

ALL ACCESS WHEELCHAIR SOLUTIONS

GLIDEGUIDE 1

AN INNOVATIVE BRAKING SOLUTION THAT IMPROVES THE SAFETY
OF MANUAL WHEELCHAIRS



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MCEN 4045 Engineering for Social Innovation
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Executive Summary

All Access Wheelchair Solutions is committed to developing an innovative braking system for manual wheelchairs. This design is a multi-function braking system that enables users to safely control their speed and movement while eliminating the risk of injuries or fatigue.



Opportunity

In America alone, there are over 1.5 million manual wheelchair users and 1.2 million temporary users yearly. Due to a lack of effective braking technology, many users suffer burns and injuries to their hands while struggling to control their speed and mobility. Prolonged wheelchair users are also susceptible to fatigue and Carpal Tunnel Syndrome due to the unnatural body mechanics of conventional braking methods.



Expert Input

Seventy-eight user interviews were conducted at retirement homes and rehabilitation centers across the front range to discuss pain points with their current manual wheelchairs. Four relevant experts were interviewed, including physical therapists, caregivers, and nurses. The consensus from these interviews was that manual wheelchair users are susceptible to mobility-related injuries such as burns, fatigue, and falls during transfers. This is a challenge for older people or those experiencing a physical decline. These conversations guided the team toward the final design.

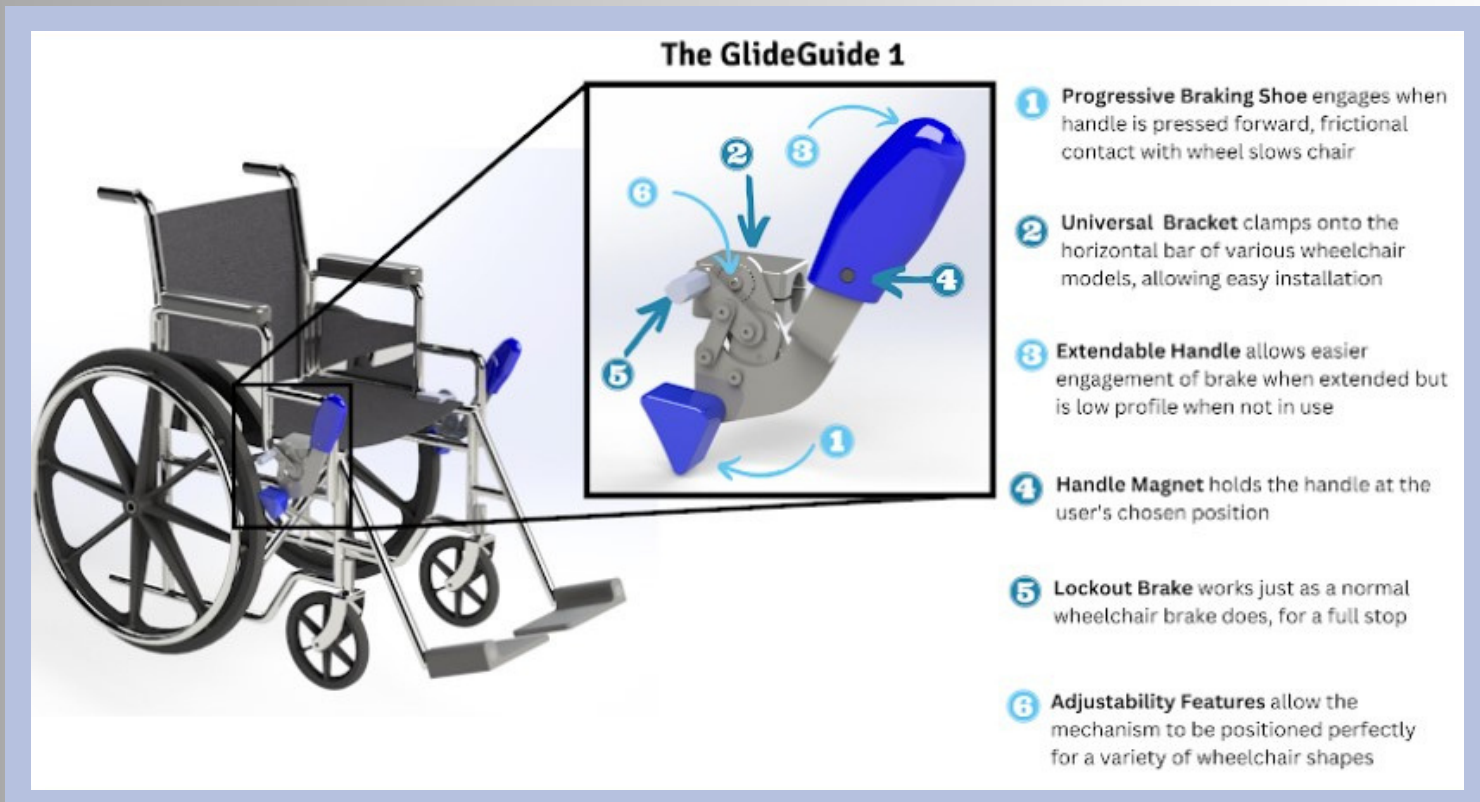


Our Solution

The *GlideGuide* is a multi-function mechanical system that introduces advanced braking capabilities. This product comprises a locking mechanism and a lever-actuated friction brake. The brake handle enables the user to engage the brake during movement and control their speed while going down hills or ramps. Alternatively, the user can effortlessly engage the locking brake to prevent any unwanted movement of their wheelchair. When not in use, the telescopic handle can be collapsed and stored out of the way. Additionally, the product features a universal bracket and adjustable mount for use on various wheelchair models. The purely mechanical design improves durability and minimizes the user input required for brake actuation.

Our Design

The GlideGuide braking system was created through a passion driven by improving the lives of wheelchair users. We interviewed over 78 individuals and heard their stories on avoiding basic survival activities such as grocery shopping or seeing loved ones, all because of the struggle to control wheelchair speed and mobility. It was ridiculous that no products on the market addressed this essential need at a reasonable cost. That's where we come in; our brake consists of a CAM system, an adjustable handle, a standard lockout brake, and a pad.



Manufacturing Considerations

Current Design

During the production of each prototype, the team was constrained by the lead times of essential materials and on-campus resources. The couple had access to waterjet cutting and machining equipment at the Idea Forge shop, providing a convenient and inexpensive means of manufacturing. All parts in this iteration were designed to be manufactured by the on-campus lathe and mill to avoid the associated costs of outsourcing.

Future Design

In future designs, the GlideGuide Braking system will incorporate cost-effective manufacturing technologies to reduce the price per unit. Low-stress components in the design will be produced via injection molded plastic, and critical mechanical components will be manufactured quickly via laser cutting. Future design iterations will also minimize the required number of fasteners, further reducing the total cost and weight.

Testing and Results

Qualitative and Quantitative Testing

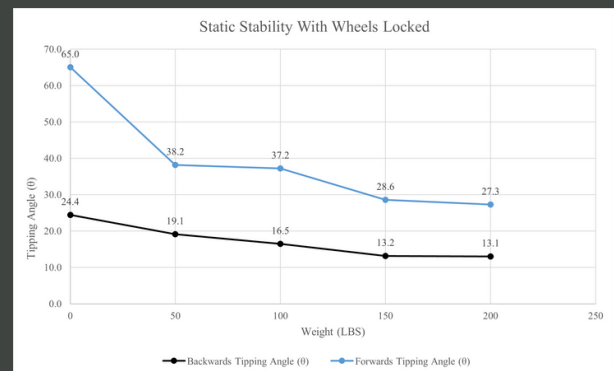
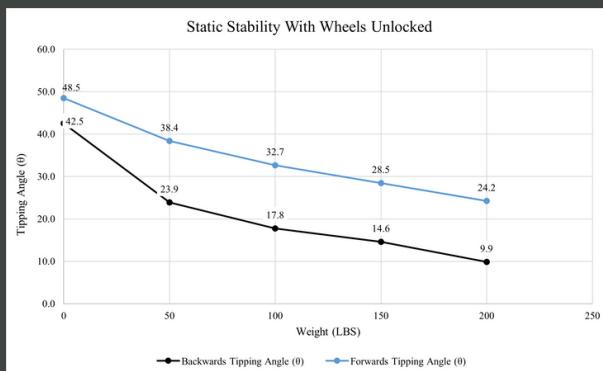
The testing for this project consisted of qualitative and quantitative testing across three test phases. Phase one involved prototype validation and design iteration. Phase two consisted of a series of six tests to determine the static stability of manual wheelchairs given a variable load and incline. Finally, phase three consisted of fatigue and braking performance testing with a test group of end users.

Phase 1: Qualitative Testing

Qualitative testing began by printing the brake prototype from acrylic and PLA plastic. This first assembly aimed to validate the dimensional accuracy and placement of all parts and fasteners and uncover any necessary design changes. From this first assembly, we found that the handle was far too large to be comfortably operated. This design insight led to several iterations to improve the comfort and ergonomic grip of the handle. Additionally, a jog was implemented into the lever to improve the clearance with the wheelchair without the need for spacers or alternative mounting accessories.

Phase 2: Quantitative Testing

Phase 2 of testing consisted of design validation based on the defined project requirements. These tests were performed using an adjustable incline ramp to determine the maximum threshold angle before tipping. These tests were performed with two wheelchair configurations, wheels locked and unlocked, and testing both the forward and rearward stability with varying weights. These tests determined that the tipping angle decreases as the weight increases. Additionally, we found that the wheelchair was always at the greatest risk of tipping when set facing up in the direction of the incline. The braking performance was also tested to determine the force required for braking and the measured braking distance.

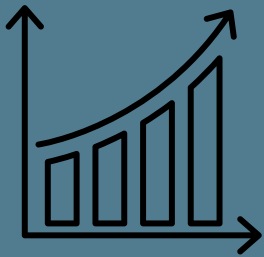


Phase 3: Validation Testing

The final testing phase will be performed with end users:

- Assembly fatigue
- Maximum load on brake mechanism
- Rate of fatigue on brake foot
- Day in the life tests

Business and Market Considerations



Market Size

The total addressable market is the global wheelchair market, which is valued at 6.6 Trillion USD, assuming a 200 USD evaluation of our product. The serviceable addressable market is wheelchair users in developed countries worldwide, valued at 4.4 billion USD. The serviceable obtainable market is this same market refined to focus on manual wheelchair users. With valuations this high, there is a clear potential to leverage the markets with the competitive advantage of the GlideGuide 1 braking solution.



Competition

Our two main competitors are the speed-controlling brake from Wigit and the brake handle add-on made by AliMed. Wigit is the only other US company attempting to address the speed control issue; however, their brake fails to align with the different needs of wheelchair users. It is far too expensive, heavy, and intrusive. In addition, the brake made by AliMed is affordable and lightweight but does not help the user control their speed.



Revenue Streams

All-Access Wheelchair Solutions plans to sell our product directly to customers, and businesses, and through a subscription service. We plan to sell directly to customers through our website and platforms like Amazon. All-Access also offers a wholesale option where we plan on selling to any companies that sell wheelchair extensions, such as Craig, rehabilitation centers, retirement homes, and Walmart. Lastly, to ensure a constant income stream, we plan on supplying a subscription service to our users regarding their brake pads and software to be developed later.



Company Traction

All-Access is currently in the process of filing a utility patent application after initial funding. We are creating a user-friendly website where potential users can learn about the nature of our company and purchase brakes and subscription services. Our group is also in the process of applying for conventions to show off our technology.

Conclusion



All Access Wheelchair Solutions is committed to developing safe, affordable, and innovative braking solutions for manual wheelchair users.

After discovering a lack of innovation within the mobility industry, All-Access Solutions has developed a novel braking system to improve the safety of manual wheelchairs. Product testing and user feedback have motivated numerous design iterations with clear improvement with each iteration. User testing and product analysis have generated key insights, leading to a successful product that addresses user pain points.

Through intense customer development, design analysis, prototyping, and business development, The GlideGuide 1 braking system is ready to disrupt the mobility industry.



Our Team



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