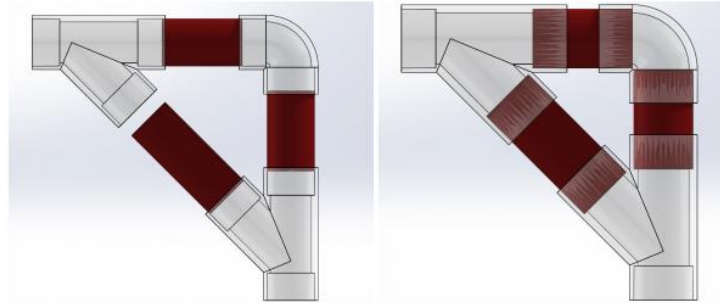


**P14031 Jib Transfer Bench - MSD I Phase Review**  
**December 13, 2013**

**Feasibility to Assemble PVC Arm**

The red colored pieces are the straight PVC sections, the joints have been turned translucent. The straight sections will be inserted into the joints as shown in the first image, then all of the pieces will be pressed together simultaneously resulting in the second image.



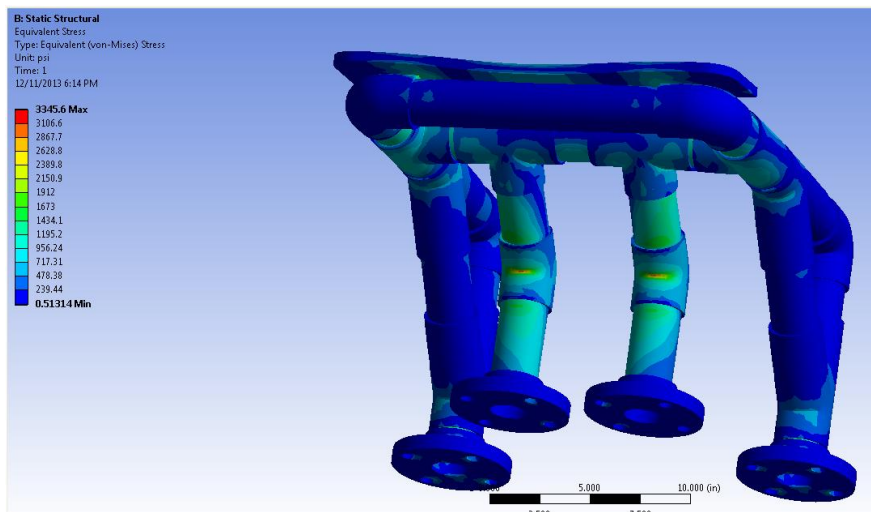
The set time for the PVC primer and cement selected is ~5 minutes, which should allow for enough time for the user to assemble the PVC components and press them together.

**Schedule 40 vs. Schedule 80 Design Concerns**

The team re-evaluated the use of schedule 40 fittings on the back legs, since schedule 40 is more commonly carried in stores than schedule 80. The table below shows the comparison of the designs using schedule 40 and schedule 80 PVC fittings on the back legs of the device:

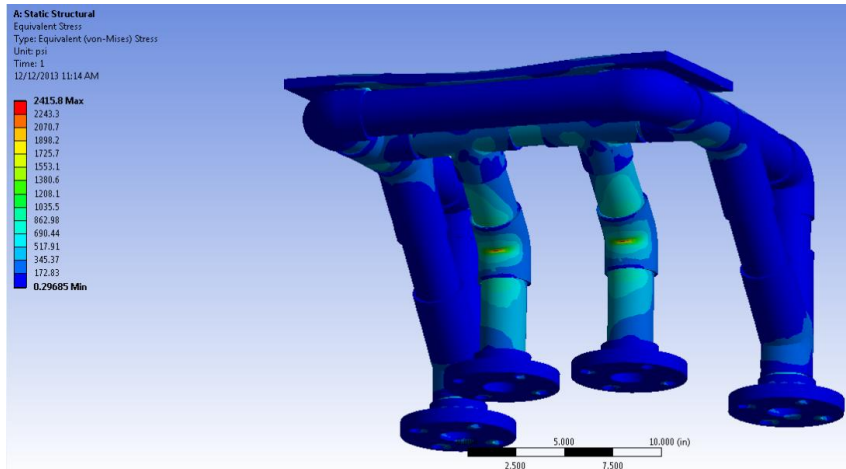
<b>45 degree elbow</b>	<b>Factor of safety</b>	<b>Fitting PN</b>	<b>Cost/fitting</b>
Schedule 40	1.57	McMaster # 4880K360	\$2.09
Schedule 80	1.91	McMaster # 4881K360	\$9.04

The proposed design now uses schedule 40 fittings on the back support leg. The image below is the stress analysis with the schedule 40 design:

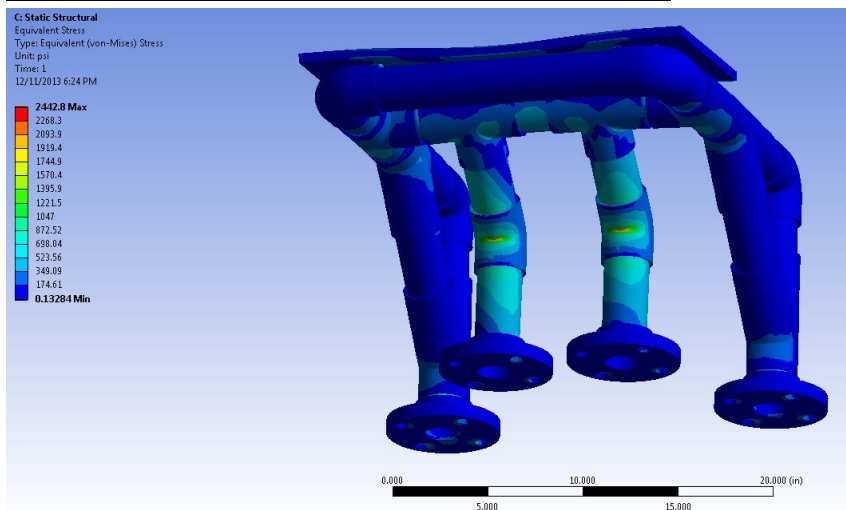


## Varying Forces – Model user motions other than sitting straight down (all schedule 40 PVC)

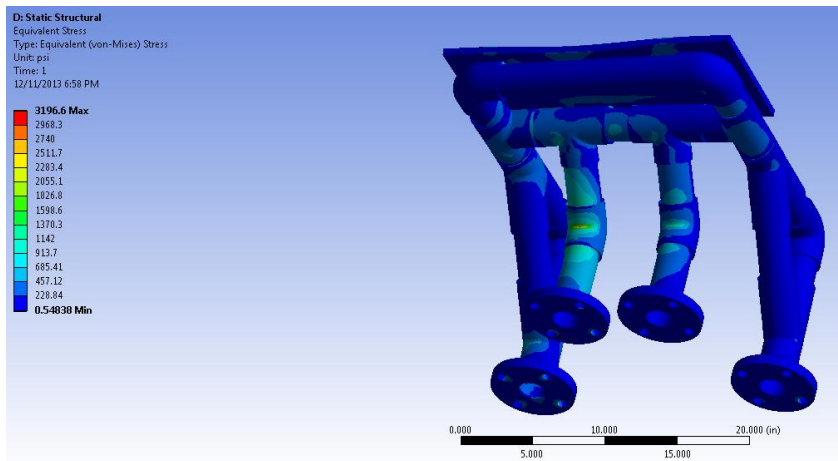
*Standard loading – user is seated in a upright position with weight equally distributed over the seat*



*Side load – user tries to “scoot” while it was still locked*



*Moment load – user leans/twists while seated*

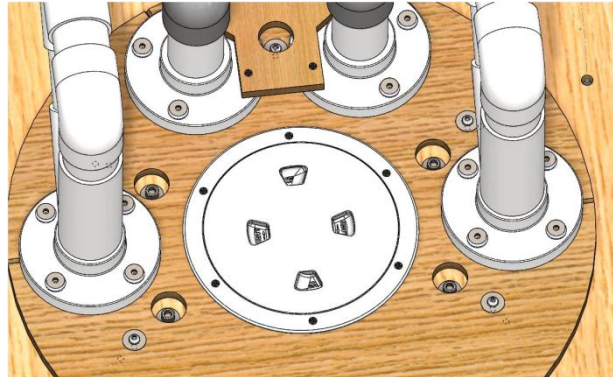


## Accessibility of Screws

Since there are layered bases, there was concern with the accessibility of screws.

That said, we have incorporated access holes into the bases to ensure all screws are accessible.

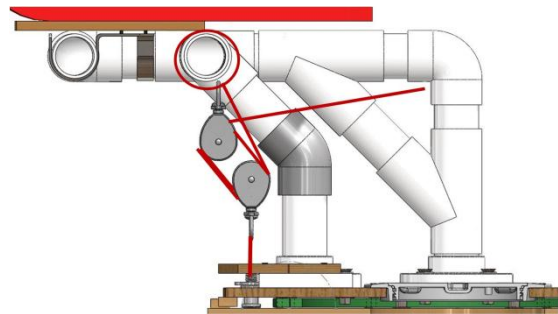
There are 5 total access points



## Securing Mechanism

### Force required to disengage the lock:

With the current spring the force required to disengage the locking mechanism is 37.5 lbs, which is quite large for a person who has one sided weakness. We have designed a block and tackle system to reduce the force required to 9.4 lbs.



### Groove in the base from rotations:

At the start of spring semester team will conduct a test to see what depth the braking system will “dig” into the base. To do this we can put a piece of plywood into a lathe and run a screw head into the wood. Knowing the run time and speed we can calculate the number of cycles.

The max depth of a groove that would allow our device to function properly is 0.25”. We can extrapolate the data to find how many use cycles it will take to “dig” a groove this deep.

The team is planning on using a liquid rubber sealant coating on the bases to increase the coefficient of friction. This will increase the number of cycles the device can be used without wearing a groove. Also, the rubber can be reapplied occasionally to prevent the grooving.

### Reinforcing the locking hole:

If a bushing was to be used in the holes, and there was a groove in the base, the locking mechanism would get not be able to get into the locking position; it would instead hit the “lip” of the bushing. For this reason we are not reinforcing the holes.

## Effects of cold on PVC

As temperature decreases below 73 degrees F (the temperature at which standard PVC specifications are given), tensile strength and modulus of elasticity increase while the impact strength decreases. While in storage, the chair will not be loaded so the change in properties is not relevant. We have not found any evidence that exposure to cold temperatures have any lasting effect on PVC. Therefore, we feel confident that the PVC will not sustain any long-term negative effects due to exposure to winter temperatures.

## Water Drainage

Though the device will likely not become filled with water, the team has included grooves in the top base plate for drainage. In the event that water gets into the PVC arm assembly, the water can flow into the flanges and out of the device via these grooves:



## Other Notes/Updates since DDR

- Found Screw-In Deck Plate for \$27.99 from West Marine to use to cover the hole in the bases. Received drawings to use for SolidWorks model
- The block that should be placed under the seat while the user is sitting down needs to be 1" x 1" x 21" in size. This will reduce the severity of the user "plopping" into the seat.
- Handles were added to the bottom base to increase the ease of picking up the bottom base. There are now holes drilled into the base and line is tied into those holes.
- Epoxy was added to the BOM to use on the bases – only can purchase in 1 gal quantities
- Need Detailed Drawings for the following (to be completed by 12/18/13):
  - Clamp Bars
  - Angle Brackets
  - Bottom Base Plate
  - Base Uprights
  - Hard Stop
  - Upper Base Plate
  - Brake Plate