

# Individual Assignment 1

MECHENG 4B03

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## The Problem

The target market for this product is rock climbers. On moderate to long climbing routes, rock climbers typically carry chalk with them. Applying the chalk increases the user's grip and reduces slipping caused by sweat. Chalk is an essential tool in the sport of rock climbing, but the transportation and application of the chalk during a climb can be tedious.

Rock climbers who want to carry a chalk supply with them have one option: a chalk bag. Chalk bags are typically cylindrical containers made of fabric with an opening in the top where the user can reach through to apply chalk to their hands. They are fastened to the user with a belt and snap-fit clasp.

Chalk bags are great at transporting chalk, but they can swing around during climbing, can spill if the user swings suddenly, and most importantly, can make applying chalk difficult while climbing. Chalk bags are small in size so to minimally impede the user while climbing, which in effect means the opening is small. Typically, chalk bags are mounted to the rear of the user's beltline, meaning that the user must reach an awkward position during a climb to apply chalk. Often, users are only able to apply chalk to their fingertips due to the position of the bag and the size of the opening. Changing the position and increasing size can potentially lead to the bag getting in the way while climbing.

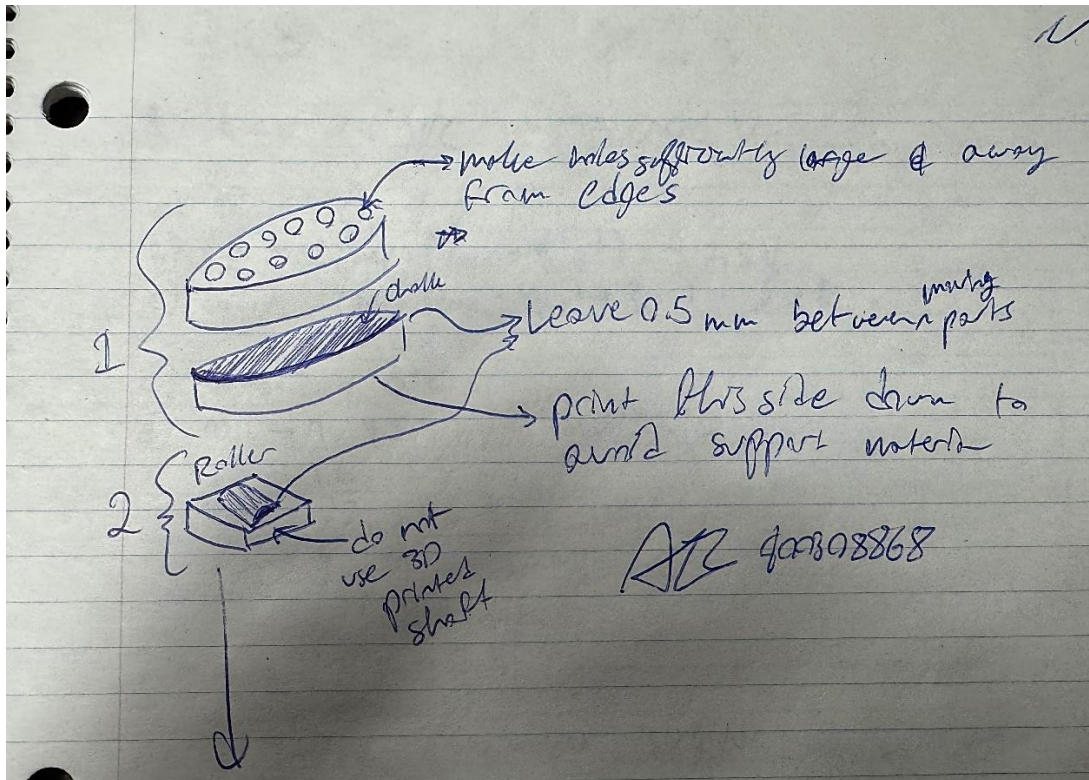


This presents the problem: how can we transport chalk on a climb in a secure manner while making application easy? My product aims to solve this and overcome the drawbacks of chalk bags. The product stays put during large dynamic movements by mounting flush to the user's outer thigh. It ensures easy and even application of chalk to the user's entire hand rather than fingertips by using a roller system to collect and apply chalk. Spillage is minimized by containing the chalk in a solid, plastic enclosure and reducing spillage through the opening via the roller.

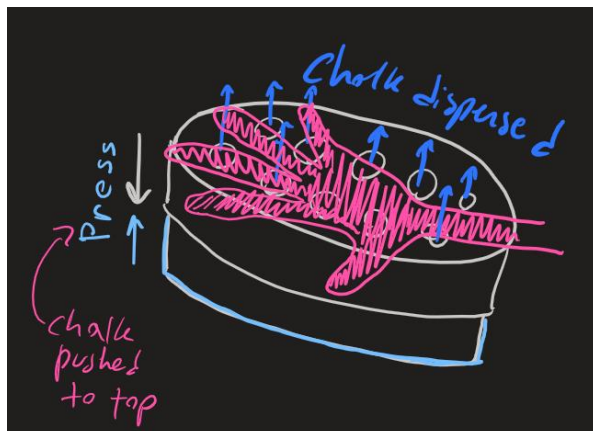
## The Design Process

### Preliminary Sketches

I started with 2 main ideas: a chalk dispenser and a chalk roller.



The intention with the dispenser was that it pushes chalk out of the perforations in the surface upon applying force, similar to pump systems seen in nail polish removers and isopropyl alcohol dispensers. However, through design iteration and discussion with Dr. Hassan, it was determined that a chalk pump mechanism adds a deep layer of complexity

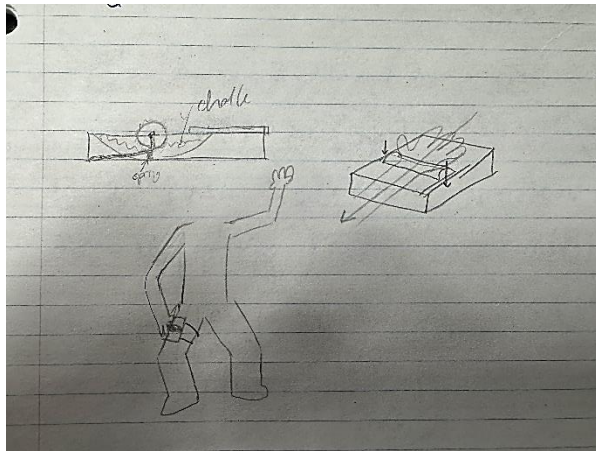


to the design and may not be feasible for the individual assignment. Also, having many moving parts in contact with chalk could cause problems such as clogging.

Another challenge I encountered with this design was how to handle storage. Since the top was perforated, it needs to rest with

the perforations oriented upward or else chalk will spill out. It also cannot be stored in a backpack without risking spillage. I was planning on addressing this with the pump mechanism, but it was proving to be an increasingly complex solution.

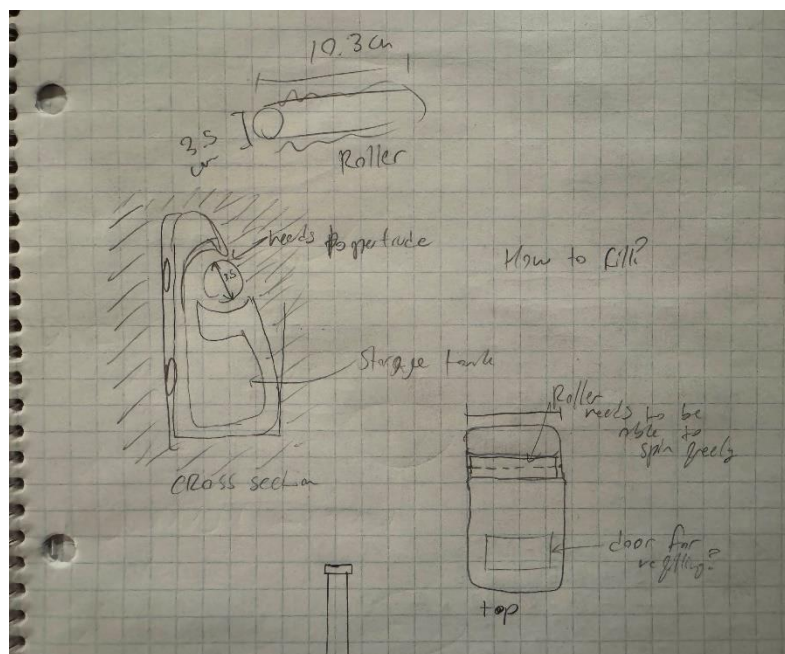
The chalk roller is much simpler: a container and a roller comprise the system. When oriented vertically on the user's thigh, the chalk will naturally move downward into the



bristles of the roller. Then, the user can glide their hand over the roller to apply chalk. A few design considerations: the tolerance between the roller and the walls of the container need to be small enough that very minimal chalk escapes, but large enough that the roller can move moderately freely.

Additionally, the hollow interior needs to be such a shape that it can hold lots of chalk but not allow it to move into the roller all at once. Since the device is to be mounted over the user's thigh, it needs to have an exterior shape that is ergonomic when gliding one's hand over it.

A problem I encountered with this design was how to effectively refill the container with chalk. At first, I thought a removable roller would be an effective solution, as this would allow for the chalk to be refilled without creating an additional opening. However, I was concerned with moving parts getting clogged by chalk as well as improper mating around the roller due to wear over time. As mentioned, the tolerance surrounding the roller position must be precise, and I thought it best to not

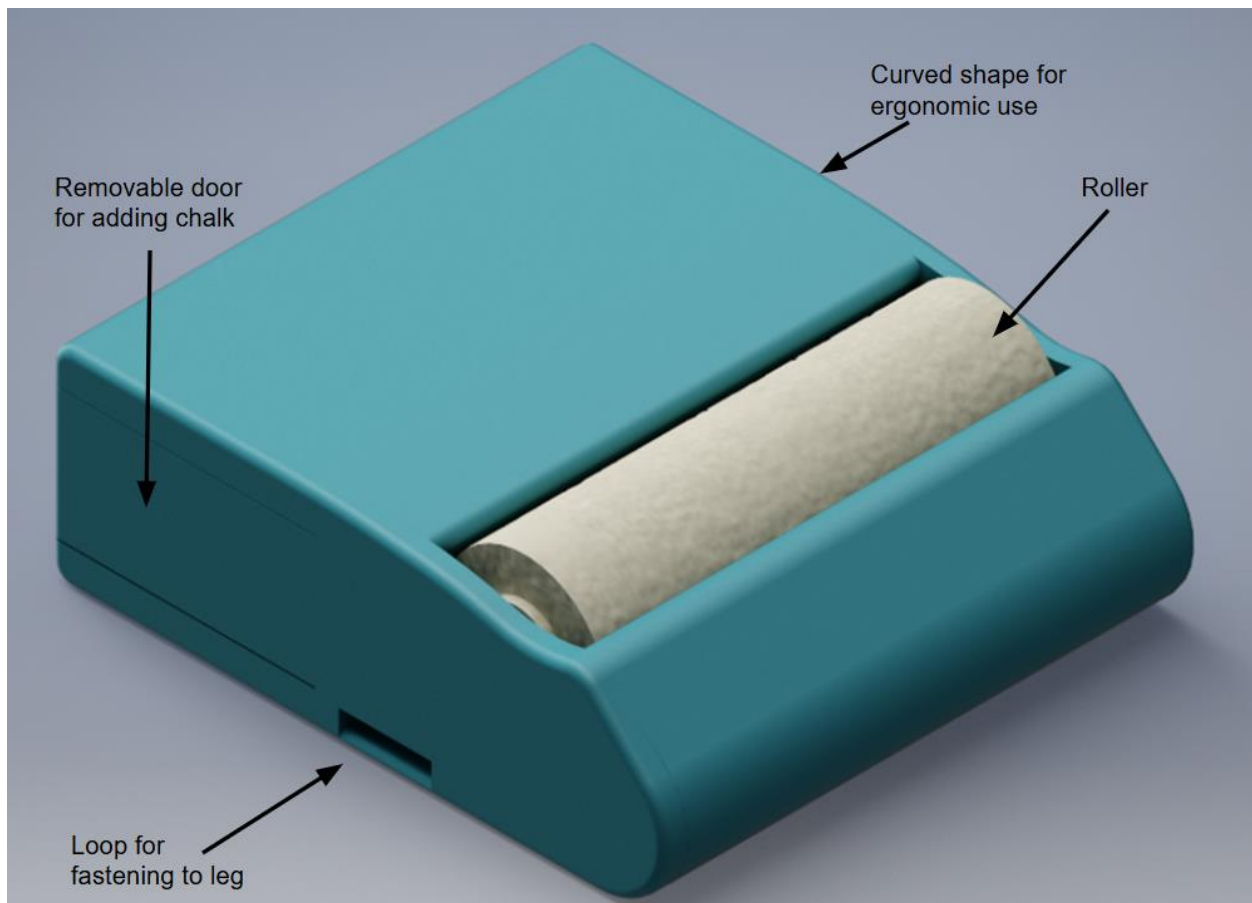


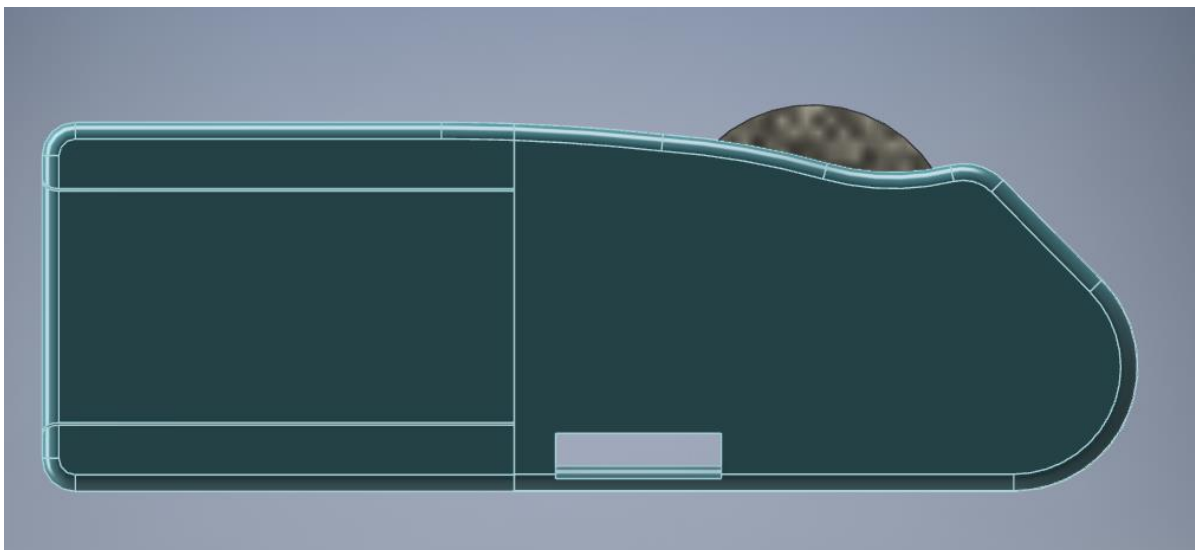
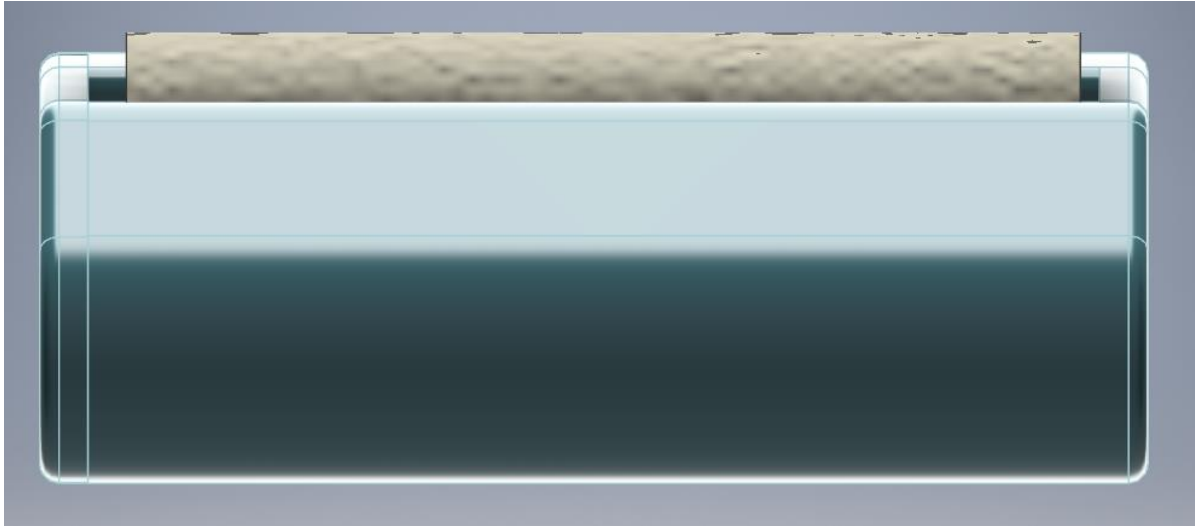
compromise that. I experimented with placing doors in various locations and various fastening methods, but ultimately, I landed on a dovetail joint door on the side of the device. The dovetail joint will help to ensure minimal spillage and is more resistant to clogging than other fastening methods.

### *Final Prototype Render*

With the above considerations and iterations in mind, I modeled my device in inventor. Below is the final product.

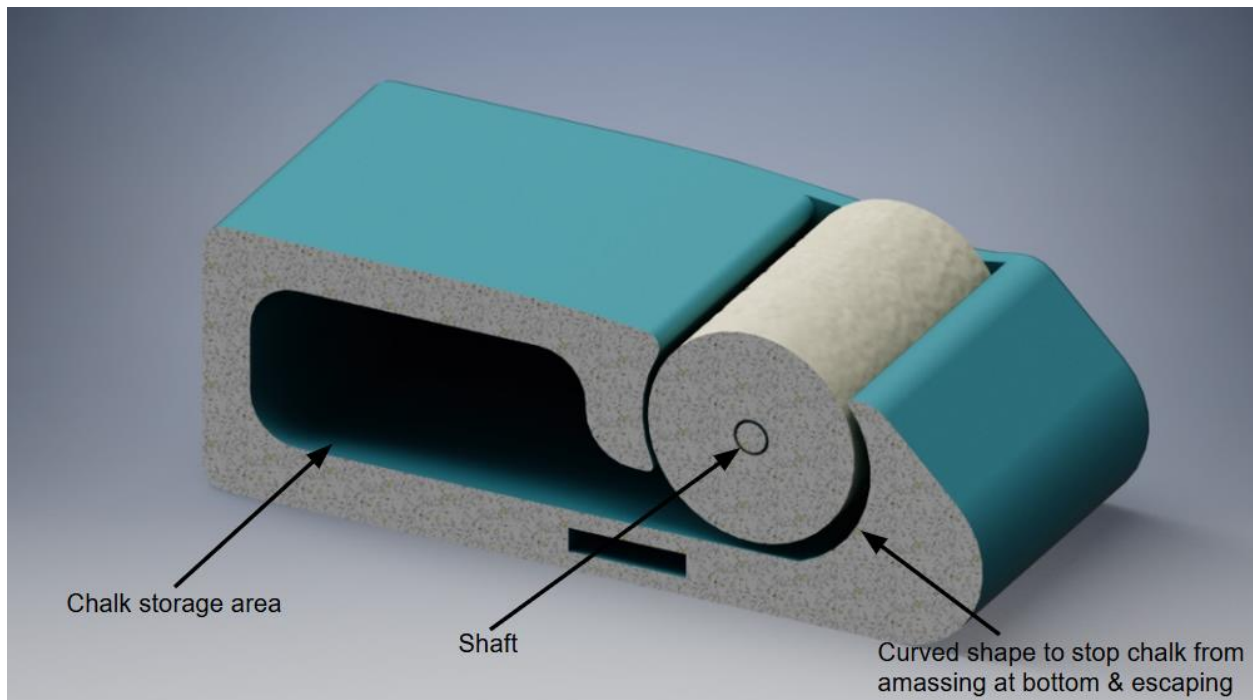
Full assembly



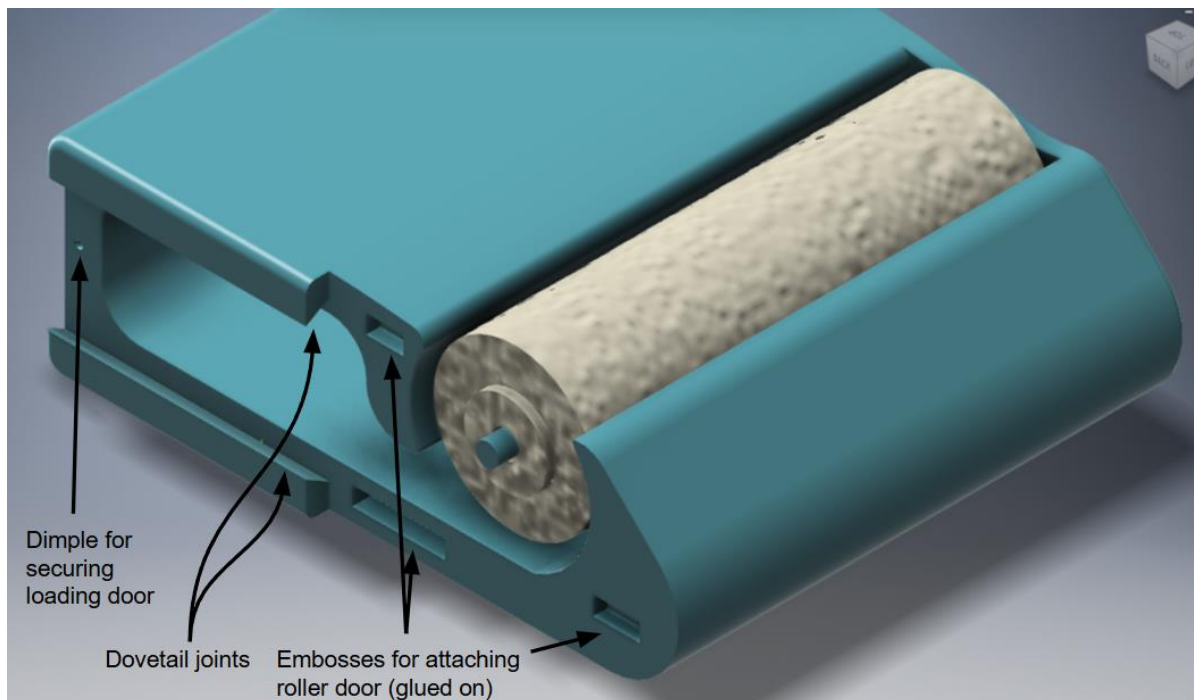


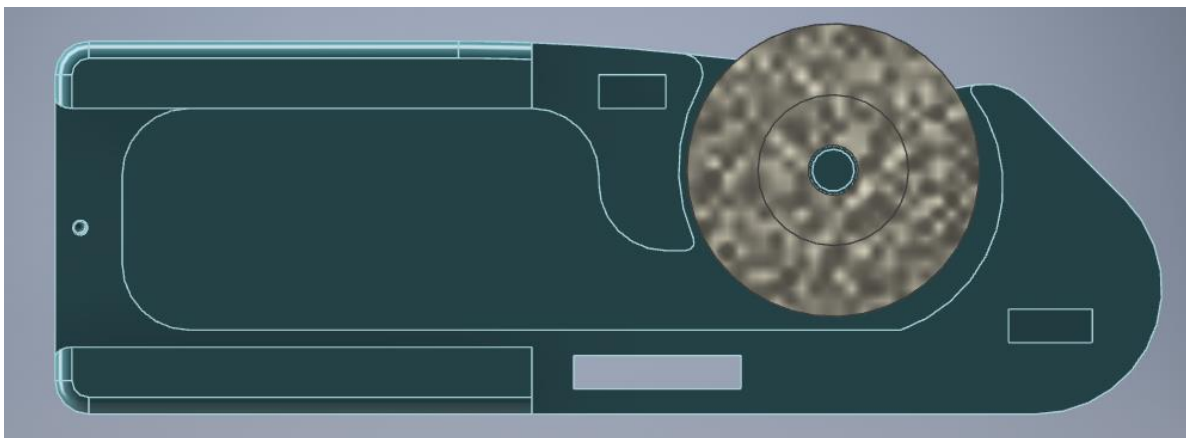
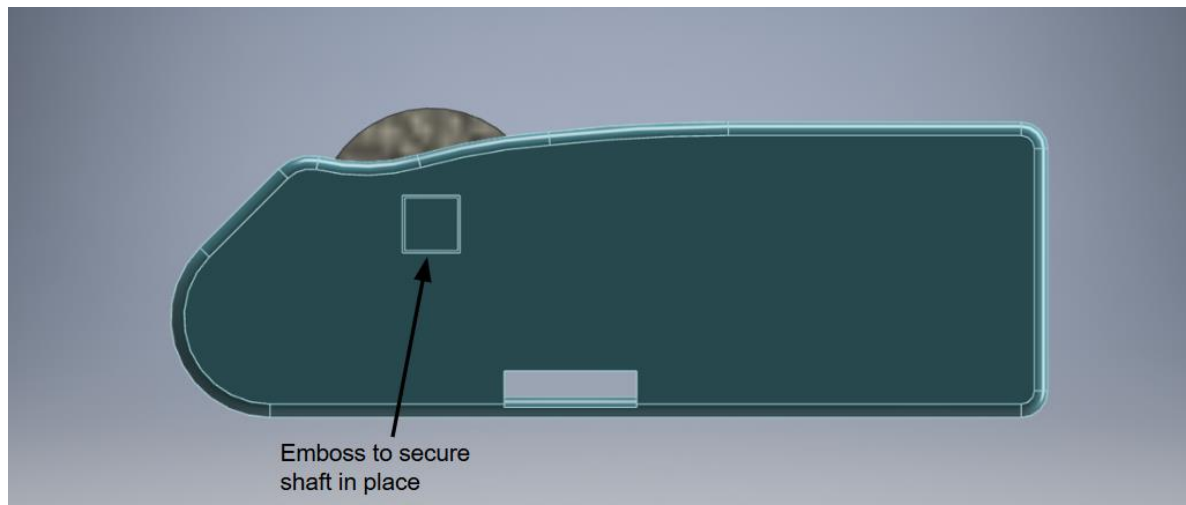


## Half Section View



## Main Body with Roller and Shaft



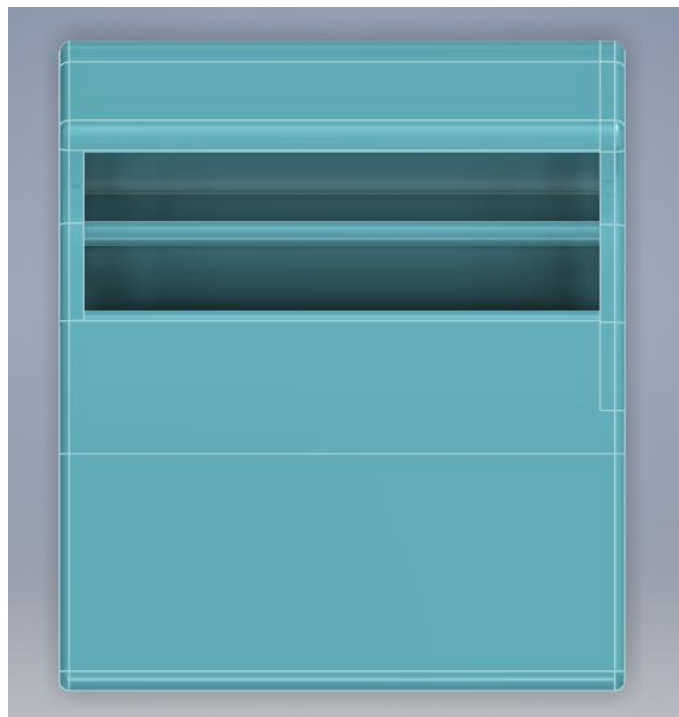




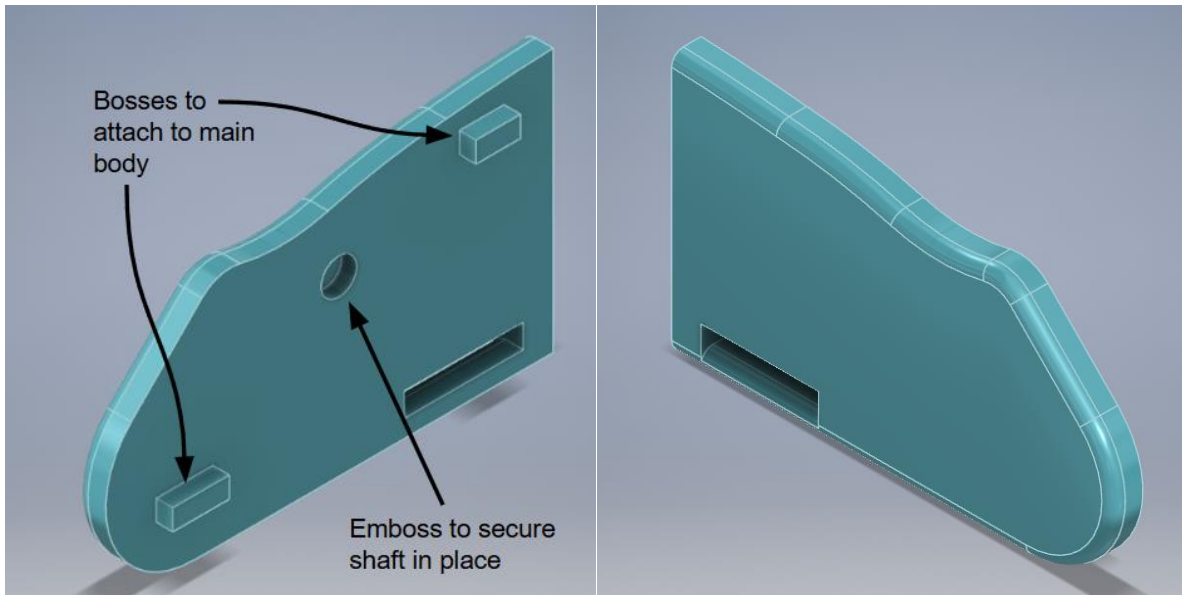
Full Assembly – Top view



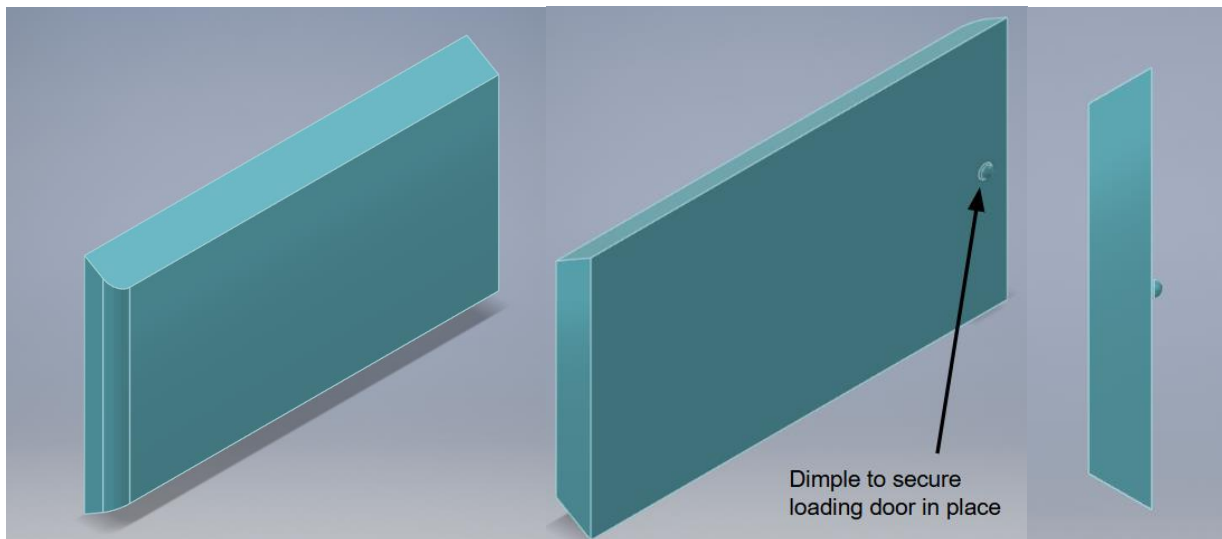
Full Assembly – No shaft



## Shaft/Roller door



## Loading door – slides in and out



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Shaft

