Assisted Walker

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***Abstract*—Mobility plays a big role in our daily lives. It can take us from point A to B with little effort. Methods for mobility can refer to vehicles, bicycles, scooters, etc. For this case, we are introducing our mobility aid device, which was designed to assist walking for those with an impairment, are unable to sustain their own weight, and/or have a physical injury. We took a given design and developed a device with similar functions but with the following differences: reduction of overall cost and a redesign for easier construction.**

Keywords- Walker, Wheelchair, Disability, Alinker

I. INTRODUCTION

Mobility aids were designed to help individuals with difficulty getting around, people who have disabilities or injuries, or older adults who have a higher risk of falling, muscle weakness, joint problems, or are unable to care for themselves. A few of the mobility aids available today include crutches, canes, walkers, wheelchairs, and motorized scooters, but choosing one of the devices requires time and research. Each of these devices should be fitted to the person's disability and physical condition because its sole purpose is support. A study from the University of Central Arkansas reported that out of 158 rolling walker users over the age of 65, the most common misuse was incorrect height [1]. If the device is not matched to their body type correctly, using it can be uncomfortable, unsafe, and can cause further issues.

Over the years these devices have taken on many forms, from a wheeled device suitable for indoor use to sturdier use on grass or paved surfaces. Our goal was to design a safe, comfortable, and easy to maneuver alternative to traditional aids. Factors to consider were improving stability, reduced loading and generating movement.

We were given the task of taking a current design such as the Alinker (Fig. 1) and improving targeted characteristics of the device [2]. The device is a non-motorized walking bike without pedals. In other words, it is a walking trike designed for those who need minimal assistance getting around [3]. Its design is a three-wheeled bike with an arched aluminum frame connecting two 16-in front wheels with an 8-in rear wheel and an adjustable seat mounted in the middle of the dropping tube. It uses standard bicycle hardware and is designed to work with most standard accessories. It folds up at a joint near the seat, creating a compact design to slide into a trunk. The overall weight of the device is 26.5-lb and supports up to 250-lb. The design had to have similar function but with the following differences: simpler design (straight lines) for easier construction, same tire/wheel size for easier maintenance/repairs and reduced overall cost. Therefore, it was our goal to design and build a device that would be suitable for all types of terrain and help individuals be more included in society.

Figure 1: Alinker

II. METHOD AND MATERIALS

Designing the frame was one of the first steps we took during our procedure. We wanted to make our mobility aid as small as possible but still true to many of the standards of modern-day bikes and mobility aids. One major objective we had to address was that it had to withstand a force of 250-lbs without distorting. The frame is made of circular tubing that has two types of diameter (Fig. 2), which increased the overall weight but made it secure and able to reach our 250-lb user goal. The front steering axle is at a 10-degree angle, increasing frame strength while allowing users' weight to be set farther behind the front axle for reduction of stress. This makes the device well balanced when encountering bumps and rougher terrain. Additionally, a brace was integrated in the front fork for increased stability. A-513 Carbon Steel was the optimal material for the frame due to its high strength, durability, low cost, weldability and resistant to fatigue [4].

A. Raw Material:

- A-513 Carbon Steel
- Circular Tubing (Frame)
  - 1.125" OD*0.120" Wall, HREW tube
  - 1.000" OD*0.120" Wall, HREW tube

B. Seat Components:

- Bicycle seat memory foam

- Bicycle seat post with height dimensions
- Seat Post Clamp with clip quick release

C. Brake System:

- Universal Caliper side-pull brake set with caliper, brake lever, cable, and housing

D. Other Components:

- 12” Air tire
- Handlebar Stem Riser
- Butterfly Handlebar with Sponge

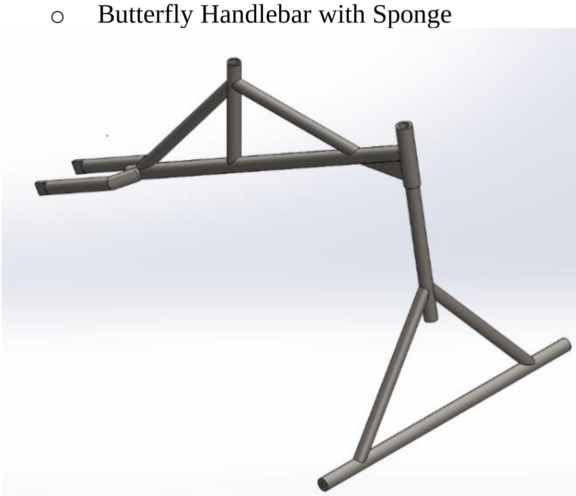

Figure 2: SolidWorks Model of frame

III. Results

Once we planned our final design, we were able to conduct a stress analysis study using Ansys. We set a point load at the seat post of the frame of 250-lb. We tested multiple materials with different thicknesses and diameters. This allowed us to determine what sizes we would use, and we were able to reduce the weight by using smaller and thinner materials. We found that A-513 Carbon Steel was the best for our frame because it had a maximum stress of 7328.6 psi (Fig. 3). Based on this we found that the frame would be able to support a 250-lb person. In the simulation we are also able to find the total deformation to be 0.0065 inches (Fig. 4).

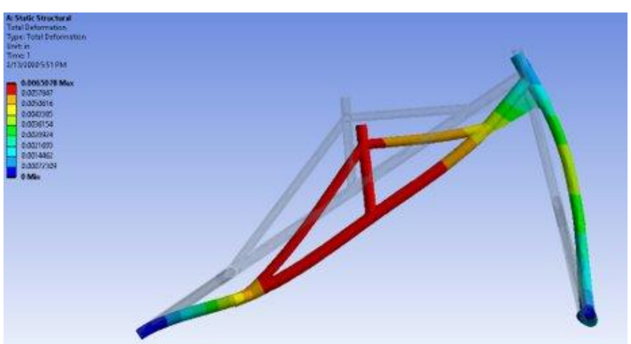

Figure 3: Upper Bound Axial and Bending Stress

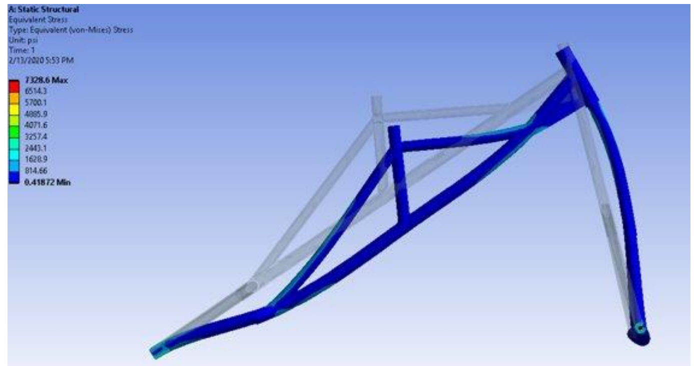

Figure 4: A-513 Carbon Steel, Total Deformation

IV. Conclusion

With many different types of mobility aids, we were able to design a simpler device that can be easily manufactured. This will minimize the cost of not only the parts being used but also the cost of production. The total price of the parts is $496. When designing the walker, we wanted to make it affordable so it can reach a wider range of individuals, and with some walking devices costing a $1,000 we were able to achieve our goal.

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