Project Statement and Specifications

ARC Slide

Team #7

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Statement of Need

The purpose of this project is to design an adaptable slide for a 6 year old male with cerebral palsy, Joey. Due to his condition, Joey can not gain full control of his posture or limbs, thus making it very difficult to be an active child. Despite his physical obstacles, Joey loves to play outdoors and is in need of custom made recreational equipment for his activities. Recently, he used a slide called the Extreme Coaster by Step 2. This 30" slide is composed of a plastic slope and 4 wheel seating cart. See Figure 1 below. Due to lack of supports, his mother had to hold him and run next to him as he went down. Furthermore, she had to push him up the slide every time he wanted to go back down, causing strain on her back.

The slide to be constructed has to be adaptable to Joey’s growth. Along with not being suitable to Joey’s physical disability, the step 2 slide has a limited weight load of 65 lbs. Because Joey is quickly growing, the new slide must be able to withstand a weight load of a growing young male. It must also have a modified seat to support Joey’s body, as well as an automated lift system to alleviate the physical strain on the guardian.

Figure 1: Image of Extreme Coaster by Step 2

Introduction and Overview

Cerebral Palsy is a disorder that affects motor functions, learning, seeing, hearing, and thinking due to complications with brain development. Physical symptoms of cerebral palsy may include abnormal movements, abnormal muscle tone, limited range of motion, and partial to full loss of movement. The six year old boy with Cerebral Palsy, Joey, is unable to walk unassisted, maintain posture of his upper body, and is lacking full control of his limbs. Joey
likes to play outdoors, but currently there is no recreational equipment available to meet his needs on the market.

The adaptable slide will include a custom seat to contour to Joey’s body and provide all necessary supports for his chest and lower limbs. It will also have an automated lift system to pull him back to the top of the slide after descending. The seat should be positioned almost completely upright and include a head rest and harness. Furthermore, the cart will be long enough to comfortably fit and support his legs. A modified chain conveyer system and motor will be used to operate the lift, and the mother should be able to start and stop it by the touch of a button. Finally, Joey’s growing body and environmental conditions will be taken into consideration when constructing a slide that is comfortable, safe, and enjoyable for Joey to ride.

**Realistic Constraints**

The modified slide for Joey Toce must meet health, safety, environmental, and sustainability constraints most notably. With Joey’s cerebral palsy, many of his muscles are weakened. Due to the muscular inhibitions, Joey cannot safely go down a regular slide by himself. The car for the slide must be able to safely carry his weight and restrain his upper trunk portion in the proper position while traveling down the slide.

The materials that he will come into contact with Joey must not cause physical discomfort. Every effort must be made to positively help his comfort while riding the slide. Materials used should not cause skin irritation or abrasions. Padding must be used to keep Joey safely in place during movement. The quality of the materials used must be also considered. Materials of lower quality but better cost may wear down faster than costlier, higher quality materials. For this slide, Joey’s personal safety must be taken into account during every stage of the design process.

In order for this slide to last in outdoor weather conditions of the northeastern United States, the materials must be chosen that will be durable for many years of use and must also be environmentally friendly. The materials cannot degrade and release harmful chemicals to the environment. The plastics used must be able to endure a wide temperature range and not
brittle from sunlight or cold weather. Lastly, the slide should be easily disassembled and stored in the winter season.

Other Data

The need to build such a device partially stems from the clients need to constantly haul Joey and the car to the top of the slide each time he wishes to go down. This repetition is physically demanding and ultimately exhausting. There is room in the clients back yard is large enough to fit the new size of the modified slide. The client resides in Southington, CT.
Questions

1. What is our budget?
2. What types of gears, pulleys, and chains will be needed to construct the lift?
3. Should we have the lift operate from the front or back of the slide?
4. What is Joey’s weight and to what age will he be using this slide?
5. What are the spatial constraints of the yard?
6. Would it be more fitting to have a remote controlled lift or a push button on the side of the slide?
7. What materials should the track be made of?
8. Will there be access to a power cord nearby?
9. How wide should the cart be?
10. Will we be able to use the extreme coaster slide and modify it?
11. Will we be able to make the slide and cart look appealing?
12. What is the stopping location and distance of the cart after it descends from the slide?
13. How would we automatically get the cart to unhook from the conveyor lift?
14. What types of safety requirements should we consider when designing the slide?
15. How will we made the slide so that it is easily assembled and disassembled?
16. Where will the slide be stored over the winter?
17. Will the slide be left out in the rain?
18. How much work will the mother have to do in order for Joey to play on the slide?
19. What is the maximum weight load that the slide should be able to hold?
20. What materials are most conducive for a product exposed to the elements in outdoor weather?
Technical Specifications

Subject: Joey Toce

Height: 42”
Weight: 35lbs
Age: 6

Physical

Materials
Track: 9 ft (2.7 m)
Supports: Wolmanized Wood
Platform: 30” (76.2 cm)
Car Dimensions: (H x W x D) 20” x 17.5” x 35”
Car Frame Material: Stainless Steel
Seat Dimensions: (H x W x D) 25” x 15” x 12”
Seat Material: Rubber Coated Polyethylene foam
Harness: nylon, polyester
Tires: 8” diameter, Rubber, metal bearings
Car shaft: ¼” diameter, steel

Mechanical

Winch Motor
Type: 12 VDC
Power: 0.5 Horse Power
Speed of lift: 1.5 feet/second
Maximum input voltage: 12V DC
Maximum input current: 30 A

Platform Lift Motor
Type: 12 VDC
Power: 1/8 HP
F/L RPM: 94
Maximum input voltage: 12 V
Maximum input current: 5 A

Electrical

Wireless Controller
Frequency: 1.0-3.7 GHz
Range: 10 – 30 meters
Protocol: RF

Status LED Tower Light
Maximum input voltage: 24 V DC
Maximum input current: 1.5 A
Environmental:

**Storage Temperature:** 0°-100°F  
**Operating Temperature:** 30-90°F  
**Operating Environment:** Outdoors, humidity, snow, rain

Safety:

Do not operate in rainy conditions. Ensure harness and leg supports are correctly positioned. Do not use on concrete, asphalt, packed earth or any other hard surface. Refer to operator’s manual for complete safety instructions.

Maintenance:

Occasional check of electrical components may be necessary. Oil coaster car wheels regularly. Inspect the fasteners and bolts on occasion to ensure structural safety.