# **GNG2101 Report Template**

**Project Deliverable D** 

Submitted by

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October 9, 2022

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### Abstract

Having chosen our final concept, our team was tasked with establishing the details of our concept and creating the first prototype. Firstly, this included providing a detailed sketch of the concept and outline of every subsystem. Furthermore, a Bill of Materials (BOM) was created to summarize the type of material being used, for what, the cost and the source. Finally, our team built a focused physical prototype that concentrated on providing us data on the ease of steering and force production of the connecting rods.

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# List of Acronyms

Acronym	Definition
BOM	Bill of materials
Q&A	Questions and Answers

#### **1** Introduction

In this deliverable, we will review client feedback we have acquired from our last client meeting, provide an updated version of our design concept, create a bill of materials to be approved and used in our design, created a first prototype and preformed tests on it with critical assumptions and relating it back to the target specifications we have formulated, lastly will create a plan for our next client meet to reflect on how we will move forward in the project.

#### 2 Client Feedback Summary

To begin our second client meeting, our team prepared a presentation of three concepts to show and receive feedback. We then asked the clients their opinions on each design which is outlined in sections 2.1-2.3 along with a figure of the correlated design. To conclude, we asked the clients more specific questions about updated metrics and requirements shown in section 2.4.

### 2.1 Push Arm Concepts

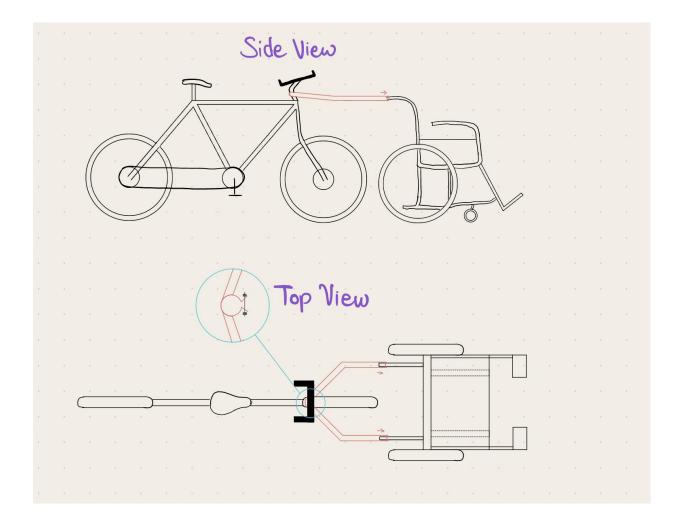


Figure 1 Push Arm Concept Drawing

The clients were insistent that their dad would not like for the wheelchairs to be attached by the arms of the chair as they do not want any added pressure on the back of the chair.

### 2.2 Push Platform Concept

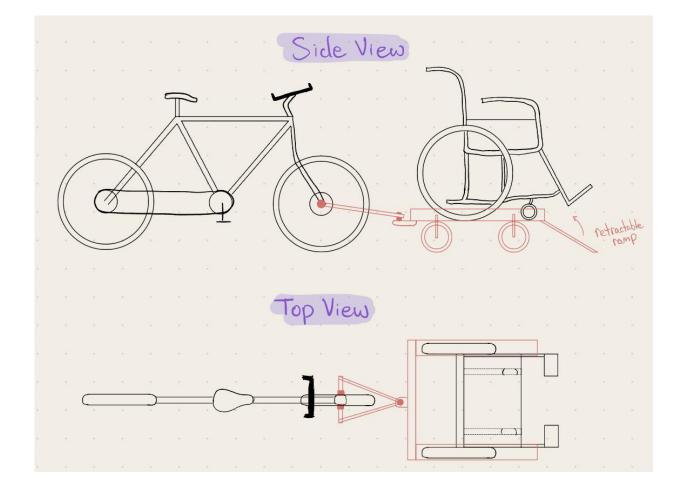


Figure 2 Push Platform Concept Drawing

The clients were the most impressed with this design as it includes a platform. They have made it clear from this meeting that they would most definitely like to include a platform in the design to be secured to by secure points on their chairs.

### 2.3 Pull Arm Concept

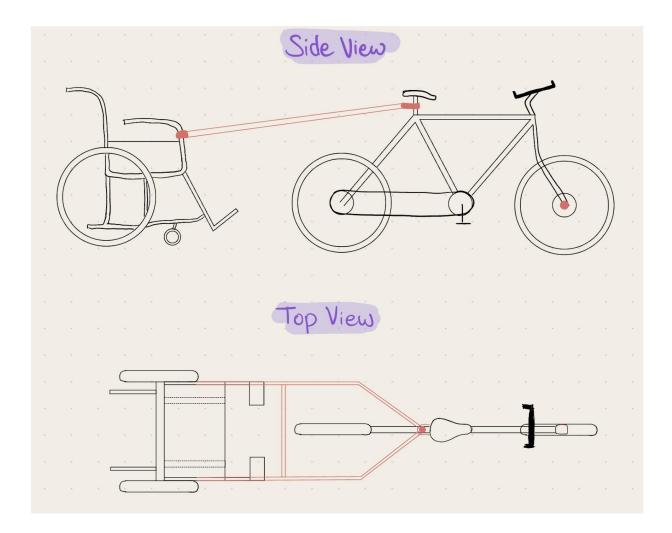


Figure 3 Pull Arm Concept Drawing

The clients also did not like this design as it attaches directly to their wheelchair.

## 2.4 Client Meet Q&A Results

Question	Answer
Ask the clients what their preferred location	The clients had no preference this meet over
for the wheelchair is. In the front or back?	being in the front or back.

You mentioned along the canal and on trails,	The clients would like to ride the bike on		
would these paths be ideally straighter or more	straighter paths.		
curved			
What is the model and make of the wheelchair?	The clients let us take a picture of the make		
	number to research ourselves.		
Ask how necessary it is for them to ride fast	The clients would prefer for a more leisurely		
	pace of biking.		
Is there anything else that could be added that	There is several points on wheelchairs that are		
would help you feel safe and secure on the	built in to be able to strap onto.		
bike?			
Are there any preferences of colour being	The clients would like for the design to be red		
added to the design?	with flames.		
Table 1 Client O&A			

Table 1 Client Q&A

## **3** Updated Design Concept

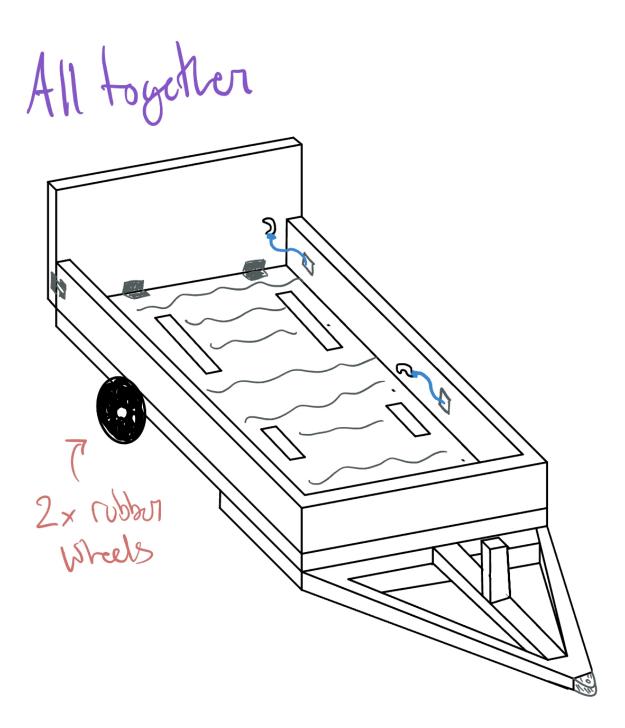
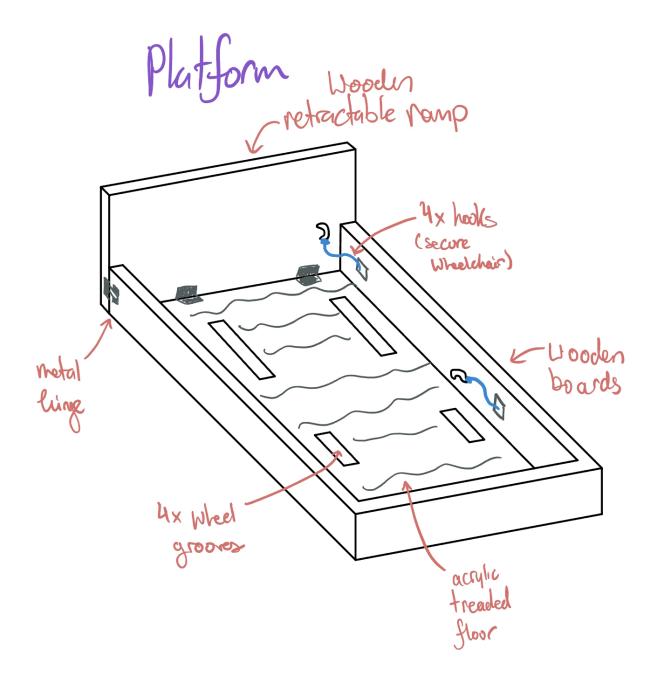


Figure 4 Updated Design Concept Drawing

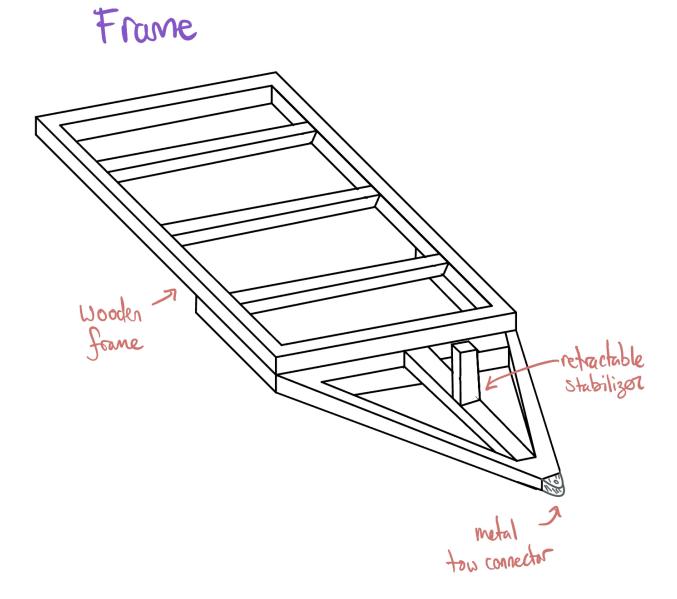
#### 3.1 Subsystem 1 Platform



**Figure 5 Platform Drawing** 

The platform will be connected onto the wooden frame through screws. The borders on the platform will be nailed into the platform and the tread pattern will be created through laser cutting. The ramp will be connected to the platform via metal hinges that will be screwed in.

#### 3.2 Subsystem 2 Frame



**Figure 6 Frame Drawing** 

Updated Design Concept

The frame will be created out of wood and connected through screws and nails. The frame will connect to the bike through a tow hitch, where the ball end will be connected to the bike, and the hitch will be attached at the end of the triangular frame.

The wheels will be attached to the wooden frame, by screwing the frame of the wheels and the rod into the bottom of the wooden frame.

Item Number	Item Name	Quantity	Price (\$)	Total (\$)
#1	Wood plank (36?" x 36?" x 1") <u>#</u>	1	30	30
#2	Hinge set <u>#</u>	1	9	9
#3	Acrylic sheets <u>#</u>	2	12	24
#4	Screws? <u>#</u>	120	14	14
#5	Nails <u>#</u>	5000	18	18
#6	Red Paint <u>#</u>	128mL	2	2
#7	Black Paint <u>#</u>	126 mL	2	2
Total	·		-	\$99

#### 4 Bill of Materials

Table 2 BOM

### **5** Critical Product Assumptions

The most critical product assumption is the cost of the project. We have an absolute budget of \$150 and cannot go over. Other important metrics that must be strictly followed include materials used and weight. We cannot afford to use materials that are too expensive such as carbon Bill of Materials fiber or too heavy such as steel. Instead, we can use aluminum which is only about \$0.65 per pound compared to carbon fiber at around \$10 a pound and is much lighter than steel. We can also go for wood which will cost us about \$30 in total and acrylic which costs \$12 a sheet.

One critical functionality that we must account for is the ability for the bike to turn. Although the clients express their need to only be able to ride leisurely in a straight line, that is not realistic to the real world, and we must be able to design the bike so that it can turn safely and keep the passengers secured. For that we would need to run multiple tests and find the point of gravity that will allow the bike to stay upright. Once the bike starts leaning to a side, it might cause the bike to crash or for the riders to feel unsafe. Thus, we will ensure that the bike functions 100% as we expect and can make sharper turns if needed.

#### 6 **Prototype 1 Documentation**

The first prototype our team has created is comprised of materials found in the STEM building. These include a push wheelchair and some crutches to test the attachment position. We also sampled some materials to find weight of the platform

#### 6.1 Test A: Attachment Position

In this test, we analyzed two different attachment places from the bike to the platform. We weighed each option depending on the smoothness of the swinging motion on the turn. The following link and images show each position.

#### https://uottawa-

my.sharepoint.com/personal/adesy017\_uottawa\_ca/\_layouts/15/guestaccess.aspx?folderid=064f3 33a8bdd04a25b53986ac5a79723d&authkey=AZqO79cTeItCOe2OIYmlBSg&e=0JYplC

#### 6.1.1 Position A



Figure 7 Image of Position A

#### 6.1.2 Position B



Figure 8 Image of Position B

#### 6.1.3 Conclusions for Test A

After analyzing both tests, our team has concluded that the platform to bike collection should mimic that of position A.

### 6.2 Test B: Weight of Materials



**Figure 9 Wood Material Weighed** 

The weight of a 2x4x13 piece of scrap wood weighs 1.6Ibs. We can do a few simple equations to calculate the weight of the platform. The equations are shown here:

Width=4\*7=28

Prototype 1 Documentation

Weight=3\*7=21\*1.6=33.6Ibs

Therefore, The weight is outside that of our marginal values and our target specifications should be reassessed.

Time (s)	Prototype 1 (km/h)	Prototype 2 (km/h)
2	0.5	0.5
4	3	5
6	8	9
8	13	15
10	17	21
12	20	30

#### 6.3 Test C: Speed Test

Table 3 Speed Test

The Speed for our prototypes fit into the marginal values shown in our target specifiations.

#### 7 Client Meet 3 Information

We are going to briefly explain the deliverables. How our concepts and prototypes developed based on the feedback that clients gave to us. We are going to use powerpoint and several diagrams to show that. Design and quality of the experiments will be rated from 1 to 5 and we will decide the final design based on this survey. Therefore, we have to make 3 other designs based on the 2nd client meeting, build several prototypes using the testing results in this deliverable and prepare the presentation for the clients to select the final design.

### 8 Wrike Link

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=23tuAI0811GXoFQy 996t8GdN35f4dgGs%7CIE2DSNZVHA2DELSTGIYA

### 9 Conclusions and Recommendations for Future Work

In this report, we have fixed our concept and prototype based on the feedback from the client meeting. Our group design has changed to a platform concept from camping concept. In the new design, the wheelchair will be located on the platform behind the bike. Since we changed the location of the object, we tested two prototypes that connect the platform and the bike. We measured which prototype reached 30km/h. At the test, Prototype 2 reached 30km/h faster than prototype 1. For the next deliverable, we will present our prototype and testing result to our client and develop the plan to make the product.

## **APPENDICES**

No information to be added in this section.