

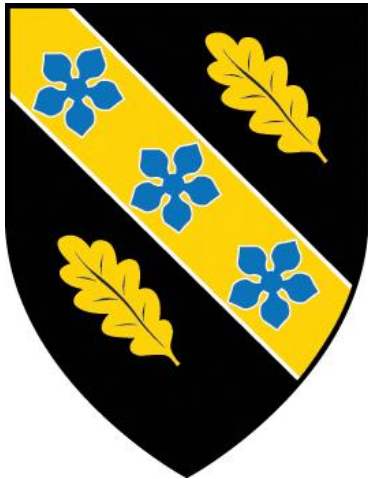
University of Wales Trinity Saint David

Wales Institute of Science and Art

March 2021

The Buoys – Soapbox

Integrating Project (ACHA4008) - Group 2



PRIFYSGOL CYMRU

Y Drindod Dewi Sant

UNIVERSITY OF WALES

Trinity Saint David

Tom Back, Jake Lawrence, Bartosz Malinowski, Evan Craig & Liam Chess
(2014186) (1450966) (2005342) (2012643) (2004144)

Contents

Contents

Contents.....	1
1 Introduction	2
2 Literature Review	3
3 Methodologies	4
4 Design and Analysis Discussion.....	5
5 Conclusions	7
6 Evaluation	8
7 References	9
8 Appendix	10
9 Minutes	13

List of Figures

Figure 1 – Design Iteration 1.....	6
Figure 2 – Design Iteration 2.....	6
Figure 3 - Gantt Chart	10

1 Introduction

Soapbox racing is a gravity-propelled downhill sport where teams build single-seater vehicles to compete against one another.

The main aim of the project was to design a gravity racer to enter the Richards Castle soapbox derby. The design will consist of a custom frame and utilise off-the-shelf parts.

A team planner took the lead on team organisation and each member of the team took responsibility for an area of the project, with all areas having consideration and work as a team. Communication is through Microsoft Teams, due to the current situation.

2 Literature Review

Initial research was conducted into the regulations of the event, the course, and likely conditions. The course is relatively simple, so the design should be simple and focus on light weight design. The course was viewed online videos of previous runs (Soapbox course full run, 2010).

"The course is 550m long with a descent of 50m. It should be noted that this is not indicative of the gradient of parts of the course. In places it is much steeper, and participants can expect to reach 30-40mph. Soap boxes will be given the opportunity of at least three runs and will set off singly at intervals, electronically timed." (*Richards Castle Soap Box Derby Regulations*, 2020)

The most notable design regulations from section 2 of Richard's Castle Technical, Design and Structural Regulations are as follows. Dimensions; length 2500mm and width 1500mm, wheel quantity: 4, 3 or 2? Ground clearance should be at least 50mm to clear the starting ramp, and the brakes need to hold the soapbox stationary on a 1 in 8/7.13°/12.5% hill.

The kart must be designed with 'pedestrian friendly sympathies' implying no sharp edges on the exterior, also interior protrusions (examples given are steering columns and brake levers) should be carefully designed to keep the driver safe in the event of a crash/rollover, also bar-end plugs are required on handlebars if used. Our soapbox car needs to adhere to all these rules, cue the design.

The differences between four and three wheeled designs were considered. 3 wheels is beneficial as a roll hoops may not be needed, as the regulations state *"Soapboxes based on a conventional bicycle or tricycle frame a roll bar is not compulsory but a 3-wheeler constructed from tubular steel or similar then a roll bar is compulsory"* (*Richard's Castle Soap Box Derby Regulations*, 2020).

Therefore, the frame will be constructed to resemble a "conventional" tricycle frame. A detachable roll hoop will be designed in case it was needed during scrutineering as the regulations are vague. We also considered a 4-wheel design as that would offer great stability, however we decided against it for simplicity of the steering, as well as weight.

The main materials researched were steel and aluminium tube sections. Specifically, 4130 Chromoly Steel and 6082-T6 Aluminium. 4130 Steel is durable, has good strength to weight, widely available, easy to work and is corrosion resistant. (Kumar *et al.*, 2019). 6082-T6 Aluminium is light weight, has good strength to weight, widely available, easy to work and is corrosion resistant. (Bajaj, 2008). Both materials are suitable, we opted for the Aluminium because of its lower weight, despite a lower specific strength compared to the steel. The tricycle frame does not require the high strength offered by steel, for example Plywood would suffice adequately.

The design relies on off-the-shelf parts. As such three main area of research conducted was into BMX, mountain bike and wheelchair parts. BMX parts are widely available, cheap, strong. Mountain bike parts are widely available and strong. BMX and mountain bike parts were considered for the front end (steering and brakes) and the front/rear wheels. Wheelchair parts were considered as they are designed to be mounted on one side of the axle where the other are not and as such are stronger than their BMX or mountain bike counter parts.

Multiple braking methods were considered including, disk brakes, V/U brakes and a braked rear axle. These braking methods we considered for the front and rear wheels. The brakes do not need to be very strong to halt the gravity racer.

Welding methods were research for our project. TIG welding was selected as it produces strong welds as described by Singh, G *et al.* (2017).

3 Methodologies

The team planner took the lead on team organisation. Each member of the team took responsibility for an area of the project, however as the project progressed the responsibilities changed to any areas that required work.

As previously mentioned, Microsoft Teams was the hub of communications between team members; this maintains contact and made it easier to share ideas as COVID-19 hampered any efforts to meet in person. Microsoft Teams is an excellent tool to use to run projects as it integrates with other MS programs, meaning multiple people can edit multiple files remotely and file sharing is simple. Microsoft Teams is incorporated into all the Office applications allowing the use of OneNote as file sharing system; therefore, our research was always available for all team participants to view and edit at any time. The sharing of designs and idea was facilitated using photos and drawings in the class notebook section of Microsoft Teams.

Milestones were set and these milestones were then plotted on a Gantt chart (in appendix) to monitor progress of the on the project. These milestones were then further broken up into main aims that needed to be completed at relevant times over the course of the project. Meetings were organised to include three 2hr meetings a week with set agendas. At the end of each meeting the agendas for the next were set. The meetings and agendas were organised through Microsoft Teams. The main aims of the timeline were:

- Team introductions to establish team structure.
- Establish initial planning structure and decide how the plan would be executed amongst the team.
- Complete research into gravity racers, common designs, the course, and the event regulations.
- Produce a basic design concept.
- Write a report encapsulating our design criteria.

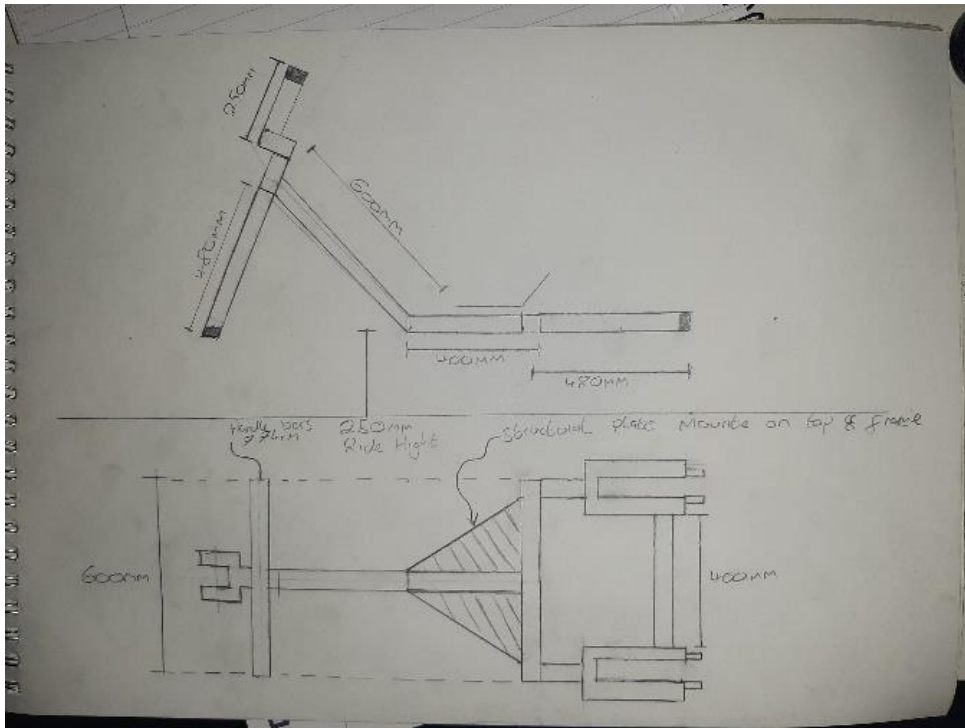
4 Design and Analysis Discussion

A three wheeled design was chosen to simplify the steering and enable the use of bike parts on the front end. Four wheels were considered for stability and the steering design would have been overly complicated and time consuming. A three wheeled design was chosen as a lighter design could be produced if the frame were kept "Conventional" (*Richards Castle Soap Box Derby Regulations*, 2020). A roll hoop was designed in case it was needed during scrutineering.

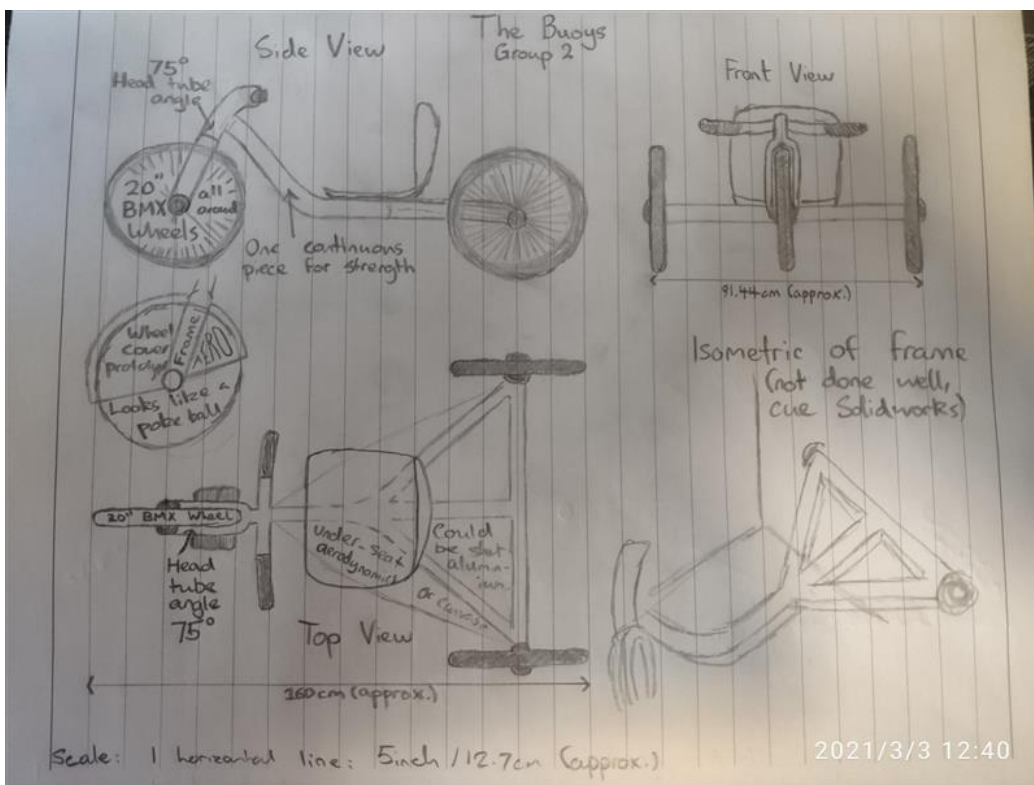
The frame was designed to resemble a conventional trike using tubular frame. The initial design used a tubular frame and utilised BMX forks to attach the rear wheels (Figure 1). A design iteration was created where the main difference is the main structure of the design will include a bent bar in order to eliminate structural weaknesses caused by welding joints as detailed in the design sketch (Figure 2). The rear wheels will now be attached using a small box section through which the axle is attached. The material selected is 6082-T6 Aluminium and its lightweight is an advantage over 4130 Chromoly Steel. Weight was a key consideration of the design. The seat used will be an off-the-shelf "drift trike" seat. The aerodynamics of the racer was considered, wheel covers were considered for drag reduction, but the benefit is minimal, however an 2mm aluminium undertray will be used to minimise the amount of dust and stones kicked up towards the rider.

The cost of the off-the-self parts will be £253.91. The cost of the 6082 Aluminium tubular stock will be roughly £34.44 for the frame and additional stock for the undertray and rear wheel mounting for £41.12. The total for the project will be £329.47 (Breakdown shown in appendices).

Standard 20-inch BMX wheels were chosen for their wide availability, low weight, and relatively high strength for the task. The steering will be using all traditional BMX parts for simplicity of the design, wide availability, and ease of integration with braking systems. Braking was handled by a U brake on the front wheel as the front forks already have the mounting points and not much braking force is needed to bring the trike to a stop at the end of the course and hold it in position at the top of the start ramp.



1.1 Figure 1 - Design Iteration 1



1.2 Figure 2 - Design Iteration 2

5 Conclusions

The main aims of the project were completed, the project structure helped us manage our time effectively to which results have been produced. Relevant research was conducted into all areas of the design and this was used to produce a basic design with an estimated cost. The group is happy with the outcome of doing group work with people that have never worked together before or met in person. We designed a tricycle gravity racer, together as a team.

6 Evaluation

The team structure worked well, and targets were met despite the complication of not being able to communicate in person or share idea or drawings on paper due to the current global pandemic. Microsoft Teams worked well as a file sharing system, enabled live editing of documents that allowed us to work together on the same document and enabled easy communication through video meetings despite being in different locations. Microsoft Teams is a great tool that we plan on using in future projects.

We experienced difficulties initially in working together as none of the team members had previous experience with this kind of project. These problems were over come through the scheduling of regular meetings with set agendas. Time was taken at the start of the project for the team to get to know each other and establish project responsibilities. Once project structure was in place the project made regular progress.

We had trouble deciding how much research and design development to do as this work may be included in part 2 of the assessment, as a result our research overran the time allocated in the Gantt chart.

7 References

Bajaj, P. (2008) 'Mechanical Behaviour of Aluminium Based Metal Matrix Composites Reinforced with SIC and Alumina', *Department of Mechanical Eng. Thapar University Patiala, 147004*.

Kumar, M. D. *et al.* (2019) 'Design Optimization and Simulation Analysis of Formula SAE Frame Using Chromoly Steel', *Journal of Engineering Sciences*, 6(2), pp. d9–d13. doi: 10.21272/s.2019.6(2).d2.

Singh, G. *et al.* (2017) 'Experimental comparison of friction stir welding process and TIG welding process for 6082-T6 Aluminium alloy', *Materials Today: Proceedings*, 4(2), pp. 3590–3600. doi: 10.1016/j.matpr.2017.02.251.

Richards Castle Soap Box Derby Regulations 2020. Accessible at: <https://www.richardscastlesoapbox.co.uk/race> Date accessed: 1/02/2021.

Soapbox course full run (2010). Accessible at: <https://www.youtube.com/watch?v=OqJlOu7-eVI&feature=youtu.be> Date accessed: 1/02/2021.

8 Appendix

Gantt Chart

The Buoys (Group 2) - Soapbox Gantt Chart

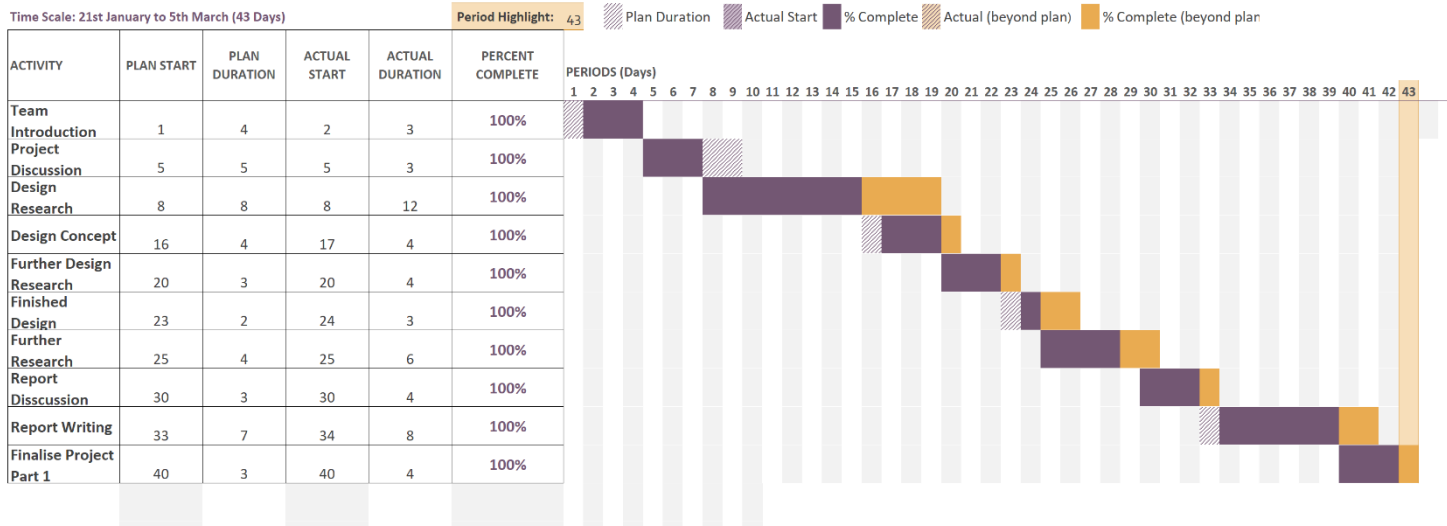


Figure 3 - Gantt Chart

Off-the-shelf parts/materials costing breakdown.

Front Wheel -- Raleigh Trubuild - £20.99

https://www.rutlandcycling.com/components/wheels-wheel-parts/raleigh-trubuild-20x175-inch-junior-front-wheel--black_335082

Head tube -- BFS -- £24.06

<https://bearframesupplies.co.uk/bfs-44mm-head-tube-steel-130mm/>

Front load system -- seal BMX - £7.99

https://www.chainreactioncycles.com/seal-bmx-switch-front-load-stem/rp-prod162975?gs=1&sku=sku600975&utm_source=google&utm_term=&utm_campaign=&utm_medium=base&gclid=CjwKCAiAmrOBBhA0EiwArn3mfAykb-pWRxV1nW2VuPdvP_myOPNztAiWLocrCf6166cUiIK9h82EhoCFnkQAvD_BwE&gclsrc=aw.ds

Rear Wheels -- Raleigh Trubulid - £14.99 x2

https://www.rutlandcycling.com/components/wheels-wheel-parts/raleigh-trubuild-20x175-inch-junior-rear-wheel-silver_319800?currency=GBP&chosenAttribute=RGR720&gclid=CjwKCAiAmrOBBhA0EiwArn3mfB_v9t93VhxNgZnLnMAzXshm2AQ4L2Drk3gWZnQIZFi6BgqTb33WkxoCWxYQAvD_BwE&gclsrc=aw.ds

Headset – FSA Hammer 11/8in threadless – £18.00 (maybe not needed)

[https://www.halfords.com/cycling/bike-parts/headsets-stems/fsa-hammer-1.1%2F8-threadless-headset-544959.html?cm_mmc=Google+PLA- -Cycling%3EBike+Parts%3EHeadsets+and+Stems- -Cycling%3EBike+Parts%3EHeadsets+&+Stems- -544959&istCompanyId=b8708c57-7a02-4cf6-b2c0-dc36b54a327e&istFeedId=62b447cf-331e-4fec-a47a-9985ff72d404&istItemId=xawqlxm&istBid=tzxt&_ \\$ja=tsid:94971|cid:868555867|agid:49387669652|tid:aud-518244443164:pla-329845322560|crd:203456299122|nw:g|rnd:16512837710577229883|dvc:c|adp:|mt:|loc:9045362&gclid=CjwKCAiAmrOBbHA0EiwArn3mfKQLCCE8w8ENPLfpEk0khrpcxG9RoBiiSJgCxyksfipVeeUp1IFd9xoC13gQAvD_BwE](https://www.halfords.com/cycling/bike-parts/headsets-stems/fsa-hammer-1.1%2F8-threadless-headset-544959.html?cm_mmc=Google+PLA- -Cycling%3EBike+Parts%3EHeadsets+and+Stems- -Cycling%3EBike+Parts%3EHeadsets+&+Stems- -544959&istCompanyId=b8708c57-7a02-4cf6-b2c0-dc36b54a327e&istFeedId=62b447cf-331e-4fec-a47a-9985ff72d404&istItemId=xawqlxm&istBid=tzxt&_$ja=tsid:94971|cid:868555867|agid:49387669652|tid:aud-518244443164:pla-329845322560|crd:203456299122|nw:g|rnd:16512837710577229883|dvc:c|adp:|mt:|loc:9045362&gclid=CjwKCAiAmrOBbHA0EiwArn3mfKQLCCE8w8ENPLfpEk0khrpcxG9RoBiiSJgCxyksfipVeeUp1IFd9xoC13gQAvD_BwE)

Handle bars – Blank Niner - £19.99

https://www.chainreactioncycles.com/blank-niner-bmx-bars/rp-prod134958?gs=1&sku=sku488583&utm_source=google&utm_term=&utm_campaign=&utm_medium=base&gclid=CjwKCAiAmrOBbHA0EiwArn3mfKmlcYV2PWMP32yqIVkRLEo_ILSkrlGEwKhysLY0oKHLawuJvd_HpBoCYhkQAvD_BwE&gclsrc=aw.ds

Grips – Renthal – £9.99

https://www.chainreactioncycles.com/renthal-bmx-push-on-grips/rp-prod49150?gs=1&sku=sku173559&utm_source=google&utm_term=&utm_campaign=&utm_medium=base&gclid=CjwKCAiAmrOBbHA0EiwArn3mfIwCwXlrUvF50HSYhTWW1FqdJ26Qcbw3rQeJ3Qomg1oI2iyALYBSuBoCcBIQAvD_BwE&gclsrc=aw.ds

U Brakes – Jet BMX Pro - £16.99

https://www.sourcebmx.com/products/jet-bmx-pro-v-brake-kit?variant=31801774801007¤cy=gbp&gclid=CjwKCAiAmrOBbHA0EiwArn3mfFAdzLB1ZyQUOBzIXAerzi1rN3LViMJOFFc0Y3Zi3C27fCoW9b7bvxoCdDEQAvD_BwE

Seat – FFS Seat - £18.94

https://www.amazon.co.uk/Replacement-Seat-for-Drift-Kart/dp/B079T3PPSF/ref=asc_df_B079T3PPSF/?tag=googshopuk-21&linkCode=df0&hvadid=278548372216&hvpos=&hvnetw=g&hvrand=4092385789250843699&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9045362&hvtargid=pla-432657831775&psc=1

Forks – Chrome threadless - £25.00

https://www.ebay.co.uk/itm/183759969482?var=0&mkevt=1&mkcid=1&mkrid=710-53481-19255-0&campid=5338343596&toolid=10001&customid=eb%3Ag%3Avms%3Aeb%3Ap%3A183759969482%3BCjwKCAiAmrOBbHA0EiwArn3mfI00VkJMkof3xqk8aSvA2zOMbSw5qgJwEz45Ikh12xWsENRwEfNtxoCKKMQAvD_BwE&gclid=CjwKCAiAmrOBbHA0EiwArn3mfI00VkJMkof3xqk8aSvA2zOMbSw5qgJwEz45Ikh12xWsENRwEfNtxoCKKMQAvD_BwE

Headset spacers optional – Brand-X - £3.99

https://www.wiggle.co.uk/brand-x-spacer-pack-alloy-5-x-10mm-1?lang=en&curr=GBP&dest=1&sku=100280768&kpid=100280768&utm_source=google&utm_term=&utm_campaign=Shopping+-+All+Products&utm_medium=base&gclid=CjwKCAiAmrOBbHA0EiwArn3mfG1aW0SKtG7ou_PcT_E16NZarSjILKdV3i4_FfjTKsuORTWalsPRsBoC2xEQAvD_BwE&gclsrc=aw.ds

Tyres – Halfords BMX Tyre - £12.00 x 3

https://www.halfords.com/cycling/bike-parts/bike-tyres/halfords-bmx-tyre-20-x-1.95-466345.html?istCompanyId=b8708c57-7a02-4cf6-b2c0-dc36b54a327e&istFeedId=367c5610-f937-4c81-8609-f84582324cd6&istItemId=witxmaqmq&istBid=t&_sja=tsid:94971|cid:868555867|agid:49387669172|tid:aud-487955255419:pla-328627650222|crid:203456299104|nw:g|rnd:8933910983400297233|dvc:c|adp:|mt:|loc:9045362&gclid=CjwKCAiAmrOBBhA0EiwArn3mfGcwmu5BPevZqPgplGgf6m-IT8hnh6y59bGAVZP2rwyFkGeaXC7jkxoCHbMQAvD_BwE

Inner tubes – Schwalbe - £4.00 x 3

https://www.chainreactioncycles.com/schwalbe-bmx-20-tube/rp-prod24639?gs=1&sku=sku83743&utm_source=google&utm_term=&utm_campaign=&utm_medium=base&gclid=CjwKCAiAmrOBBhA0EiwArn3mfCkBNspQpgLfCm-dkqsJ7uPMpHbWj956P0eJlA3VHPFGW8-PA6BXxoCrk0QAvD_BwE&gclsrc=aw.ds

Stunt pegs – Jet BMX CR-MO - £9.99

<https://www.sourcebmx.com/products/jet-bmx-cr-mo-pegs-pair?variant=20039477035119>

Aluminium Undertray - 1m x 1m - £38.73

<https://www.metals4u.co.uk/materials/aluminium/aluminium-sheet/aluminium-mill-finish-aluminium-sheet/3118-p>

Aluminium Tubular Stock - 4m - £34.44

https://www.metals4u.co.uk/materials/aluminium/aluminium-tube/987-p?gclid=CjwKCAiA65iBBhB-EiwAW253W9h4tvHXDGTcJ8nnBK-3A9bWx0Ruu2_Uda7yb8-pkV4OlM5DsQSFmXoCJVAQAvD_BwE&gclsrc=aw.ds

Aluminium Tube for attaching rear wheels - 1m - £2.39

<https://www.metals4u.co.uk/materials/aluminium/aluminium-tube/973-p>

Total £329.47

9 Minutes

Note: this contains 2,713 words and makes up >50% of the report.

Date of meeting no. 1: 1st February 2021
Start time of meeting: 15:00
Finishing time of meeting: 16:11, 1hr 11mins
Attendees: Tom (leader), Jake, Evan
Absentees: Bartosz, Liam
Location: Online using Microsoft Teams

Date of next meeting: 4th February 2021
Time of next meeting: 15:00
Location of next meeting: Online using Microsoft Teams

Agenda

- Team Introduction.
- Plan future meeting times.
- Discuss Initial designs and research.
- Decide on a team manager.

Discussion

- Meet and greet discuss each team members skills and previous experience.
- Meeting times discussed and concluded that future meetings will occur every Monday, Wednesday, and Friday at 1330 for 1 1/2 hours unless otherwise publicised.
- Soap box regulations and initial design criteria are discussed, four wheels for stability or three for simplicity? Two wheels is out of the question/not happening.
- Materials; steel, aluminum, alloys, composites? To come.

Summary?

No conclusions set in stone as of now, purely discussion as first meeting.

Agender for next meeting

- Investigate frame designs.
- Research wheels, tyres, and brakes.

Date of meeting no. 2: 4th February 2021
Start time of meeting: 15:00
Finishing time of meeting: 16:20, 1hr 20mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 5th February 2021
Time of next meeting: 12:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Frame diagrams and plans.
- Resume team meet, greet and introductions.
- Tyres and wheels.
- Plan future meeting times.

Discussion

- Compare photos and technical sketches of tricycle frames and think about how ours will be designed.
- Examine rolling resistance figures about tyres and thinking of wheel sizes for the trike, 26" wheels liked at the time (to be changed)
- Meeting times discussed and concluded that future meetings will occur every Monday, Wednesday, and Friday at 1330 for 1 1/2 hours unless otherwise publicised.

Summary?

- Tricycle with the singular front wheel is agreed upon.
- Tyres; a road bikes for speed, or MTB for grip? More research and chatting needed.

Agender for next meeting

- Wheels and tyres
- Preliminary frame design concepts
- Plan a time scale for the project, the Gantt Chart.

Date of meeting no. 3: 5th February 2021
Start time of meeting: 12:30
Finishing time of meeting: 13:57, 1hr 27mins
Attendees: Tom (leader), Bartosz, Jake, Evan
Absentees: Liam
Location: Online using Microsoft Teams

Date of next meeting: 8th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Wheels and tyres
- Preliminary frame design concepts
- Plan a time scale for the project, the Gantt Chart.

Discussion

- Confirmed schedule for meeting times (Mon, Wed & Fri @ 13:30)
- Divide the project into smaller manageable sections, discussions to who leads what.
- Gantt chart template chosen and begins to fill with information.

Summary?

- Team management/organisation
- Documents ready for research about the soapbox trike.

Agender for next meeting

- Confirm tasks and jobs for all.
- Discuss meeting no. 3.
- Basic cost analysis
- Basic design and finalise (all next week)
- Roll bar, necessity or unnecessary?
- Minute's re-format

Date of meeting no. 4: 8th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 14:56, 1hr 26mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 10th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

Confirm tasks and jobs for all.

- Discuss meeting no. 3.
- Basic cost analysis
- Basic design and finalise (all next week)
- Roll bar, necessity or unnecessary?
- Minute's re-format

Discussion

- Team members assigned to different elements of the trike.
- Glossed over meeting 3 due to Liam's absence. o_o
- Frame, wheels, forks, handlebars, bearings, brakes, seats...
- Verdict on the roll bar's existence still uncertain.
- Minutes have been reformatted to how they look now.
- First sketch of frame drawn photo next page (artist: Jake).

Summary

- Wide variety of off-the-shelf parts discussed, and this approach is fully agreed upon.
- First visualisation of how the frame will look, and we all like it.
- Documents; report, minutes and Gantt chart all coming on strong.

Agender for next meeting

- Discuss assignment brief and break down the report.
- Gantt planner
- Design
- Materials
- Costing

Date of meeting no.5: 10th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 14:50, 1hr 20mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 12th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Discuss assignment brief and break down the report.
- Gantt planner
- Design
- Materials
- Costing

Discussion

- Begun structuring the report, to be continued.
- Gantt planner originally proposed by Liam is pronounced over-complicated; a new template is found, and data is transferred.
- Materials: Aluminium 6082 is suggested and liked for its all-round great properties.
- Costs discussed, to keep them down off-the-shelf parts are further researched.

Summary

- Documents are starting to look professional, progress ongoing.
- Material choices are between 6082 Aluminium and 4130 Steel.

Agender for next meeting

- Check progress from previous meeting.
- Design
- Materials
- Costing
- Show our faces.

Date of meeting no. 6: 12th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 14:10, 40mins
Attendees: Tom (leader), Jake (late), Evan, Liam
Absentees: Bartosz
Location: Online using Microsoft Teams

Date of next meeting: 15th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Check progress from previous meeting.
- Design
- Materials
- Costing
- Show our faces.

Discussion

- Aluminium: grade 6082 favoured for frame construction, Metals4U source tubes of it with a 38.1mm diameter and 3.2mm thickness, costing around £10 per metre, this reduces with more purchased (1000mm = £11.48, 6000mm = £45.92, ~25% less!). Discussed how much we need but unsure as of now. Steel has slowly phased out of the discussion due to its high weight.
- Wheels: 20" BMX wheels favoured, although the hubs may need changing and that would require re-spoking each wheel. Not expensive but time-consuming.
- Following the costing talk from last meeting, off-the-shelf steering components are researched; the BMX platform will offer more inspiration due to simplicity (the reason we went with a 3-wheel platform, not 4, to Liam's despise).
- Only Liam turned on his webcam, everyone else could not be bothered lol.

Summary

- Aluminium is now the material of choice for the frame. To be scrutinised
- Off-the-shelf BMX parts are favoured, further research to come.

Agender for next meeting

- Catch up from last meeting.
- Discuss frame design changes and different wheel options.

Date of meeting no. 7: 15th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 15:40, 1h 10mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 17th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Catch up from last meeting.
- Discuss frame design changes and different wheel options.
- Head set and steering finalise.
- Materials research
- Further costing
- Discuss Report

Discussion

- Frame: research mainly regarding the rear (axle), diagram drawn see below.
- Wheels: wheelchair wheels considered for the rear to reduce complexity and save weight, may also alleviate the need to re-spoke wheels at the cost of limited tyre options.
- Steering: BMX headset investigated; decision unsure but due to other parts from it being used this will likely be the case.

Summary

- We have a good idea of what we want the frame to look like at this point, design subject to change but will be something like above.
- Still unsure about wheels (which will heavily influence frame design) so to be confirmed.

Agender for next meeting

- Catch up from last meeting.
- Discuss Report
- Materials Costing?
- Finalise Parts Collection
- Gantt to be more complete.
- Aerodynamics?

Date of meeting no. 8: 17th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 15:41, 2hrs 11mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam (late)
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 19th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Catch up from last meeting.
- Discuss Report
- Materials Costing?
- Finalise Parts Collection
- Gantt to be more complete.
- Aerodynamics?

Discussion

- Wheels: discussion leans towards bicycle wheels due to the wider tyre options (what a joke lol) and wheel hubs, disc brakes also considered. Wheelchair parts have not been forgotten however, re-spoking the wheels is the deciding factor at this time.
- Aerodynamics: a layer over (and/or under) the frame is discussed, material is between aluminium for strength or canvas for lightness.
- Further regarding the above point, the seat and how it will be mounted is discussed. A small sheet of aluminium (or maybe even steel to minimize flex, galvanic corrosion however) underneath it may be needed. Failing this a mounting bracket can be fabricated, its size will depend on the dimensions of the seat and frame.
- Documents: the report is now structured and beginning to fill with info, likewise with the Gantt chart.
- Liam's detention for being late was to create the frame in Solidworks, as not required it is merely a 3D visualisation of the frame (unfinished as of then), but handy for dimensions and finding specific OTC parts.

Summary

- Further design considerations regarding the frame and components.
- Aerodynamic improvements now being considered, further research to come.
- Report writing coming on strong.

Agender for next meeting

- Focus on report.
- Gantt planner
- Academic references

Date of meeting no. 9: 17th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 14:51, 1hr 21mins
Attendees: Tom (leader), Bartosz, Jake, Liam
Absentees: Evan
Location: Online using Microsoft Teams

Date of next meeting: 22nd February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Focus on report.
- Gannt planner
- Academic references

Discussion

- References: articles regarding materials, notably Aluminium 6082 are read and noted.
- Gannt planner is updated with notable design ideas.
- The report's discussion section is now planned and being written, to progress.

Summary

- Progress on referencing, important that.
- The report is as above.
- Same with the Gannt chart.

Agender for next meeting

- Project report
- Materials Costing
- Finalise Parts Collection
- Aerodynamics

Date of meeting no. 10: 22nd February 2021
Start time of meeting: 13:30
Finishing time of meeting: 14:43, 1hr 13mins
Attendees: Tom (leader), Bartosz, Jake, Evan, Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 25th February 2021
Time of next meeting: 11:00
Location of next meeting: Online using Microsoft Teams

Agenda

- Project report
- Materials Costing
- Finalise Parts Collection
- Aerodynamics

Discussion

- The report's literature review/research section now contains the major design considerations with the rules of the soapbox race, as well as materials.
- An undertray is discussed, benefits include a cleaner air passage under the trike and a reduction in stones/dirt/etc. being kicked up towards the rider. Materials are between Aluminium and canvas for (obvious) reasons previously mentioned.
- Costing: approximate measurement of frame material calculated, rounded up to 4 metres (£34.44 for 4,000mm). This does not include the undertray or bodywork.
- Parts discussions involve the rear wheels and attaching them; hubs and bearings of different types considered, wheels discussion still torn between bicycle and wheelchair.

Summary

- Further design considerations made; specifics unsure but the ideas are liked.
- Documents are starting to look markable.

Agender for next meeting

- Continue writing report.
- Gantt planner
- Minutes

Date of meeting no. 11: 25th February 2021
Start time of meeting: 11:00
Finishing time of meeting: 12:38, 1hr 38mins
Attendees: Tom (leader), Bartosz, Jake, Evan
Absentees: Liam
Location: Online using Microsoft Teams

Date of next meeting: 26th February 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Continue writing report.
- Gantt planner
- Minutes

Discussion

- Report's literature review section is close to completion.
- Gantt planner is now up to date.
- Liam's detention (habit) is the Minutes, up to date as of now.

Summary

- Our large amount of research is now mostly drafted into report form, with the other documents coming on strong too.

Agender for next meeting

- Report writing, the next week is the last week.

Date of meeting no. 12: 26th February 2021
Start time of meeting: 13:30
Finishing time of meeting: 15:34, 2hrs 4mins
Attendees: Tom (leader), Bartosz, Jake, Evan (silent), Liam (technicalities)
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 1st March 2021
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Report writing, the next week is the last week.

Discussion

- The report draft has continuous improvement with more information and conciseness of language, not much else to say.

Summary

- Progress on the report, the due date is coming.

Agender for next meeting

- More report writing, this will commence the last week of this assignment.

Date of meeting no. 13: 1st March 2021
Start time of meeting: 13:30
Finishing time of meeting: 15:18, 1hr 48mins
Attendees: Tom (leader), Bartosz, Jake, Evan (silent), Liam (late)
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 2nd March 2021
Time of next meeting: 15:00
Location of next meeting: Online using Microsoft Teams

Agenda

- More report writing, this is the last week of the assignment.

Discussion

- Methodology section is now close to completion, literature review is extensive and the design analysis coming along nicely. Word count is more than 1,000.

Summary

- As we are all working together on the report, not much else to say apart from it is going well.

Agender for next meeting

- Brief meeting to check over all the files that we have created and organise what will be submitted.

Date of meeting no. 13.5: 2nd March 2021
Start time of meeting: 15:00
Finishing time of meeting: 15:44, 44mins
Attendees: Tom (leader), Bartosz, Jake, Liam
Absentees: Evan
Location: Online using Microsoft Teams

Date of next meeting: 3rd March 2021
Time of next meeting: 11:00
Location of next meeting: Online using Microsoft Teams

Agenda

- Shorter meeting scheduled outside the normal routine, sorting out data.
- Discuss exactly what needs doing before the submission date.

Discussion

- MS Teams > Files are now all sorted into folders, looking lovely and organised.
- Project write-up assessed and plan finalised, to progress onwards.

Summary

- Sorted the data on Microsoft Teams' files and class notebook sections, ready to get this assignment done.

Agender for next meeting

- Project writing

Date of meeting no. 14: 3rd March 2021
Start time of meeting: 11:00
Finishing time of meeting: 13:22, 2hrs 22mins
Attendees: Tom (leader), Bartosz, Jake, Evan (silent), Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 4th March 2021, second to last
Time of next meeting: 15:00
Location of next meeting: Online using Microsoft Teams

Agenda

- Project writing

Discussion

- Slow but continuous improvement to the report draft, begun transferring the data from the class notebook to the report template.
- Minutes and Gantt documents also close to completion.
- We discussed text colour; a dark purple is liked but probably not allowed.
- Discussed the need for another meeting, another x.5 is scheduled.

Summary

- The final push to get the assignment done is undergoing.

Agender for next meeting

- Continuous improvement of the report, ready to submit at the end of the week.

Date of meeting no. 14.5: 4th March 2021
Start time of meeting: 15:00
Finishing time of meeting: 16:15, 1hr 15mins
Attendees: Tom (leader), Bartosz, Jake, Evan (silent), Liam
Absentees: None
Location: Online using Microsoft Teams

Date of next meeting: 5th March 2021, the last one!
Time of next meeting: 13:30
Location of next meeting: Online using Microsoft Teams

Agenda

- Continuous improvement of the report, ready to submit at the end of the week.

Discussion

- Worked on the formatting of the report, inserting Minutes and Gantt chart to the report.

Summary

- The final push to get the assignment done is undergoing.

Agender for next meeting

- Finish and submit the report. :O

Date of meeting no. 15: 5th March 2021 the last one!
Start time of meeting: 13:30
Finishing time of meeting: 16:15, 1hr 15mins
Attendees: Tom (leader), Bartosz, Jake, Liam
Absentees: Evan...
Location: Online using Microsoft Teams

Date of next meeting: The end, bring on part 2!
Time of next meeting: Unknown, probably 13:30
Location of next meeting: Online using Microsoft Teams, most likely

Agenda

- Finish and submit the report. :O

Discussion

- Proofread every section, minor improvements all over, the report is DONE.

Summary

- We did it, we designed a tricycle and wrote about it!

Agender for next meeting

- Get waved in celebration and await further instructions.

End of report, thank you for reading.