Portable Wheelchair Ramp
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Introduction

There are many wheelchair ramps currently on the market. However, they are heavy, difficult to transport, and require multiple individuals to set up. Many wheelchair users face situations where they must climb one or two steps to access areas without proper wheelchair access. This new innovative wheelchair ramp gives manual wheelchair users greater independence.

Design Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Goal</th>
<th>End Result</th>
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</thead>
<tbody>
<tr>
<td>Weight</td>
<td>&lt; 25 lbs.</td>
<td>21.2 lbs.</td>
</tr>
<tr>
<td>Strength</td>
<td>Support 500 lbs.</td>
<td>Supports 500 lbs.</td>
</tr>
<tr>
<td>Setup Time</td>
<td>&lt; 5 min</td>
<td>2 min 40 sec</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1500</td>
<td>$1030.54</td>
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</tbody>
</table>

Table 1: Metrics that guided the design process

Design

Support Rods – Built from 3 foot sections of 80/20 aluminum rods connected with a steel hinge. The left and right support rods are separated by 25”. Once assembled, the entire ramp is 6 feet in length.

Hinges – Constructed of 304 stainless steel and welded together. The hinge is bolted to the bottom of the support rods. Hinges allow the support rods to be extended and collapsed with ease.

Support Feet – The ends of the support rods have support feet attached to assist the user in riding on and off of the ramp. The feet are 3D printed using PETG plastic filament.

Slats – Made from 1/16” 5052 aluminum sheet metal. The rib across the middle adds rigidity. There are 6 removable slats on the ramp that slide down the support rods during assembly.

Analysis

FEA – With specific fixturing and a 500 lb. loading condition, deflection and stress results were acquired through SOLIDWORKS simulation.

Testing – Strength tests were performed at various stages of prototyping to understand loading capabilities.

Results

- Fully collapsible and portable (22 lbs.)
- Assembled by manual wheelchair user (setup time < 5 min)
- Supports two users (500 lbs.)

Next Steps

While we are excited about what we have achieved, there are additional steps worth mentioning. First, dipping the slats in an abrasive material will add grip and decrease the noise of the slats against the support rods. Second, creating multiple versions of the ramp for different user weights will ensure safety while remaining ultralight. Lastly, performing beta testing will ensure ramp longevity.