

# Kneeling Seat

# Working and relaxing on the floor comes naturally.

The kneeling seat supports your body in a natural, upright posture, allowing for better focus and free-flowing ideas without the discomfort traditionally associated with floor seating. Whether you are igniting your creative spark or gathering with loved ones, the kneeling seat elevates these experiences, bringing the intimacy and flexibility of the floor without fatigue.

Lawrence Chang  
Lawrence.LC.2277@gmail.com  
Northwestern University Segal Design Institute  
Design 395 Furniture Design Winter 2024  
Course Instructor: Hemmat Jha  
Fabrication Instructor: Eric Capper

Special thanks to Josh Ippel from the Kresge ATP Wood Shop for aiding in the manufacture of the Kneeling Seat



# In the embrace of the floor, creativity unfurls.

A ground-level canvas free from the rigidity of desks and chairs.

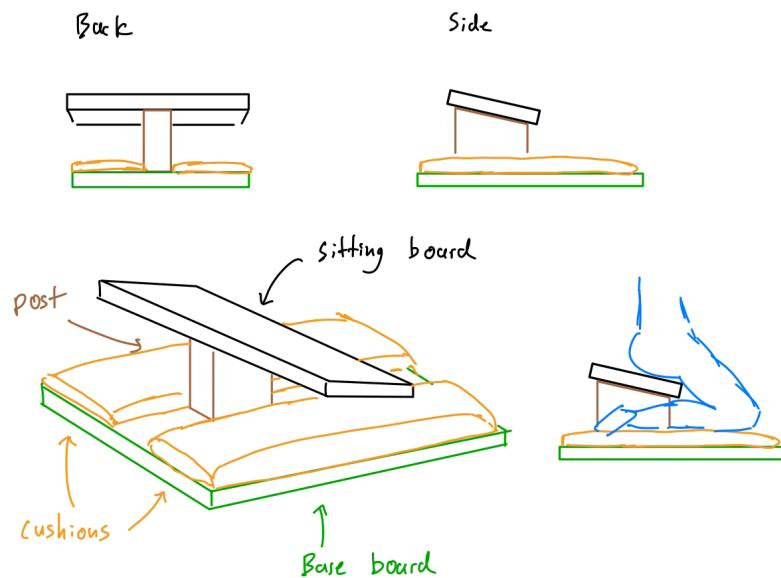


In the warmth of gathering,  
intimacy spreads through the  
shared space.

# Rapid prototyping

I first created a scrappy wooden mockup of the kneeling seat idea to find the optimal parameters for fatigue-free sitting.

I systematically adjusted the the seat height, seat angle, seat width, and seat dept until an optimal combination was found.







After extensive testing, I found a basic form for the kneeling seat. The optimal parameters are as follows:

Seat height: 220mm  
Seat angle: 7 degrees  
Seat width: 200 mm  
Seat length: 200 mm

During this experimentation I discovered that the seat width is not very important, so long as it is wide enough to accommodate the user's pelvic sit bones.

Conversely, the depth of the seat makes a large impact on comfort since it allows the user to adjust their weight back and forth.



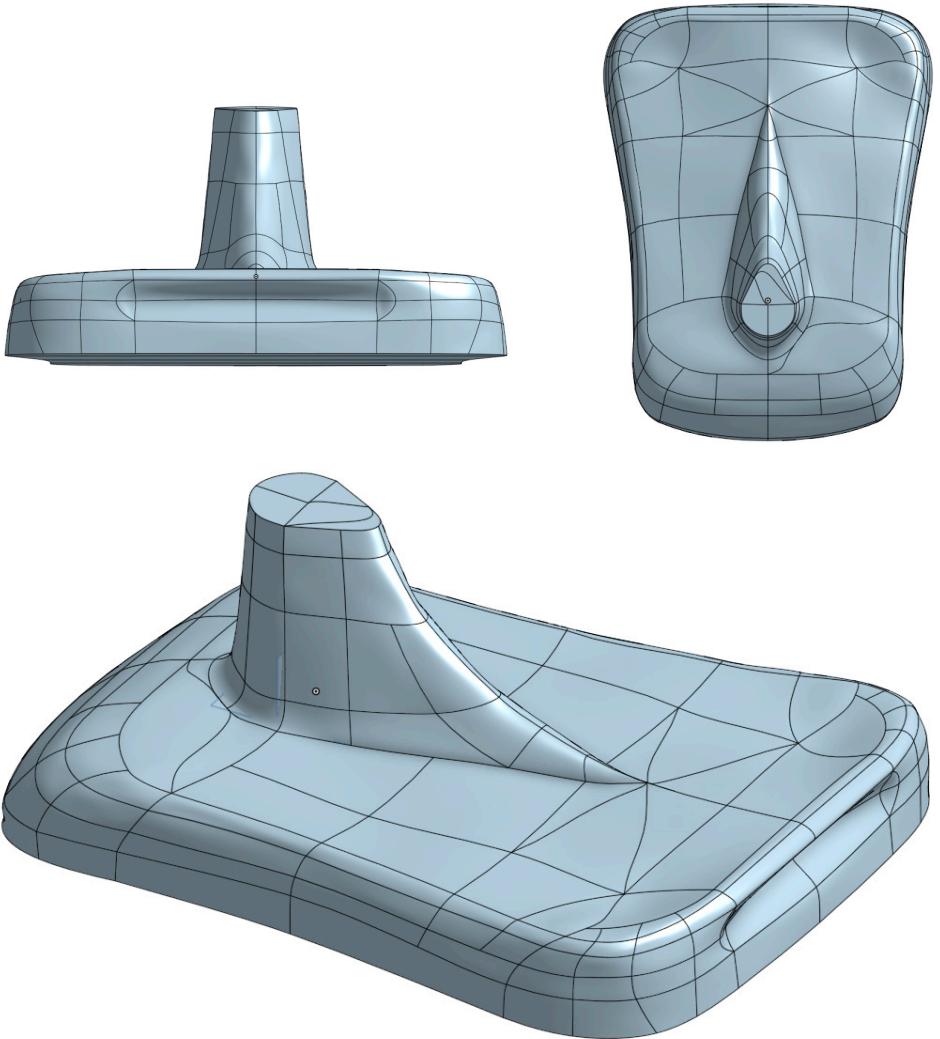
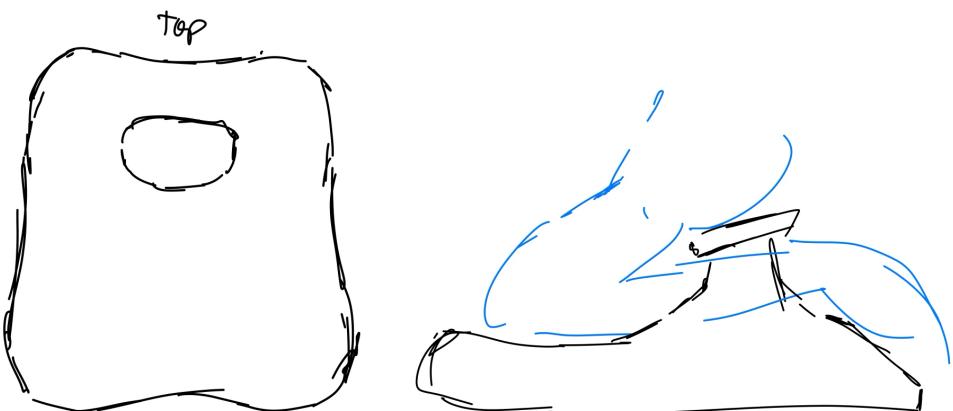
Additional testing revealed the need for ankle support when using the kneeling seat.

To test this I placed wooden blocks under the shins to elevate the ankles slightly.

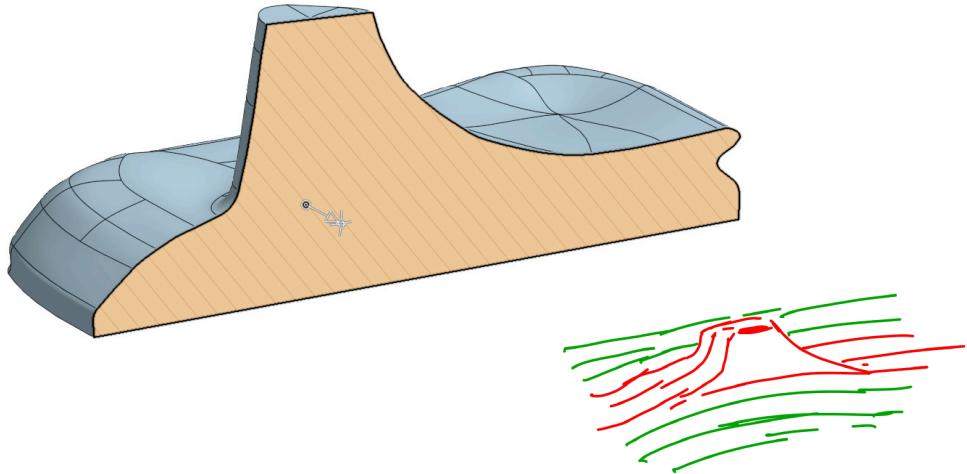


## Full scale prototyping

Utilizing free-form 3D modeling software, I created a higher fidelity full-scale prototype to dial in the final the shape of the Kneeling Seat.



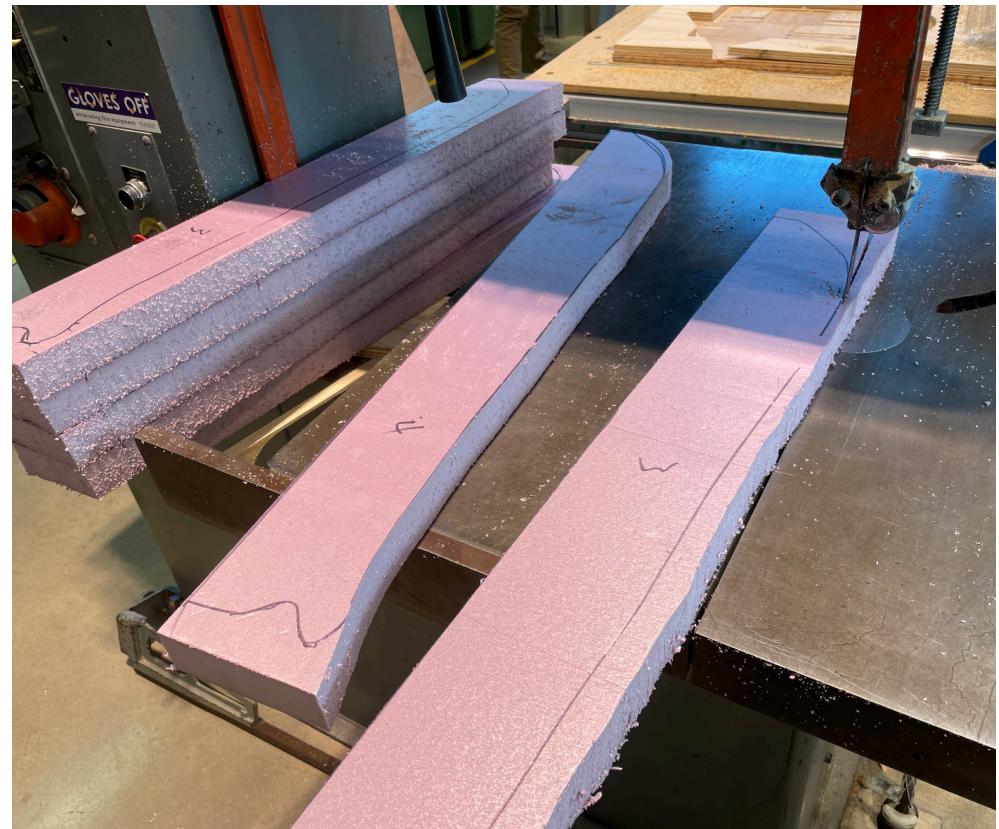
The free-form modeling software allowed me to sculpt my design to fit the contours of the users legs and feet. The free-form model dimensions were referenced from the wooden mockup.

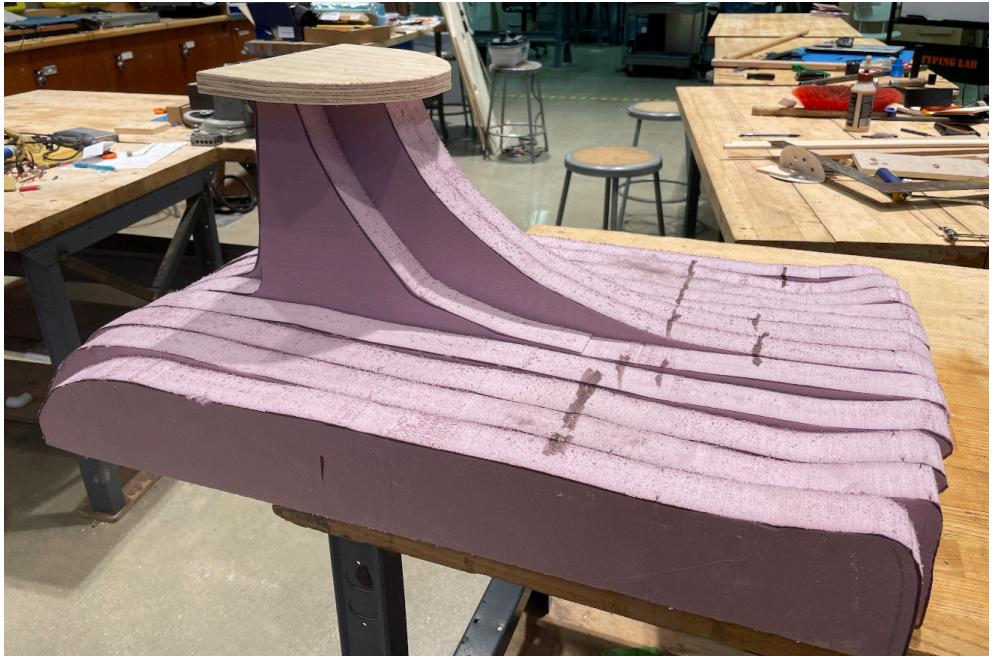


To construct the physical prototype, I sliced the 3D model into several layers and used the profiles to laser cut cardboard stencils.

I then used these stencils to trace the shape of each slice onto stiff insulation foam panels.

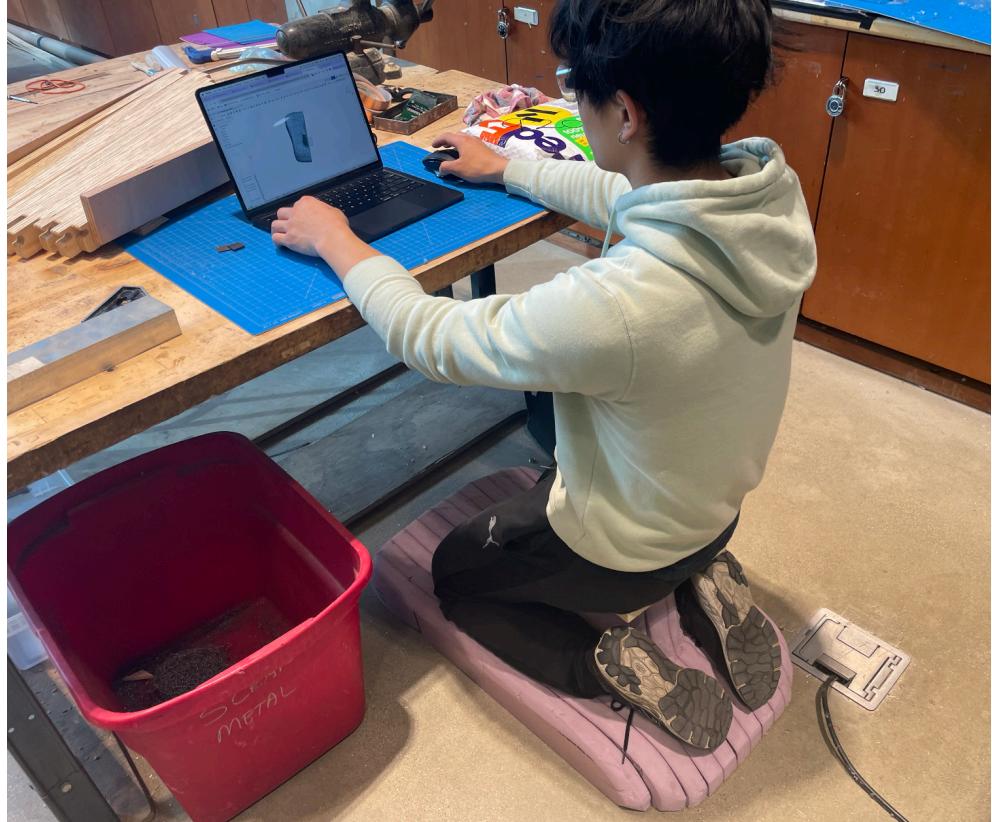
Next, I cut the foam layers and glued them together.





After some initial testing with the foam model, I trimmed some more pieces away to better enhance the shape.

The form was easy to iterate on because the model is made of foam.



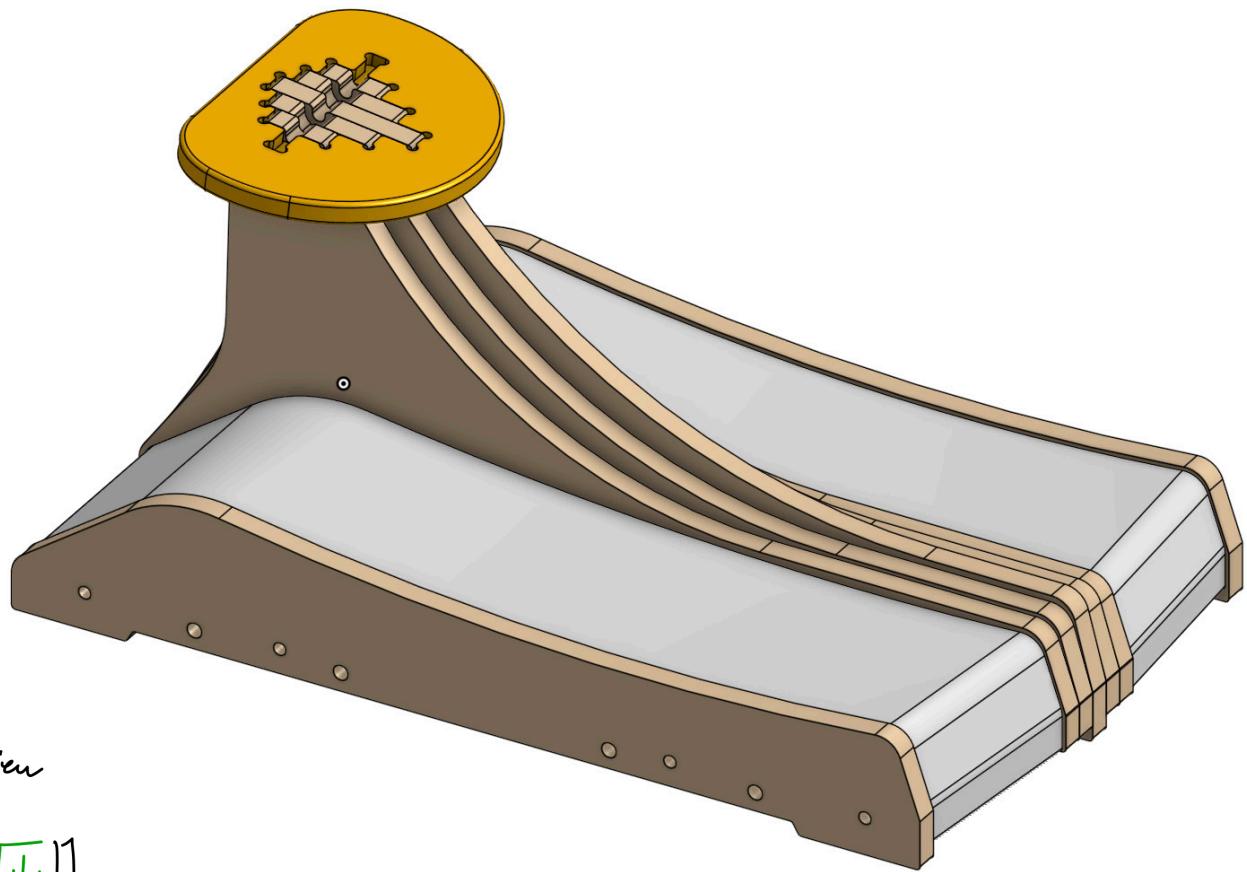
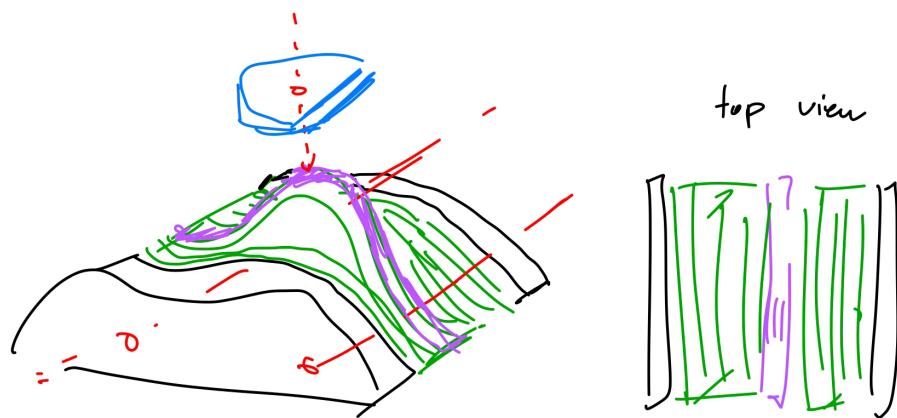
After trimming the back of the foam model and sanding the faces smooth, the new contour was able to nicely support the ankles.

This shape allows the toes to point downwards which requires less ankle flexibility to sit comfortably.



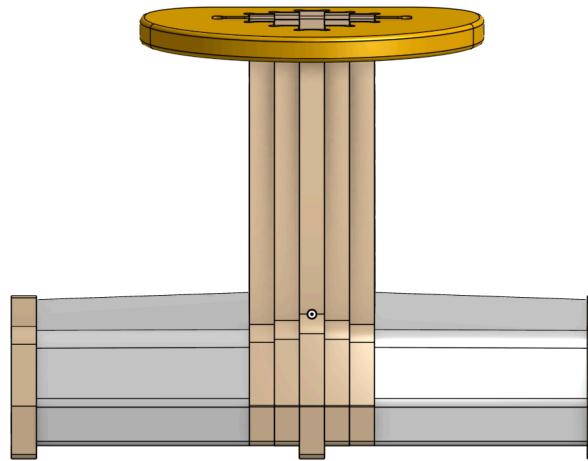
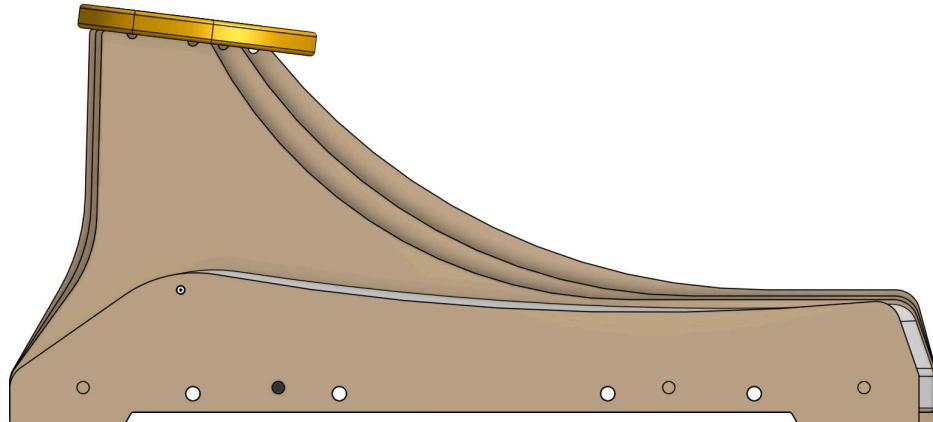
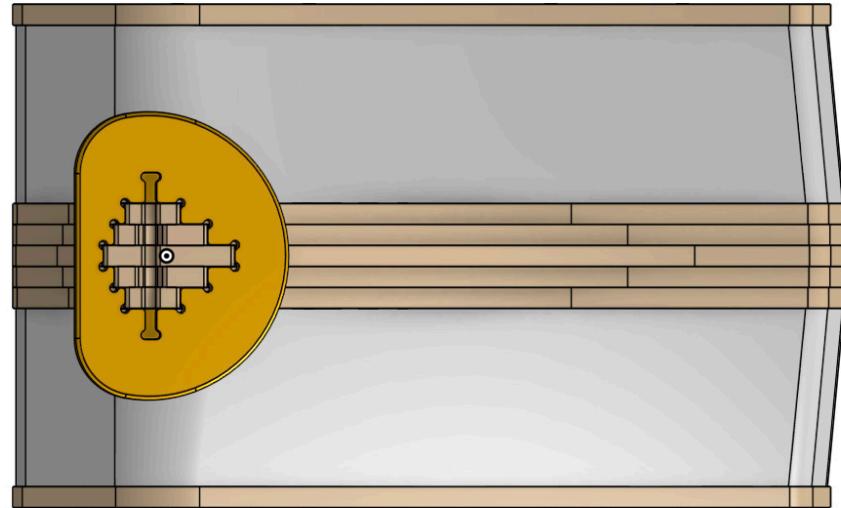
# Final Design

For the final design, I strived to showcase the interesting contours and shapes of the seat. To do this, I am utilizing stacks of several thin profiles. When stacked together, the layers form a flowing, 3D shape.



The final design consists of stiff wood panels on the outer-most faces and a cluster of stiff wood panels that compose the center seat post.

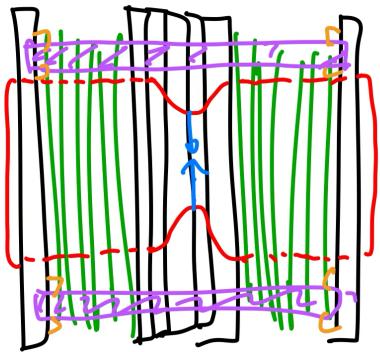
These stiff wood panels compose the main structure of the seat.



The gray volumes between the wood panels are made of a softer material for better comfort when kneeling.

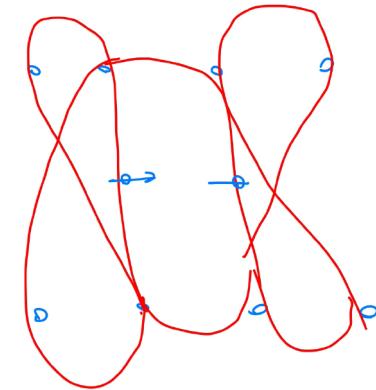
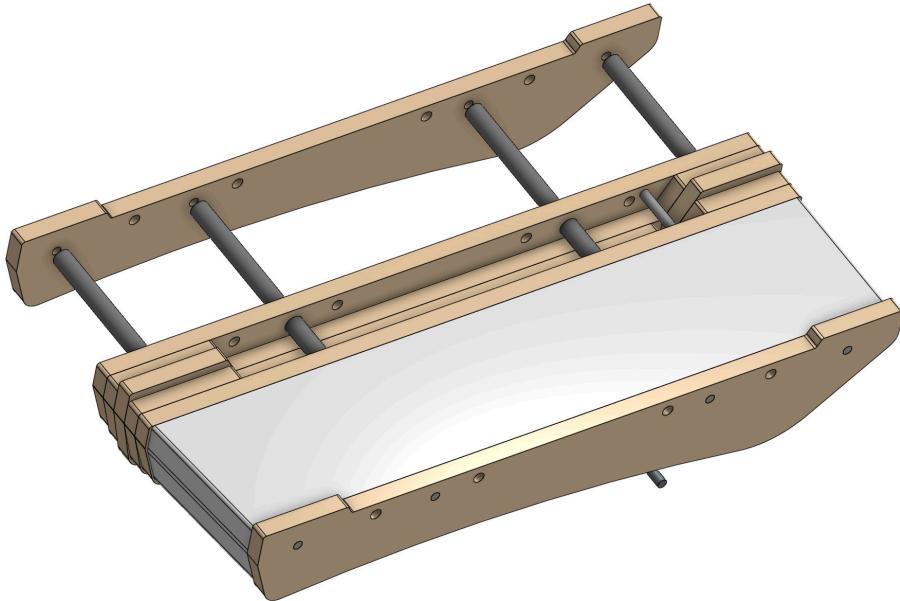
After sampling dozens of foams, composites, and rubbers, I decided to use composite cork floor underlayment. It has as good balance of stiffness and compliance.





The design features a unique assembly system that uses a series of dowels and laces to compress the layers together.

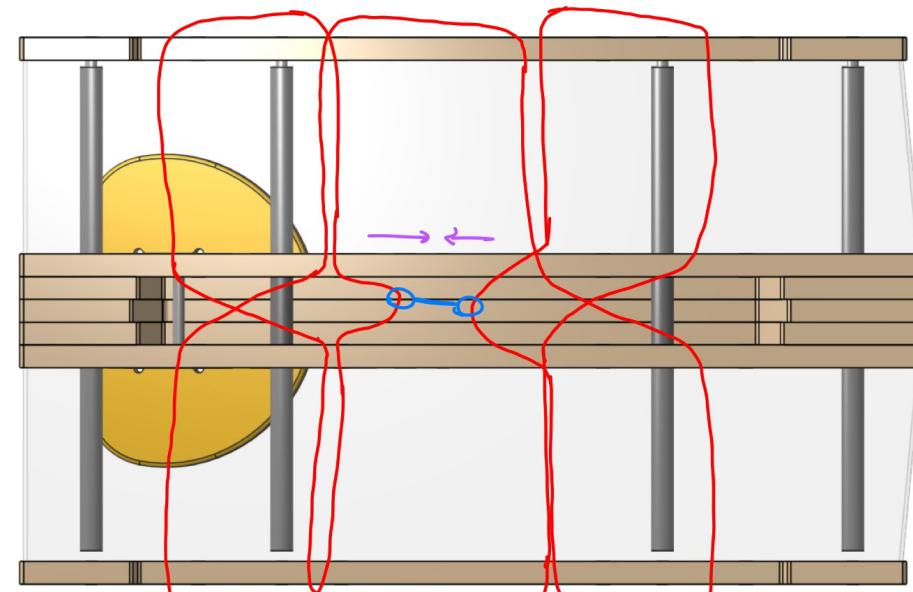
This was done to simplify the disassembly process and eliminate the need for glue or traditional fasteners..



There are four long dowels that span the width of the seat. These dowels locate and fix the positions of the cork and wooden layers.

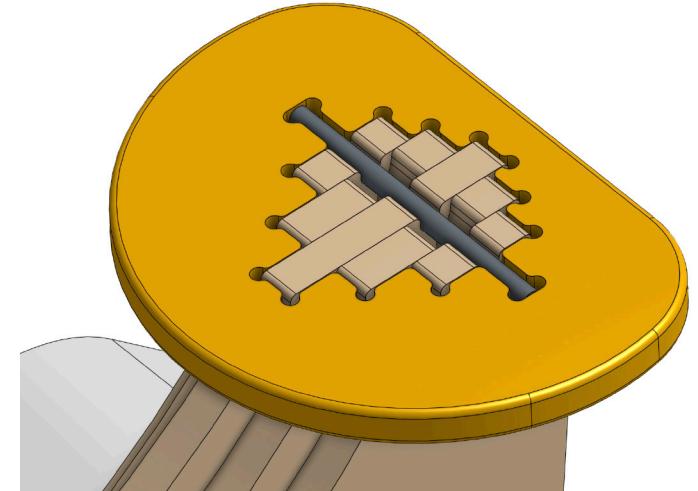
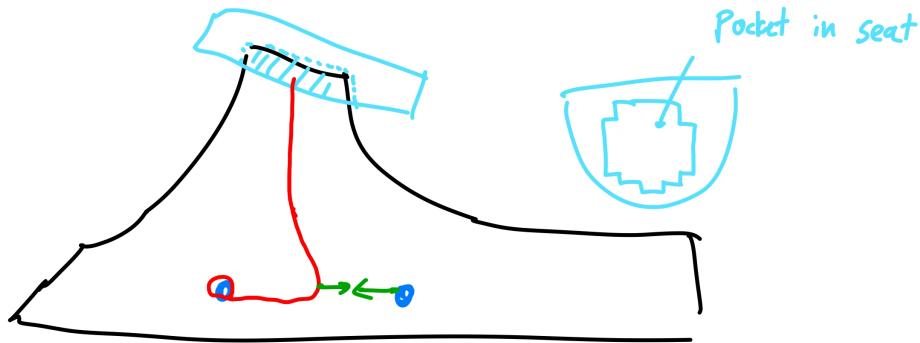
A continuous loop of rope is strung through the layers in a lace pattern.

The rope has two segments that meet in the center of the seat where there is a cavity. This cavity houses a turnbuckle which pulls the loop taught, compressing the layers of the seat.



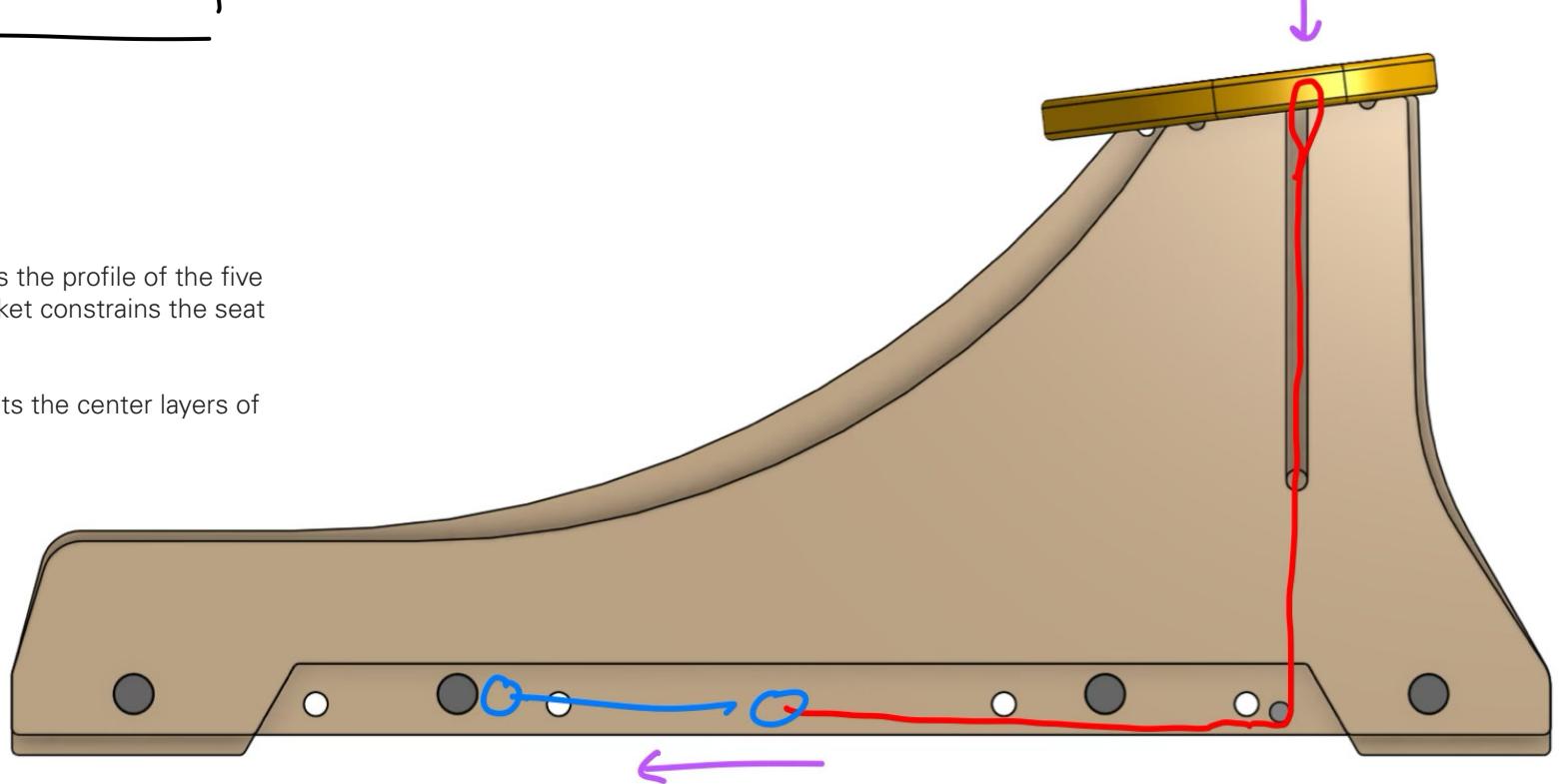
A long steel pin pulls the seat down onto the seat post.

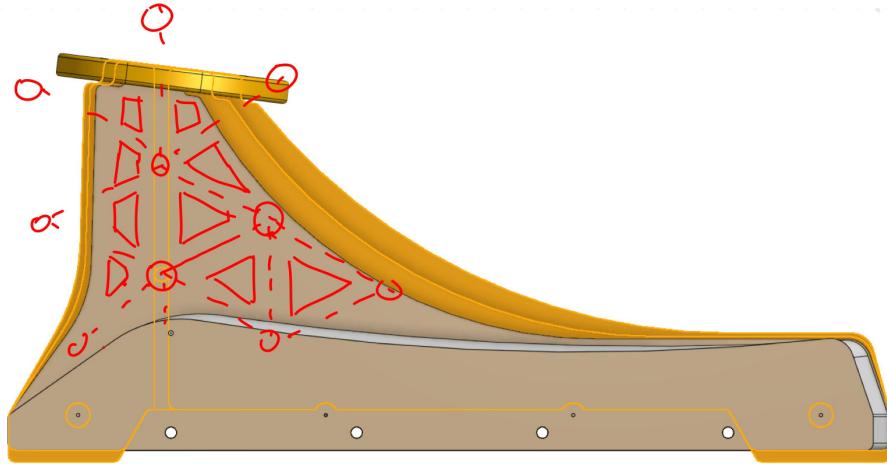
The pin is secured using a rope that runs through channels in the seat posts and tensioned with another turnbuckle.



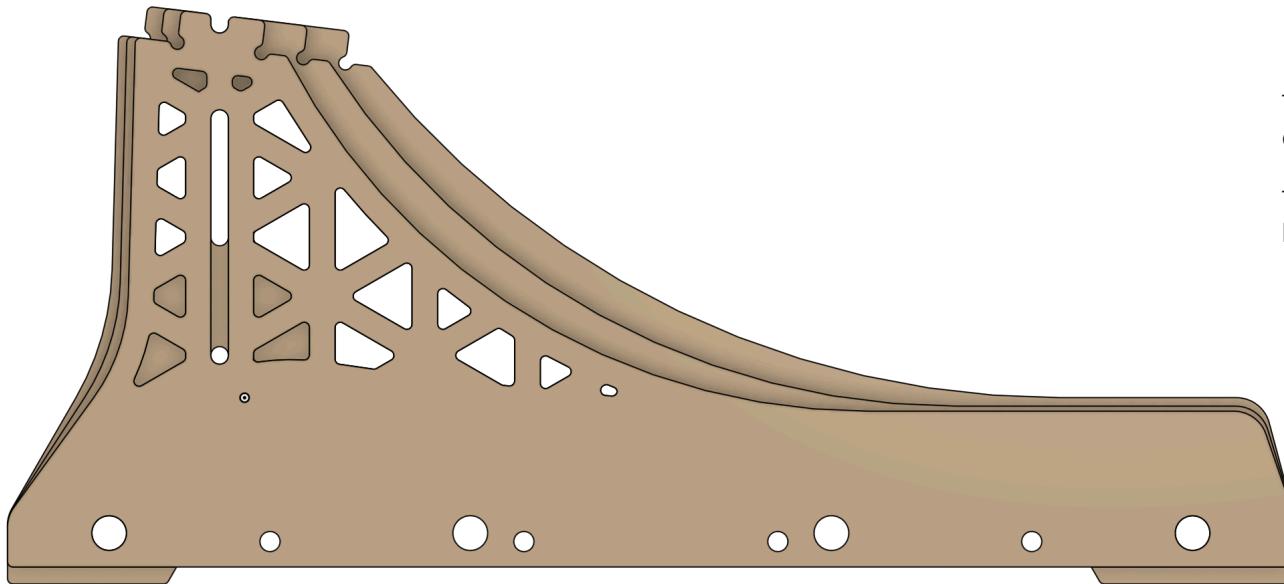
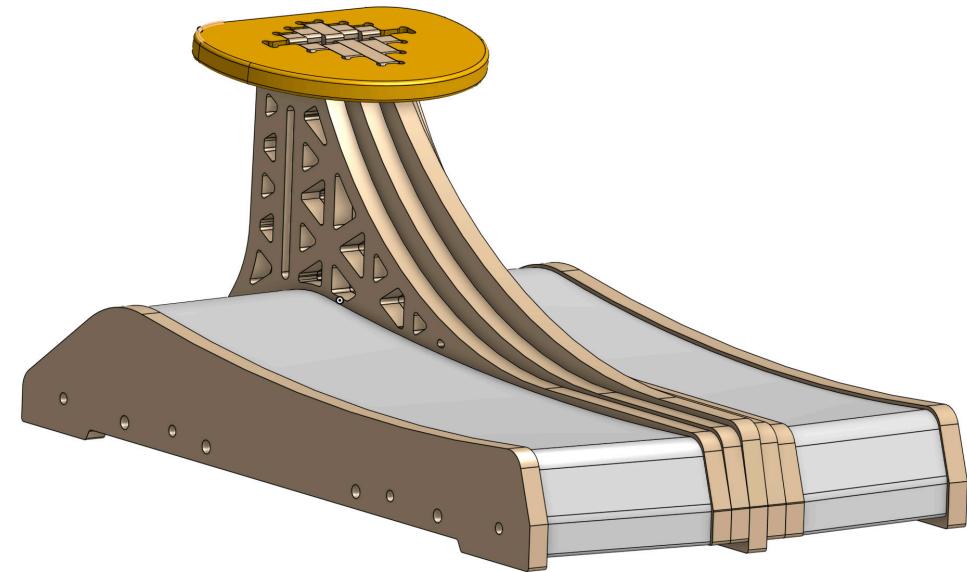
The seat has a center pocket which matches the profile of the five stacked wood panels in the center. This pocket constrains the seat securely to the seat post.

The seat acts as a sort of ferrule and prevents the center layers of wood from spreading apart.



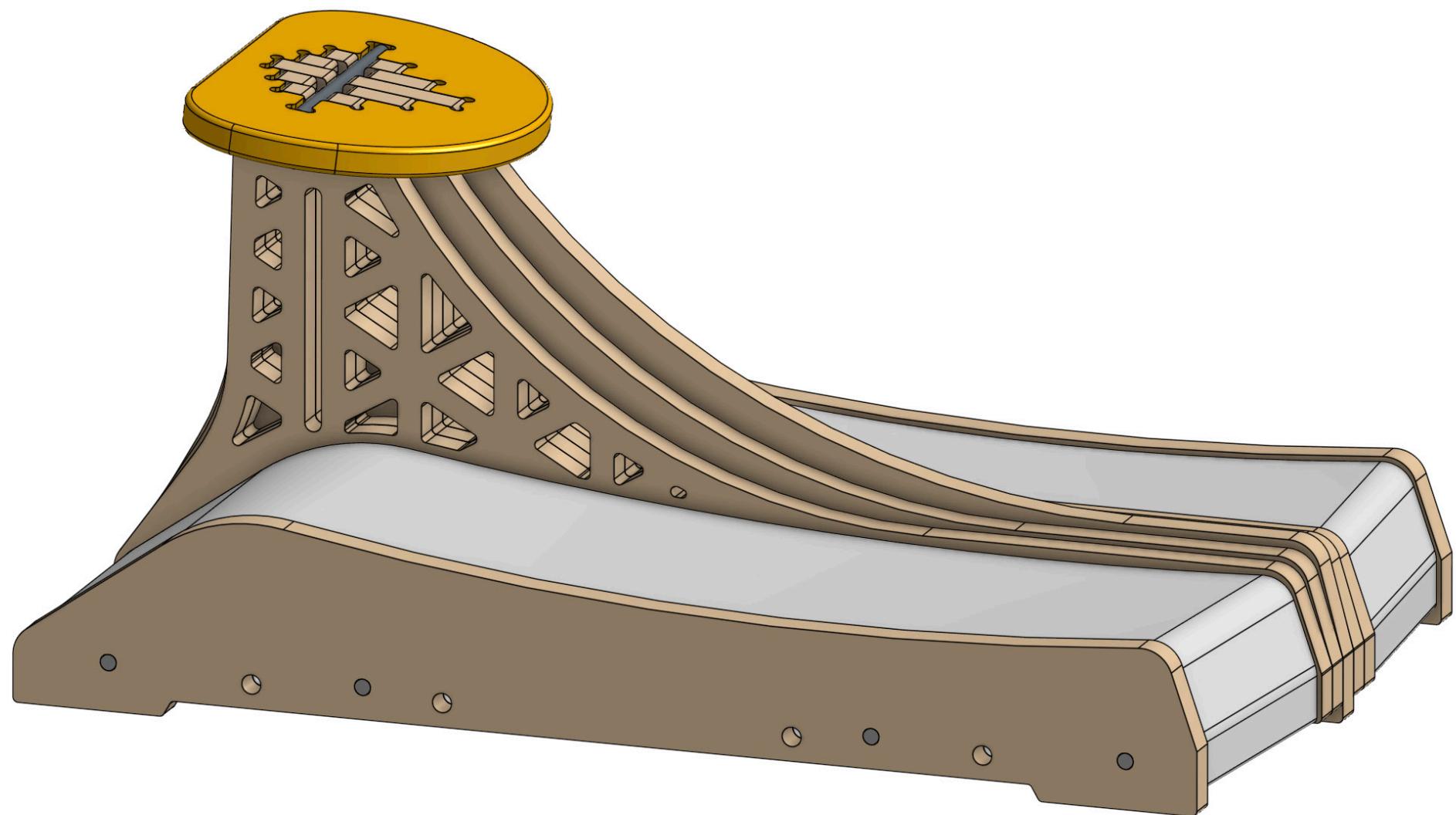


Finally, to lighten the final product I added triangular windows throughout the face of the wood panels.



The windows add visibility into the internal mechanism because it exposes the center cord running through the seat post.

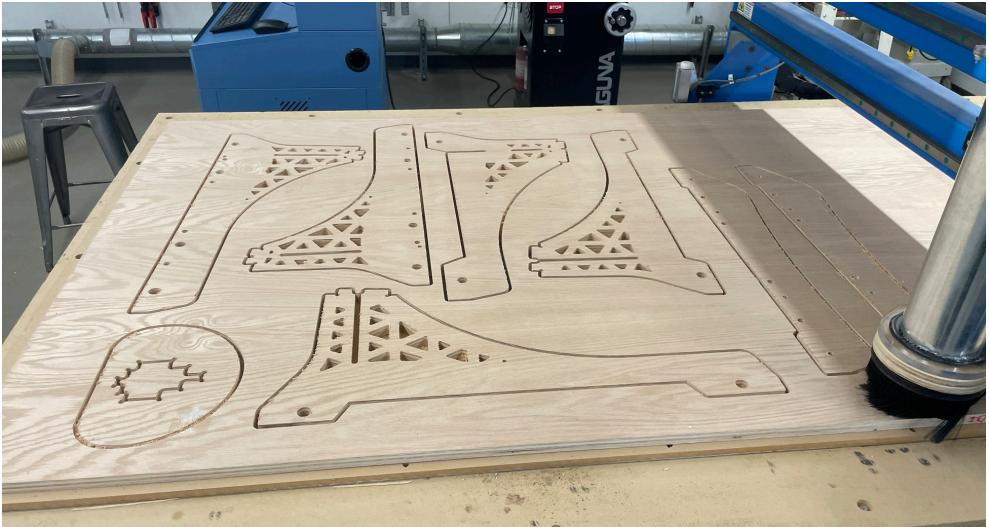
The windows add a compelling texture to the seat while also letting light to pass through.



# Manufacturing

Due to a CNC router malfunction in the Ford Engineering Design Center, fabrication of the Kneeling Seat was delayed. However thanks to the generosity of Josh Ippel from the the Kresge Art Theory and Practice Wood Shop, I was able to borrow their machine to complete the fabrication.





After removing the panels from the wood board and some light sanding, the pieces fit together perfectly.

