Project Description

• Design a system of devices to assist a child with spina bifida
  – 8 years old, 36 lbs
• Two transitions: floor to wheelchair and floor to bathtub
• The device must meet any additional goals stipulated by the client
Goals

• Safety
• High portability
• Ease of use
• Low cost
• High quality
• Aesthetically pleasing
• Long service life

Constraints

• Portability
• Budget
• Time
• Materials
• Rapidness of use
Concept 1: Platform and slide

Advantages

• Automated
• Can be used with varying height bathtubs or wheelchairs
• Requires little interaction from the child or parent
Disadvantages

• Requires power source
• Control issues
• Safety
• Cost
• Non-mobile

Concept 2: Moving crane

Track
Winch
Controller
Seat
Advantages

• Automation
• Little interaction with child and parent
• Can be used with multiple tub heights
• Clean, refined appearance

Disadvantages

• Requires power source
• Safety
• Complicated controls
• Extremely non-mobile
• High maintenance
• High cost
Concept 3: Ramp and Slide

Advantages

- Portable (collapsible ramp concept)
- Low cost
- Safety
- Long service life
- Simple construction
Disadvantages

- Low adaptability
- High interaction required from child
- Parent must set up
- Appearance

Prioritization Matrix

<table>
<thead>
<tr>
<th>Portability</th>
<th>Ramp/Slide Weight/Rank</th>
<th>Platform/Slide Weight/Rank</th>
<th>Overhead Crane Weight/Rank</th>
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<tbody>
<tr>
<td></td>
<td>Weight/Rank 0.2 3</td>
<td>Weight/Rank 0.2 2</td>
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Cost Analysis

- $450 for expenditures, $800 for donations, and $350 for shop time for a total of $1600
- Platform/slide estimated total cost: $1050
- Moving crane estimated total cost: $1150
- Ramp/slide estimated total cost: $650
  - Material cost: $400
  - Machine shop time: 10 hours @ $250 total

Project Schedule

Form group
Collect information on spina bifida
Brainstorm ideas
Develop chosen initial concepts
Select design to pursue
Create formal design review presentation

Formal design review
Perform necessary design calculations
Create AutoCAD drawings
Order components
Design review 1
Design review 2
Build device
Design review 3
Test device to ensure quality
Perform any needed modifications
Create final project presentation
Final design review
Design Issues

- Economic-Selected best design/price combination
- Sustainability-Long service life due to low usage of moving parts
- Manufacturability-Simple design is easy to repair and build
- Health and Safety-No moving parts reduces risk of injury
- Environmental-No power requirements, no fluids (hydraulic etc.) leaves no environmental impact

To Do List

- Calculate the buckling loads on the ramp and slide
- Design the rail and pin systems to make the ramp collapsible
- Check deflection numbers on ramp and slide
- Research and select frictional materials for the ramp and slide surfaces
- Optimize device to decrease weight
- Optimize ramp and slide angles
- Fatigue calculations
Conclusions

• The ramp/slide is the best choice based on the following criteria:
  – It is the simplest for the child to use
  – It has the least necessary maintenance
  – It is the safest design due to no moving parts
  – The combined device delivers the most function and fulfills the most goals to the greatest extent