University of Wales Trinity Saint David

Wales institute of Science & Art

Academic Report

Integrating Project

Soap Box

Code: ACHA4008

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(Done Individually)

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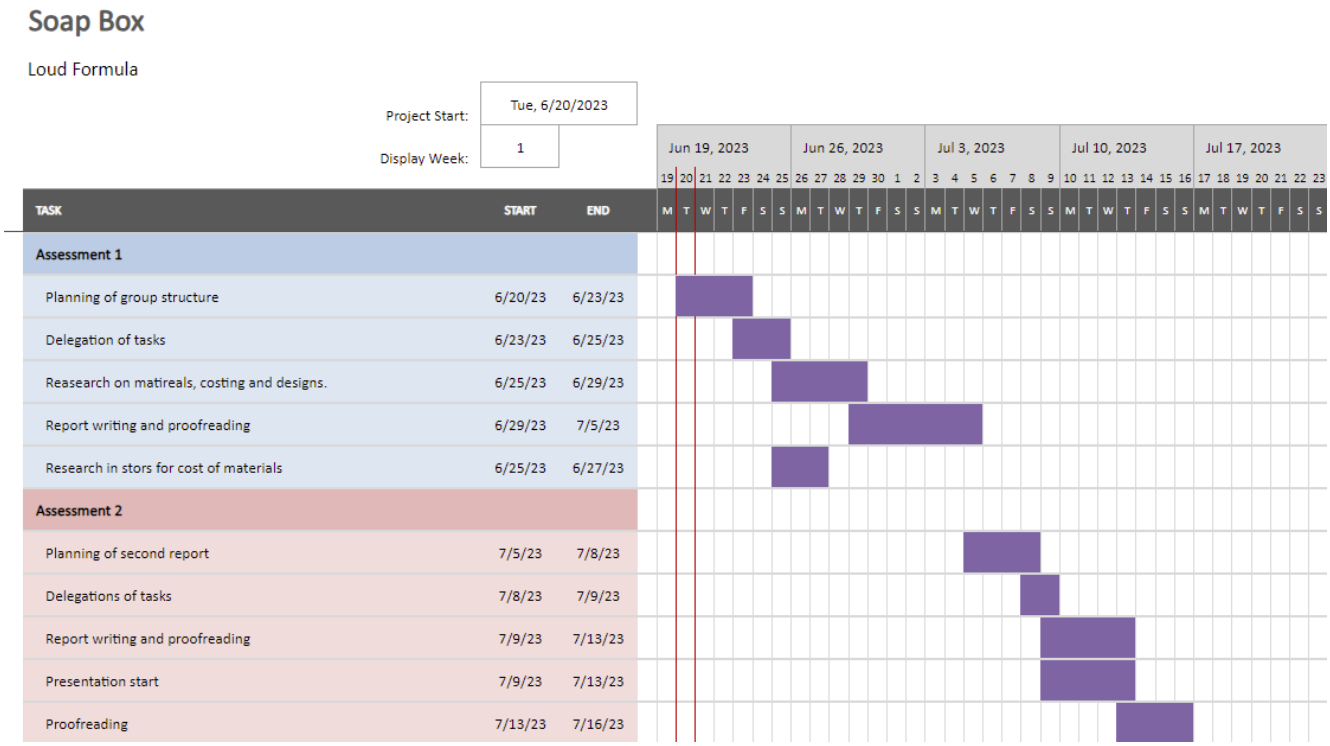
1 Gantt chart



2 Introduction

This report aims to look at the creation of a soapbox racing vehicle that can be used in the Richard's Castle Soapbox Derby. This soapbox must be made in accordance with the Richard's Castle Soapbox Derby rules and regulations. The report will include some research on the materials that can be used for the soapbox, cost-analysis of the materials and parts needed to put the soapbox together, and the design of the soapbox. This report will show the processes the group went through to create the soapbox for the Richard's Castle Soapbox Derby.

2.1 Team Organisation

Here is the list-

- Materials (Jahed, Thab)– which materials would be suitable to construct the kart from and why?
- Costing (Ziki) – explain why you have chosen certain materials, construction processes, steering/braking methods etc.

- Organisation and communication (Ali, Ziki) – show how you have organised your group work via Gantt charts and meeting minutes. This is normally the hardest part of a group project!

The team aims to be able to complete the project within a month of starting as well as to use as little money as possible to build the soapbox as we aim to use more of recycled materials. We also aim to get as may sponsors logos on the soapbox as it will support the companies in accordance with the rules and regulations.

3 Research

3.1 Background Information on Soapboxes

The soapbox originated from the United States Of America (USA) in the 1930s(Know Ohio: How the Soap Box Derby Came To Be | Ideastream Public Media). During this period there was a great depression in the USA, which is said to have boosted the creativity in children as they started creating homemade carts to compete against each other. These carts were usually made from wooden soap crates, this is where the name Soapbox came from. The children raced these soapboxes downhill which motivated a new trend of racing the soapboxes down hill as they had no engines(Soap Box Derby at Scotts Bluff (U.S. National Park Service). The first soapbox derby took place in 1934 in Dayton, Ohio. This derby sparked popularity around the country leading to a global trend as soapbox derbies started popping up around the globe. Years later the soapboxes have been changed as they are now being made from various materials.

Figure 1: First soapbox derby in Ohio 1934

3.2 Materials

For the soap box we have done research on what materials would best fit our design and how well would these materials help us with our goals for the soapbox derby. According to the regulations of the derby the materials of the soapbox should not include glass or any other materials that will shatter as they may cause injury to drivers and spectators. The soapbox should also have a roll bar to ensure safety of the driver. Taking this into consideration we discovered that our soap box will need to have a solid base to allow the roll bar to be fitted in. The group discussed and agreed that the soapbox should be made from a lightweight material, as it will allow the material to move faster as it will not be too heavy. The group also discussed on which materials would be more suitable for the base of the soapbox. The materials that were listed to be suitable after our discussion were plywood sheets, fiberglass, and galvanized sheeting. Below is a list explaining the material and its advantages and disadvantages of the material:

1. **Plywood sheets-** is a manufactured material made from tin layers peeled from debarked wood of veneer that are glued together adjacently which creates the cross-grain pattern on the plywood surface.

Figure 2: plywood

Advantages of plywood:

- It has resistances to high impact.
- It has a high strength to weight ratio due to the way the veneers are glued.
- it is chemical resistant.
- It is more cost friendly.
- Plywood is also eco-friendly.

Disadvantages of plywood:

- The layers of the veneers can start to separate.
- Cannot be exposed to wet or moist conditions for long.
- Less durable than wood.

2. **Fiberglass-** is reinforced fibre plastic that is made from glass fibre. The fibres may be arranged randomly into a sheet that is known as a chopped strand mat or a glass cloth.

Figure 3: Fiberglass

Advantages of fibreglass:

- Does not corrode.
- Has structural strength.
- It has a high heat distortion temperature.
- Can be moulded easily and quite close to the tolerances needed.
- Good strength to weight ratio.

Disadvantages of fibreglass:

- It is quite costly.
- It discolours over time.
- Fibreglass can shatter.

3. **Galvanised steel sheeting-** it is a zinc coating that is applied to a sheet of steel using a process known as continuous hot dipping. This is when a steel sheet passes through a bath of molten zinc creating a protection layer on the steel sheet.

Figure 4: Galvanised steel sheet

Advantages of Galvanised steel sheet:

- Low cost in getting them.
- Long lasting.
- Corrosion resistant.
- Easy to shape.
- Can withstand some hard impact.

Disadvantages of galvanised steel sheet:

- The zinc layer may corrode overtime.

From the above-mentioned materials that were researched on the group compared the advantages and disadvantages and came up with a decision for the material of choice for the soapbox. The main factors the were used in the discussion were cost, resistance to elements, workmanship and impact resistance. These factors allowed the group to scale down the decision to the galvanised steel sheet. This is because it is the cheapest material on the list, the zinc layer allows it to be corrosion resistant, it is easy to work with in terms of moulding shape and is impact resistant. The galvanised steel will allow for the soapbox to be great as it is also lightweight.

4 Parts

Although we have selected the main material for the soapbox to be made from, there are still other parts needed to be able to make the soapbox take shape. These parts include wheels, rivets, brakes, and steering column.

4.1 Wheels

For the wheels there were a lot of considerations as these are a very vital part of the soapbox. The group decided to enter the 4-wheel segment of the race. The group saw that the 12/3000mm wheels are the perfect size for the brainstormed ideas.

Figure 5: Four 12/3000mm wheels

4.2 Fasteners

For fasteners, the material was considered as it is essential in deciding the fasteners that need to be used in joining the materials together. The considered fasteners were pop rivets as they are good for galvanised steel sheet and are strong enough to keep the materials together without the materials breaking apart.

Figure 6: Pop Rivets

4.3 Brakes

The brakes are an essential part of the soapbox as it will need to be able to stop as well as it is a big part of the rules and regulations of the soapbox derby. The group discussed about breaks and concluded that disk brakes are the best option for the soapbox as they are more durable and reliable than the other brakes on the market.

Figure 7: Disc Brakes

4.4 Steering

For the steering column for the soapbox the decided steering solution was as simple steering shaft with linkages that are connected to both front wheels. This is because it is believed to be reliable as it has been there for many years and is simple to clone.

Figure 8: steering solution for soapbox

5 Costing

The costing of the materials required the group to do some market research and to do a field day going to physical shops to check and compare prices. We also looked at ways such as recycling centres and scrap yards where we could obtain the needed parts for a cheaper price or for free. This will help the group to cut costs in getting the needed part and materials. When the field work and research was done a list of the cheapest materials and ones, we could get for free was compiled and put in the table shown below:

Item	Amount	Price
Galvanised steel sheet	4 sheets	£40
Rivets	150	£5
Wheels	4	**Recycled**
Brakes	4	£60
Steering components	N/A	£40
Aluminium Tubing	4x800mm	£50
Total	----	£195

Table 1: Cost and Quantity

The above table shows the materials and parts the group needs for the construction of the soapbox. Under steering components this includes the steel rods and brackets to make the linkages. The aluminium tubing is for the construction of the roll cage that is required by the rules and regulations. It also highlights the amount it will cost for the materials and parts and the total. The total will not be fixed as there will be other costs such as workshop costs and other expenses that may come up unexpectedly. This total may be seen as a rough budget needed for the construction of the soapbox.

6 Designs

For the design of the soapbox the group wanted to go for something unique, the group also looked at some of the existing soapboxes on the market and brainstormed. The group had some specifications in mind as they discussed the soapbox design. Some of the specifications were that it should be aerodynamic and unique. Below are some of the existing soapboxes the group looked with their advantages and disadvantages:

1. The image bellow shows a soapbox made from metal sheeting. It has more of a rounded design and unique in terms of making it look like a car with the addition of the air vent or grill in the front. The group liked the design of the soapbox, but thought it was not as aerodynamic as they wanted it to be. The group also did not like the big wheels as they thought they add extra weight to the soapbox.

Figure 9: Soapbox existing design 1

2. The soapbox bellow is made from high-density polyethylene which is a hard type of plastic. It has more of a sharp edge design and quite a unique shape. The group found this soapbox great as it is quite aerodynamic due to the shape as it fronts of the car slants down allowing for better airflow over the vehicle. However, they did not like the fact that the soapbox is quite small.

Figure 10: Soapbox existing design 2

3. The image bellow shows the final existing soapbox that the group looked at. The bellow soapbox caught the group members eyes as it fits their wanted characteristics quite closely. The group liked the aerodynamics of the soapbox and liked the shape. The disadvantage was it had big wheels.

Figure 11: Soapbox existing design 3

The existing designs help the group brainstorm and come up with ideas for the soapbox. From the existing designs shown above the group has decided that the 3rd design resembles a lot with what they intend on building.

7 conclusions

In conclusion for the first half of our project the group has looked at organising our team, Materials, cost of the materials and parts and some ideas of the soapbox using some existing designs. The group also found out the final materials to be used for the soapbox which are mild steel sheeting. The group also found factors that need to be considered to be able to make this project successful. The research carried out here will be used in the second half of the project as the group dig deeper into the final productions of the soap box for the derby.

8 References

(*Know Ohio: How the Soap Box Derby Came To Be | Ideastream Public Media*, no date)

(*The Soap Box Derby | History| Smithsonian Magazine*, no date)

(*Soap Box Derby at Scotts Bluff (U.S. National Park Service)*, no date)