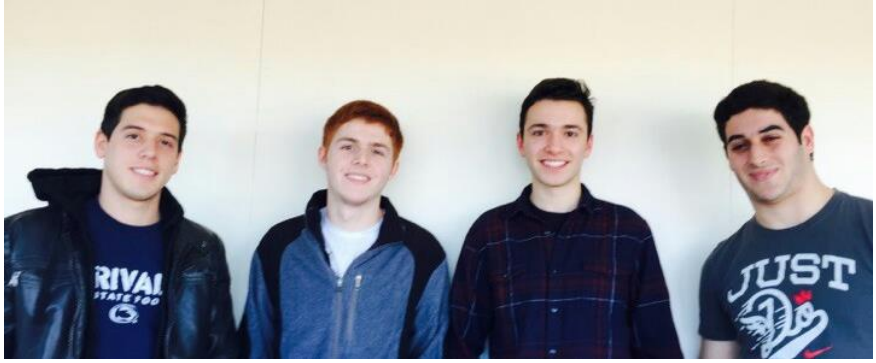
EDSGN 100: Introduction to Engineering Design
Section 10 Team #3

Folding Shopping Cart
Design Project #1
'THE FOLDINATOR'



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Submitted to:

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Spring 2015

http://www.personal.psu.edu/tms5843/DesignProject1FINAL.pdf

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INTRODUCTION

This project deals with solving a common problem that people face when going shopping for groceries or any other things that they need to carry from a certain place to another one. They basically need some help moving their products from their car to their house. So our job is to design a shopping cart that will comply with the needs of people and that will be safe to use. Our basic restraints for the project are a maximum amount of $50 and making sure it hold 100 lbs without any danger of hurting someone. Therefore, in order to design the shopping cart, there were several things that our team took into consideration in order to make this car very comfortable, easy to use, very helpful and useful.

Throughout the project, in order to come up with the final idea, many ideas and sketches were made in order to make a comparison between them using the Gantt chart, which makes you understand which model is better taking into consideration many aspects that you want your design to have. More specifically, our team decided to create a model in which the compress and expand mechanism of the cart is very easy, the capacity of elements is very high, and also taking into consideration the comfort fact, which is very important since for example, old people may be using it and they have special requirements. To increase the total capacity that the cart can carry, the installation of small sticks on the sides was made, in order to serve as bag holders. So, after all these steps our team finally stuck with the best design that we made, and we proceed to the next step, which is building the cart.

Thus, it can be seen that this project required a very deep understanding of the problem, in order to be able to come up with the best design that can solve the problem in the easiest possible way.

Abstract (executive summary ~50 words)

People who live in homes without a garage, or lack parking close to the house often have a hard time moving their groceries from their car to their home. For this reason, we developed a strong, light, small, and foldable shopping cart that can be carried in a car all the time. The purpose is for people to have a way to finish the transportation of their groceries minimizing their effort. Our shopping cart design was focused on maximizing the volume of groceries that can be carried. Not only the car has a great synthetic bag to hold most of the groceries, but it is also surrounded by hooks perfect to hold more plastic bags, and a bendable platform at the bottom that can hold boxes and adds a significant support to the car.

DESIGN TASK

Problem Statement

Some people must carry groceries a long distance to their home or do not own cars to and must walk a far distance holding their groceries.

Mission Statement

We aim to facilitate certain shoppers in transporting their groceries by providing them a simple, collapsible, easily stored shopping cart that is attractive, functional, lightweight, and satisfying to the target consumer.

Design Specifications

The folding shopping cart should:

- Be easy to use (and assemble, if required)
- Be ideal for transporting groceries and some other materials
- Fold compactly for easy storage.
- The folding shopping cart should have a weight capacity of 100 lbs.
- The material cost for the folding shopping cart should not exceed $50 unless it can be justified.

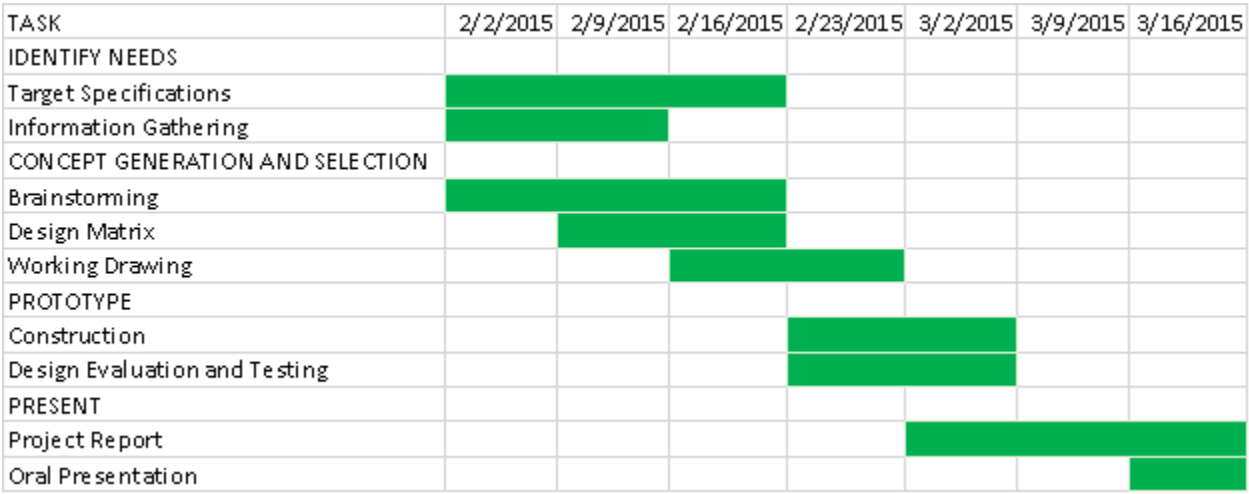
DESIGN APPROACH

Customer Needs Assessment

The shopping cart must:

- Be lightweight and portable
- Be easy to assemble, utilize, collapse, and store
- Ergonomically designed for pushing comfort
- Roll smoothly
- Have an appropriate capacity and basket depth for an average amount of groceries
- Be relatively inexpensive (under $50 in cost)
- Be able to hold 100 lbs

Fig. 1 - Gantt Chart



Information gathering (research), and target specifications were the first tasks to begin with, and they are essential during the brainstorming stage. In order to choose the design concept, a decision matrix had to be made. This would lead to the next step of creating the working drawings of the chosen design. Brainstorming continued even after the concept was chosen, since slight modifications could be made. Evaluating and testing the prototype during construction was an important task to ensure the mechanisms of our design functioned properly.

Concept Generation

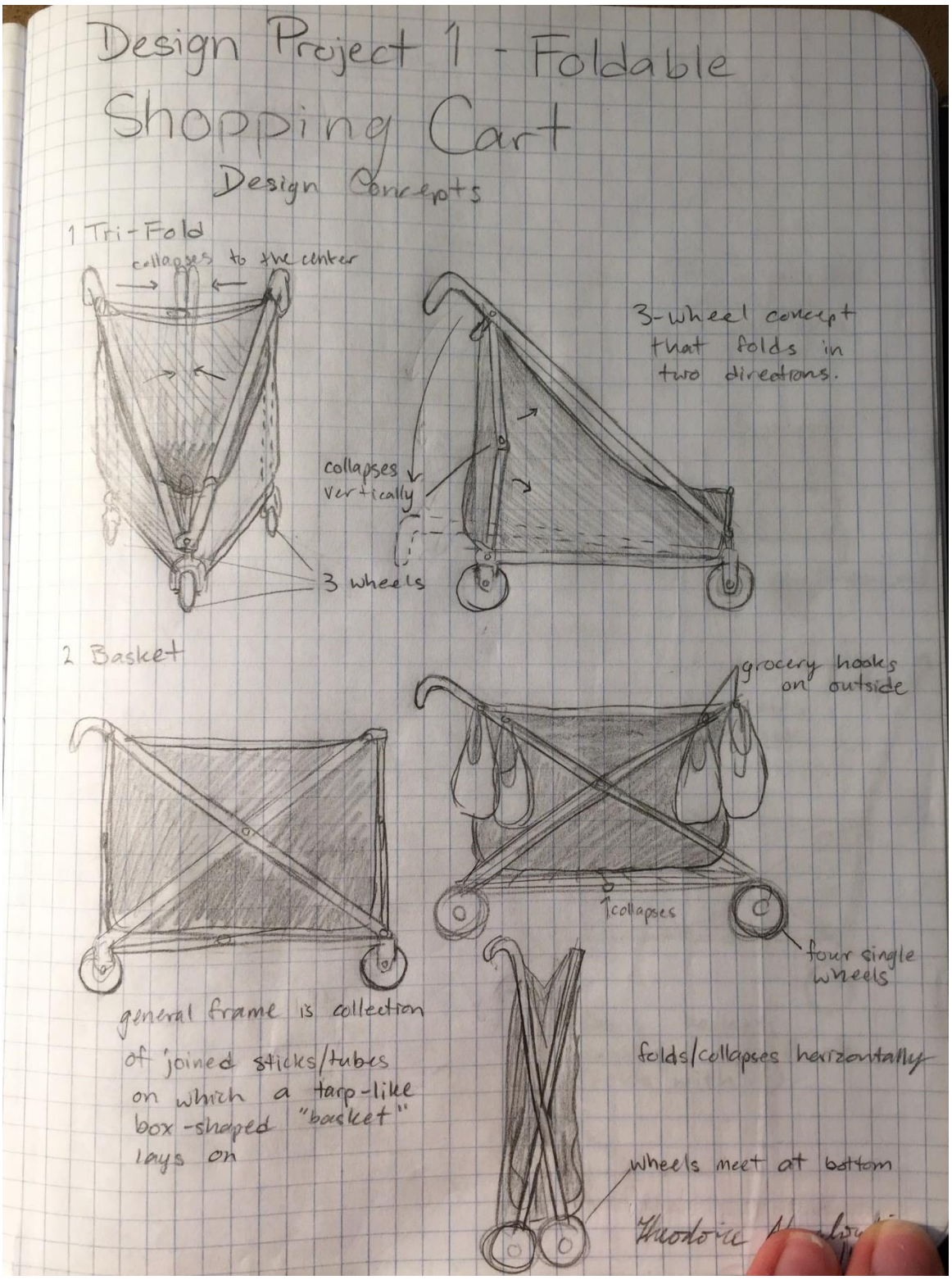
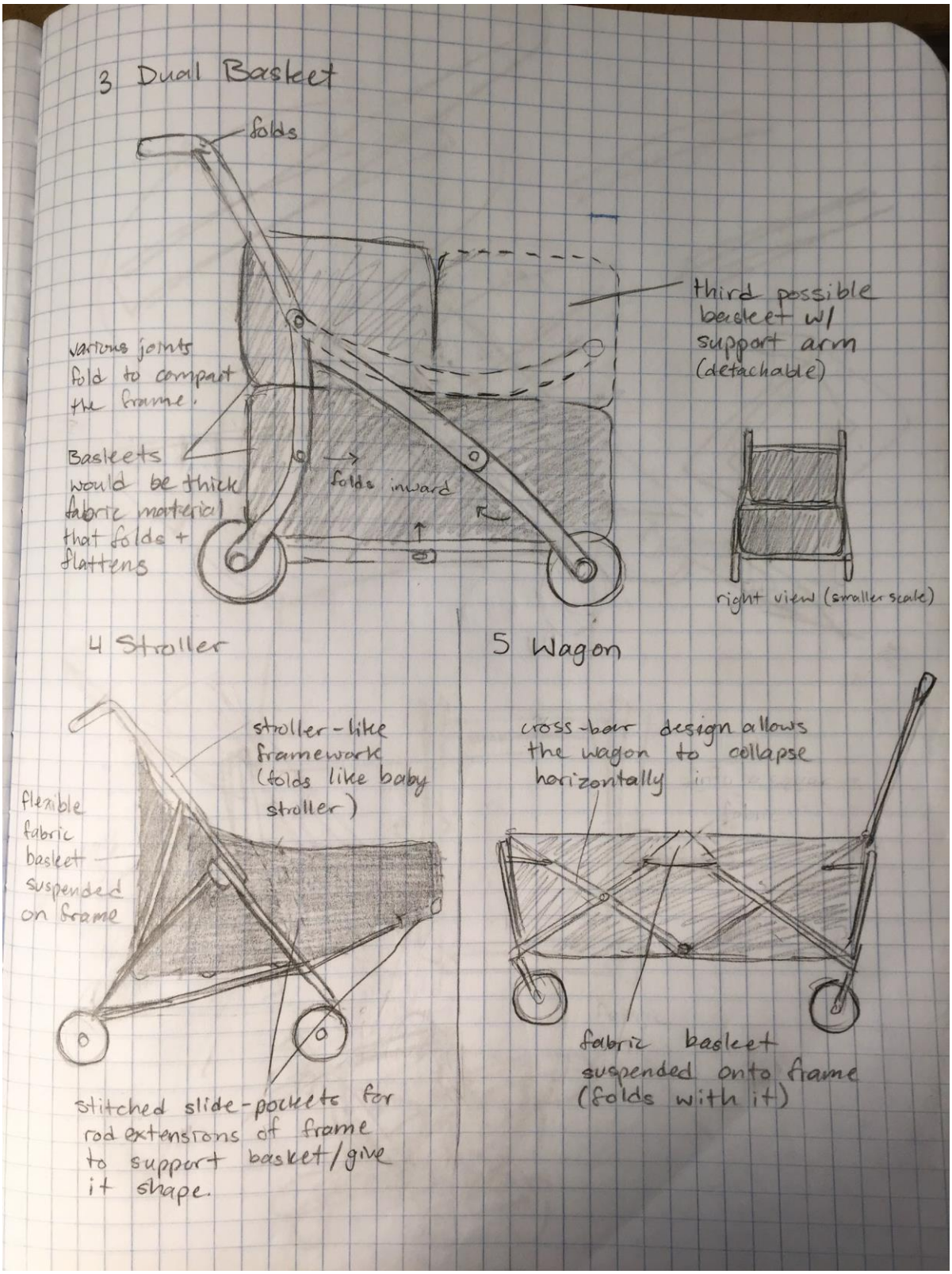

Design Project 1 - Foldable Shopping Cart
Design Concepts
1 Tri-Fold
collapses to the center
3 wheels
3-wheel concept that folds in two directions.
collapses vertically
2 Basket
grocery hooks on outside
collapses
four single wheels
general frame is collection of joined sticks/tubes on which a tarp-like box-shaped "basket" lays on
folds/collapses horizontally
wheels meet at bottom

Fig. 2

Fig. 3



Design Selection

Table 1. Decision Matrix

	Concepts				
	A	B	C	D	E
Selection Criteria	Tri-Wheel	Basket	Dual Basket	Stroller	Wagon
Cost	+	0	-	-	0
Ease of Manufacturing	-	+	-	-	+
Ease of Handling	+	0	-	0	0
Ease of Use	+	+	+	+	-
Portability	+	+	+	+	-
Weight	+	+	-	-	0
Durability	-	+	0	0	+
Basket Capacity	-	+	+	-	0
Ease of Collapsing	+	+	-	+	+
Storage Efficiency	+	+	-	+	0
Sum +'s	7	8	3	4	3
Sum 0's	0	2	1	2	5
Sum -'s	3	0	6	4	2
Net Score	4	8	-3	0	1
Rank	2	1	5	4	3
Continue?	Revise	Yes	No	No	No

FINAL DESIGN & PROTOTYPE

Working Drawings

On the following pages are the working drawings of our parts of the final design. We included extra part drawings to illustrate what our true design would roughly look like, since it deviates slightly from our prototype.

Fig. 4

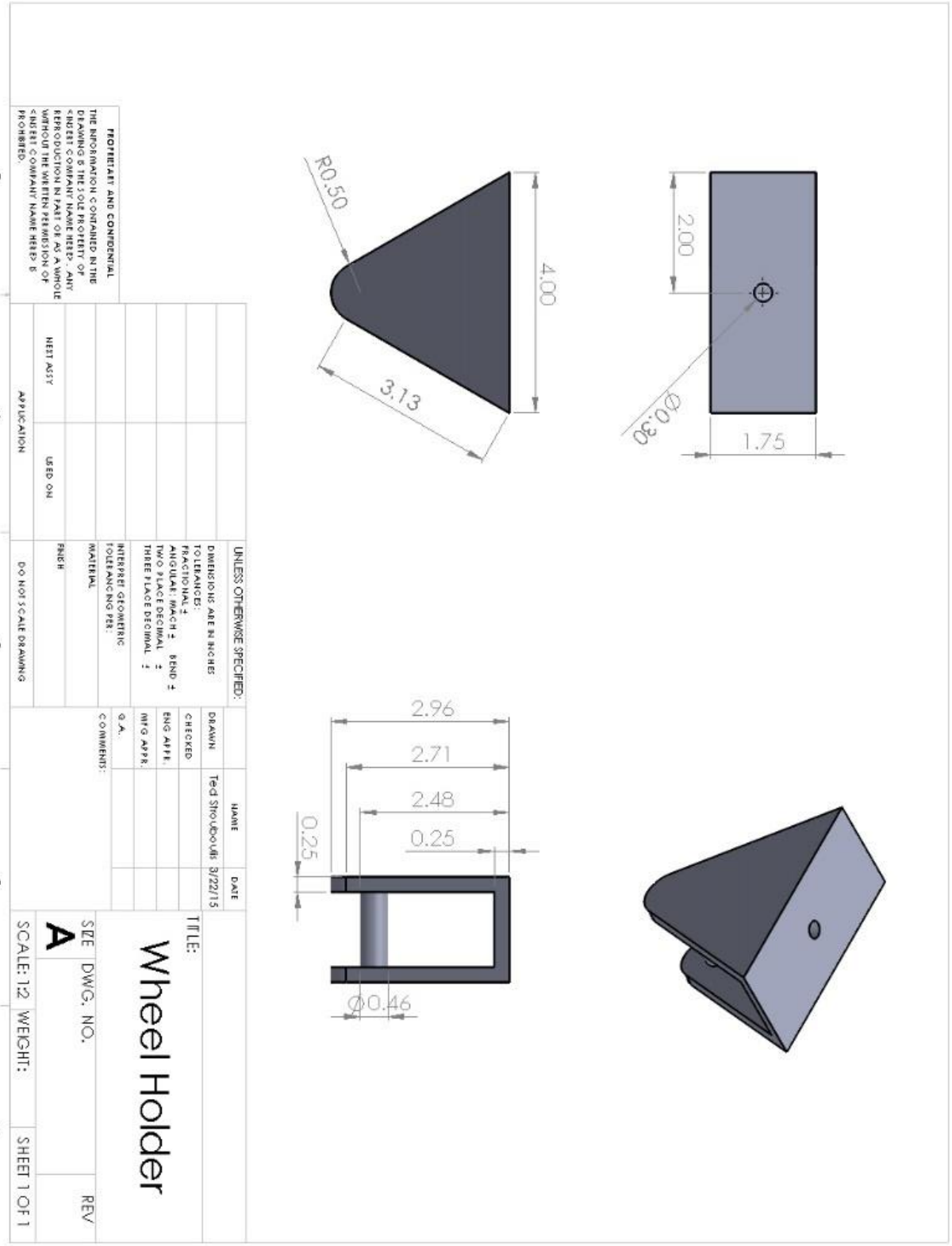

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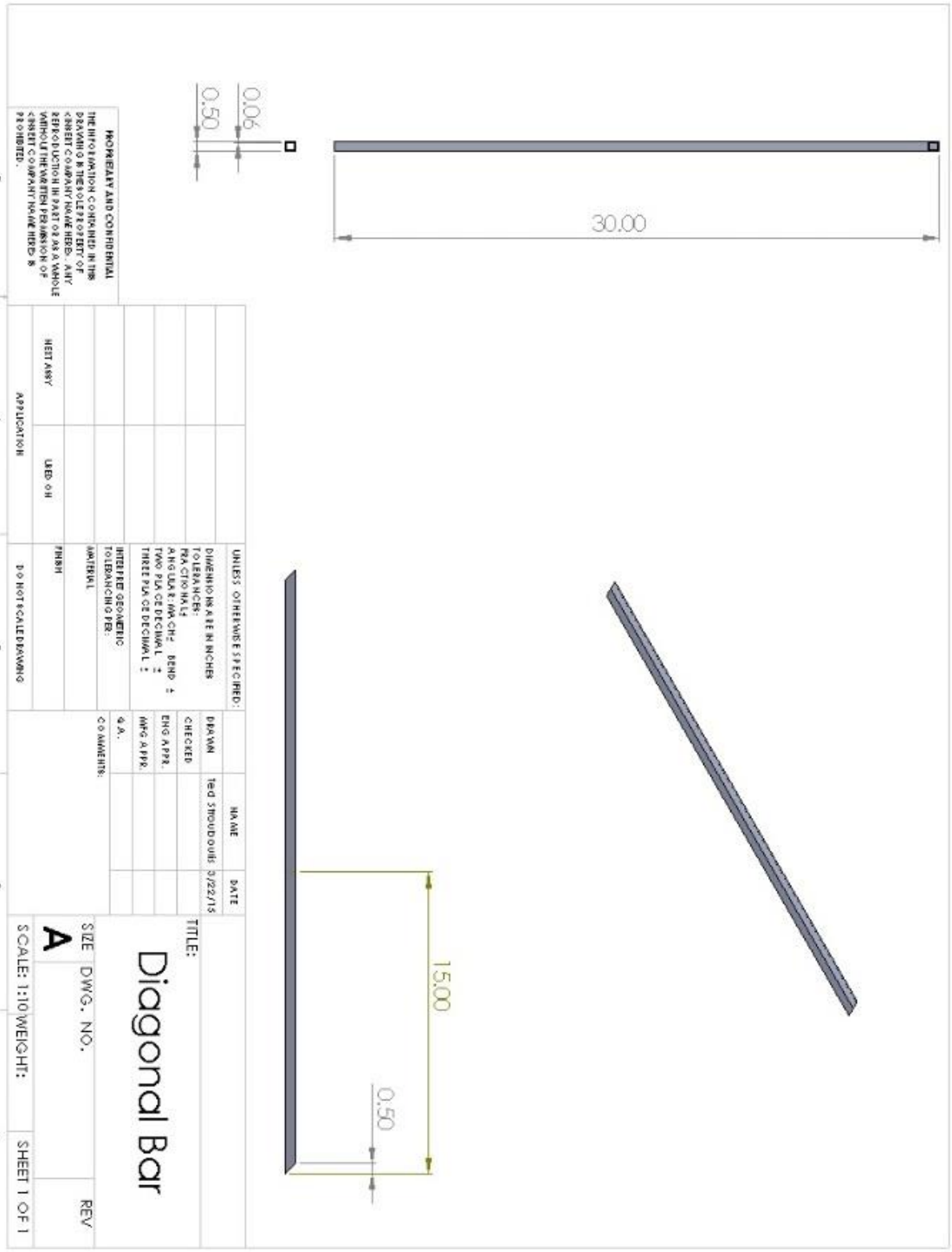
Fig. 5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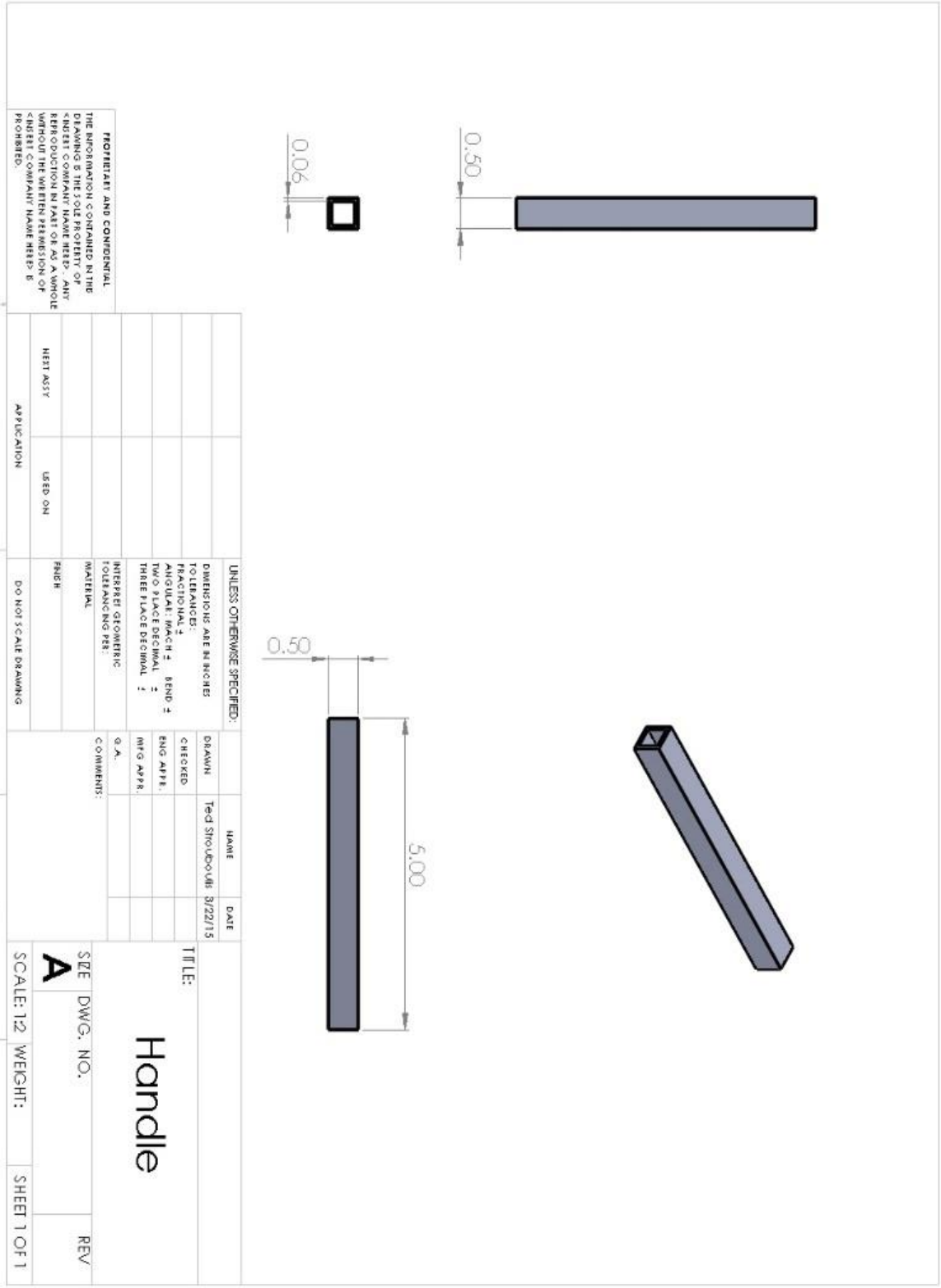
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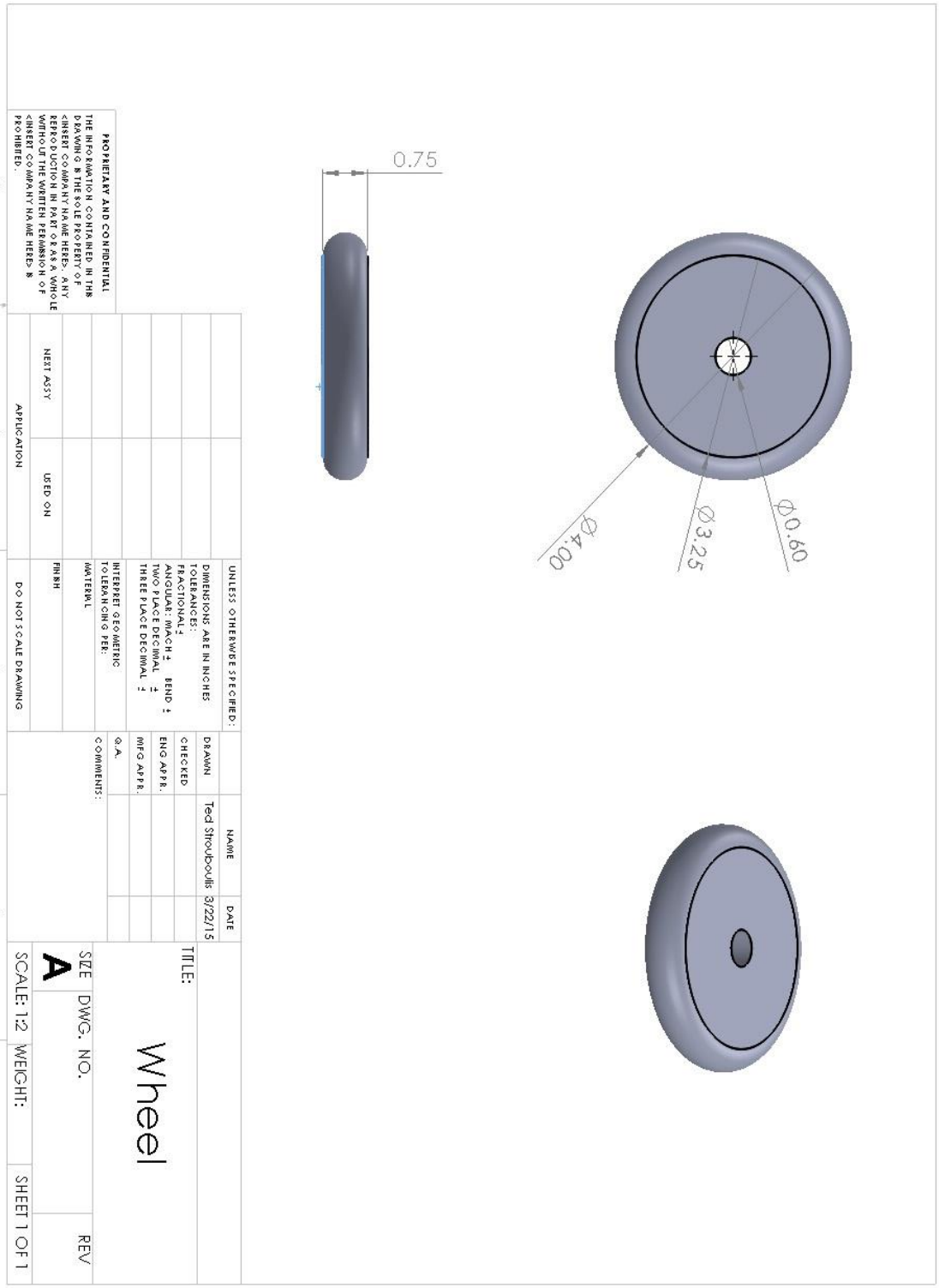
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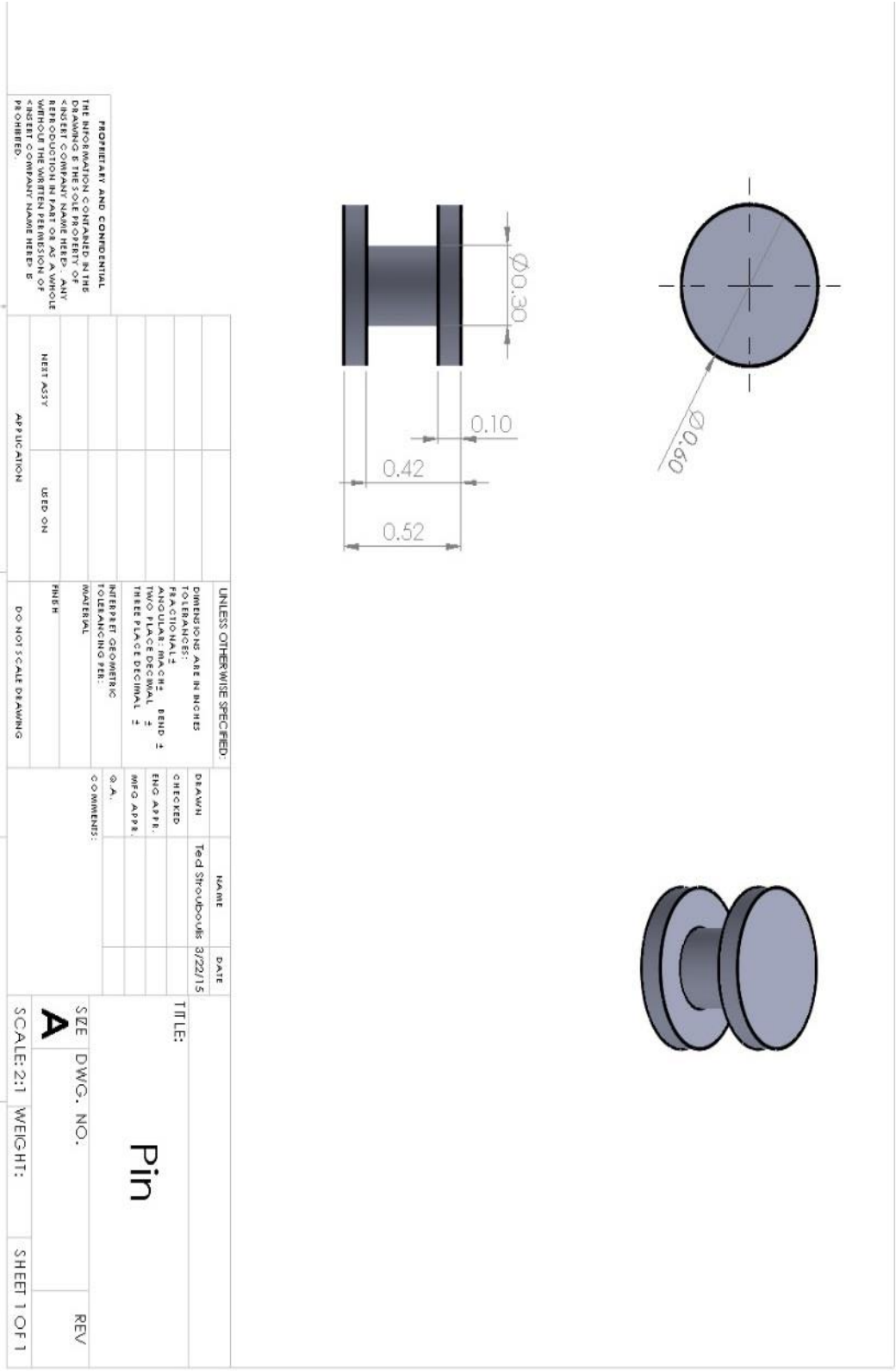
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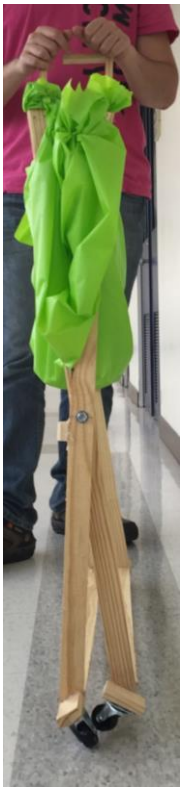
Prototype Scale and Digital Images [Ted]

Our prototype has slightly different dimensions than the true design but the overall size would be at a 1 : 1 scale



Design Features [Ernest]
The shopping cart features includes:

- X - Frame that pivots at a midpoint that allows the frame to vertically collapse
- Rigid rear wheels (do not rotate)
- Swivel front wheels (rotate) for steady steering control of the cart
- Hooks - each hook is specialized to hang extra bags such as plastic or grocery bags in order to carry more groceries
- Extended handles
- Canvas basket is fixed but can be washed on the frame outdoors
- X-Frame breaks that keeps the frame and cart sturdy and safe

Operation Instructions (explain to consumer how to use) (David)
The operation instructions for the use of the shopping cart are the following:

1. In order to expand the cart, hold both handles at the same time and pull them in opposite directions towards the outside, so that, the cart will open.
2. Open the cart until the handles stop moving. This is the when the cart reaches the end of its size, meaning that the cart cannot expand more than that.
3. After the 2 steps mentioned before, the cart is all set and can start being used.
4. By just pushing the cart in the desired direction, you can use the cart and start putting the things inside the cart as needed.
    4.1. If more space is needed, use the little sticks located on the sides as bag holders.
5. When done using it, hold both handles and push them in the same direction towards the center to compress the cart. Keep doing this until the cart is completely compresses (almost completely flat).

ENGINEERING ANALYSIS

Working Mechanism and Engineering Analysis
Basically, the cart was made in such way that just by using the handles, people can compress and expand the cart by pulling them towards opposite directions to open it, and pushing them in the same direction to close it. The cart has a mechanism consisting of four wheels in the four ends, which facilitate the mobility of the cart. In the middle of the cart there is a very resistible bag that can be compressed as well, made of canvas material that is sturdy and able to hold up to 100 lbs without fail.

Cost Analysis

Item	Quantity	Price per Quantity	Total Price
Everbilt 4 in. Swivel Non-Marking Rubber Caster	2	$8.47	$16.94
Structural Steel Square Tube 1/2 in. x 1/2 in. x 16ga	20.5 ft	--	$15.63
Everbilt 4 in. Rigid Non-Marking Rubber Caster	2	$7.47	$14.94
5'x7' All Purpose Blue Poly Tarp	1	$1.79	$1.79
Everbilt 5/16 in. Zinc-Plated Steel Flat Washer	4	$0.12	$0.48
5/16 in.-18 tpi Zinc-Plated Hex Nut	2	$0.05	$0.20
Crown Bolt 5/16 in.-18 tpi x 3/4 in. Zinc-Plated Hex Bolt	2	$0.18	$0.36

Total Materials Cost: $50.34

The cost exceeds the $50 limit by 34 cents because the tarp/canvas material for the basket would actually be ordered in mass quantity square footage, making the price cheaper for all customers.

CONCLUSION

In conclusion, it can be seen how a design project takes several steps, and requires a lot of study and time to come up with the best final idea for the design. While trying to come up with a design that is going to serve as a solution for a certain problem, people have to take into consideration many things in order to be able to solve the problem in the best possible way.

After working in the different steps, we were able to realize that the work and the design are never done, unless until the very end of the project, since even though you can have an idea of the design before building it, while you are constructing the prototype more ideas can come to you, and you can put them into practice and change your final design a little bit. Also, people may think that when designing something, it is not that complicated, but we were able to realize that since there are many things that need to be taken into consideration when making a design, this process is in fact very complicated since you have to follow a very complex procedure in order to end up with the best idea to solve the problem. However, even though we had a lot of obstacles along the design project, our team was able to overcome each of them, which was the

reason why we end up with the desire design that we decide that would be the best to solve the problem stated before.

Thus, it can be seen that this design project made us understand and learn how to approach any problem in a very specific way, such that, each step has to be carefully followed and revised to be able to have the best solution. In our case, we found these steps very useful since they let us have a very organized way to approach the design, and at the end, we achieved our goal for this project which was designing a foldable and comfortable shopping cart to solve the problem of moving things from one place to another one. The results were better than expected.

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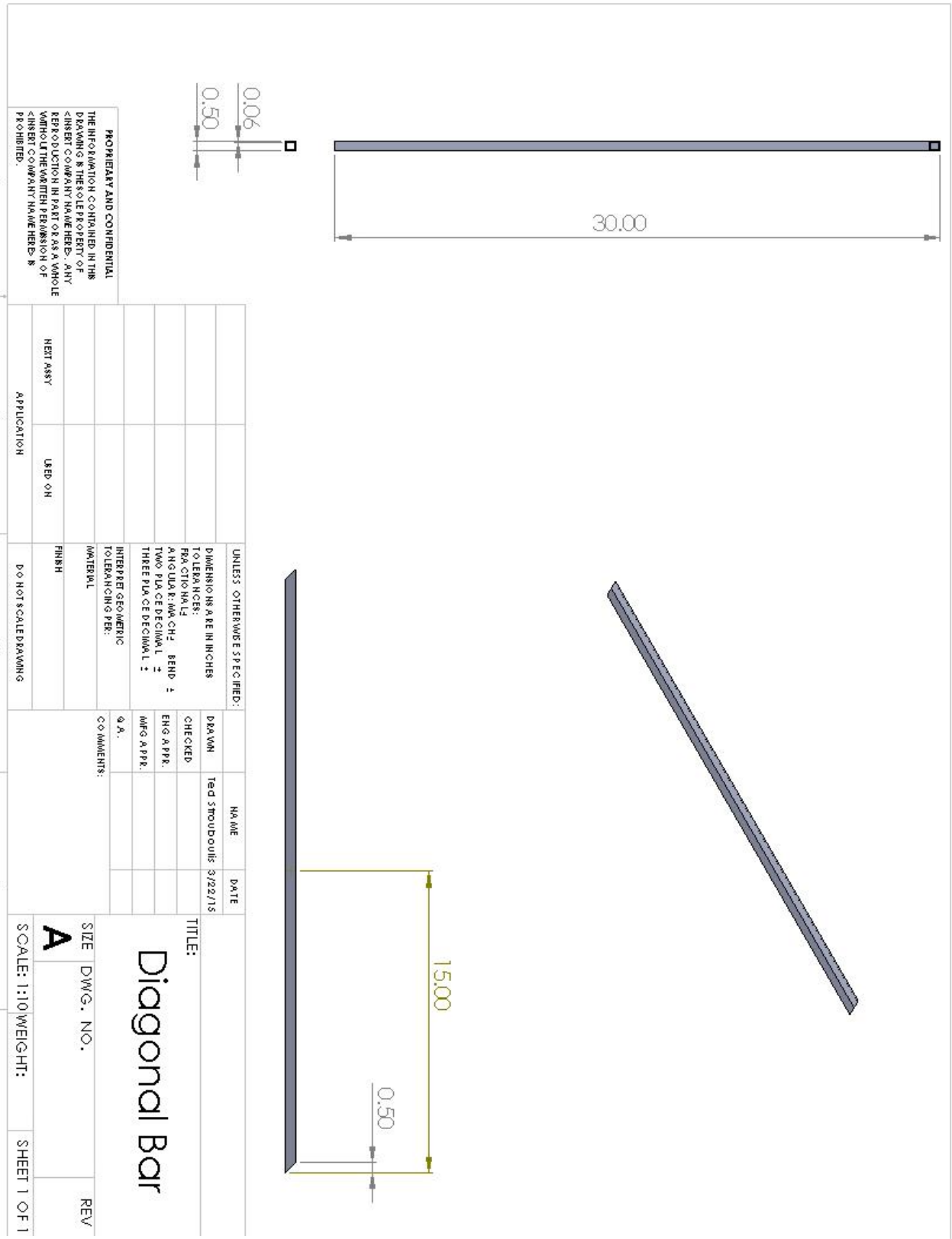
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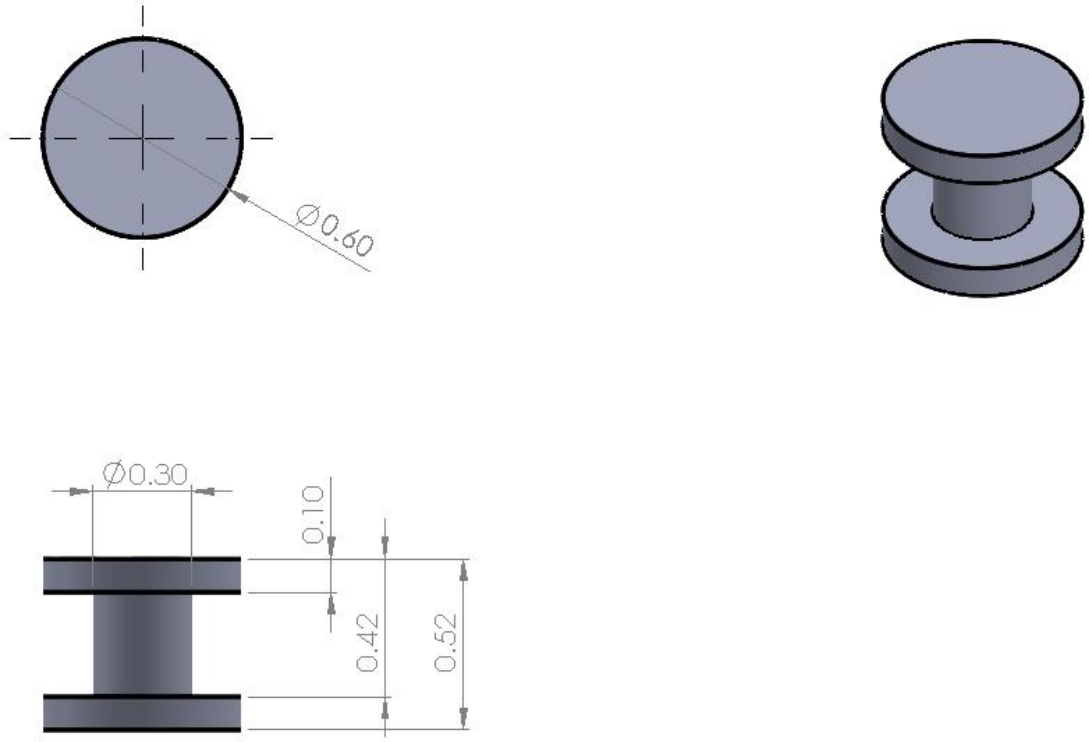

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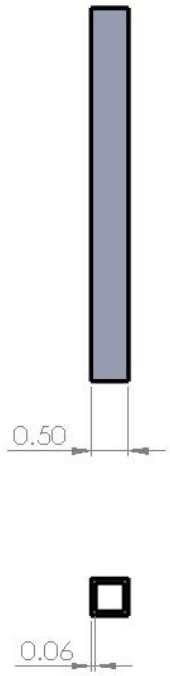

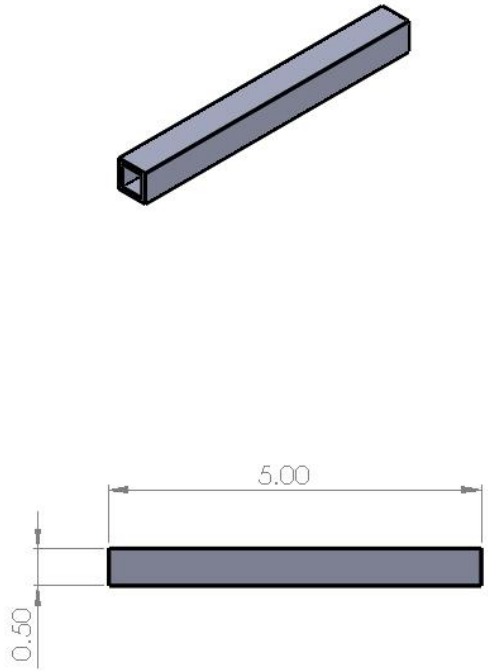

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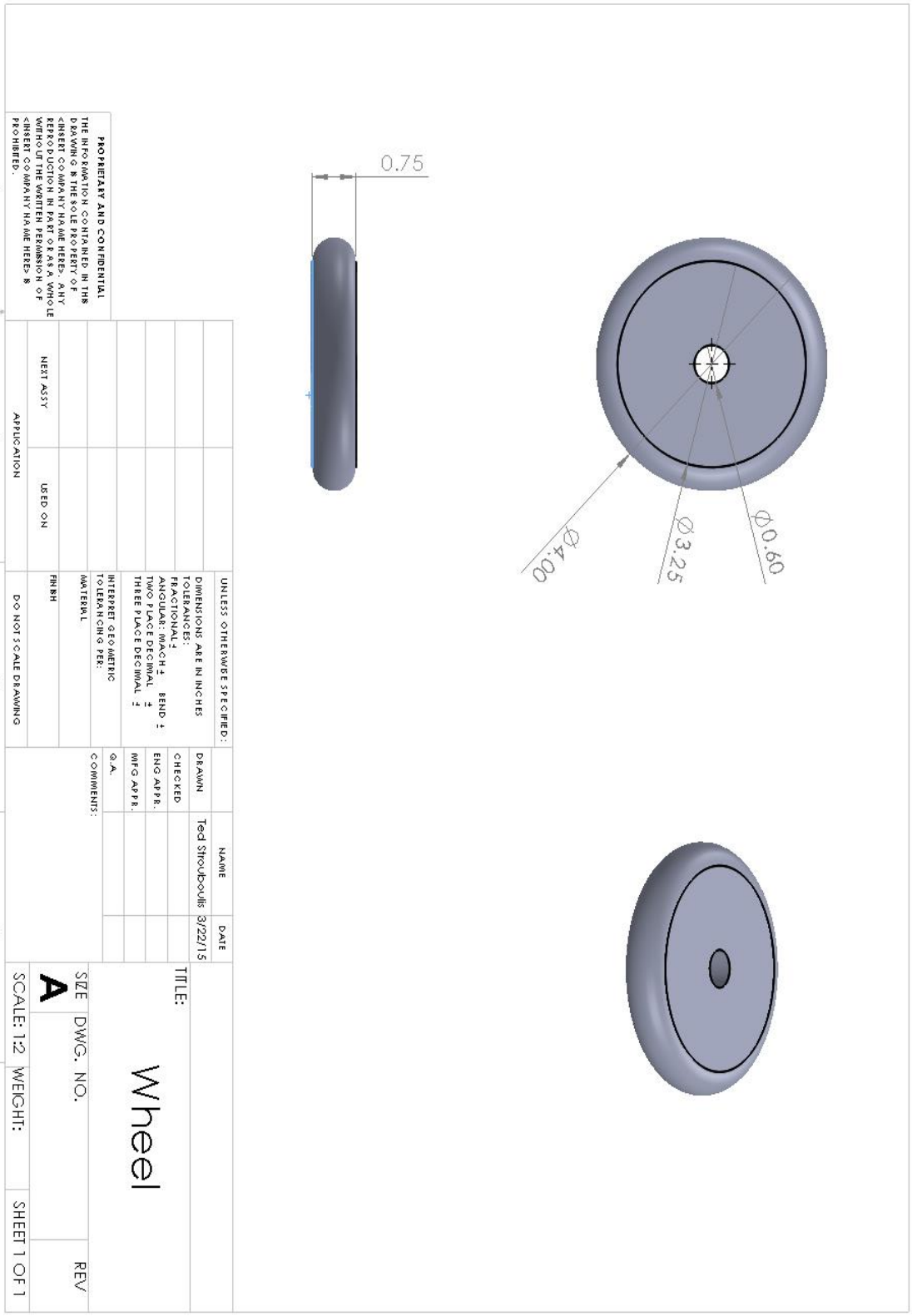
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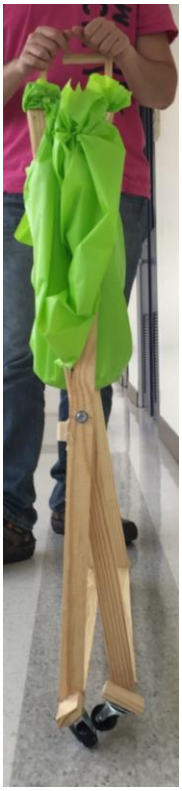
COMMENTS:
TITLE:
Wheel
SIZE
A
DWG. NO.
REV
SCALE: 1:2
WEIGHT:
SHEET 1 OF 1
5
4
3
2
1

Prototype Scale and Digital Images

Our prototype has slightly different dimensions than the true design but the



overall size would be at a 1 : 1 scale

Design Features

The shopping cart features includes:

- X - Frame that pivots at a midpoint that allows the frame to vertically collapse
- Rigid rear wheels (do not rotate)
- Swivel front wheels (rotate) for steady steering control of the cart
- Hooks - each hook is specialized to hang extra bags such as plastic or grocery bags in order to carry more groceries
- Extended handles
- Canvas basket is fixed but can be washed on the frame outdoors
- X-Frame breaks that keeps the frame and cart sturdy and safe

Operation Instructions

The operation instructions for the use of the shopping cart are the following:

1. In order to expand the cart, hold both handles at the same time and pull them in opposite directions towards the outside, so that, the cart will open.
2. Open the cart until the handles stop moving. This is the when the cart reaches the end of its size, meaning that the cart cannot expand more than that.
3. After the 2 steps mentioned before, the cart is all set and can start being used.
4. By just pushing the cart in the desired direction, you can use the cart and start putting the things inside the cart as needed.
    4.1. If more space is needed, use the little sticks located on the sides as bag holders.
5. When done using it, hold both handles and push them in the same direction towards the center to compress the cart. Keep doing this until the cart is completely compresses (almost completely flat).

ENGINEERING ANALYSIS

Working Mechanism and Engineering Analysis

Basically, the cart was made in such way that just by using the handles, people can compress and expand the cart by pulling them towards opposite directions to open it, and pushing them in the same direction to close it. The cart has a mechanism consisting of four wheels in the four ends, which facilitate the mobility of the cart. In the middle of the cart there is a very resistible bag that can be compressed as well, made of canvas material that is sturdy and able to hold up to 100 lbs without fail.

Cost Analysis [Ted]

Item	Quantity	Price per Quantity	Total Price
Everbilt 4 in. Swivel Non-Marking Rubber Caster	2	$8.47	$16.94
Structural Steel Square Tube 1/2 in. x 1/2 in. x 16ga	20.5 ft	--	$15.63
Everbilt 4 in. Rigid Non-Marking Rubber Caster	2	$7.47	$14.94
5'x7' All Purpose Blue Poly Tarp	1	$1.79	$1.79
Everbilt 5/16 in. Zinc-Plated Steel Flat Washer	4	$0.12	$0.48
5/16 in.-18 tpi Zinc-Plated Hex Nut	2	$0.05	$0.20
Crown Bolt 5/16 in.-18 tpi x 3/4 in. Zinc-Plated Hex Bolt	2	$0.18	$0.36

Total Materials Cost: $50.34

The cost exceeds the $50 limit by 34 cents because the tarp/canvas material for the basket would actually be ordered in mass quantity square footage, making the price cheaper for all customers.

CONCLUSION

In conclusion, it can be seen how a design project takes several steps, and requires a lot of study and time to come up with the best final idea for the design. While trying to come up with a design that is going to serve as a solution for a certain problem, people have to take into consideration many things in order to be able to solve the problem in the best possible way.

After working in the different steps, we were able to realize that the work and the design are never done, unless until the very end of the project, since even though you can have an idea of the design before building it, while you are constructing the prototype more ideas can come to you, and you can put them into practice and change your final design a little bit. Also, people may think that when designing something, it is not that complicated, but we were able to realize that since there are many things that need to be taken into consideration when making a design, this process is in fact very complicated since you have to follow a very complex procedure in order to end up with the best idea to solve the problem. However, even though we had a lot of obstacles along the design project, our team was able to overcome each of them, which was the

reason why we end up with the desire design that we decide that would be the best to solve the problem stated before.

Thus, it can be seen that this design project made us understand and learn how to approach any problem in a very specific way, such that, each step has to be carefully followed and revised to be able to have the best solution. In our case, we found these steps very useful since they let us have a very organized way to approach the design, and at the end, we achieved our goal for this project which was designing a foldable and comfortable shopping cart to solve the problem of moving things from one place to another one. The results were better than expected.

REFERENCES (mostly inspiration)

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http://www.bing.com/images/search?q=Collapsible+Cart&FORM=IRIBIP&=0&=1#view=detail&id=D3303DF5B5662AC351D0C011986035DEA6BCE3A6&selectedIndex=31

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