ENGG 160 - Intro. To Engineering Design

What-If Analysis <E2_13 - Trebuchet>

1 Final Design Concept

The following design concept was chosen by the team. This was the best concept chosen via our design concept evaluation as it was the most complete, featuring enough information about certain components (such as the rubber shoes, the counterweight mounting method, and the net, as shown in Figure 1) so that we could use it as a baseline. The concept features other ideas such as a ball bearing in the joint.

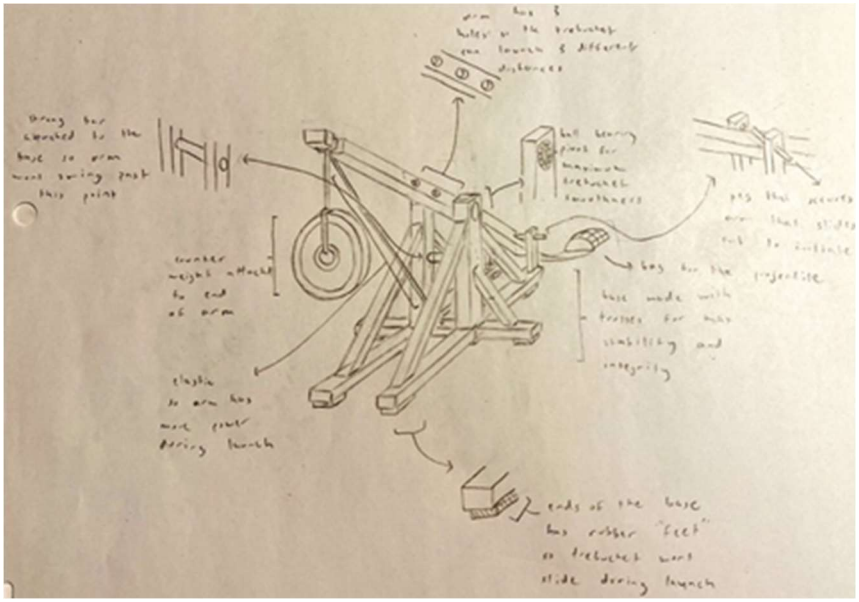

Figure 1 Design sketch for Concept #3.

1 Prevention Through Design – What-If Analysis

In engineering design, safety is paramount. Therefore, a What-If Analysis was completed for the final design concept, in order to identify safety concerns early on in the design process and provide solutions increasing the safety of the design. The analysis was performed using the What-If Table shown in Table 1.

ENGG 160 - Intro. To Engineering Design

What-If Analysis <E2_13 - Trebuchet>

Table 1 What-If Analysis for final design concept.

Activity or Area of Concern	What If…	Cause(s)	Consequence	Risk Level	Existing Control Measure(s)	Recommendation(s)	Residual Risk Level
Launching the Projectile during Testing	The projectile hits someone?	Inaccurate launch or a misfire	Small welt or bruise, small potential for eye damage	2	Proper PPE (C)	-Have people stand clear of the trajectory during launch (L) - Only load trebuchet when people are clear of the launch (L)	0
Handling the Trebuchet	You get a sliver?	Wood not being sanded	Sliver stuck in skin	6	Rough sand to make the wood smooth (C)	- Caution while handling the wood (L) - Wear gloves (L)	4
Handling the Trebuchet	Wood planks create pinch points?	Improper handling of wood stock	Mild Pain	1	Pieces of wood are small enough, so this isn't a big issue (C)	Caution when handling wood stock (L)	0
Cutting the wood stock to size	A Teammate cuts themselves?	Dangerous usage of cutting tools	Mild cut to amputation	4	Wear PPE when cutting (C)	Be aware of the Elko equipment safety procedures (L)	1
Material Selection	The scrap material isn't recyclable?	Utilization of unsustainable materials	Long-term industrial pollution	4	Trebuchet is constructed from wood (C)	Use materials in Elko garage that are sustainable or plant-based (L & C)	0
Launching on Test Day (Social Impact)	The trebuchet does not meet requirements?	Poor design procedures by team	Stakeholders are embarrassed	2	Design concepts are realistic (L)	Ensure that sufficient testing is done on the trebuchet (L &C)	1

Appendix A - What-If Analysis marking rubric

Table B1 Marking rubric for What-If Analysis of Final Design Concept.

Criteria	Scoring			
	Substandard (Score 1)	Acceptable (Score 2)	Exceptional (Score 3)	Mark
Five or more activities or areas of concern are listed in the table (two can be repeated)	✗	✗	✓	/3
At least three different activities or areas of concern are listed in the table (all must be different)	✗	✓	✓	
Five or more unique what if questions are provided (for a total of five rows in the What-If table)	✗	✗	✓	/3
At least four unique what if questions are provided	✗	✓	✓	
Two probable or likely causes are provided for each what if question	✗	✗	✓	/3
One probable or likely cause is provided for each what if question	✗	✓	✓	
Four or more existing control measures are identified within the What-If Table (and indicate if the control measure reduces L or C, or both)	✗	✗	✓	/3
At least three existing control measures identified within the What-If Table (and indicate if the control measure reduces L or C, or both)	✗	✓	✓	
Ten recommendations identified and indicate if the recommended control measures reduces L or C, or both	✗	✗	✓	/3
Between six and ten recommendations are identified and indicate if the recommended control measures reduces L or C, or both	✗	✓	✓	

- Table continued on next page -

- Table continued from previous page –

Criteria	Scoring			
	Substandard (Score 1)	Acceptable (Score 2)	Exceptional (Score 3)	
Two or more What-If questions address consequences related to social impacts on workers, end users, and/or the public	✗	✗	✓	/3
One What-If question addresses consequences related to social impacts on workers, end users, and/or the public	✗	✓	✓	
Two or more What-If question addresses consequences related to environmental impacts related to air, land, and/or water	✗	✗	✓	/3
One What-If question addresses consequences related to environmental impacts related to air, land, and/or water	✗	✓	✓	
Score ____ out of 21				