Design of a low cost device to ease use of attendant propelled wheelchairs over difficult terrain

Greater Glasgow and Clyde

Introduction

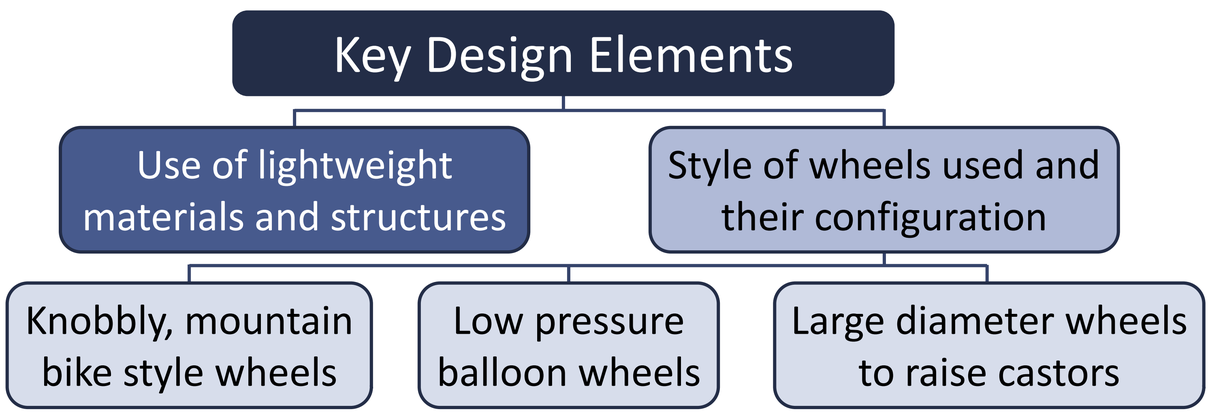
Pushing an individual in an attendant propelled wheelchair can be a challenging task. While it is essential that the user is transported safely and comfortably, the attendant must also be able to operate and manoeuvre the chair safely, with minimal physical strain. When traversing uneven ground, the small wheels of attendant propelled wheelchairs can make manoeuvring difficult and result in an uncomfortable journey. Although all-terrain wheelchairs exist, they are expensive, highly specialised, and are not available from the NHS.

AIM: Design and production of a low cost, lightweight device to improve travel of an attendant-propelled wheelchair over difficult terrain

Research

A number of products exist to make rural settings more accessible to manual wheelchairs (Fig. 1.) Although reasonably expensive, they are considerably cheaper than a dedicated all-terrain wheelchair. Key design elements across the products were identified:

Figure 1(a): Beach Easy Wheelchair **(b):** Cad Weazle Trike **(c):** Lomo 360 **(d):** FreeWheel



Design Process

Product Design Specification (PDS)

A PDS was created to identify the device requirements taking into account the customer needs and technical requirements. Amongst the requirements were that the proposed device should:

- allow easy travel over different terrains including grass, cobbles, stones and forest paths;
- be easy to use i.e. easy attachment and detachment of the device;
- be hardwearing and durable;
- be safe to use and reliable;
- be comfortable for passenger use;
- be comfortable for attendant use;
- have a total cost of less than £100 to produce; and,
- not exceed a total mass of 7 kg.

Concept Creation and Selection

- Seven concepts created
- One final concept emerged following a selection process

Description: Two additional large diameter, knobbly wheels located external to and behind the castors. The wheels lie outside the wheelbase, increasing side to side stability of the chair. Thick tyres used to aid in traversing soft ground.

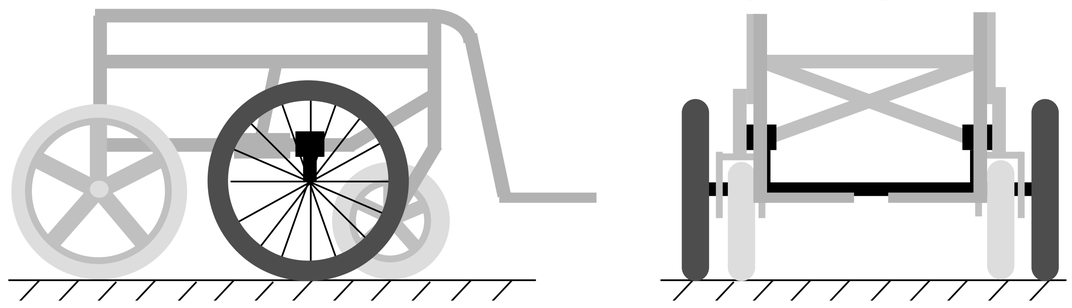


Figure 2: Representation of final concept following selection process

Prototype Construction and Evaluation

The final prototype was fabricated from standard parts to keep production time and cost to a minimum (Fig. 3). The majority of the desirables laid out in the PDS were met in the design, e.g. the final device weighed 3.6kg and cost £77.30 to build.

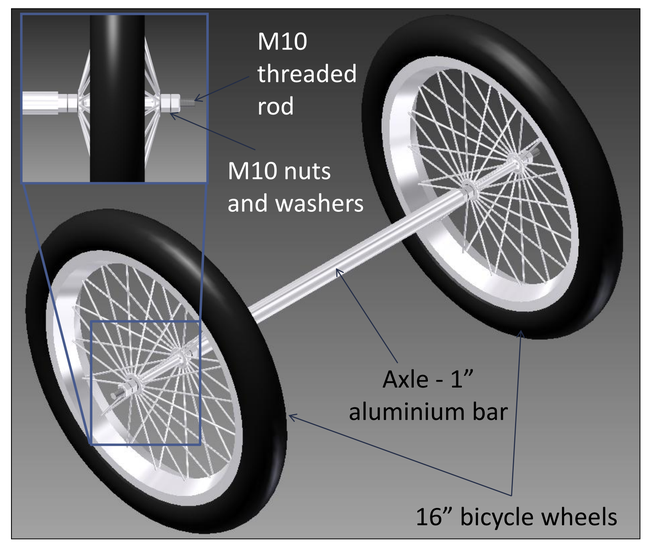


Figure 3: Inventor drawing of final design

Results of preliminary testing with able-bodied volunteers

Without device	With device
Attendant found propulsion extremely challenging, occupant was almost tipped out of chair, significant effort necessary to initiate movement. Occupant reported ride was relatively comfortable although it was clear attendant was struggling.	Attendant found propulsion somewhat easier, did not strain as much to start chair moving. Occupant reported that ride was similar to previous trial although felt that it might have been marginally more comfortable with the device.

Figure 4: Final prototype construction and testing

Conclusion

Although the device developed through the course of this project does not completely remove the difficulties associated with propelling a wheelchair over rough terrain, it does go some way towards easing the burden. With more testing and further refinement it could be a viable device, allowing all-terrain travel at a fraction of the cost of those devices currently on the market.

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