GNG2101 Deliverable C.1

Portable Ramp - Group 11

Submitted by

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University of Ottawa

Table of Contents

Table of Contents **2**

Introduction **3**

2.0 Concepts **4**

A. Rohit Nath 4

B. Stuart Gerus 5

C. Brianna Lecavalier 6

D. Mostafa Khafagy 8

F. Andreas Tauber Jakobsen 11

3.0 Concept Evaluation **12**

3.1 Concept Screening 12

3.1.1 Feasibility Judgement 12

3.1.2 Concept Groups 12

3.2 Concept Ranking 13

4.0 Concept Screening Result **13**

5.0 Group Design Concept **14**

6.0 Project Planning **15**

7.0 Prototype Bill of Materials and Parts (BOM) **15**

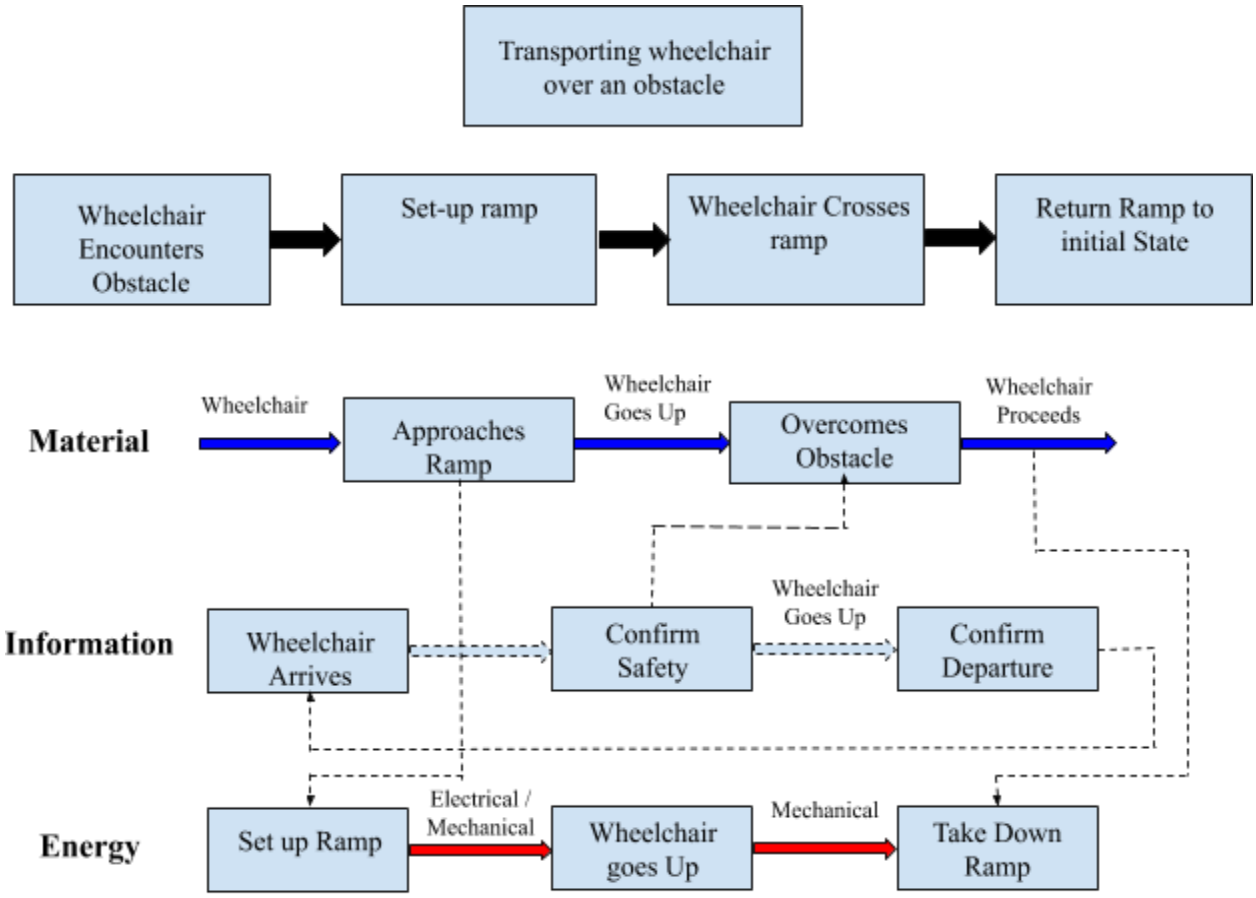
8.0 Feasibility Study **16**

9.0 Reflection **17**

Introduction

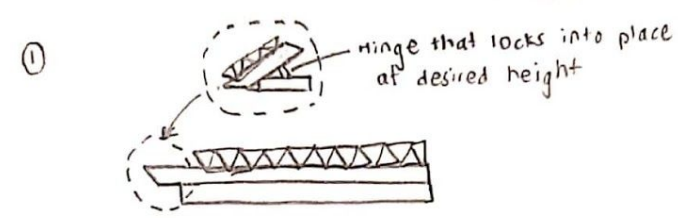
In deliverable B, we identified metrics and target specifications for the project. In this deliverable, we will begin by creating a functional breakdown of the project. Then, we will create a large number of design concepts and filter them down to only the plausible designs. We will then rate the designs based on our metrics, and decide on a tentative final design for the project.

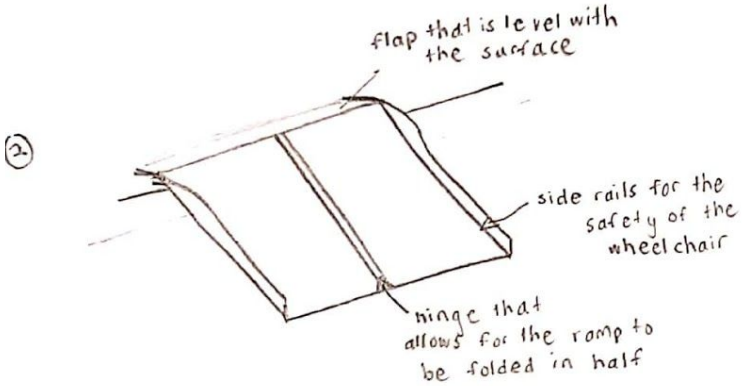
1.0 Functional Breakdown

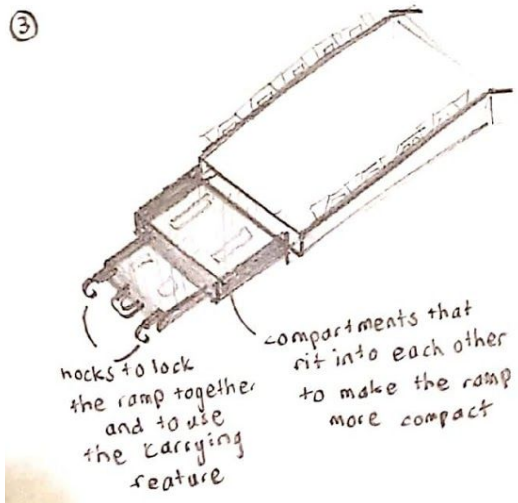


2.0 Concepts

A. Rohit Nath

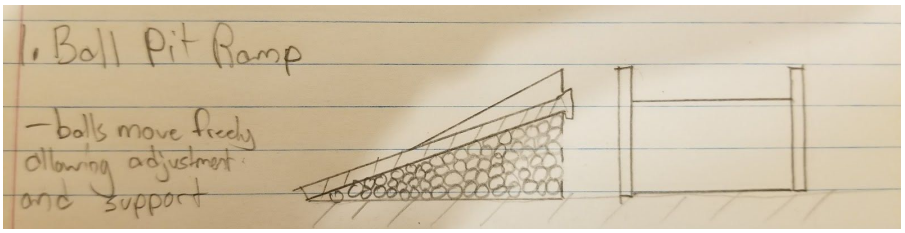




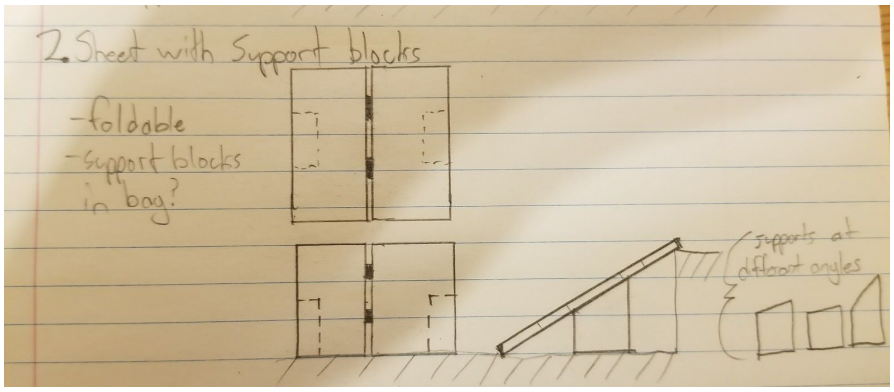


B. Stuart Gerus

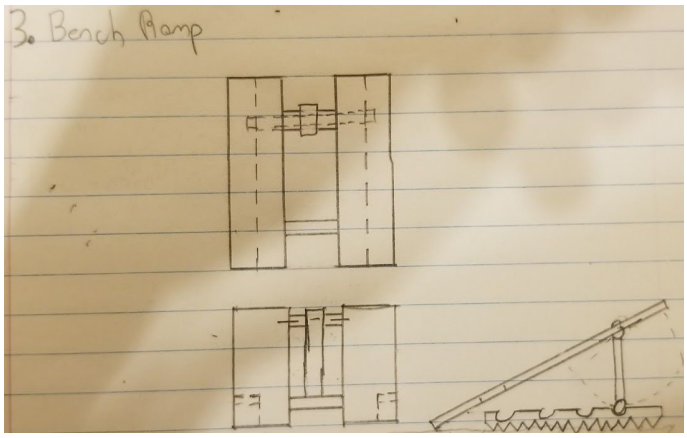
B.1 Ball Pit Ramp



B.2 Support Block Ramp

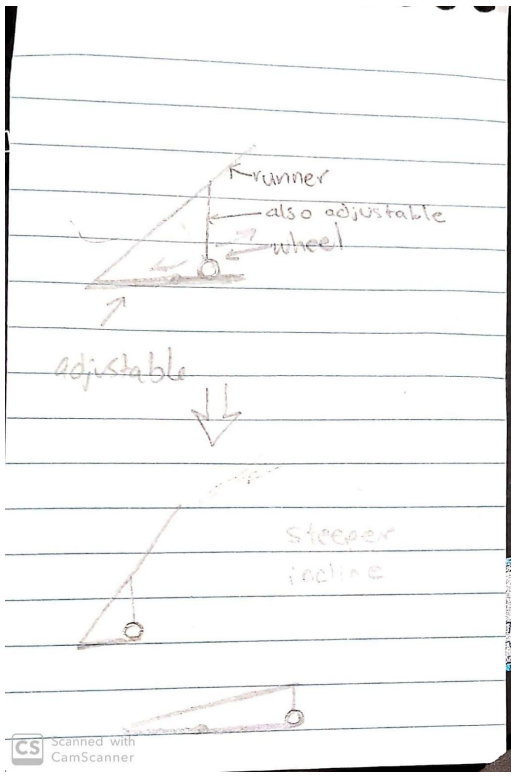


B.3 Bench Ramp

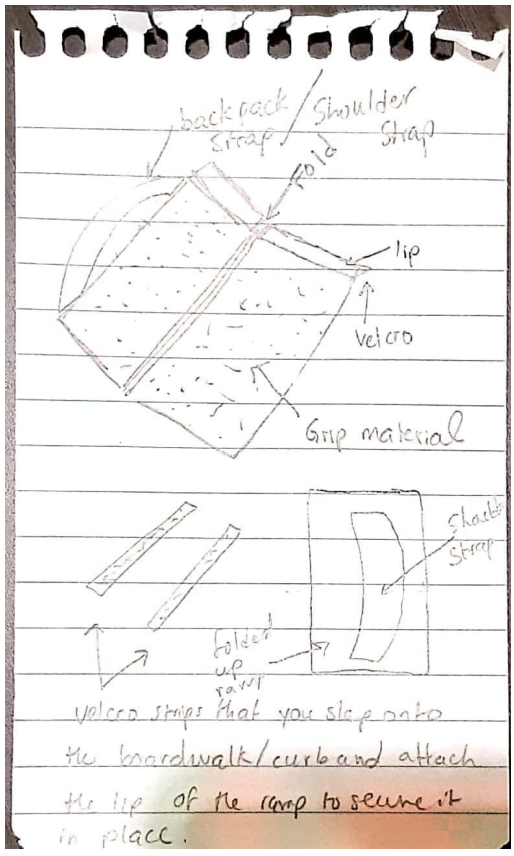


C. Brianna Lecavalier

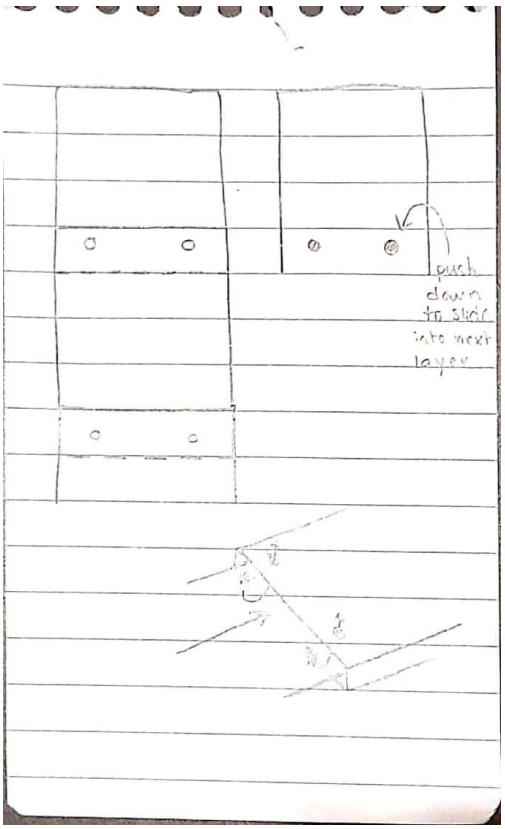
C.1



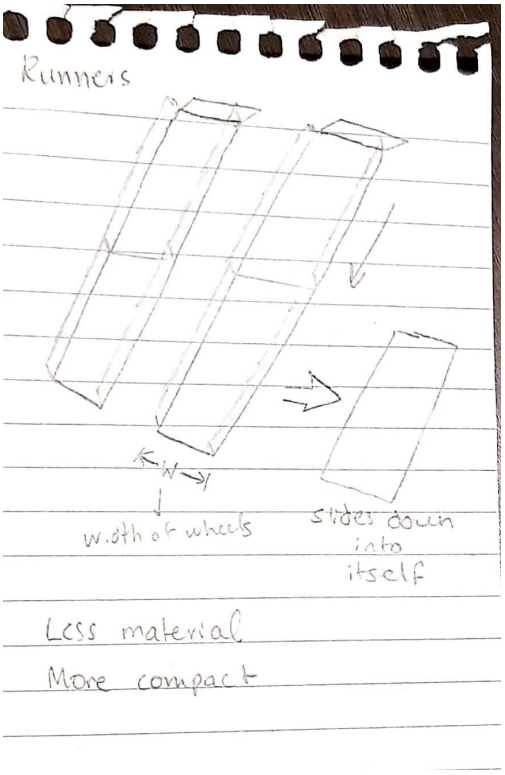
C.2



C.3

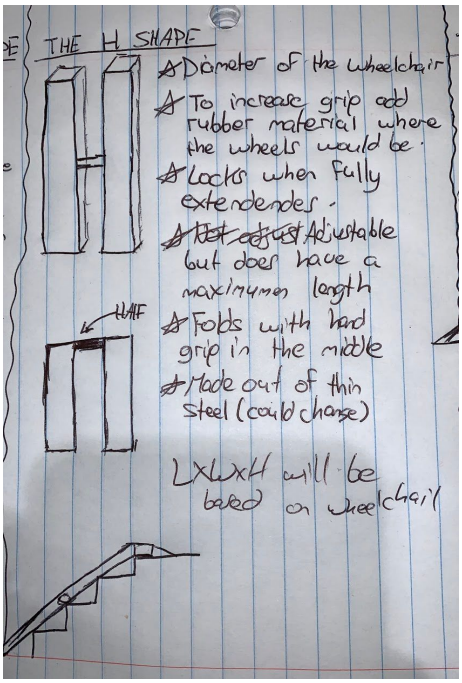

push down to slide into next layer

C.4

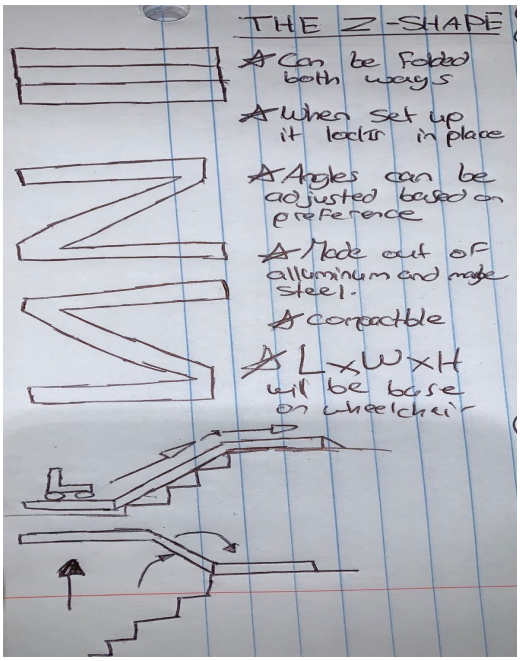

Runners
width of wheels
slides down into itself
Less material
More compact

D. Mostafa Khafagy

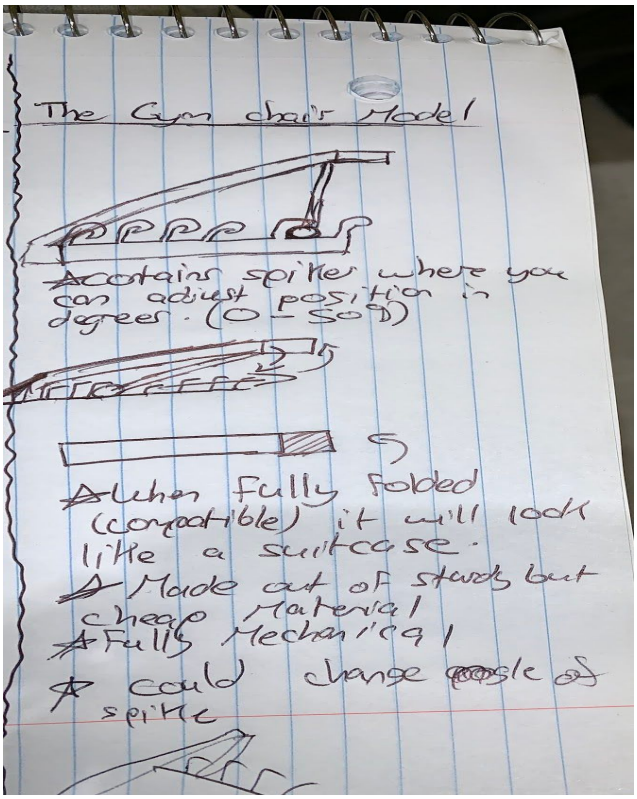
D.1



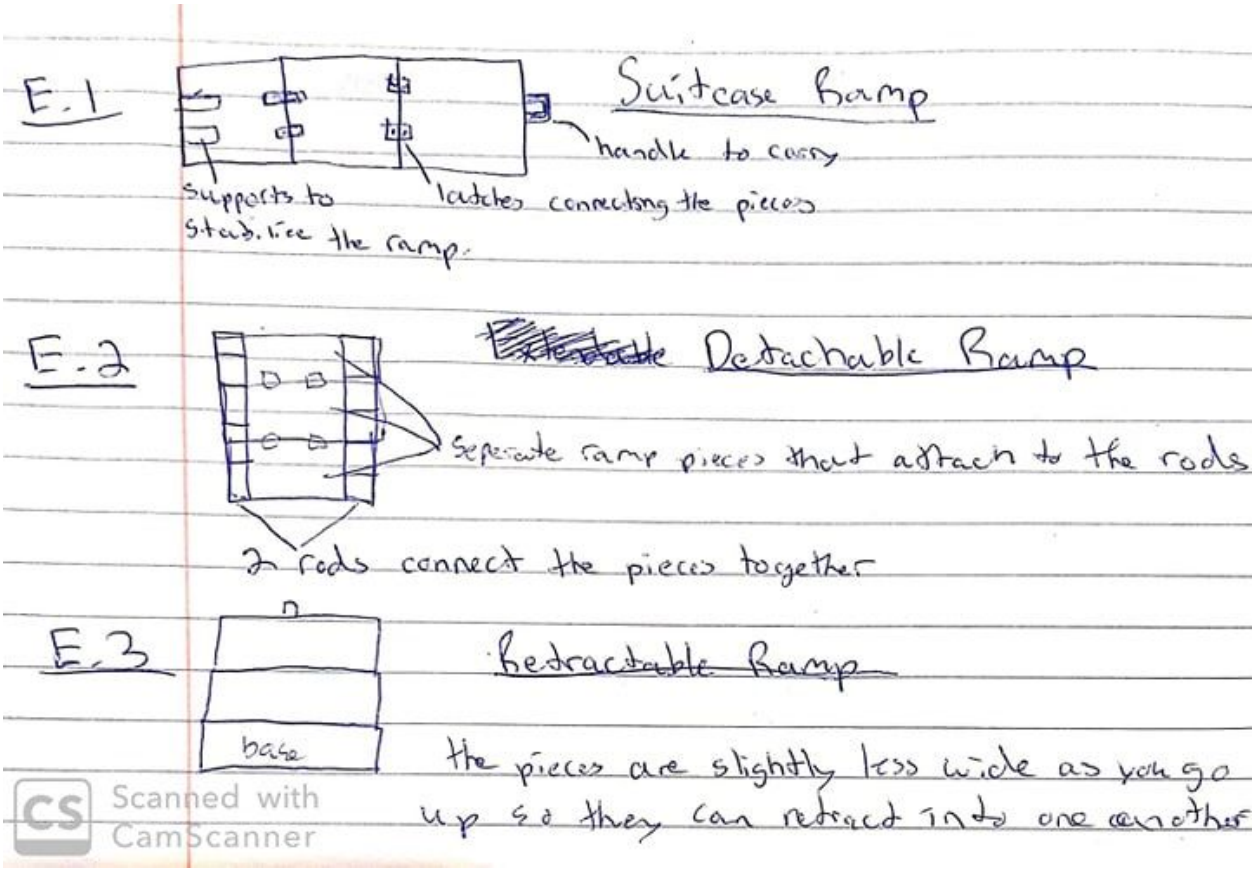
D.2



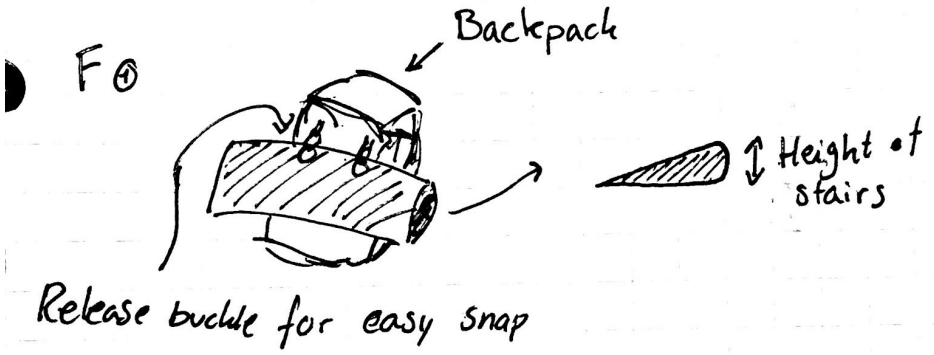
D.3

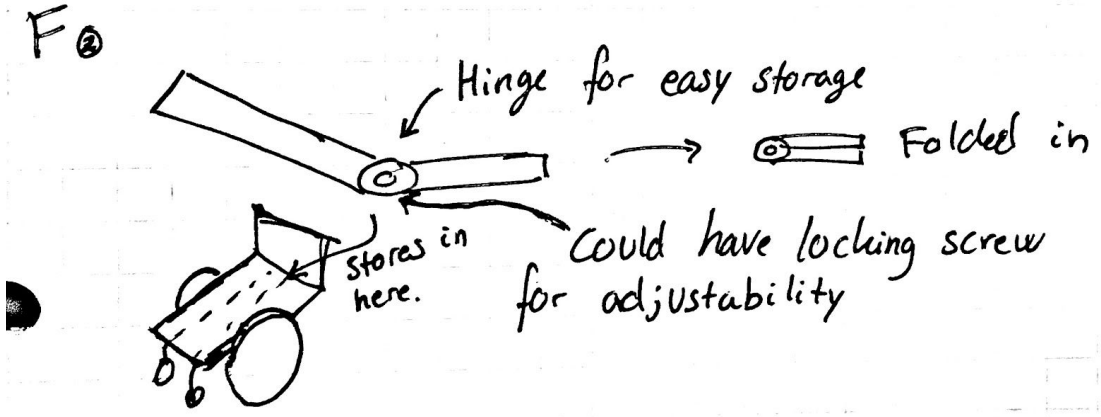

The Gym chair Model
Acertains spikes where you can adjust position in degrees. (0-50°)
When fully folded (compatible) it will look like a suitcase.
Made out of sturdy but cheap Material
Fully Mechanical
could change angle of spike

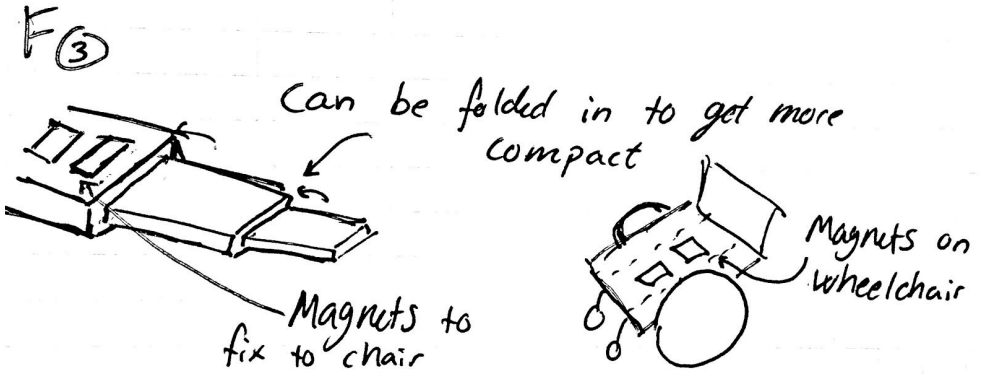
E. Jasmeet Mander



F. Andreas Tauber Jakobsen







3.0 Concept Evaluation

3.1 Concept Screening

Since we have so many concepts to sort through, we will begin concept screening by analyzing each idea and eliminating the most infeasible ones. Once we have narrowed down our selection to a top 3, we will compare them by a weighted table to ensure we select the most promising design for our project.

3.1.1 Feasibility Judgement

In terms of feasibility, B.1 was infeasible due to the lack of materials. The design would require a lot of balls to occupy the space under the ramp for adjustability. Also, the balls would need to be made out of a strong material to sustain the weight of the wheelchair, which can not be done with the budget we have. The balls ability to move around can also be a safety concern as we need a great deal of stability for the wheelchair to cross the obstacle.

3.1.2 Concept Groups

Foldable Ramps

A.2, B.2, C.2, D.1, D.2, E.1, F.2

Extendable Ramps

A.3, C.3, C.4, E.2, E.3, F.3

Adjustable Ramps

A.1, B.3, C.1, D.3

Roll up Ramp

F.1

Since some of our designs are similar to others, we categorized each design into a concept group. The concept groups allowed us to eliminate designs that are the same and compare the benefits/downsides of each. The designs that covered more groups were the concepts we used due to their versatility.

3.2 Concept Ranking

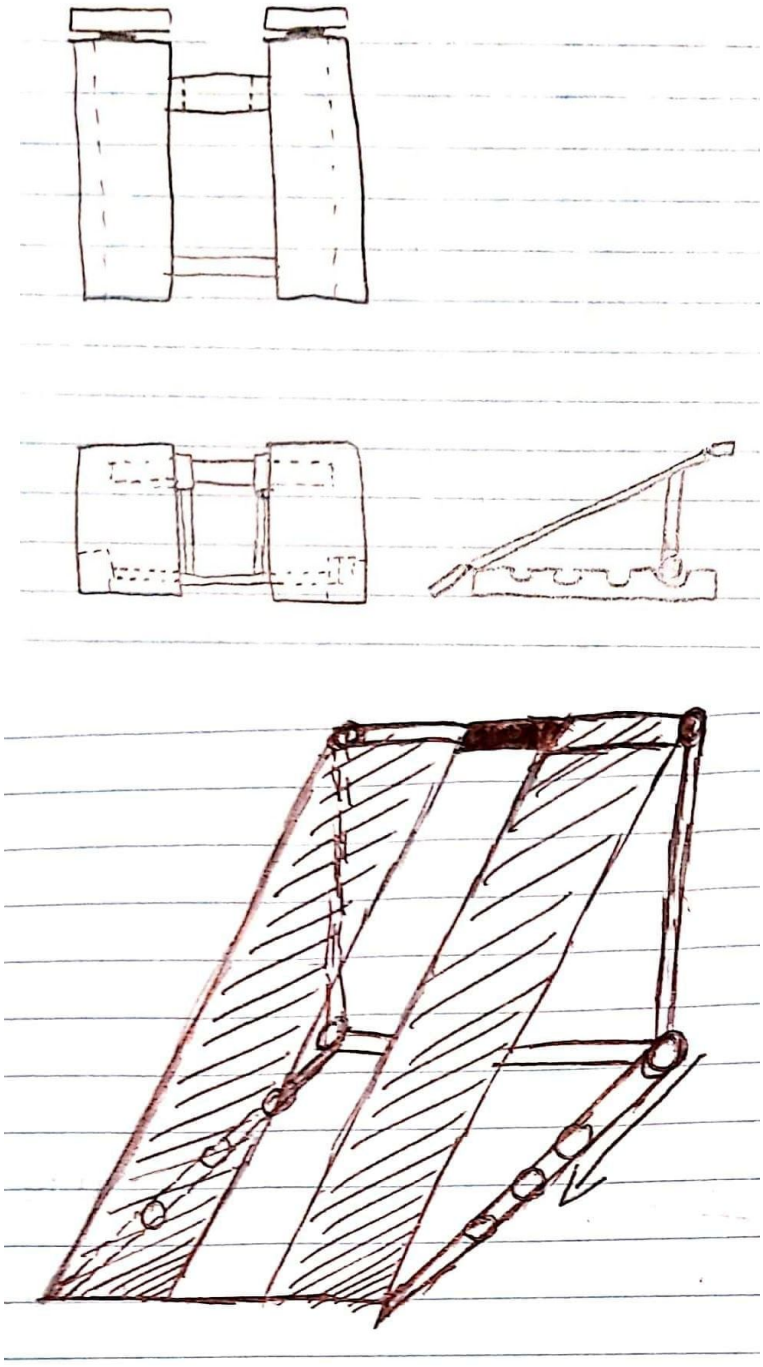
From the concept groups in part 3.1.2 we selected the best designs and ranked them using the criteria below.

	Concept Options				
Selection Criteria	**The H-Shape (Reference)**	**Gym Chair Ramp**	**Foldable Sheet Ramp**	**Suitcase Ramp**	**Extendable Ramp**
Cost	0	0	0	0	0
Ease of use	0	0	+	-	0
Maximum Load	0	+	0	0	-
Total Mass	0	0	0	0	-
Setup Time	0	+	+	-	+
Number of + **Number of -** **Number of 0**	0 0 5	2 0 3	2 0 4	0 2 3	1 2 2
Total Score	0	2	2	-2	-1

4.0 Concept Screening Result

The table tells us that the Gym Chair Ramp and the Foldable Sheet Ramp are the most suitable design concepts. As a group, we decided to combine the ideas of these two ideas and create an all-encompassing design.

5.0 Group Design Concept



Description:

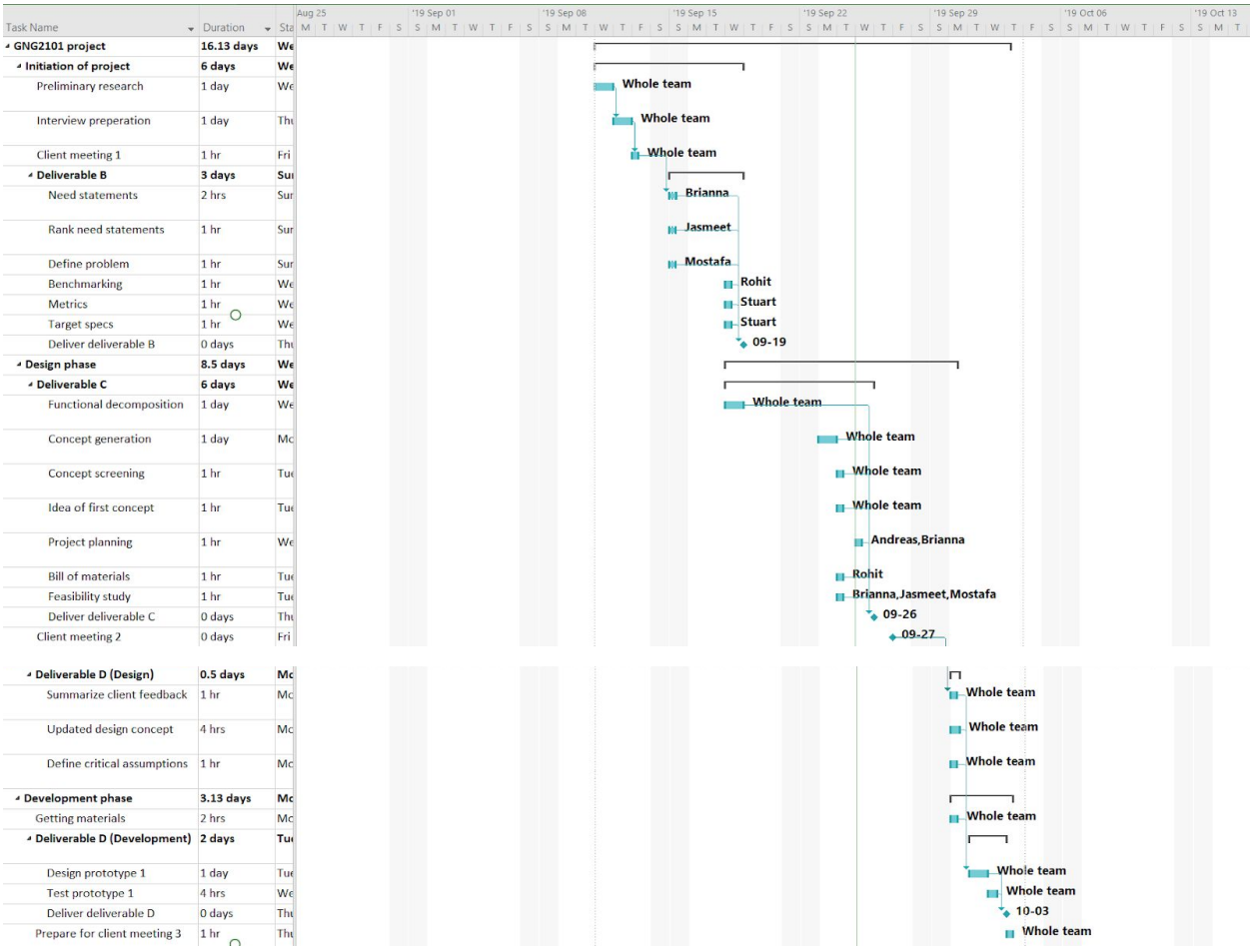
This idea incorporates the adjustability of the Gym Chair Ramp idea while also folding like the Foldable Sheet Ramp. From the orthographic views in the image to the left, the shaft will be used for the adjustability of the ramp. The ramp will collapse when the shaft is resting between the runners to allow the user to carry the ramp in its compact form. The shaft will be adjusted by fitting it into different cutouts in the base, fixing the desired angle. The shaft will be made out of a strong alloy as it is the primary component holding the load of the wheelchair. However, it is essential that we focus a lot of our time on researching the material and strength of the shaft as it will be holding most of the load of the wheelchair. It must be a hard material so overtime it doesn't deform after multiple uses. The ramp can easily be setup and taken down in minimal time as the shaft will lock under the ramp, thus allowing it to collapse with very little effort.

Deliverable C.2

6.0 Project Planning

To properly control and monitor the project we made a Gantt chart and broke down the project into smaller chunks. The Gantt chart functions as a schedule so we can see when and what needs to be completed.

Our critical path ensures that the projects deadlines is kept and to keep track of important milestones and tasks. The critical path follows the strict line through the project where if one of the tasks on the critical path is delayed then the whole project is delayed. We choose to group our project into different phases with the deliverables included, as seen underneath in the uncollapsed version.



Uncollapsed version

To get a broader overview, the phases can be collapsed and we can see when our phases are supposed to end.

Task Name	Duration	Start	Finish
GNG2101 project	16.13 days	Wed 19-09-11	Thu 19-10-03
Initiation of project	6 days	Wed 19-09-11	Thu 19-09-19
Design phase	8.5 days	Wed 19-09-18	Mon 19-09-30
Development phase	3.13 days	Mon 19-09-30	Thu 19-10-03

Collapsed version

7.0 Prototype Bill of Materials and Parts (BOM)

Part Name	**Description (Identify Prototype #)**	**Quantity**	**Unit Costs ($CAD)**	**Extended Cost (Qty x $)**
Prototype 1				
Cardboard Box	-	1	0	0
Straws	-	50	0	0
Duct Tape	-	1	0	0
Prototype 2				
Corrugated Plastic Sheet [1]	Coroplast 24 in. x 36 in. (Makerspace)	1	0	0
Wood	2 in. x 4 in. (Found in makerspace)	4	0	0
Prototype 3				
Metal Sheets	To be decided (Aluminum, Steel, Alloy etc.)	1	≈ 40	40
Shaft	Carbon Steel (¾” Dia.) - 24” length	1	22.56	22.56
90^0 Folding Hinges [2]	430 Stainless Steel—Dull (3 x 1 ½ x 3 in.)	2	5.60	11.20

Friction Tape [3]	394644 Friction Tape, 3/4-Inch by 30 Feet, Single Roll, Black	2	3.06	6.12
			Total	79.88

8.0 Feasibility Study

Technical:
Does your team have enough expertise and technical resources?

- Our team is comprised of 6 mechanical engineers that are currently in their second year and above. Since our project is heavily mechanical we have enough expertise due to taking classes like mechanics, Introduction to design and others that provided us with the required knowledge. We can also learn and adapt new skills to further enhance our knowledge and help us complete our tasks. The Manufacturing Training Center and Brunsfield center will be beneficial when machining metal parts and assembling our design. 3D printers are also made available to us by the Makerspace which will be a potential prototyping opportunity.

Economic:
Can the cost of your project be reasonable?

- Given a budget of $100 our team expects to undergo a prototyping process for our design. We will be ordering parts (see Bill of Materials) to complete the final prototype. Costs may also be dispensed for earlier conceptual prototypes if a breakdown for one of the components such as the framework is necessary. However, since we have access to a wide variety of materials through the makerspace lab for free, the cost of our project can be reasonable and within the $100 budget. We will only need to buy materials that are not readily available such as metals, fasteners etc...

Legal:
Are there any legal issues with releasing your solution to the public?

- Since our portable ramp will be used by someone in a wheelchair, there are legal issues surrounding the overall stability of the product and if it can be used safely by the client. Hence, when developing the ramp we must address any defects/problems with our design before it can be used by our client.

Operational:

Are there any organizational constraints that will prevent your success?

- There are a few organizational constraints as we all have other classes that we need to put work into as well. Although so far we have been meeting up as a group regularly. Plus, as midterms and examinations approach it will be harder to conduct meetings and work together as a group.
- In terms of location, most of the members on our team live far from campus and far from each other. There are a couple that need to bus to school which makes it important to discuss plans in advance and stay well communicated with each other.

Scheduling:
What are the deadlines and are they reasonable for your solution?

- The prototypes will be completed according to the deadlines provided with the corresponding deliverables. As for client meetings we plan to have those happening within a few days after making our prototype and design, to make sure we get feedback from the client as soon as possible.
- That is reasonable since our client open to communicating through email and voice calls as often as needed.

9.0 Reflection

In the last deliverable, we went through the process of defining the problem statement from ranked customer needs, and determining metrics and target specifications. With our target specs in mind, every member of the group created three design concepts to bring to our following meeting. As we started to evaluate each other's designs, we found that many of the concepts shared key design features and we were able to group the concepts into 4 main categories. From these categories, we rebuilt a new concept as a team incorporating the strongest features of the highest scoring designs. The ranking showed that the gym bench ramp and foldable sheet ramp were the most efficient, so we implemented them to create the design described in section 5.0 of this document. In the near future, we will continue to develop this design through the prototyping process.