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Integrating Project (ACHA4008)

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Introduction

For this group project, our objective is to design a soapbox race car, while adhering to regulations set out by the organization. The project has been divided into specific roles, with each team member responsible for a key aspect of the design and development process:

- **Team Manager/ Finance: JJ**
- **Materials: Owain**
- **Designer: Bekka**
- **Aerodynamics: Jacob**
- **Braking, wheels and suspension: Tom.**
- **Steering: Ryan**

1. Project Objectives

Create a 'soapbox' style car which adhere to the regulations provided which are briefly highlighted below:

- Length: Maximum: 2500mm; from front to rear.
- Width: Maximum: 1500mm; from outside to outside.
- Height: 1.5 feet
- Roll Bar: Must be at least 35mm above the drivers helmet when the driver is seated normally; as well as a second roll bar must be at least 25mm beyond the drivers gloved hands when positioned at 12 o'clock.

2. Materials

1.1. Material Choices

1.1.1 Plywood

Plywood is wood that has been created by putting several thin sections of wood glued together. When the wood is assembled the grain of the wood is turned 90 degrees for each layer in order to strengthen the wood, this is a process called cross graining.

Advantages	Disadvantages
Cross graining helps reduce the risk of wood splitting while being nailed or screwed.	Plywood cannot be exposed to wet conditions for extended periods of time.
Cross graining helps reduce the chance of the wood shrinking or expanding.	Can splinter easily during its transportation.
Plywood can be easily cut into various shapes.	Can be somewhat difficult to cut depending on its size.

Table 1: Plywood

1.1.2 MDF

MDF stands for medium density fibreboard. This is because the properties of MDF are the fact that it is thick, flat, stiff, and it is easy to machine. MDF is created using a large number of small particles.

Advantages	Disadvantages
Lack of grain means it is easy to work on without the risk of damage.	MDF cannot withstand extreme stress as this causes the wood to crack and split.
MDF doesn't contract or expand	Due to its density MDF can be difficult to cut.
Can hold screws easier than other woods due to its higher density.	Due to the high glue content in MDF it causes tools used on it to blunt much quicker.
Because MDF is made of wood chippings it is very cheap to produce and to buy.	MDF absorbs liquid very easily causing it to become less structurally sound.

Table 2: MDF

1.1.5 Mild Steel

Mild steel is a type of carbon steel that has a low amount of carbon in it. Mild steel is also not an alloy.

Advantages	Disadvantages
Due to its lower carbon content, mild steel is quite soft therefore it is easier to work with, making it easier to cut and bend.	Mild steel has a low strength rating meaning it can break and deform when put under a lot of weight or stress.
Because of it being a soft metal it is easy to weld without cracking and has a low melting point causing the welding process to be easier.	In moist environments, mild steel can corrode quite easily.
Mild steel is one of the cheaper steel types.	Mild steel is a heavier metal when compared to others such as aluminium.

Table 5: Mild Steel

1.1.6 Aluminium

Aluminium is the 13 element in the periodic table and the second most used metal in the world.

Advantages	Disadvantages
Aluminium is a corrosion resistant metal due to the fact that it forms a thin layer of aluminium oxide on its surface when exposed to oxygen.	Aluminium can be quite expensive when compared to other metals such as steel.
Due to its corrosion resistance, trimmed edges on the metal do not need to be covered.	The process of welding aluminium is unique to itself meaning it can take longer and be more expensive to do.
Because of its flexibility, aluminium can be bent and cut in many ways quite easily.	Aluminium is a weaker material when compared to regular steel.
Aluminium can withstand a lot of pressure being put onto it due to the fact it is quite strong, however, despite this it is also quite a lightweight metal.	

Table 6: Aluminium

1.1.8 Carbon Fibre

Carbon Fibre is a material that is made up of strong, very thin crystalline fragments of carbon.

Advantages	Disadvantages
Due to its low density, carbon fibre is a very lightweight material.	When carbon fibre is struck with high impact such as a crash it will shatter.
Carbon fibre has a high tensile strength meaning it is one of the strongest of all commercial reinforcing fibres.	Drilling holes into carbon fibre can create weak areas in the material.
The durability of carbon fibre is extremely high meaning that when it is under constant stress it won't wear out as quickly.	Due to its high quality, carbon fibre can be a very expensive material to buy.
When it is treated properly, carbon fibre is one of the most effective materials against corrosion.	

Table 8: Carbon Fibre

1.1.9 Polystyrene

Polystyrene is a synthetic resin which is a polymer of styrene.

Advantages	Disadvantages
Polystyrene can be easily moulded into various different shapes and sizes quite easily.	Polystyrene is quite brittle and breaks easily making it one of the weakest forms of plastic.
Polystyrene is resistant to moisture meaning it can be used in an outdoor environment safely.	Polystyrene is quite flammable and can catch fire quickly.
Due to the fact that polystyrene can be found in most shops it can be easily acquired and for a cheap price.	

Table 9: Polystyrene

1.1.10 Cardboard

Cardboard is very similar to paper but usually thicker and made from cellulose fibre.

Advantages	Disadvantages
With relation to its weight, cardboard is quite strong with it being so light.	Due to being similar to paper, as a material it is not very weatherproof when it comes to wet weather such as rain or snow.
Cardboard can be recycled easily and is advised to be recycled, because of this it makes it quite environmentally friendly.	Buying in bulk can be a risk as you may buy more than you need.
With it being recycled it is a very renewable material.	
Cardboard can be easily bought in bulk which can save money in the long run.	

Table 10: Cardboard

1.1.11 PVC

PVC is a resistant synthetic resin which is manufactured chemically.

Advantages	Disadvantages
Due to it being one of the most readily available materials, PVC is quite cheap when it comes to other forms of plastic.	When exposed to high heat, PCV can deform quite easily.
PVC is a very dense plastic which means it can resist being hit and deforming due to it being quite hard.	When working with PVC, the fumes it can release can be very toxic and dangerous to ingest.
With its strength, it has a resistance to wear and tear.	

Table 11: PVC

1.1.12 Fibreglass

Fibreglass is a reinforced plastic made from glass fibres in resin.

Advantages	Disadvantages
Due to it being a high strength material, fibreglass can strengthen other materials.	After being reinforced by fibreglass, plastics can become a more brittle material.
Because of the glass fibres, fibreglass becomes a great material for fire resistance.	As a material, fibreglass is not the most environmentally friendly, with its creation and disposal raising potential risks to the environment.
After being reinforced by fibreglass, reinforced plastic doesn't crack as easily with an increased impact resistance.	Fibreglass can quite quickly and quite easily absorb a lot of water which could cause it to falter.
As a material, fibreglass is quite cost effective when compared to others such as carbon fibre.	

Table 12: Fibreglass

3. Steering Mechanism

There are two main designs to use when it comes to steering systems.

Most designs use either a simple steering system similar to a bicycle's handlebars, or a system similar to the wheel of a car or go kart. The first method could be connected to our soap box front wheel(s) in the same way that you would find on a pushbike. I.E., Handlebars into Steering column connected to a crown bracket, which then connects to a fork set up suspension kit, which then connects to the wheel itself.

With this steering system, any input from the driver gets fed directly to the wheel because the rotational movement is carried down the assembly, due to the fact that each component is held together with little to no moving/turning/spinning parts. The only parts that move independently from the steering input is the suspension, and even then, they still rotate around the point of movement when steering.

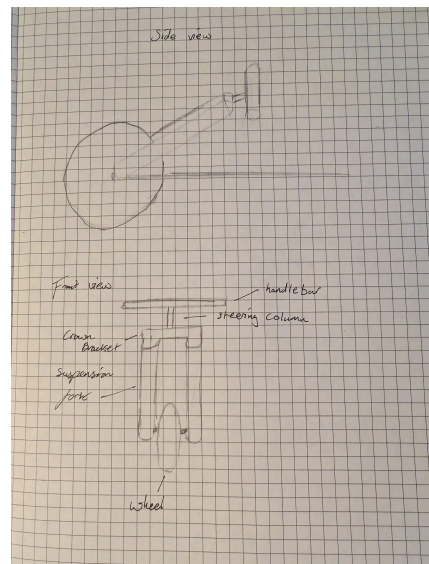


Figure 1

Figure 1 is based around a single front wheel, as we feel this steering system would be best on a 3 wheel soap box. It would give the driver instant feedback and we believe it would be easier to control when turning a single wheel. As the point of rotation is in the centre, we feel that it would also be physically easier for the driver to turn the wheel as they are able to leverage the turning motion with a handle bar, and would have an easier time turning. This is because if a steering wheel was used, they would be turning the ground wheel around the centre of the steering wheel which may cause issues with the driver's grip as they come around corners in the 3 wheel car. One reason for this is that all the steering force would be applied around this small axis of rotation directly under the centre of the wheel. All of the different forces from the wheel on the ground would all be felt on this wheel at the same time.

Alternatively, using a handlebar may make it easier for the driver as the force to turn the wheel is applied further away from the centre of rotation, using the same principles of torque

as you would when trying to loosen or tighten a bolt on a car. If you are struggling to break a bolt loose, you may find it easier with a longer handle on the tool used, as this allows you to use more leverage on the bolt. The same principles apply to this steering system. Because the front wheel sits directly below the centre of the bar, we can fine tune the length of the handle for the driver, making it easier for them to make turns where necessary, while also sticking with the dimensions and parameters of the competition.

The second steering system would be connected from the steering wheel in the following way. The steering wheel is connected to the steering column (figure 2) which is welded onto a small swivel plate. This plate has push rods/control arms that are connected to it at the bottom with some small bolts (figure 3). On the other end of these arms are brackets that push the wheel to face outwards, or pull the wheel to face inwards. (figure 4) Holding these brackets in place are some mount bars that are connected to the front frame of the car. When steering input is given to the wheel, the rotation of the wheel also rotates the swivel plate. This puts force on the push rods which is carried throughout the motion down to the brackets holding the wheel. The push rods are able to swivel on the bracket. Due to the wheel being held in place, it is this bracket that applies the turning motion to the wheel.

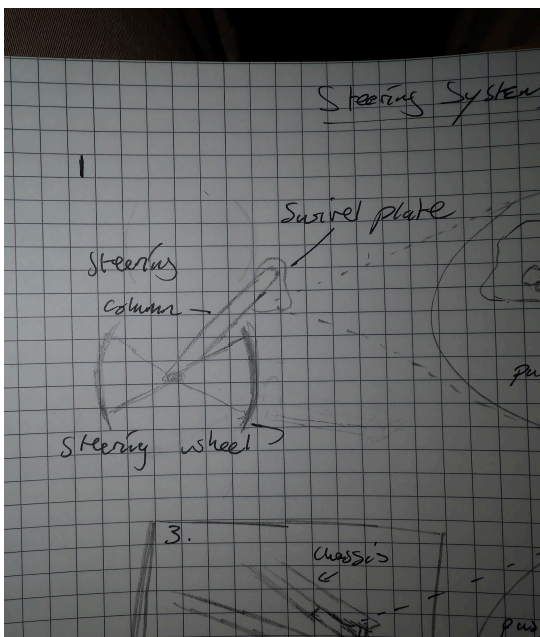


Figure 2

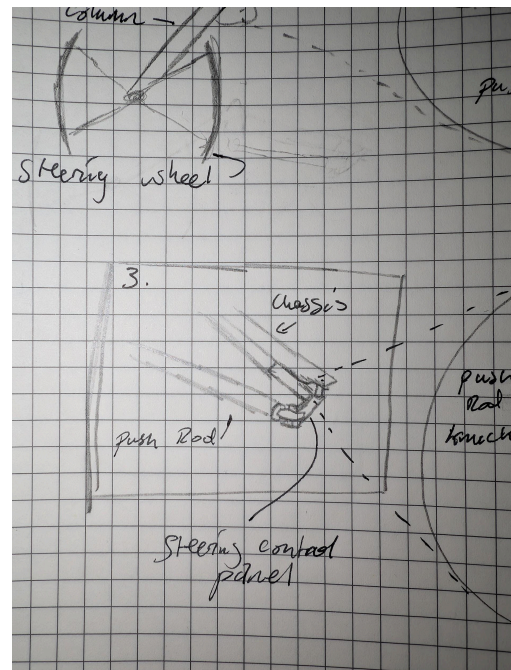


Figure 3

Below is a diagram of the assembly, with extracted views labelled figure 4 and 5.

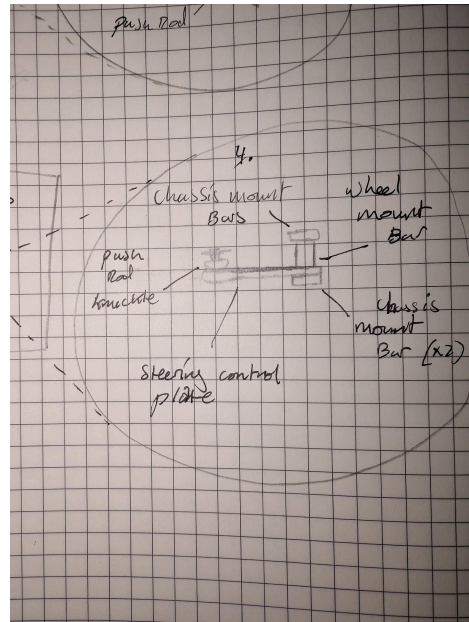


Figure 4

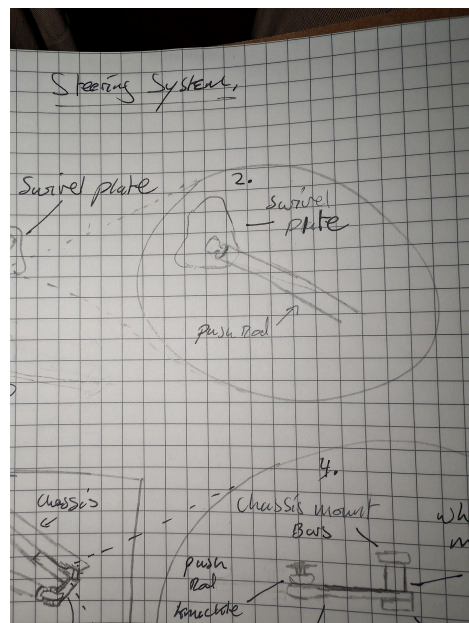


Figure 5

The following diagrams show how rotational force travels down the assembly to turn the wheel. Figure 6 shows the position of all of the parts before the rotation has happened, and figure 7 shows the positions after rotation. The arrows on the diagram represent the rotational force and the pushing force from the swivel plate.

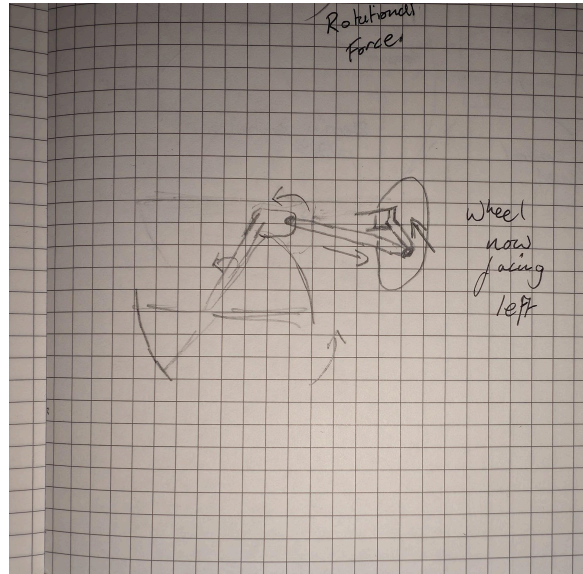


Figure 6

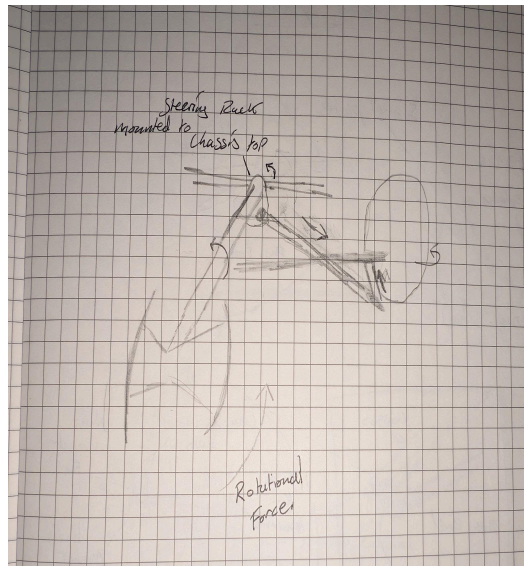


Figure 7

We have drawn this system in a 4 wheel configuration, which is why we have used a steering wheel in my diagram. We believe that the driver will have more ease operating this system as the wheel will feel more natural to them from their experience driving cars.

4. Wheels and Braking

5.1 Types of wheels for soapbox

- Road bike
- Go kart wheels
- BMX
- Moped

Types of Wheels	Positives	Negatives
Road Bike	Low drag Light weight Tires designed for speed	Flimsy Low grip under stress Unstable
Go kart wheels	Great grip Stable Durable	Heavy High drag Hard to source
BMX	Lightweight Low drag Durable Easy to source	Medium grip
Moped	Durable Medium weight Good grip Easy to source	Bulky May be hard to brake

Table 14: Wheels

Out of all the options, three stand out as the most viable, the road bike, BMX and the moped wheels. To decide which is the best option for our soap box we first must clarify the nature of the race it is to be partaking in. The Richards Castle Derby is a relatively smooth track with short patches where the soap box is expected to go off-road with one or all wheels. With this in mind it is important to choose a wheel that is robust enough to withstand the patches of rough terrain but also lightweight and streamlined enough to ensure a fast time. The best option for the robust department would be the moped wheels as they are designed to withstand impacts at much higher speeds and maintain traction while doing so, its drawback on the other hand is its weight which not only would slow the vehicle down but would also make steering difficult on the operator. The best for straight line speed would be the road bike wheels, their slender design and light weight materials would in theory make them optimal for a track but as stated there are patches of low traction and high impact, which could be disastrous for the road bike wheels as they are not designed to withstand high impact scenarios and losses of traction. The best middle ground is the BMX wheel due to its ability to absorb shock through its tires while maintaining structural integrity and also its lightweight and small profile giving it high

speed potential. Its tires not only are thicker than the road bikes but also have more tread which will be vital when not on tarmac or even in the rain.

5.2. Types of brakes for soapbox

- Bike
- Drop arm
- Hand held drag
- Disc

Types of Brakes	Positives	Negatives
Conventional Bike	Easy to source Sufficient braking force Light	Braking may be slow Only works with bike wheels
Spring	Cheap Simple	Unreliable Wears easily Not very effective Hard to use lightly
Hand held drag	Light	Too small Fragile
Disc bike	Lightweight Great effectiveness Compatible with more platforms than conventional bike Readily available Easy to implement	Can be expensive

Table 16: Brakes

Due to the fact that the wheel of choice is the BMX wheel the most suitable brakes are the disk bike brakes and the conventional bike brakes, for this track the top speed isn't especially high so heavy duty braking is not imperative. Traditional bike brakes are most commonly found on BMX's and are most likely good enough to keep the soap box stationary on the starting ramp and have ample control through the corners. This comes with the drawback that for the best result they would have to be attached to all four wheels therefore increasing complexity. On the other hand disk brakes are extremely effective, this results in them only being needed on the rear wheels therefore bringing down weight. This also increases the amount of control the driver has on the vehicle due to its sensitivity.

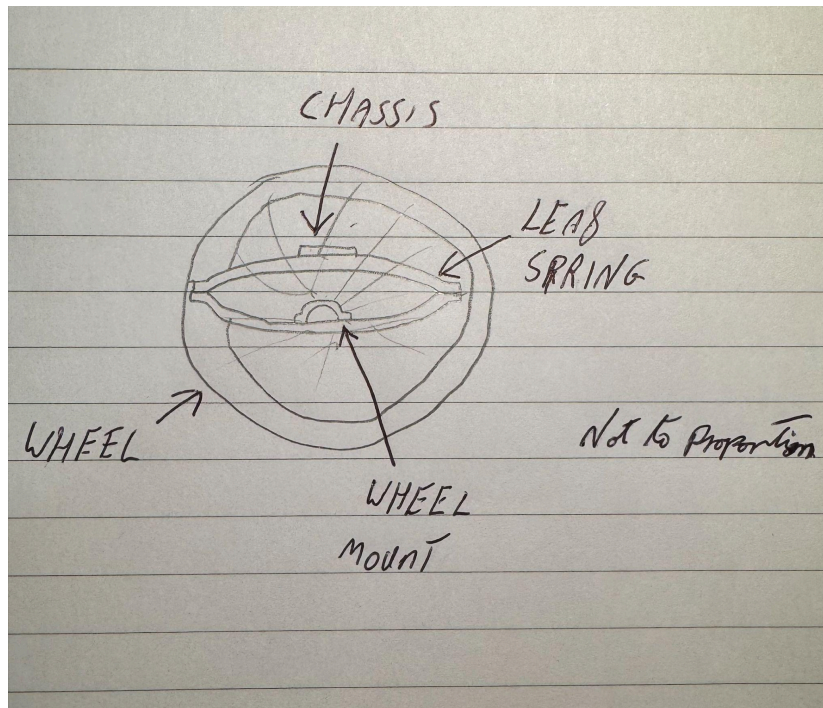


Figure 8

An example of how the wheel front wheels should connect to the chassis. The image is not a true representation as the space between parts has been elongated to more easily show the design.

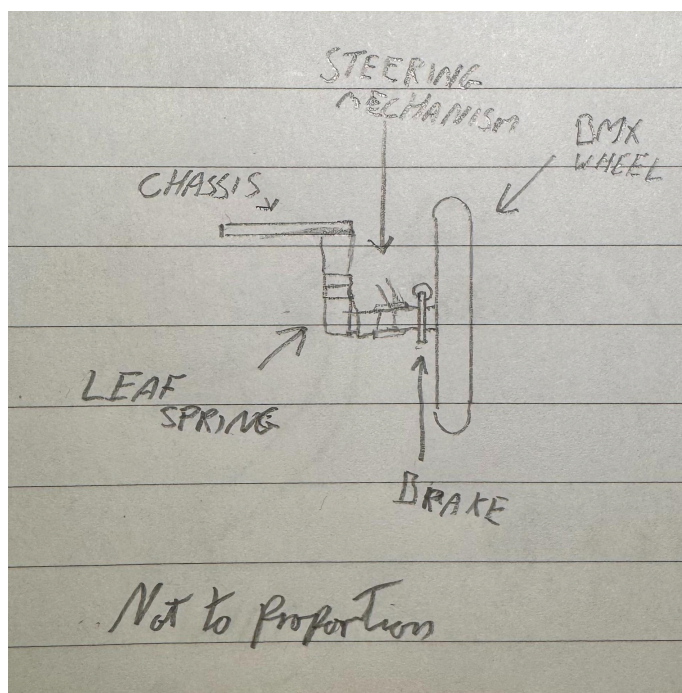


Figure 9

An example of how the wheel should connect to the suspension.

6. Aerodynamics

- Enclosed bodywork to allow streamlining.
- Increase Drag: driver position, car body size and irregularities in the bodywork.
- Find a balance with friction: too much friction equates to no movement, not enough friction equates to lack of control.

The ideal aerodynamic shape includes features of a smooth streamlined profile, which minimizes drag by reducing the size and number of turbulent airflow zones around the object. The reduction of turbulence allows the object to move through the air with less resistance which results in improved efficiency. The teardrop shape provides the best aerodynamic shape as it incorporates a tapered front end, which gradually reduces the cross-sectional area of the object. The tapered end helps to minimise drag and improve airflow by allowing the air to smoothly flow around the object.

When looking at the design aspect of the soapbox, it was important to ensure that the centre of mass is equal distance from the wheels to create balance/ equal weight distribution. An enclosed bodywork allows streamlining, further with having a symmetrical shape and ensuring the surface is smooth and evenly curved.

6.1. Concept Designs

- A. A streamlined chassis sporting front and rear wings, to respectively produce downforce. The front wing is similar in design to that of a go kart, an angular slab connected to the nose of the chassis. Having a front wing partially embedded into the nose promotes a structure that is safer, and more stable.

Both the wheel and suspension are exposed, this is to promote aerodynamic flow, a lighter car and also a more flexible turning angle/suspension. The bodywork covers the steering element, the drivers head and shoulders are exposed. The rear wing is held stable by struts connecting to the most ideal places on the chassis.

- B. Sporting a lightweight chassis with a smooth and uniform bodywork to guide airflow smoothly across the car all the way to the rear. Wheel axles are covered and instead of a rear wing the rear wheel covers have been raised featuring aerodynamic elements to counteract turbulent vortices to the rear, and stabilising the car.

6.2. Diagrams

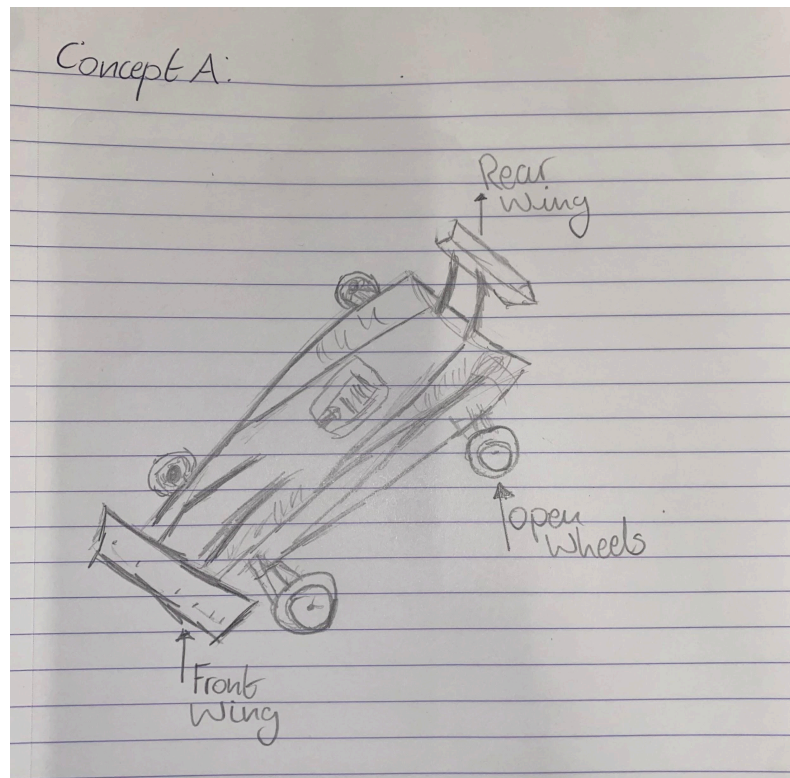


Figure 10

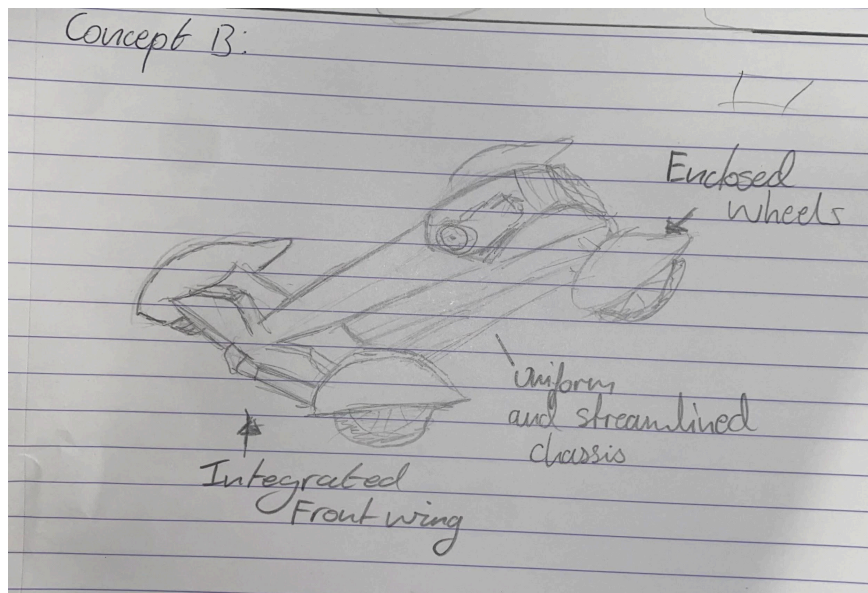


Figure 11

7. Weight Distribution

7.1. Balance

Ensure that the weight is evenly distributed, with a slightly heavier rear to avoid tipping over while turning.

7.2. Centre of Gravity

Keep the center of gravity low to ensure that the car remains stable at high speeds and during sharp turns.

7. Designs

7.1. Frame and Body Design

7.1.1. Body Shape & Aerodynamics

- **Nose Design:** A teardrop or wedge-shaped nose will help minimize drag by allowing air to flow smoothly around the car. The smooth front end reduces resistance at the higher speeds typical of the race.
- **Side Panels:** The side panels should smoothly curve inward towards the rear. These fairings will help control airflow along the sides of the vehicle to avoid vortexes, which can slow the car down. The smooth surface of the fairings reduces the drag coefficient.
- **Rear End:** A small, upward-tilting spoiler will be installed at the back. The angle of the spoiler should be subtle enough to prevent excessive drag but provide enough downforce to keep the car stable during rapid descents and hard cornering. This ensures better traction on the wheels.

7.1.2. Cockpit Design

- **Ergonomics:** The cockpit will be ergonomically designed for comfort, with a low seat position to keep the driver as low to the ground as possible, lowering the center of gravity. This improves stability and reduces the risk of flipping over.
- **Customizable Seating:** A comfortable bucket seat that can be adjusted or molded to fit a wide range of body types will be used. The seat should feature cutouts for the driver's arms and legs for enhanced freedom of movement during steering and braking.
- **Cockpit Entry:** The driver can enter the vehicle from the front or through the side with the use of a low-profile seat design. Entry and exit should be easy to minimize time spent preparing for the race.

7.1.3. Safety Features

7.1.3.1. Roll Bar:

The inclusion of a roll bar is apart of the regulations with the first roll bar being at least 35mm (3.5cm) above the drivers helmet when the driver is seated normally; as well as a second roll bar must be at least 25mm (2.5cm) beyond the drivers gloved hands when positioned at 12 o'clock.

8. Finances

This is a breakdown of the cost of materials / parts including multiple places we would buy the same material / part, for a more in depth analysis of why we have used each part or material please look at the other sections this is solely a cost breakdown. We have not worked to a set budget. As this is a student project, we have opted to use cheaper materials over others such as carbon fiber however we have still picked the better materials so it is still a well made model such as choosing the slightly more expensive plywood over MDF or chipboard.

8.1. Materials costs

8.1.1. Plywood

For a 2440 x 1220 mm piece that is 18mm thick from B&Q it is £40, in comparison from Wickes it is £23 for the same size piece but only 5.5mm in depth and finally from Travis Perkins for the same size and same depth piece it is £48.19. So we will purchase from B&Q as it is the depth we want for the best price. We have opted to use plywood in our project so this has to be factored into the financials.

8.1.2. MDF

For a 2440x1220 piece of MDF at 18mm it is £30 from B&Q, while from Sheet Materials Wholesale it is £23.93, and then from Wickes it is £26. If we were to use MDF we would use Sheet Materials Wholesale, however we have chosen not to use MDF.

8.1.3. Blockboard

For a 2438mmx1219mm piece of blockboard at a depth of 18mm from Builders Merchant it is £44.99, comparatively the same material at the same size and depth from J Gards & Sons is £48.72 per unit, it is also available for £43.68 per unit if we were to purchase 20 or more however that is far more than necessary for this project if we were to. Finally the final place we could purchase from is Harlow Bros, they offer a 2440x610 piece at a 18mm depth for £37.91. If we were to use blockboard we would likely purchase blockboard our choice would be Builders Merchant as it is the cheapest for a good size however we have decided against it.

8.1.4. Chipboard

For chipboard from B&Q prices are set at £13.97 for a 2400x600 by 18mm depth piece, where as from for a piece the same size and depth it is £9.50 from Sheet Materials Wholesale and finally from Smiths Timber for a 2440x1220 piece with an 18mm depth it is £28.80. If we were to use chipboard we would either use B&Q or Smiths Timber depending on how much we needed however we have opted against it.

8.1.5. Mild steel

For a 1000x1000 sheet of mild steel 1mm thick from Metals4u it comes to £24.98 compared to a 2000x1000 sheet at the same depth from The Metal Store it costs £54.00 for the sheet, finally from Click Metal for a 1000x1000 sheet at a 1.2mm thickness it is £45.23. In this case there would be discussion over how much we need and how thick we need it to decide where we would purchase from however we are not using mild steel.

8.1.6. Aluminium

From Aluminium-online a sheet 1000 x 1000 at 1.5mm thickness costs £34.80 whereas from first choice metals for the same size and depth it is £32.48 and finally from The metal store it is £50.50 for the same size sheet. We have opted to use aluminium so we will likely purchase from first choice metals.

8.1.7. Carbon fiber

From cut plastic sheeting a 1000x1000 with a 2mm depth it comes to a total of £104.24 while from easy composites for a 1000x980 for a 2mm depth sheet would be £234.25 and finally from carbon webshop a sheet at 1000 x 620 with a 2mm depth is £352.52. If we were to buy carbon fiber it would more than likely be from cut plastic sheeting over the other places listed however we have opted not to use carbon fiber as a part of this project.

8.1.8. Cardboard

From amazon 10 A1 boxes of cardboard can be bought for £21.99 in comparison to cardboard boxes where you can buy 10 A1 boxes for £16.98 and finally from the packaging shack you can get sheets for the same quantity and size for £23.80. Therefore for purchase we will use cardboard boxes.

8.1.9. PVC

To purchase a 2000x1000 sheet of PVC at a 1mm thickness from vision plastics it costs £18.50, whereas from PVC strip doors for the same size and depth it costs £41.06.

8.1.10. Polystyrene

To purchase polystyrene boards at a depth of 25mm at 2.4x1.2m it costs £12.97 from B&Q compared to sam turner & sons where it is £8.40 for the same size and finally from ecclestons it is £18.45 for a pack of 12 sheets that are 1200x600, for this reason we will more than likely go with ecclestons for polystyrene

8.1.11. Wheels

BMX wheels have been chosen as our wheel type, due to the vast range and specificity of these, there cannot be much cross comparison to each on the financial front as each have their own benefits and drawbacks that are not suited to finance. It would be suggested that we purchase from reputable sources however over second hand places such as ebay due to high numbers of scams and issues.

Overall we stuck to a cheaper end budget as this is a student run project, swapping out some high cost items such as carbon fiber for lower cost aluminium but keeping some such as BMX wheels as they were a necessary but expensive part of the soapbox. We are all happy with the budget and the way we stuck to it overall.

Conclusion

This group project has centered around the design and development of a soapbox race car, facilitating significant progress. To date, the following milestones have been achieved:

Design: The conceptual design has been finalized, accompanied by detailed plans and drawings that encompass both structural integrity and aesthetic appeal.

Materials: A thorough materials selection process has been conducted, emphasizing the balance between weight, strength, and cost. Appropriate materials for the car's frame, body, and components have been identified.

Aerodynamics: An aerodynamic analysis was executed to refine the car's shape, minimizing drag and improving stability at high speeds. Design modifications have been made based on the analysis results.

Braking System: An initial braking system has been designed and tested for both efficiency and safety. Prototypes have been developed, and adjustments are being implemented to ensure peak performance.

Steering Mechanism: The steering system has been crafted with an emphasis on responsiveness and accuracy. Early tests have yielded encouraging results, and further enhancements are in progress.

Thus far, the project has adhered to the timeline, with each team member actively participating and contributing to the car's development. The next steps will involve finalizing the car's construction, conducting additional testing, and preparing for the upcoming race.

Evaluation

The purpose of this evaluation is to assess the overall progress and effectiveness of the work carried out so far in the group project, with a focus on the design and planning of the soapbox race car. The evaluation will highlight both the strengths and weaknesses of the project, with particular attention to areas that require improvement.

1. Design and Aerodynamics:

- **Strengths:** The initial design phase was successfully completed, with significant research which was conducted by both design and aerodynamic leads. The design was thoroughly considered for both functionality and aesthetics.
- **Weaknesses:** Although the design process was generally successful, there were instances of rushed decisions due to the lack of communication between team leader and the rest of the group. This led to some areas not being as well integrated as they could have been.
- **Areas for Improvement:** More time should have been allocated to refining the design.

2. Materials Selection:

- **Strengths:** The materials selection process was based on a solid understanding of the project requirements, balancing cost, strength, and weight. The materials chosen were appropriate for the soapbox.
- **Weaknesses:** Due to time constraints, the depth of materials were not fully investigated to see whether they were an appropriate material for a soapbox so they were later refined when final checks over the project were done.
- **Areas for Improvement:** In future projects, more thorough research into materials should be conducted earlier in the process to explore a wider range of options and maximise performance.

3. Braking System:

- **Strengths:** The design of the braking system has been completed. Whereby an adequate choice of braking was chosen by the brake lead, which would comply with the regulations.
- **Weaknesses:** As the project progresses, adherence to group deadlines would need to be improved, to allow for less stress around the main deadline.
- **Areas for Improvement:** In future projects, the braking system should be thought out fully to see whether brakes are needed in a soapbox. If found to not be needed This would help ensure the car's safety and braking efficiency are fully optimised before the race.

4. Steering Mechanism:

- **Strengths:** The steering mechanism has been successfully designed with a focus on responsiveness and precision. Early tests suggest that it will provide the necessary control for the car during the race.
- **Weaknesses:** Due to the restraint in time, addressed the potential issues to do with not having the full length of the steering rotation, no mention of a solution so before proceeding it would be worth finding a way to get more rotation from the steering.

- **Areas for Improvement:** Future projects should allow for more time to test the steering system under a variety of conditions to ensure long-term reliability and performance.

5. Team Collaboration and Project Management:

- **Strengths:** Despite challenges, the team managed to complete key tasks successfully, with each member contributing to their area of responsibility.
- **Weaknesses:** There were significant issues with teamwork and collaboration throughout the project. At times, there was a lack of coordination, and tasks were not always completed on time. Some team members were left to carry out more work at the last minute due to delays in other areas, which caused stress and impacted the quality of work. In particular, certain components were not finalised until late in the process, leading to rushed decisions.
- **Areas for Improvement:** In future projects, more effective project management is required, with regular check-ins and clear communication among all team members. Tasks should be more evenly distributed, and deadlines must be adhered to more strictly to avoid last-minute work and ensure a smoother workflow.

Conclusion: While significant progress has been made on the soapbox race car, several areas of the project require improvement. The lack of sufficient teamwork, some rushed decisions, and last-minute work have impacted the overall quality and unity of the project. However, the core elements, such as the design, materials selection, and braking system, are in a satisfactory state. Moving forward, more attention must be paid to time management and team collaboration to ensure the project's success. With these improvements, the car is expected to perform well, but the lessons learned from this experience will be crucial in future projects.

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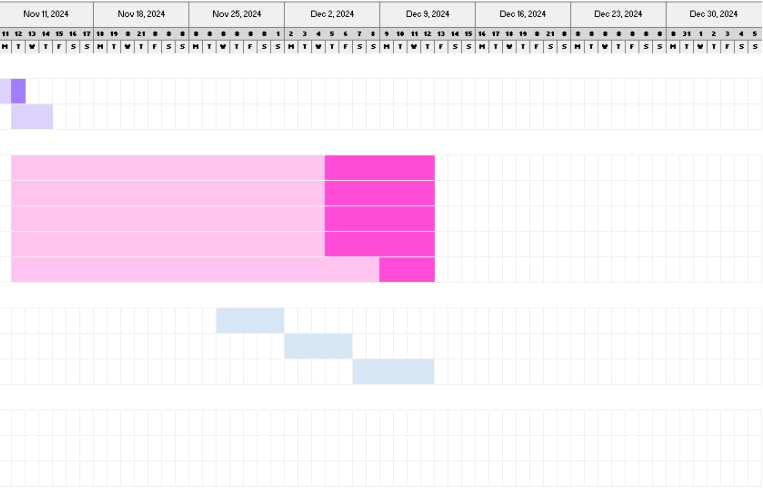
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Gantt Chart

Soapbox racecar project

Project start: 11/11/2024
Display week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
Planning				
Initial Planning	Evergore	95%	11/11/24	12/11/24
Discuss roles	Evergore	100%	12/11/24	14/11/24
Research				
Aerodynamics	Jacob Gwilliam	75%	12/11/24	12/12/24
Finance	Jayce Atkins	75%	12/11/24	12/12/24
Materials	Ovahn Hunt	75%	12/11/24	12/12/24
Suspension, Vhheels and Brakes	Tom Jones	75%	12/11/24	12/12/24
Steering Mechanisms	Ryan Hunt	90%	12/11/24	12/12/24
Design				
Gather research on designs	Bekka Pratt	100%	26/11/24	01/12/24
Produce sketches	Bekka Pratt	100%	02/12/24	06/12/24
Final Design	Bekka Pratt	100%	07/12/24	12/12/24
Evaluation				
Conclulsion	Bekka Pratt	95%	21/01/25	21/01/25
Evaluation	Bekka Pratt	90%	21/01/25	21/01/25
Completion	Bekka Pratt	95%	21/01/25	21/01/25



Meeting Minutes

Date: 28/11/2024

Time: 11am

Location: 2nd Floor Library

Meeting Called By: Jayce Atkins

Note Taker: Bekka Pratt

Attendees:

- Bekka Pratt
- Jacob Gwilliam
- Ryan Hunt

Absentees:

- Jayce Atkins
- Tom Jones
- Owain Holgate

Agenda Items:

1. A discussion was held about each role that was needed as well as the next steps to take.

Next Meeting:

- **Date:** 9/12/24
- **Time:** 12pm
- **Location:** Library

Meeting Adjourned at: 12:11pm

Minutes Prepared by: Bekka Pratt

Meeting Minutes

Date: 02/12/2024

Time: 11am

Location: 006 IQ building

Meeting Called By: Jayce Atkins

Note Taker: Bekka Pratt

Attendees:

- Bekka Pratt
- Owain Holgate
- Tom Jones
- Ryan Hunt
- Jayce Atkins
- Jacob Gwilliam

Absentees: N/A

Agenda Items:

1. **Steering**
 -
2. **Budget**
 - **Discussion:** Basic discussion of a rough budget of around
 - **Decisions Made:** We decided to not work to a set budget due to one not being outlined in the project brief.

Next Meeting:

- **Date:** Wednesday 11th December 2024
- **Time:** 11am
- **Location:** 2nd Floor Library

Meeting Adjourned at: 11:12am

Minutes Prepared by: Bekka Pratt

Meeting Minutes

Date: 09/12/25

Time: 11am

Location: 2nd Floor Library

Meeting Called By: Jayce Atkins

Note Taker: Bekka Pratt

Attendees:

- Bekka Pratt
- Jacob Gwilliam
- Ryan Hunt

Absentees:

- Jayce Atkins
- Tom Jones
- Owain Holgate

Agenda Items:

1. There was a discussion surrounding the last unofficial deadline within the group before christmas.

Next Meeting:

- **Date:** 9/12/24
- **Time:** 12pm
- **Location:** Library

Meeting Adjourned at: 12:11pm

Minutes Prepared by: Bekka Pratt

Meeting Minutes

Date: 16/01/2025

Time: 12pm

Location: 2nd Floor Library

Meeting Called By: Ryan Hunt

Note Taker: Bekka Pratt

Attendees:

- Bekka Pratt
- Jacob Gwilliam
- Owain Holgate
- Ryan Hunt
- Tom Jones

Absentees:

- Jayce Atkins

Agenda Items:

1. The discussion was fairly short as not everyone was in attendance but it was just a quick catchup where a deadline was implemented for Friday 17th January at 16:30pm for when everyone's parts must be on the document.

Next Meeting:

- **Date:** 20/01/2025
- **Time:** 12pm
- **Location:** Library

Meeting Adjourned at: 12:11pm

Minutes Prepared by: Bekka Pratt

Meeting Minutes

Date: 20/01/2025

Time: 12pm

Location: Library

Meeting Called By: Jayce Atkins

Note Taker: Bekka Pratt

Attendees:

- Bekka Pratt

Absentees:

- Ryan Hunt
- Jacob Gwilliam
- Owain Holgate
- Tom Jones
- Jayce Atkins

Agenda Items:

1. Go over the document to make any last changes before the deadline as well as confirm everyone's done all of their parts.

Next Meeting:

This was the final meeting before the assessment was handed in.

Meeting Adjourned at: 12:01pm

Minutes Prepared by: Bekka Pratt

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