

ABSTRACT

Introducing the newly redesigned toboggan experience for Pokagon State Park! Nearly 100,000 people have been riding on Pokagon State Park's toboggan run since 1935, and now the toboggans are receiving a complete makeover. Pokagon State Park sponsored this project in an effort to make toboggans more accessible, safer for the riders, and easier for the park to maintain.



Figure 1: Original Toboggan Design

The proposed new toboggan design allows for quicker replacement of the runners, improved shielding for passenger hands, and a reduced overall weight making transportation to the top of the hill easier for the passengers too!

CUSTOMER NEEDS/SPECS

Customer needs were identified in the initial meetings with the sponsor. Based on the list of customer needs given to the group, a list of specifications was created to help measure the effectiveness of the new design.

Table 1: Customer Needs and Specifications

Customer Needs	Specifications
Improve safety of previous design	One piece shell and hand guarding at least 3" high
Lightweight	Under 65 pounds
Decrease runner changeover time	Changeover of 20 minute or less

DESIGN CONCEPTS

The team created three concepts to present to the park during the fall semester of the project. Each concept had unique characteristics, and the final concept implemented aspects of each to best fit the customer needs.

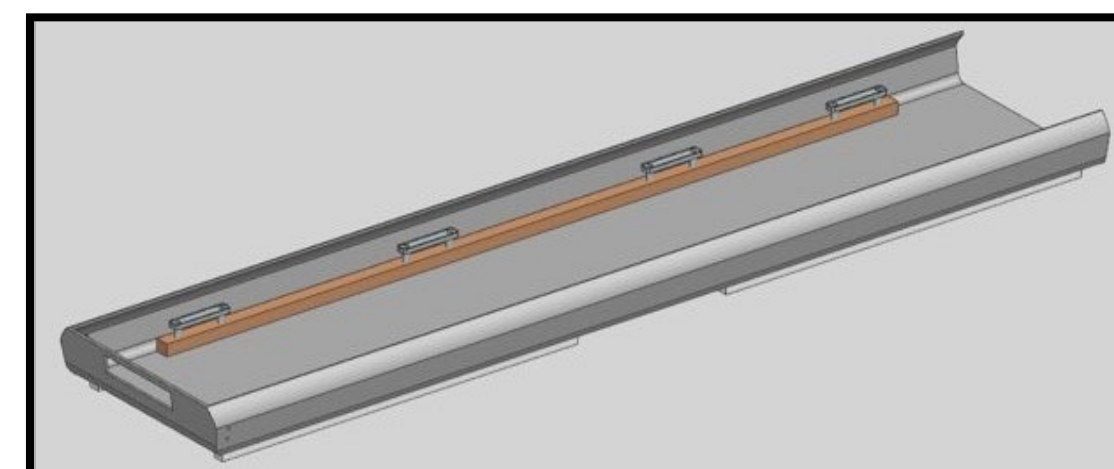


Figure 2: HDPE Toboggan Concept

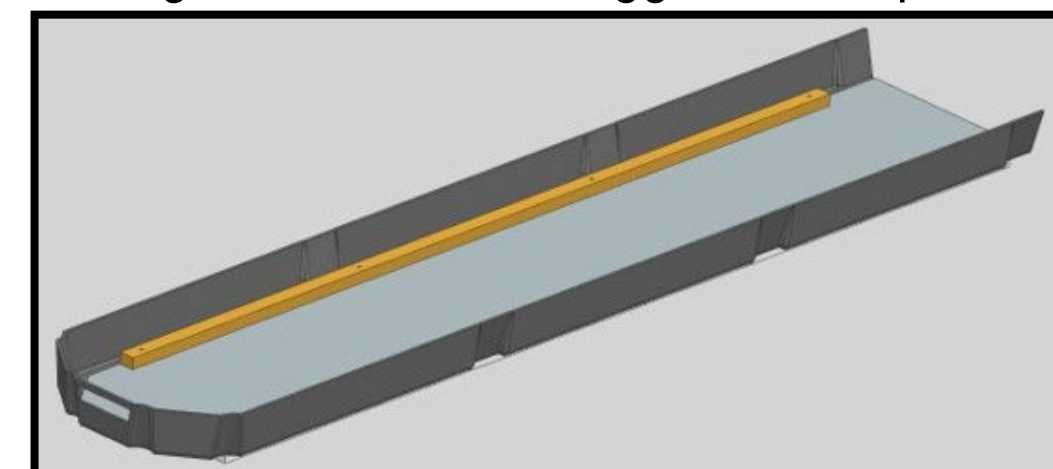


Figure 3: Fiberglass Toboggan Concept

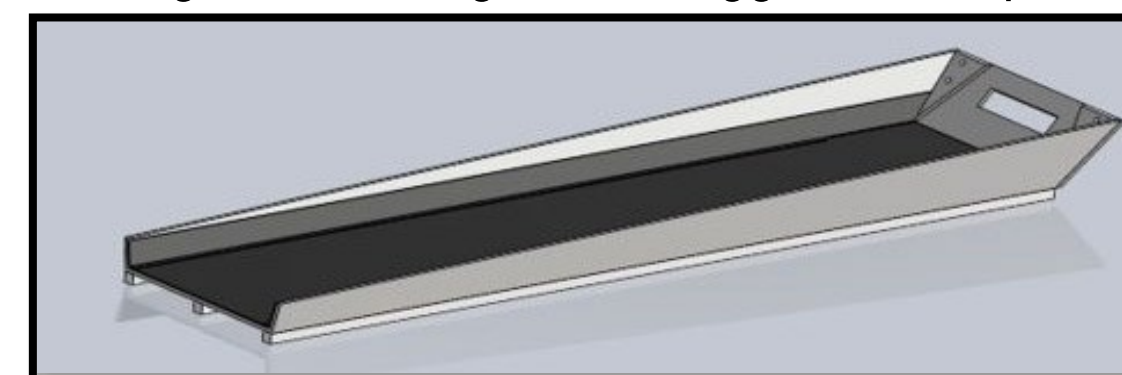


Figure 4: Corrugated Plastic Toboggan Concept

Multiple forming processes were considered, but the team ended up using workshop heaters. The first prototype helped the team understand the processes and challenges involved with forming. During the first build, the jig used placed heaters above the sled. Due to issues with the first prototype, the heaters were moved below the stock sheet for the second build. Other changes to the forming jig included adding hinges to create a more uniform bend and using chains rather than ratchet straps to hold the sheet in place while forming.



Figure 5: Initial Design

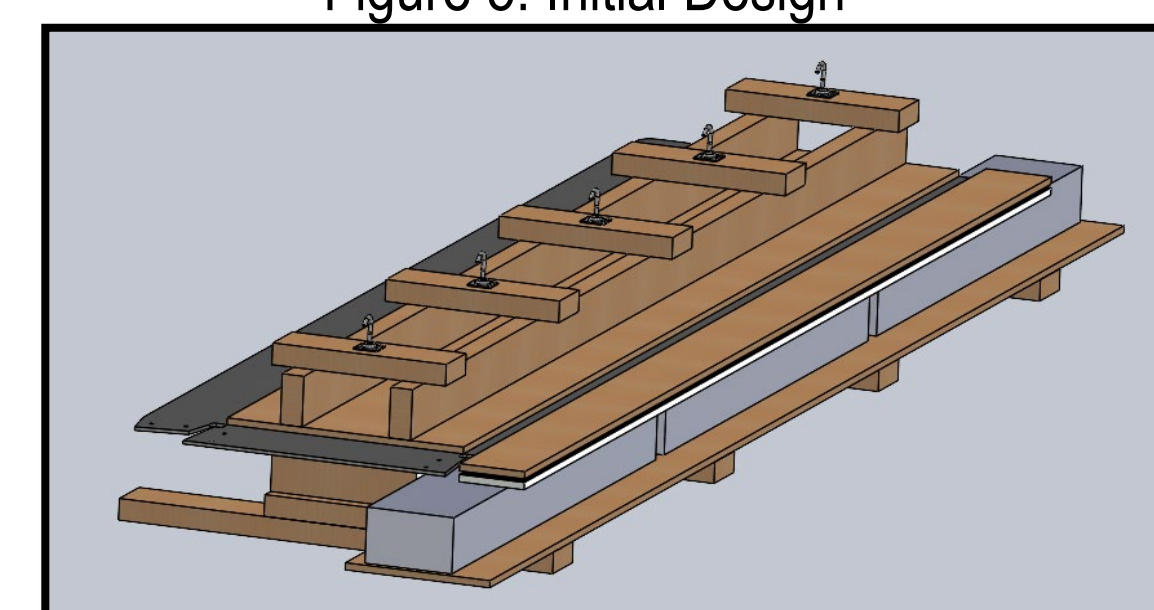


Figure 6: Final Forming Jig

TEST RESULTS

The team used the first prototype to complete testing at Pokagon. The sled successfully made its way down the track, traveling at 33 mph, which is comparable with the original sleds. The main issue during testing was that the sled was louder than the current toboggans used.



Figure 7: Testing Toboggan on Track

FINAL DESIGN

The final design was compiled using a combination of elements from the first prototype, suggestions from the sponsor, and process changes to produce more consistent results.

- 4" Sidewall height protects customers hands
 - Previous toboggan had no hand protection
- Total weight 36.4 lbs
 - Reduced weight by over 40%
- 19 fasteners total
 - Previous toboggan had 45 fasteners
- Runners cut from stock and installed – simpler and faster
 - Previously the front of each runner had to be curved prior to installation



Figure 8: Final Build

CONCLUSION

The team successfully built a redesigned toboggan to be used in the Pokagon State Park toboggan run. An initial prototype was built and tested on the track, followed by a second build which addressed the forming and performance issues present in the prototype.

The team was able to accomplish the customer needs of the project: increasing the safety of the sled, creating a lightweight design, and decreasing the runner changeover time through reducing fasteners and removing the formed front of the runners. Customers will be able to enjoy a safer, lighter weight product while still having the thrilling experience!



Figure 9: Completed Build Fully Loaded

LESSONS LEARNED

Throughout the process of this project, the team has learned:

- HDPE is very susceptible to warping when heated, consistent pressure must be applied during forming.
- To increase accuracy of desired forming, hold HDPE in place for at least an hour. Allows the HDPE to cool and hold the profile of the bend more effectively. Ensure that heat source is turned off and removed from area while it sets.
- Communication relating to scheduling is crucial. The team struggled in the first semester with finding times for everyone to meet.

ACKNOWLEDGMENTS

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- Timerson Downing, Project Manager, Trine University Innovation One
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