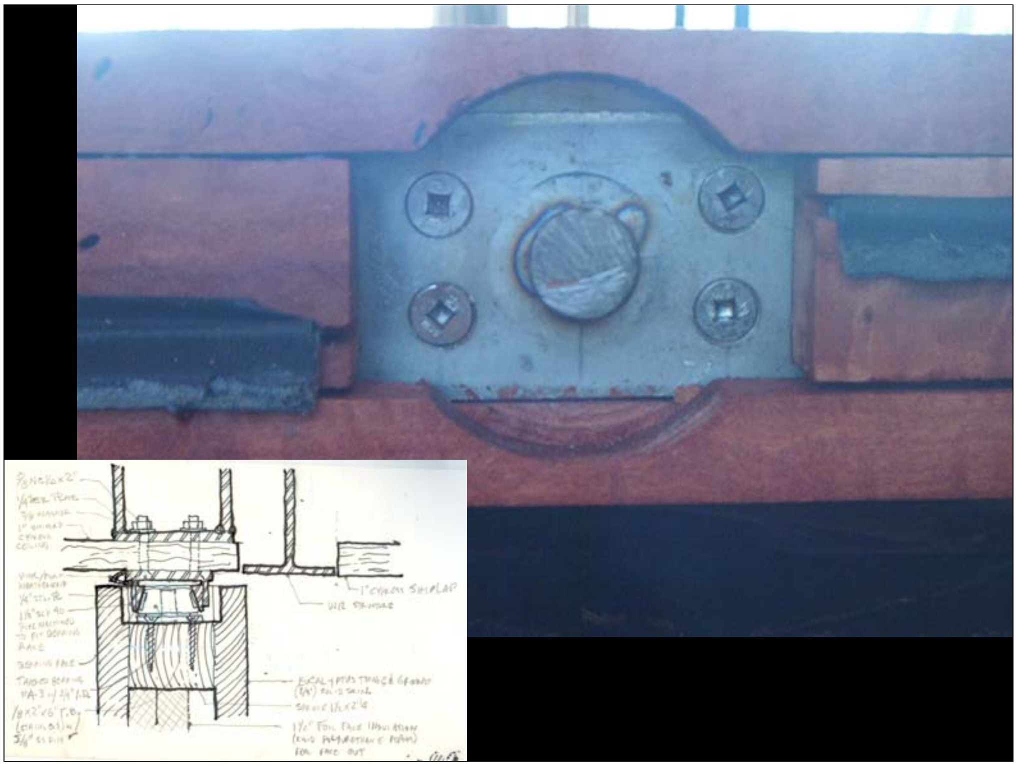
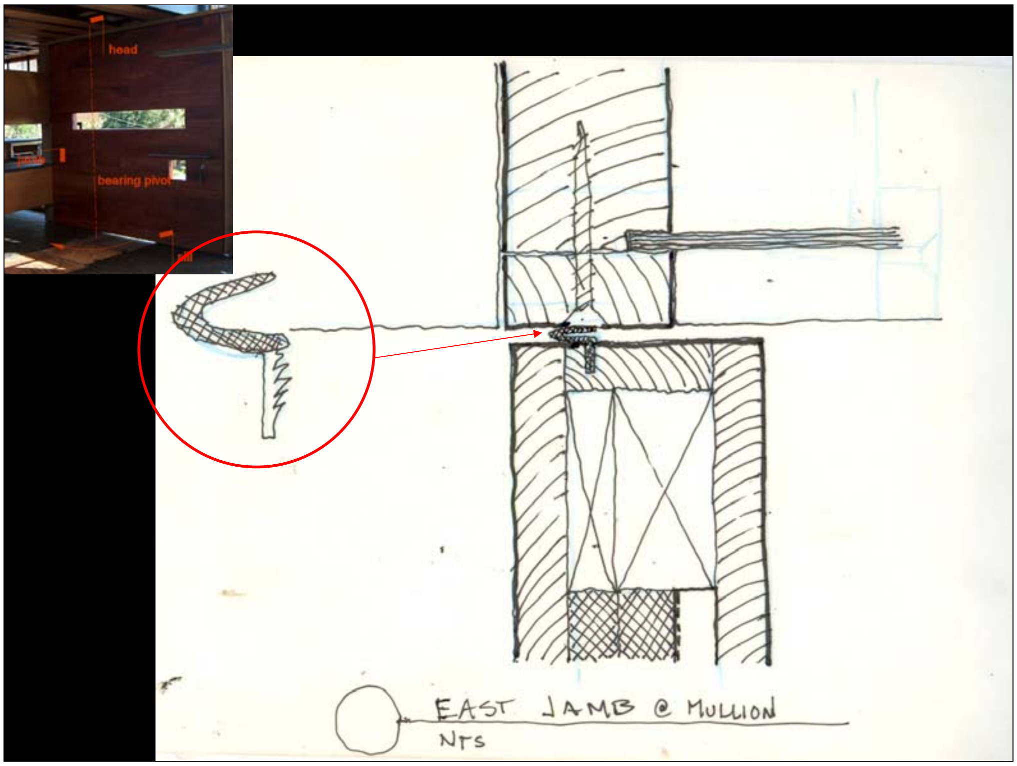
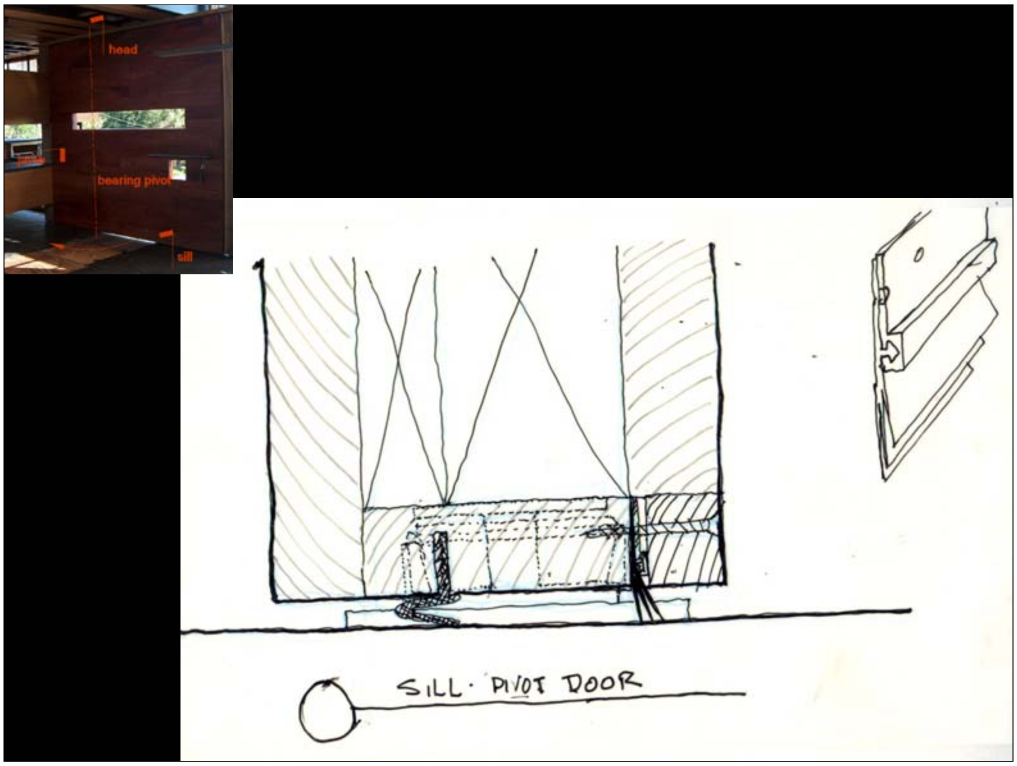


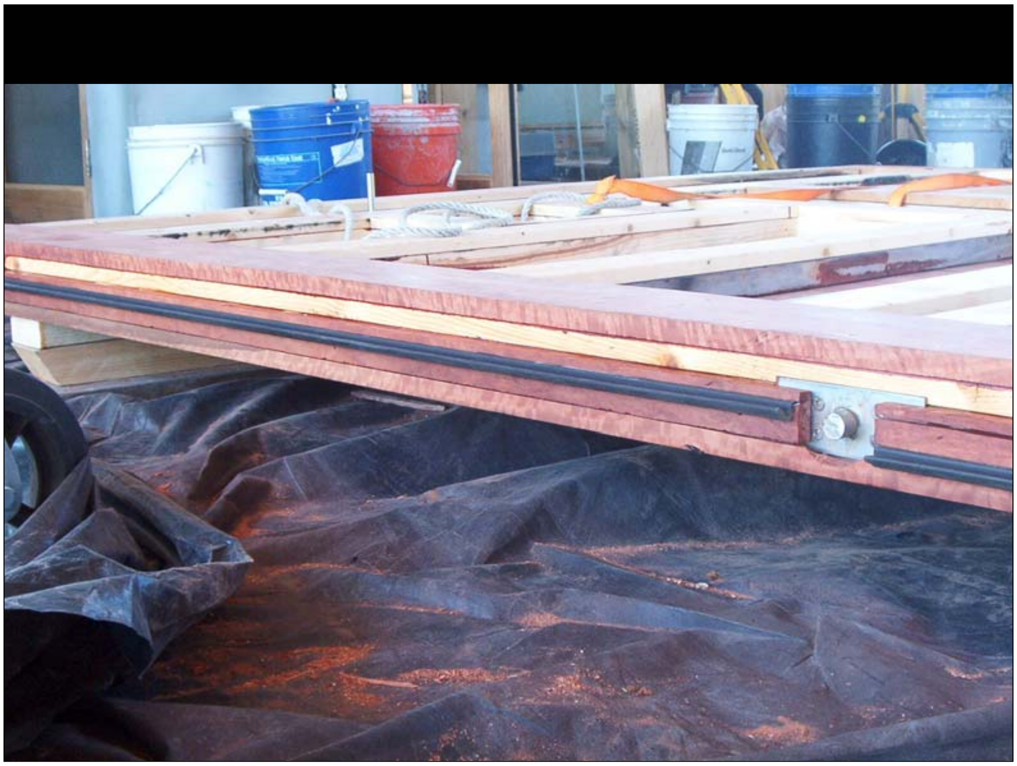
Photo of the head door bearing plate with its pin. Note the pin is welded to the plate from behind. A hole is drilled into the steel (stainless) plate the same diameter as the pin, the pin is inserted, squared, clamped in place and welded from behind so that the bearing will sit flat on the plate. The vinyl weather strip can be seen at right an left of the bearing plate.



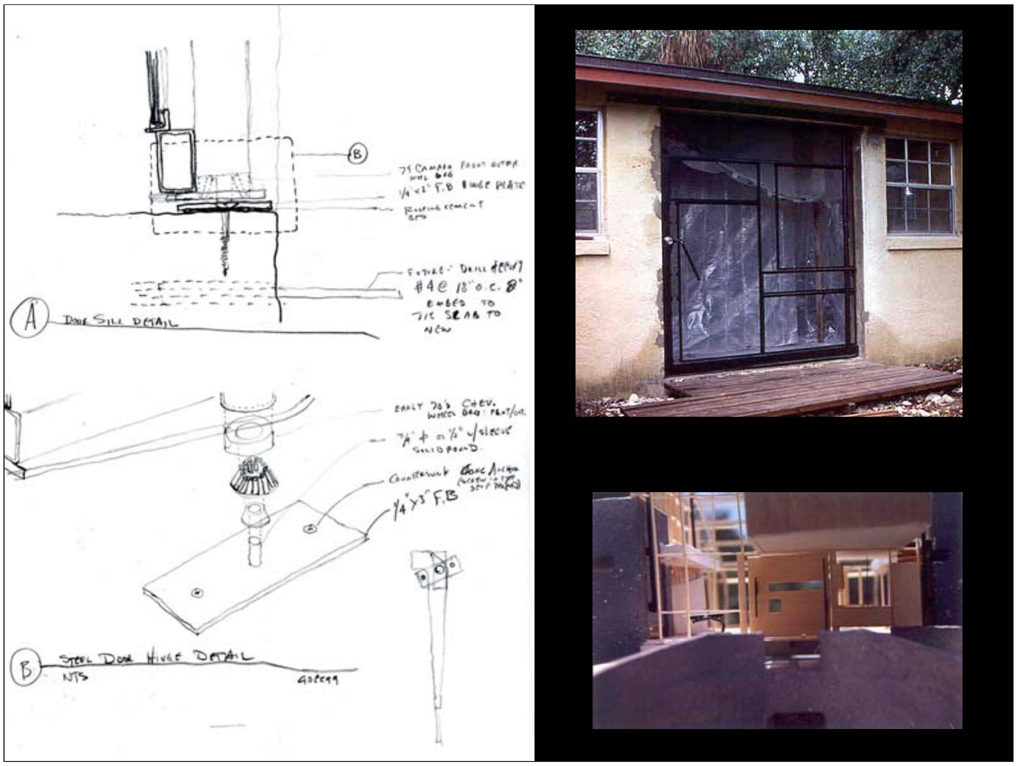
The door jamb: this drawing shows the door construction more clearly, the spruce 2x4 and 1x4 frame inside, the ¾" eucalyptus 'skin' and the polyurethane insulation with its foil face inside facing a ¾" air space. The vinyl weather strip which can be purchased at a local Home Depot or Lowes and inserted into a groove cut (using a table saw prior to installing the board onto the door) into the door edge. This jamb works for sealing against the cabinet, or the cypress 2x8 & cap which are both present at the jamb condition. (see slide back 4)



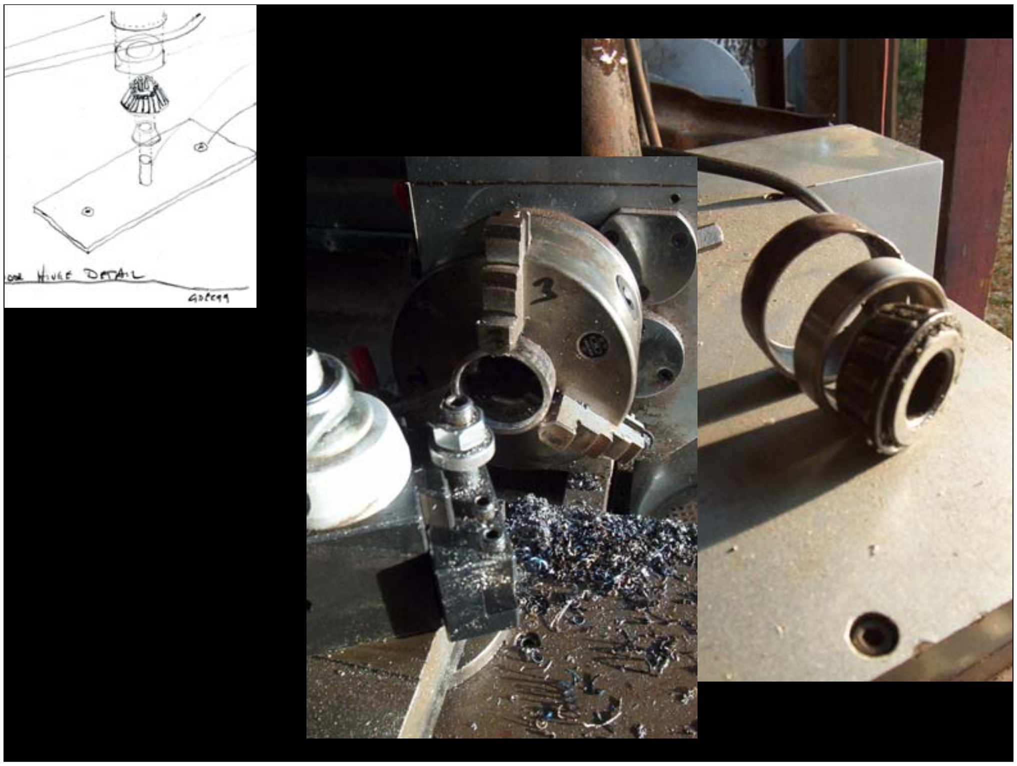
Sill Detail showing the bearing beyond, the vinyl/foam weather strip and the addition of a vinyl sweep which again can be purchased at a local Home Depot or Lowes. The lower ¾” of the door ‘skin’ is used as a lock strip for the sweep using countersunk, stainless steel, flat head, square drive screws so that it can be replaced when required.



View of the bottom (sill) edge of the door, the strip of eucalyptus missing is the lock strip for the sweep. The skin was only installed on the inside face of the door to keep the weight (550# in total) down prior to installing the door in its opening.

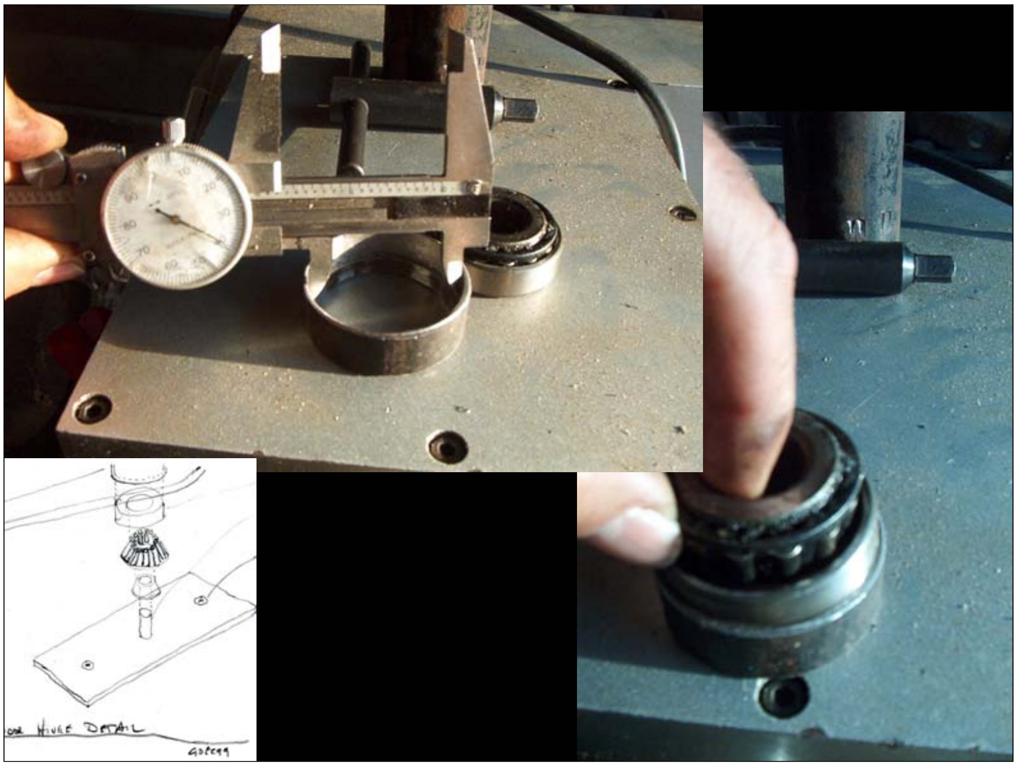


The prototype for the pivot bearing and the door concept. The bearing used is a tapered needle bearing which actually can be found at a local auto parts store and would fit a 1977 Camaro's front, outer wheel bearing. Other sources would include www.vxbbearing.com or www.mcmaster.com, or www.riedsupply.com and could be found under tapered roller bearings. Many different sizes are available and are sized by the inside and outside diameters. The tapered roller bearing was chosen because of its ability to take both vertical and lateral loads at very high rates. This bearing has a 2000# dynamic radial load capacity and a 1050# dynamic thrust load rading.

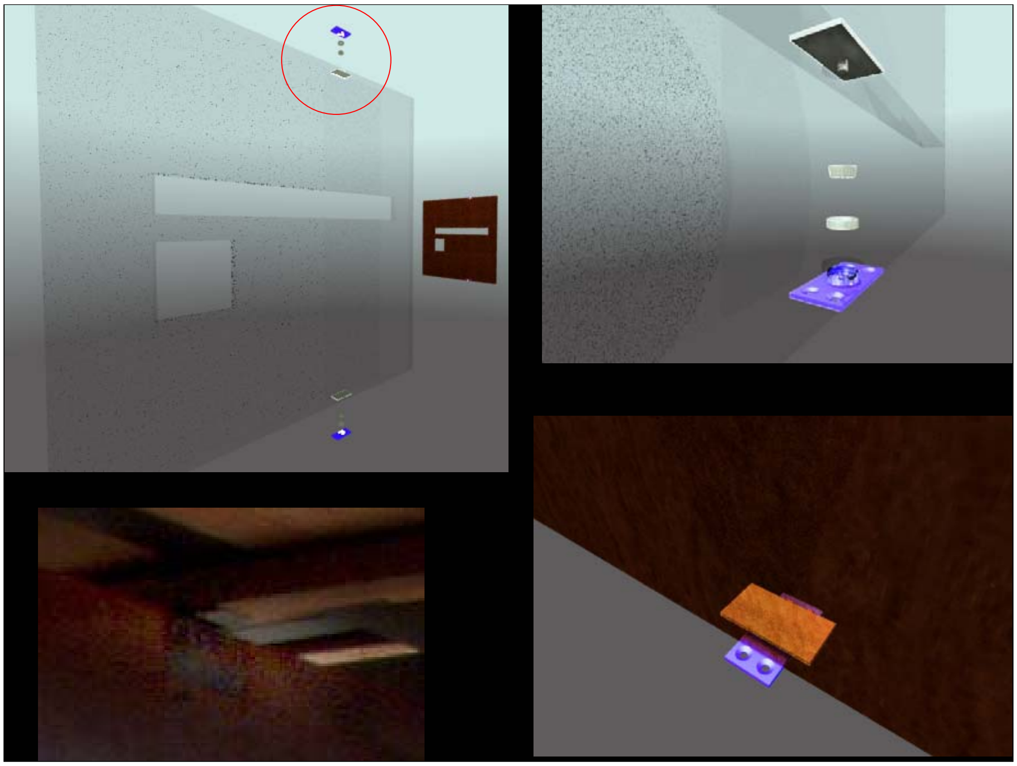


The turning of the pipe section to accept the bearing race. In this case the bearing selected which has a race with an outside diameter slightly larger than the inside diameter of a 2” schedule 40 pipe which could be turned on a metal lathe to enlarge the inside diameter to accept the race.

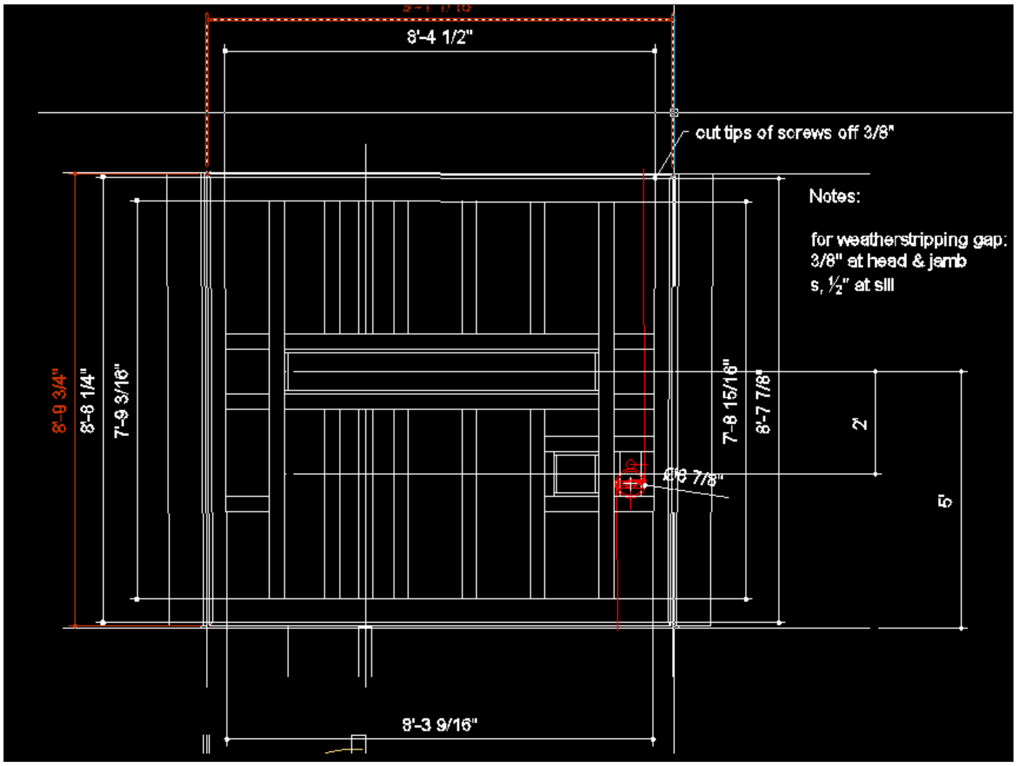
Metal Lathe. A small version with a 13”x40” capacity, this machine is very useful for a large number of applications and can also be adapted to be a CNC lathe by replacing the turning handles with small stepper motors and replacing the single speed, gear driven motor with a DC motor controlled by either a variable frequency controller or a servo driver and encoder to control the lathe axis as either a spindle or an indexing axis. (ref. The “applied CNC technology presentation on the website for more info)



The bearing parts, the machined pipe section is being checked for correct I.D. at left. Right: the tapered roller bearing being lowered into the race which is sitting in the machined pipe section. The pipe section will get welded to the steel plate that is bolted to the door header.



Series of drawings showing how the bearings and bearing plates are installed on the door and the door in the opening. The bearings and plates are installed on the door and the door is stood upright and slid into the opening with the bearings and plated in place. The door is moved to its open position where the bolt holes in the head and sill plates will be extended beyond the edge of the door allowing installation. When the door closes, the plates and bolts are completely hidden from view.



Framing drawing for the door showing the location and concept for the throw bolt hardware.

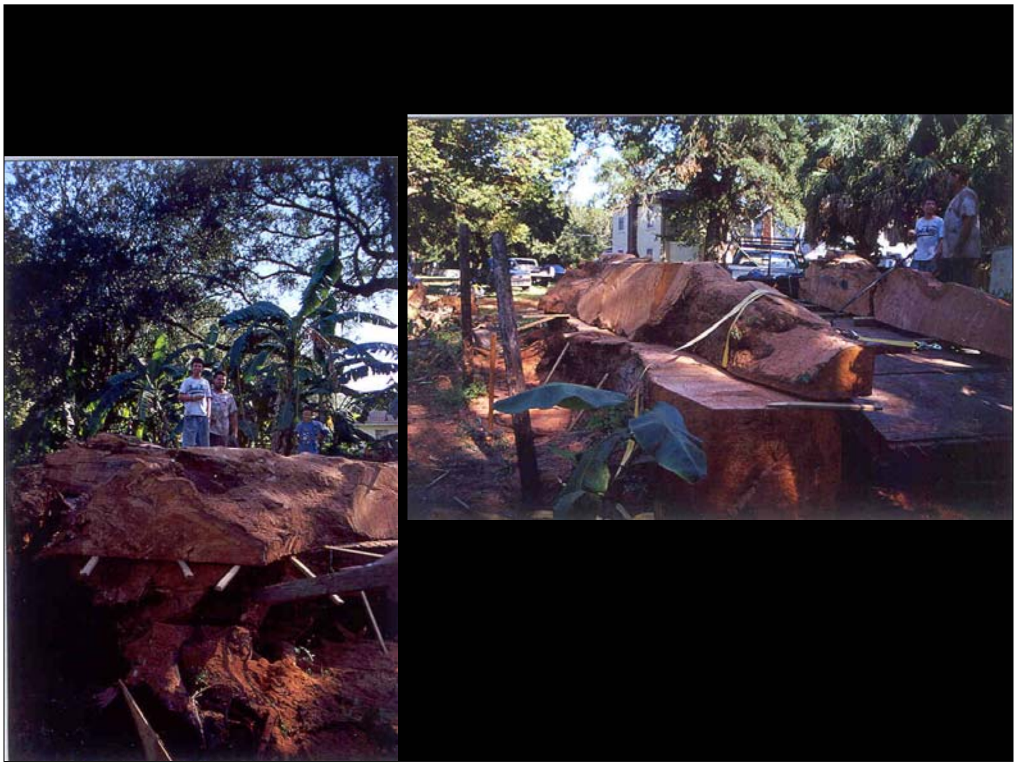
The door on its back face nearly ready for installation just after the hardware was installed in the frame.

The back face of the door after being glued and nailed with a floor nailer. The glue used is the resorcinol used in the making of the glu-lam beams which has a reddish brown tint to it and blended well with as well as worked for a filler when mixed with sawdust for the eucalyptus skin. All of the hardware is made of grade 316L stainless steel which is a low carbon alloy and has the highest weather resistance of the common stainless alloys most commonly used in construction.

Aside: The wood came from a eucalyptus tree which had fallen down a couple of blocks from the Studio in Tampa, FL. The trunk sectcion was over 18’ long and was nearly 5’ in diameter. The chainsaw is a 5hp Stihl with a full 36” bar. The aluminum pipe was used as a safety in case the saw kicked back . . . Just so no-one got cut in half. The owner of the property was giving the wood away to anyone who would take it for firewood. If you look closely at the end grain fo the tree, you can see a slight shimmer and the grain in very uneven and . . .curly. This means that the grain when sanded, and polished will be beautiful! We decided that it definitely was not firewood.

The trunk had to be quartered because we did not have anyone who could mill it so large. Right, brother Dave Calvino celebrating the splitting of the trunk.

The shimmering grain revealed. The quarters had to be slid onto a trailer to be taken to High Springs, FL to be milled into lumber.



The wedges are used to keep the upper section of tree from falling and pinching the chainsaw blade as it was cut. The wedges are cut from hard maple and purpleheart drops from the shop.

The GMC just couldn’t handle it on the way out. Yes, that’s a ford pulling it out. Where was that International when I needed it?! The tree trunk section weighed an estimated 26000# and so this was maybe 13000# just on this load. That’s not really a ½ ton is it?

Wood mill John Kinary with his portable bandsaw mill could cut up to 24” diameter, and spent a full 9 hours milling just the branches (some of which were evern too big) and could not even touch the trunk. Right: success in getting the top half of the trunk onto the trailer to take it for milling.

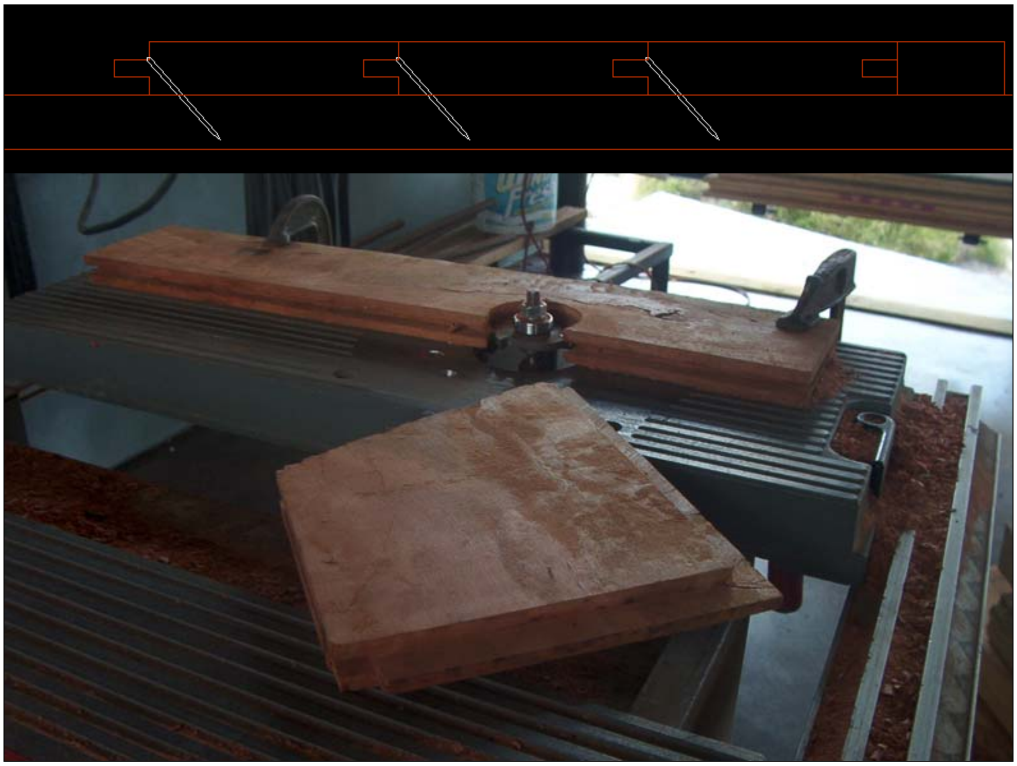
The milled lumber, cut into 4/4 pieces (4/4 is a term used to describe rough sawn lumber indicating a 1 inch nominal cut size. 5/4 would be used for lumber that shrinks a large amount and would yield ¾" finished lumber after planing in most cases. 8/4 lumber would indicate 2" thick pieces) Eucalyptus is actually Australian mahogany or Jarrah and demands quite a price on the exotic wood market. The species holds lots of water and moves, twists, and warps badly on drying and so it required strapping to help stabilize it during its drying process. The lumber is spaced apart with what's called 'stickers' which are just short pieces of ¾" or 1" x 2" dry boards used to space the lumber apart to allow air to circulate between and dry them evenly. The ends of the logs are also painted in order to prevent most of the moisture from escaping through the end grain and causing splitting on the ends. That's why then ends of boards are usually painted some color. We just used up lots of old paint that may have otherwise gone to waste.

The warehouse space where most of the lumber lived through most of its 2 year drying period. It reached a moisture content of about 17% which is normal for dried lumber..

Here is an example of what the shimmer in the grain at the end of the log (lower right) and inside the cut open trunk piece shown at upper left, will look like when planed, sanded, clear coated, and waxed. Even the pieces shown in the upper right will produce grain similar to what's shown in the lower left. It's what's inside that counts.

This series of photos shows part of the process of taking the boards from their rough sawn, dried state to usable, tongue and groove floor planks. The dried rough sawn planks are seen upper left, one long edge is cut straight using a 10’ piece of steel flat bar and vise grip clamps (do a web search to see that these look like) to hold the straight edge. Then the wide boards are run through a table saw with a rip fence set at the overall width (4” in this case) of the finished boards. I should have made them 4 ½” wide to account for the ½” tongue cut on one side of them, this would have produced a 4” wide (3 per foot) finished width visible, instead I ended up with 3.5” . . . Not on any module! . . . Live and learn.

Once they are cut to parallel widths, the boards are run through a planer to make them smooth on the flat faces and all the same thickness (3/4” in this case).

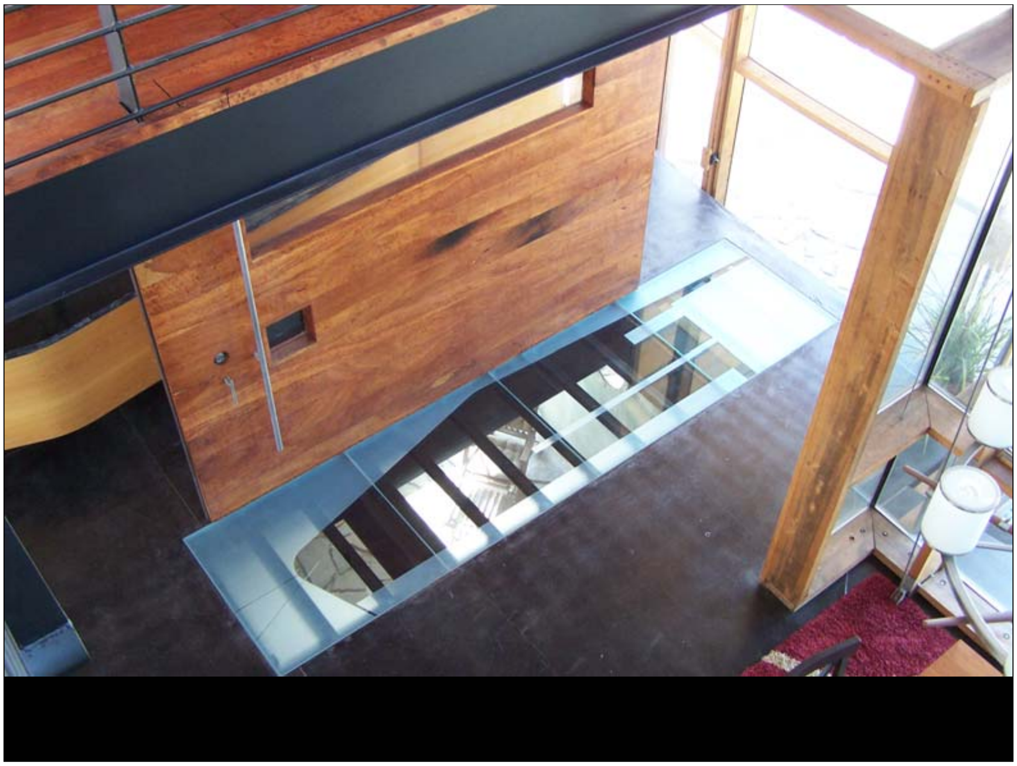


Here is a view of the tongue and groove on the boards, the tongue and groove are also routed into the ends of the boards so that the end joints are strong as well and do not allow vertical movement between boards. A router is used to cut the tongue and groove with a T&G router bit. We got 2 bits and set up 2 router tables (second one was just a board with a router bolted to the underside of it with a hole cut for the bit to stick up and a fence clamped to it. One router was set to cut the tongue and the other set to cut grooves, this way the boards could be mass produced to an extent.

The three main locations that the wood is used is on the loft floor(right) measuring 15'wide x 30' long; the main, front door; and inlays in the black stained concrete floors in each bedroom.

Back to the Door, the eucalyptus ‘skin’ was nailed in place on the outside face after the door was set in place.

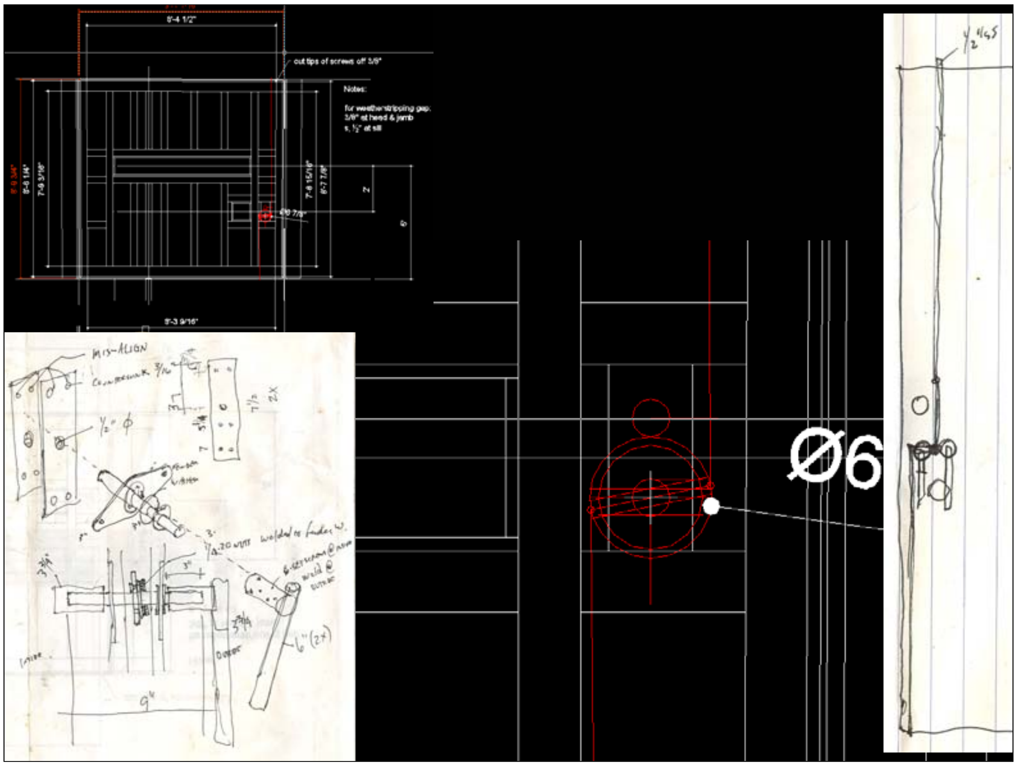
This series of photos attempts to show how the pivoting panel changes the feel of the space from a partially enclosed to a wide open space.



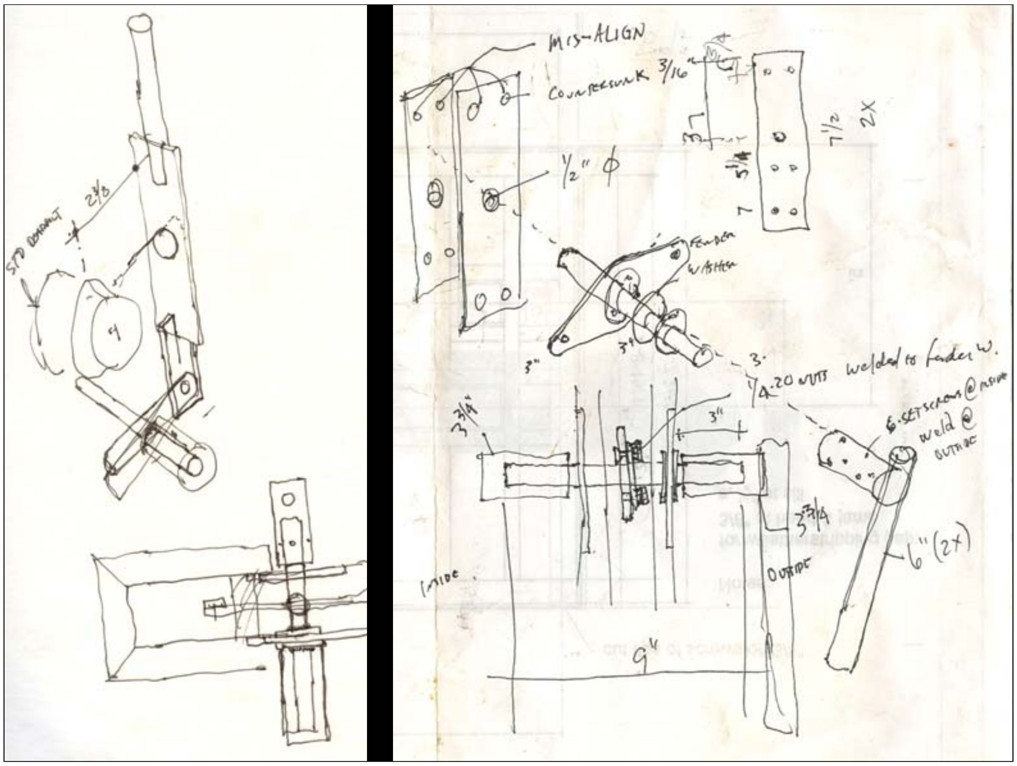
The glass floor is made of 1” thick overall (1/2” tempered, .090” thick vinyl interlayer, ½” tempered) glass. It is sandblasted on its top after it is installed. The sketch is a diagrammatic section cut through the building in the same direction. The diagram is masked using what is called frisket, a sticky backed vinyl sheet that is adhered to the glass and then cut out where it is to be blasted. The blasting medium is 240grit silicone carbide which can be purchased locally at Reed Minerals: *www.harscominerals.com* and Florida Silica and Sand Company *www.fsscompany.com*.

Hardware. These images show the standard door hardware that is available "off the shelf" None of these would really work for this door, in concept or structurally.

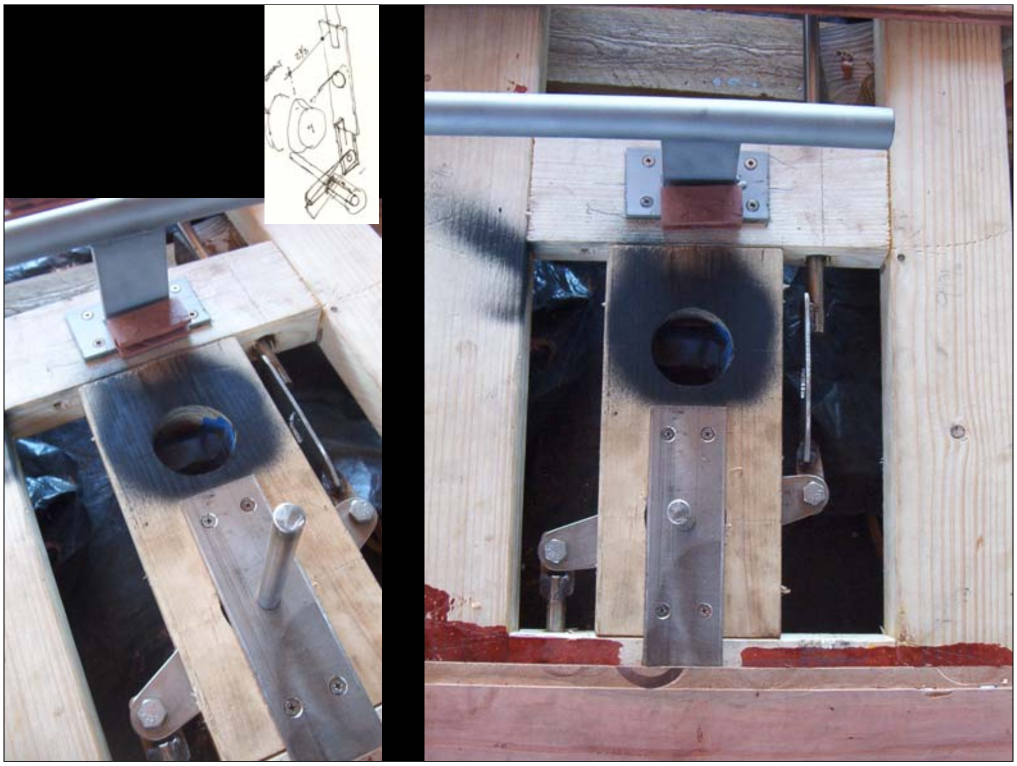
Aside - Anti-pick device. The latch plate will not let it extend all the way and if it it not extended all the way, then the latch cannot be pushed back into the latchset.



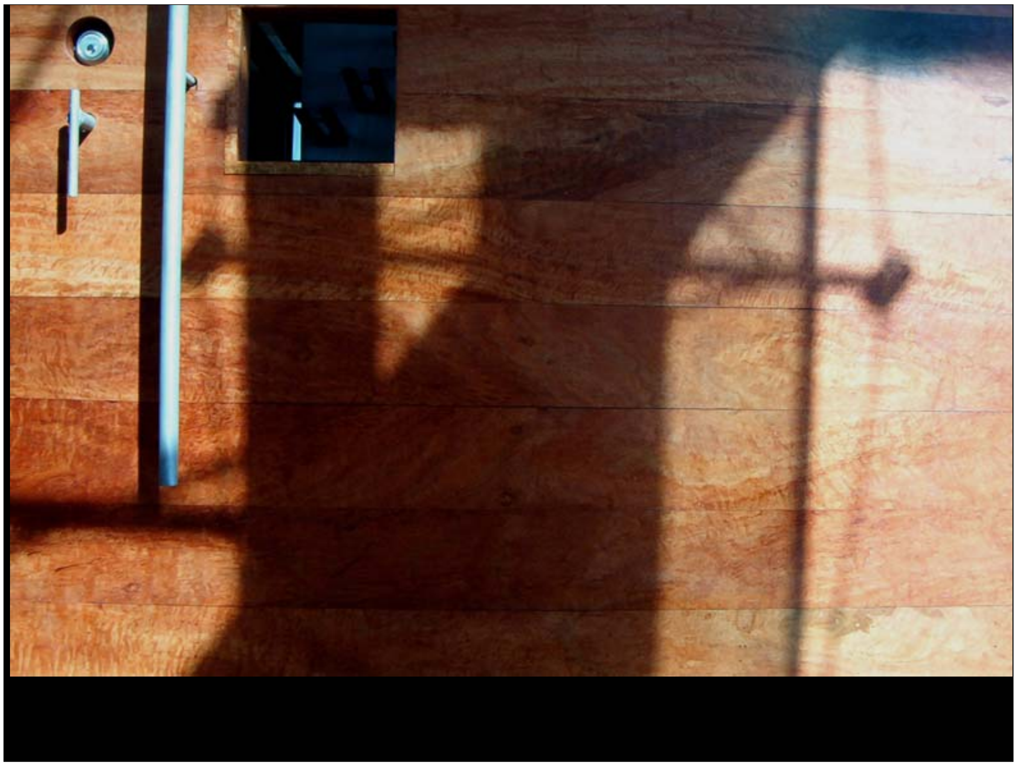
Conceptial, detail drawing of how the hardware will work. Basically, 2 throw bolts made of ½”dia. 316L Stainless steel rods with the top one being longer. The fact that the upper one was longer was used to make it fall to the closed/locked position by gravity to provide less chance of the door not being locked in either open or closed position. Because of its size, this was important to avoid having the wind blow the door around, even though it weighs in at ~550#, the needle bearings allow it to move with very little force.



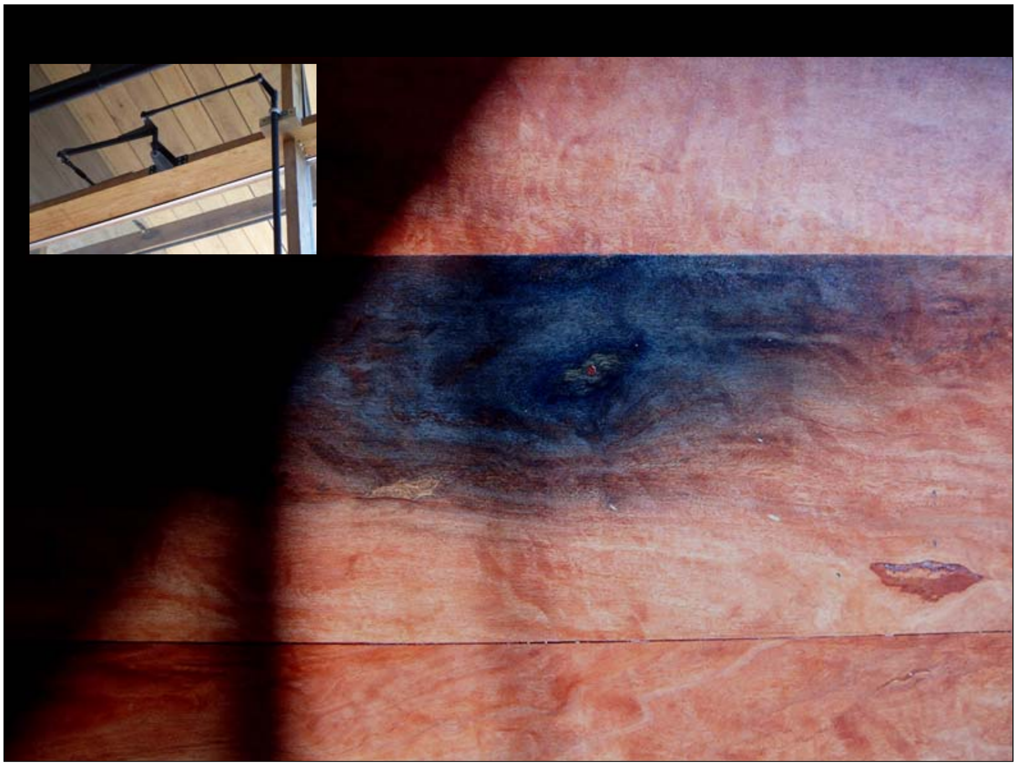
A closer look at the parts for the lock/latch shows the handle which is slid on and secured with a hidden allen head set screw, the main shaft with the two tabs which will connect to the throw bolts, the door plate which has a hole in the center through which to slide the main shaft. The main shaft has nylon washers between the two tabs and the door plate. The lock, shown at left, uses a standard dead-bolt (which can be purchased at Home Depot/lLowes) and it slides into a hole in a stainless plate which links the upper bolt to the tab on the main shaft once the handle/throw bolts are in the locked position.



Views of the hardware installed inside the framing behind the ‘skin’.



The 9” square opening for glass has a joint across the bottom so that the glass may be changed without destroying the door in the event of breakage.



This stain in the wood was produced by a nail which had been in the tree for many years. The iron oxide reacted with the acidity of the tree sap and produced a purplish color. Next, hardware design issues for large panels.