

Team #8 Wall Mounted Foldable Toilet Support Seat

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Objective

Design and fabricate a wall mounted and manually operated device that will prevent the student from falling off of the toilet so that she can use the restroom on her own.

Project Background

Cerebral palsy (CP) is a neurological disorder of the brain which affects the person's body movement and muscle co-ordination. A student at St. Lillian academy has CP, which limits her ability to use the restroom on her own. The student is unable to balance herself and needs assistance to prevent falling when seated.

Engineering Specification

Quantitative Function

Criteria	Required	Actual	P / F
System force capacity	≤ 250 lbs.	430 lbs.	Pass
Maximum stored protrusion distance	≤ 16 inches	9.5 inches	Pass
Maximum force to setup the device	≤ 50 lbs.	25 lbs.	Pass
Minimum height above grab bar	12 in	14.4 in	Pass

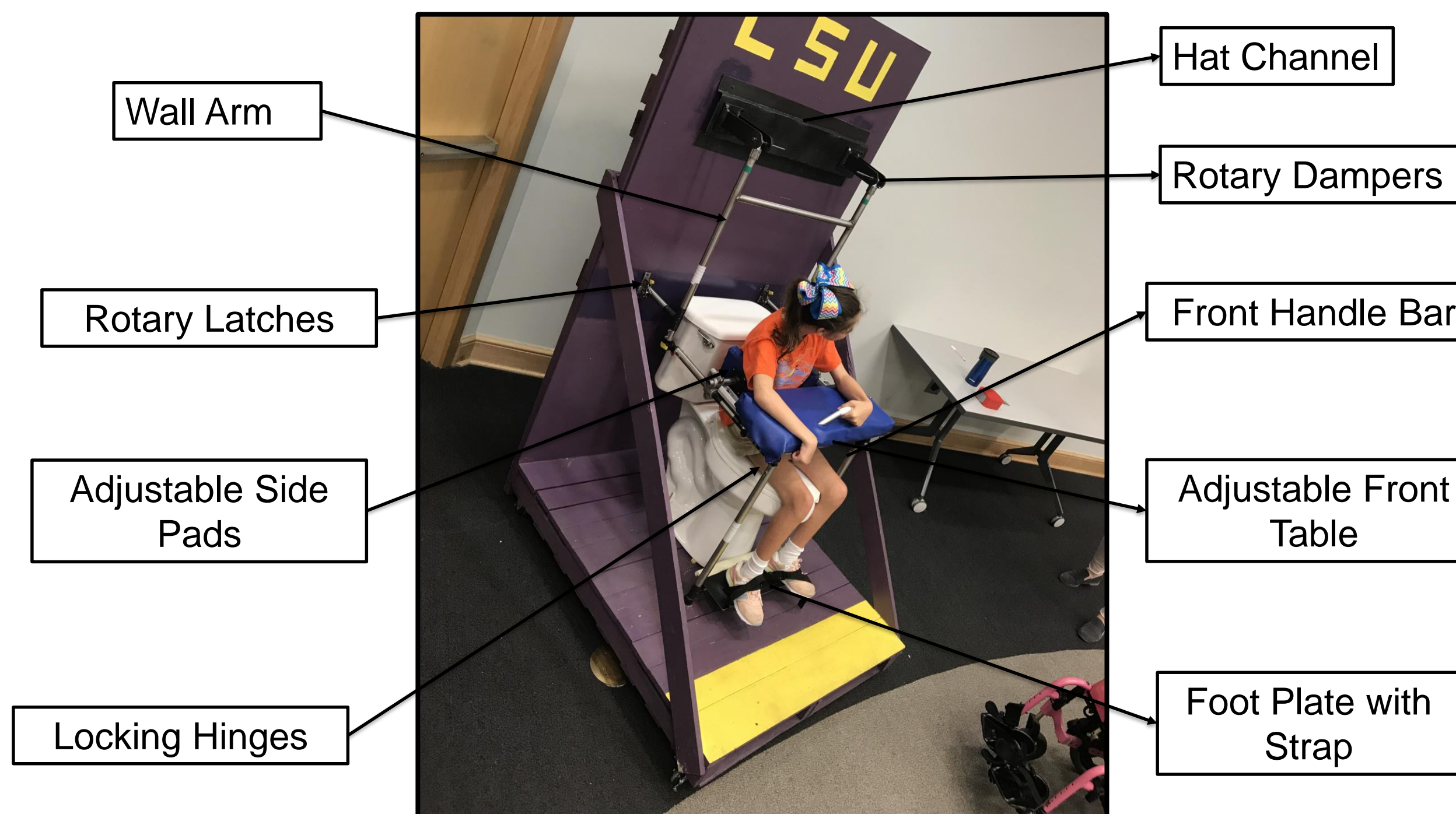
Qualitative Functions

Criteria	Survey Score
Device comfort	97
Easy to operate/setup	83
Aesthetic of the device	85
Quick to setup	28 sec

Human Survey

Criteria	
Best	100
Worst	10

Assembled Prototype



Engineering Analysis

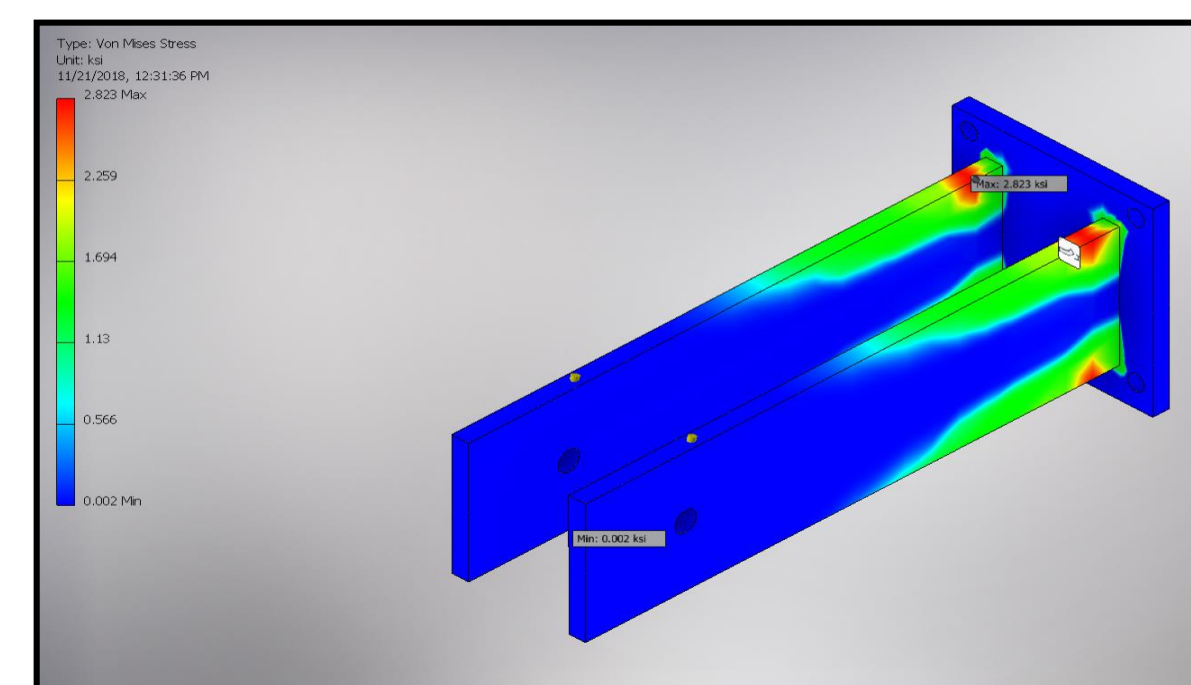


Fig - 1 : FEA for cantilever Beam

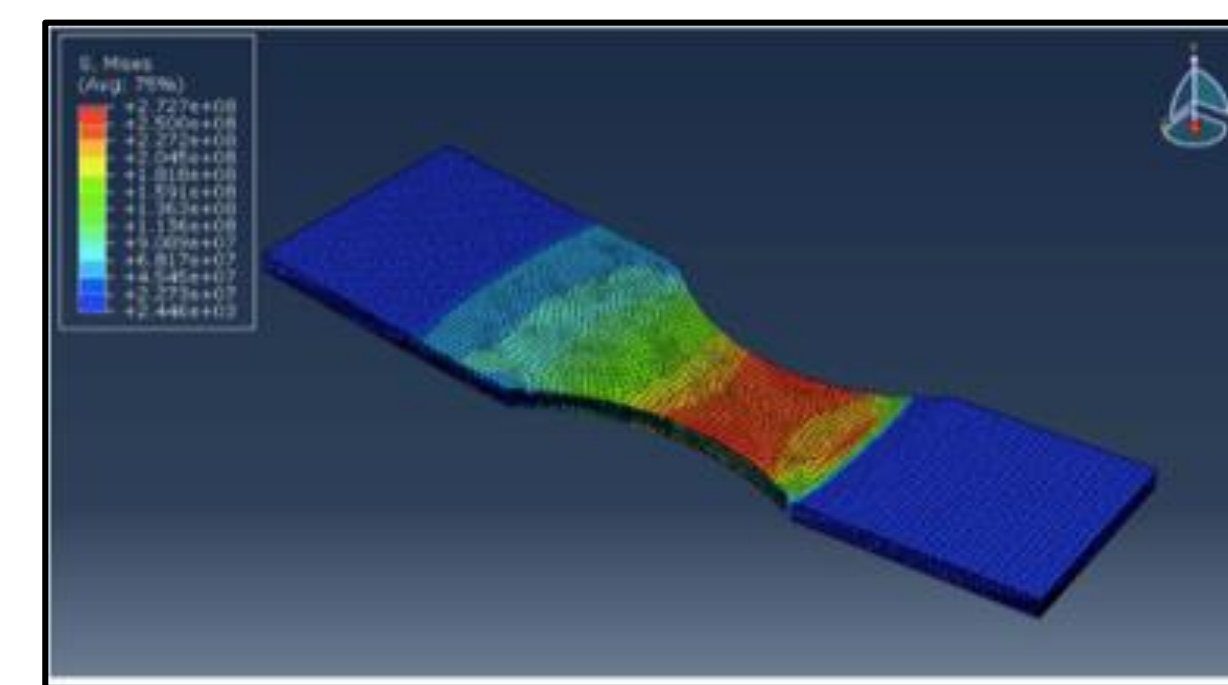


Fig - 2 : FEA results of Fatigue Test

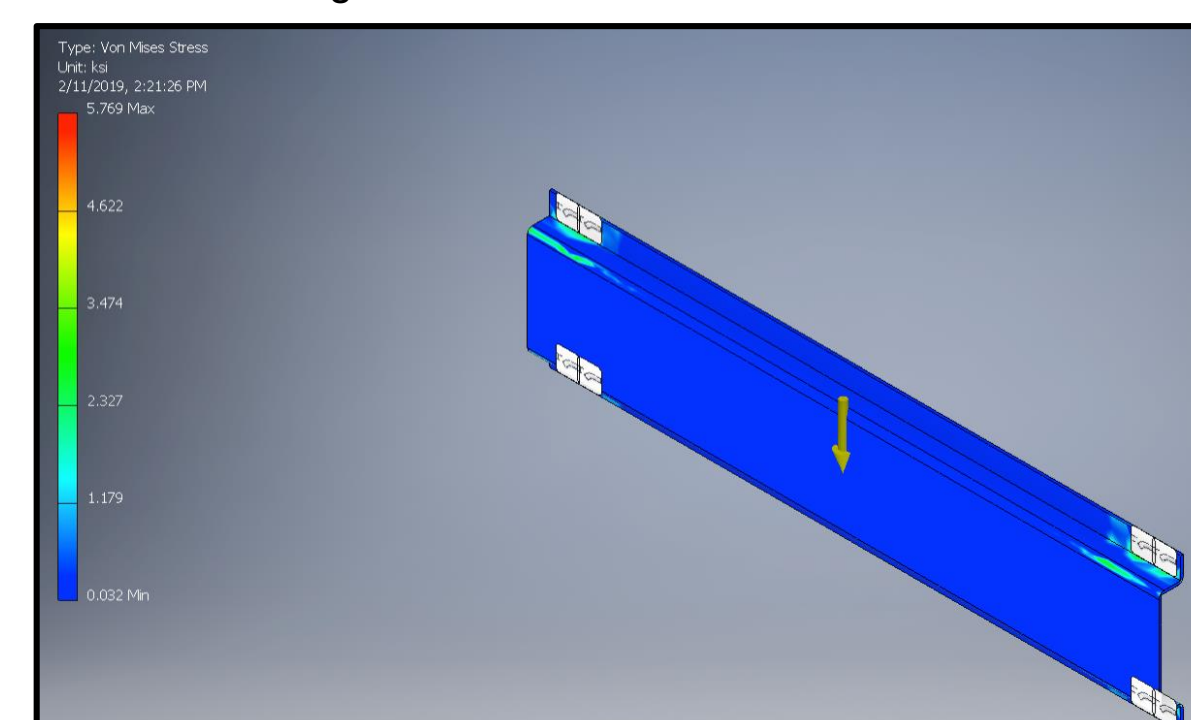


Fig - 3 : FEA results of Hat Channel

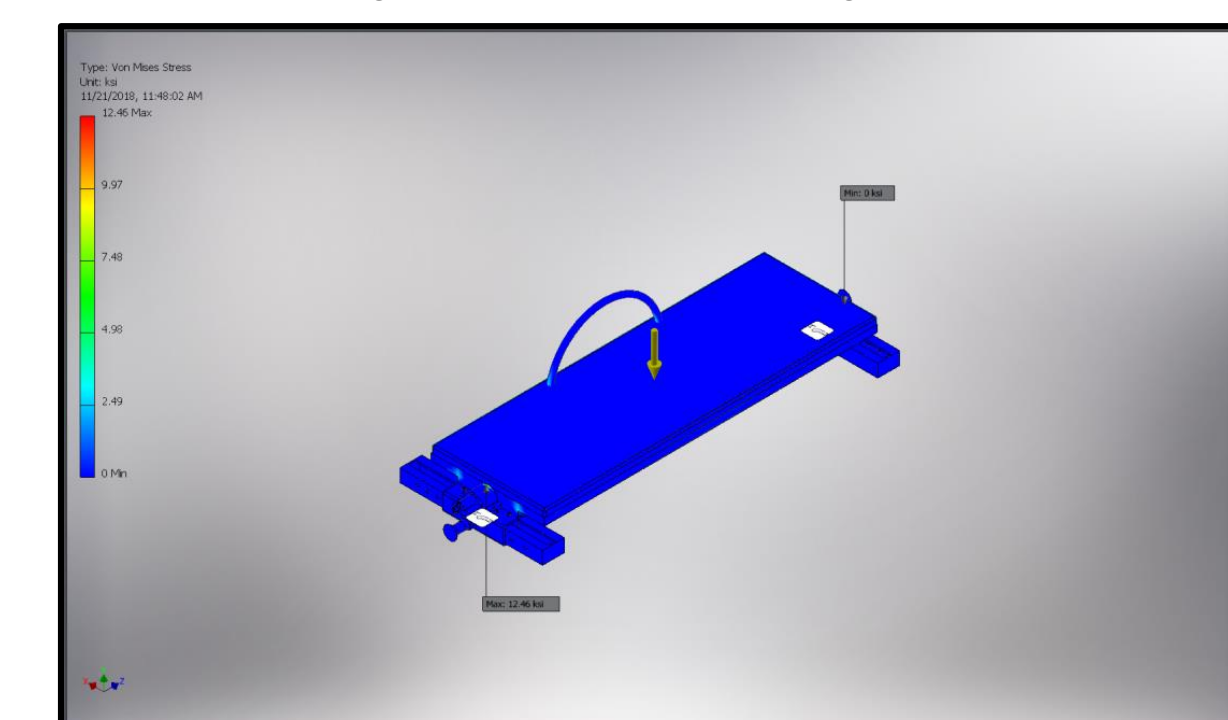


Fig - 4 : FEA results of Front Table

Engineering Analysis

- $M_{reaction} = \frac{L_{side} F_{impact}}{4}$
- Bending Stress, $\sigma_B = \frac{My}{I}$
Where $\sigma_B < \sigma_{yield}$
- $F_{yield} = \frac{4I\sigma_{yield}}{L_{side} \cdot y}$

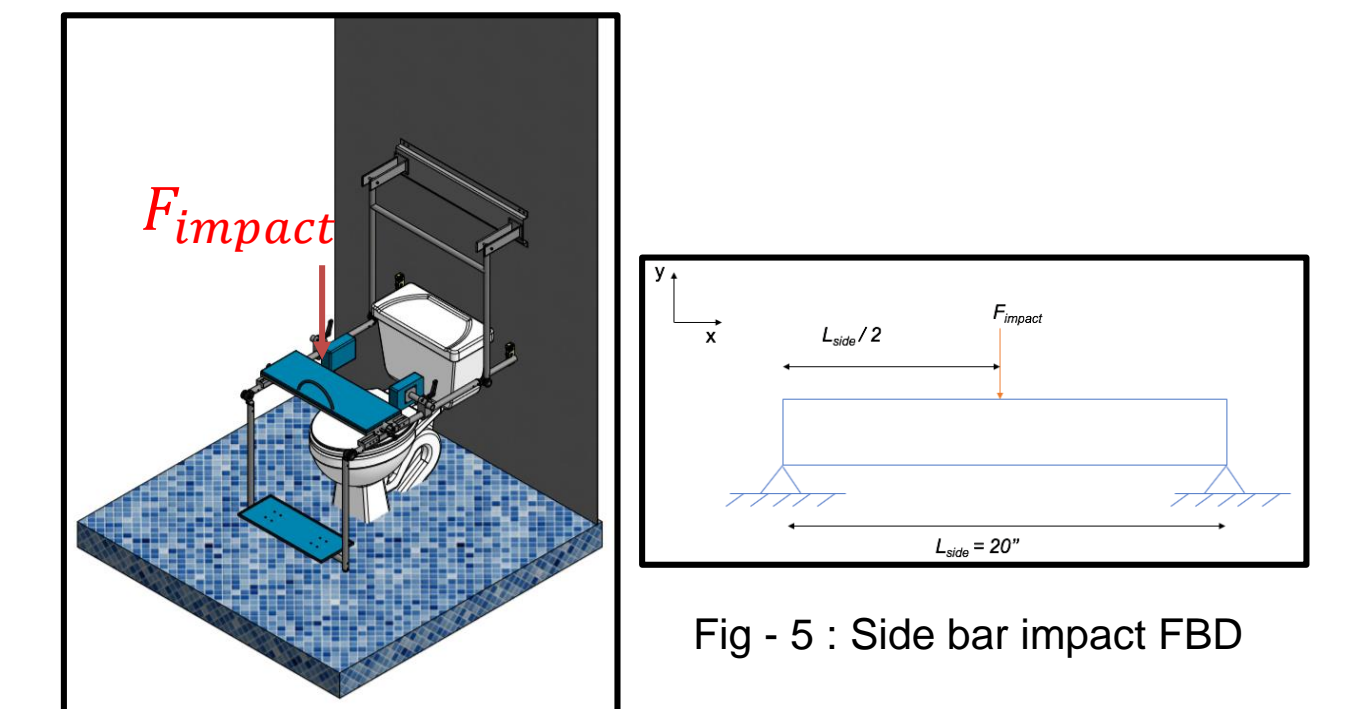


Fig - 5 : Side bar impact FBD

Safety Features

Issue	Solution
Prevent legs from kicking	Straps for feet
Device forward stability	Rotary latches
Prevent user from falling forward	Locking front table
Lateral body slumping	Adjustable side pads
Hard surfaces of the table	Cushioned table
To keep user in place	Front handle bar
Control rotation speed	Rotary Dampers
Device pivoting stability	Locking hinges

Budget

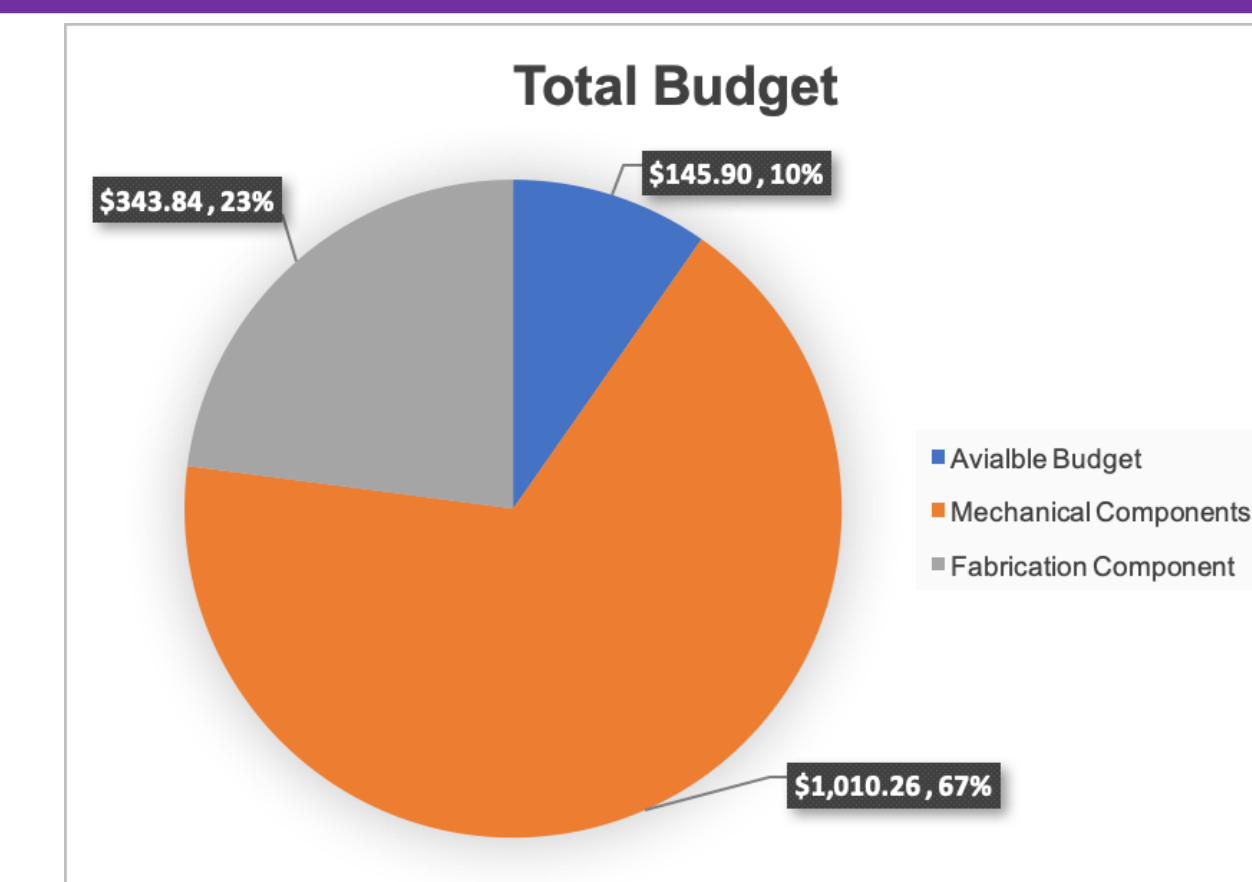


Fig - 6 : Project budget pie chart

August

September

October

November

December

January

February

March

April

May

•Brainstorming •Concept Generation •Calculation •3D modelling •Order parts •Update Drawings •Manufacturing •Manufacturing •Human Survey •Deliver Prototype

Sponsors: St. Lillian Academy, Jack Rettig

2018-2019

Advisers: Dr. Shuai Shao