GNG2101 Deliverable J

Portable Ramp - Group 11

Submitted by

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Abstract

This report contains information regarding useability of the product “The portable ramp”, as well as recommendations for future work on the product and what lessons were learned and should be taken into consideration for the next group that works on a similar project. The user manual contains features for functionality, user instructions, maintenance etc. As well as a comprehensive guide to using the product correctly without causing injury to the person using the ramp or those around it.

The recommendations contains information about what the team sees as the best next step for the ramp. This is only recommendations but these should be looked into before considering other focus points for the ramp.The lessons learned is mainly regarding the project team as a whole and seeks to enlighten the next accessibility team to overcome project management problems earlier and easier.

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Introduction

This portable ramp will enable our client Austin to overcome obstacles he encounters while hiking such as roots and boardwalks. The ramp is set to a fixed angle of 11.5° for ease of use and is capable of folding which promotes portability. Mountability to the wheelchair further extends the usability of this ramp enabling the user to bring it along with them wherever they go without difficulty. Capable of supporting a load up to 750lbs, this ramp is strong and secure at an overall mass of 41.1lbs (18.8kg). With a setup time under 30 seconds, the user can dismount the ramp by unbuckling the strap securing it to the wheelchair, unfold, simply verify the hooks are in the correct orientation and place the ramp over the obstacle by setting it down (for a root) or propping it up (for a boardwalk).

1.0 User Manual

1.1 Important Features

- Straps pull in tensile stress, relieving the ramp from the shear stress and maintaining the proper angle.
- Wooden supports act in compression to prop up the peak of the ramp and double as guard rails to ensure the safety of the user.
- The ramp folds flush such that the wooden supports are on the outside

1.2 Functionality

Our portable ramp is designed with 2 functions in mind. Those being to go over a root or similar obstacle of maximum 6 inches in height, and to go up, and likewise down a difference in elevation of around 6 inches as well. It's made primarily for wheelchairs with tire widths of maximum 7 inches, as that is the width of the tracks on the ramp.

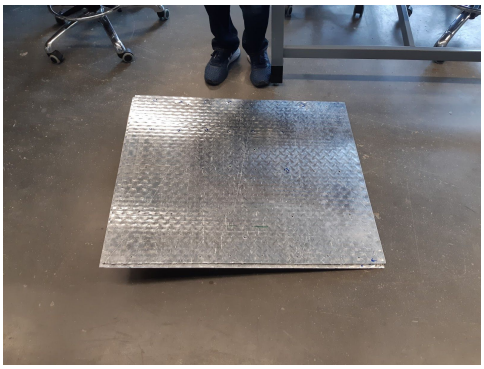
The ramp functions by being set to the fixed angle of 11.5° in both configurations. When a load is applied, the ramp tends to bend and flatten. The wooden supports counter the bending and go into compression to also help prevent the ramp from collapsing. As the load increases, the ratchet straps underneath begin to take the load and further support the ramp.

The material used was diamond plated aluminum which helps increase the friction on the ramp to prevent sliding. The hinges that are present to connect the 2 separate pieces are only to allow for foldability, and take minimal load when in use.

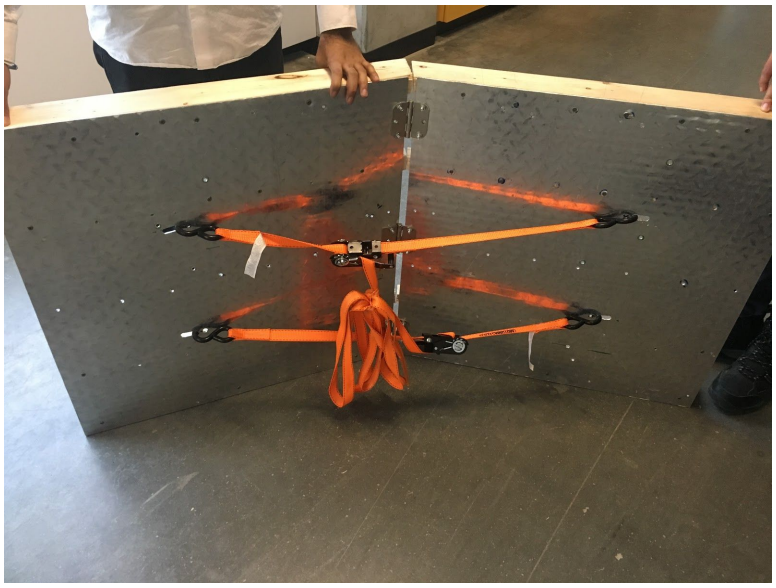
1.3 Manufacturing (detailed instructions on how the product was made, how it works, how to “install”)

The Process of Manufacturing

1. Two diamond-plated aluminum sheets were fastened with three hinges to create a triangular configuration.



2. Slots were handmade to allow the hooks of the straps to pass through and work with the strength of the aluminum.



3. Wooden supports were sawed to the desired shape and screwed on the top of the ramp (maintaining the proper clearances for the Permobil M300 electric wheelchair) to prevent the metal from bending and to provide the necessary support to the load. They also act as the guard rails.

1.4 User Instructions

First, put the ramp on it's side, and unfold it until the wooden supports are touching. Place it on the ground over the obstacle or place one end on the curb. Make sure the ratchet straps are hooked in properly and are taut. Proceed up the ramp to reach your destination. To take it down, do the reverse. Put it on it's side and fold inward, and store as desired.

For a visual representation of the user instructions refer to appendix 1

1.5 Maintenance Instructions

Make sure the ratchet straps are properly hooked in, and regularly monitor the condition of the straps to make sure they aren't damaged and are properly taking load. Inspect the wood to make sure there's no danger of fractures or cracks that could threaten the structural integrity of the ramp. Checking the hinges, along with the nuts and bolts securing them to make sure they don't fall out while in use.

1.6 Health and Safety Guidelines/Precautions

When using, be wary of the weight of the ramp which is 40lbs. Make sure to execute proper lifting techniques, and refer to section 3.4 for detailed steps on operating. Be wary of splinters that may result in the wood after repeated use of the product. Store at room temperature.

1.7 Troubleshooting (Technical Instructions)

Should the ratchet straps be loose in the extended formation, adjust the tightness using the crank provided while applying some load to the ramp to maintain the correct angle with the wood pieces touching. If the wooden supports begin to loosen, then use a Robertson screwdriver to retighten the screws. In the case of the hinges loosening, use a wrench to tighten the nuts and bolts.

If any structural damage occurs or further issues persist, contact us at our email or by phone.

2.0 Recommendations for Future Work

Working on the mounting system for mounting on the electrical wheelchair, and getting a safety factor of at least 2 is paramount for the product. The ramp is prepared for a mounting system that uses hooks that go in the same grooves as the ratchet straps that are currently in tension under load. A safety factor of 2 is gonna protect the user from any unforeseen forces acting on the ramp, such as dynamic loading and slanted surfaces. Strength wise, aluminium pieces cut the same way as the wooden pieces can go in the middle of the ramp to go into compression under load. Welding these in would be preferable due to the high cross-sectional area of the welding, compared to the relatively smaller cross-sectional area of a bolt.

Upgrading material and weight reducing initiatives would be the next thing to work on. The ramp is made up of a diamond aluminium sheet and stabilized with wooden supports. Changing the sheet to a high density polymer or a carbon-fibre sheet would make the ramp lighter and stronger. Keep in mind that changing the material from metal will make the aluminium pieces unable to be welded in. Drilling holes in the wooden supports would also lighten the weight while still providing rigidity to the sheet.

3.0 Lessons Learned

Throughout the project we developed a deeper understanding for project management and development. Especially learnings about teamwork, time management and revisions of a product have been in focus.

Teamwork ended up meaning not only being able to work together, but also meaning breaking up the group into smaller groups that work independently. A short meeting between the small group then seeks to bind the assignments that the group worked on together with the whole group.

Time management has lots of different variations. One thing is pure scheduling due to classes and exams, but the time that it takes to test a product, buy new materials, prepare the next text and doing it all over again took a lot more time than initially planned. Here we learned that small quick low fidelity test was able to give better insight than a group discussing a design problem at lengths.

Revision of the product means being okay with changing the design. Our product had a long list of demands and therefore needed to transform several times. Getting stuck on one track of thinking hurts the project in the long run. For example, we knew that the ramp had to fold, but we didn't have a solution so we kept on designing towards a product that weren't foldable, because that would solve other target specs. Keeping the target specs and customer needs in mind throughout the process is definitely a lesson learned.

4.0 Bibliography & Appendices

[1] https://youtu.be/oD0BuIjsAgA