A level NEA coursework

Bethany Bright

Candidate number: 1023

Centre number : 62451

Anything outlined like this shows feedback from clients

Any photo with this border is primary research

These show photos which appear for the second time

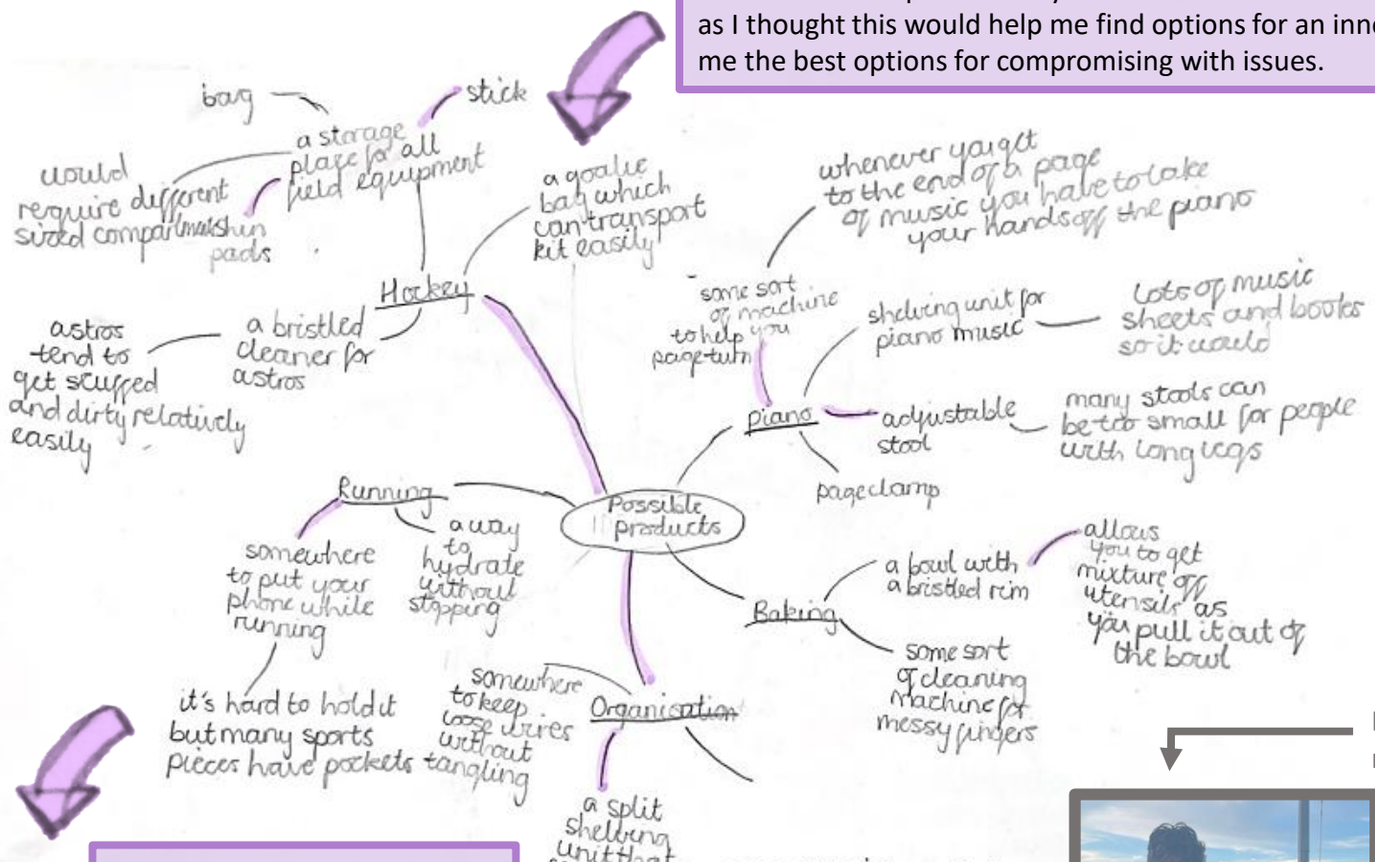
Photos outlined like this are videos or audio

Any photo with this border is secondary research

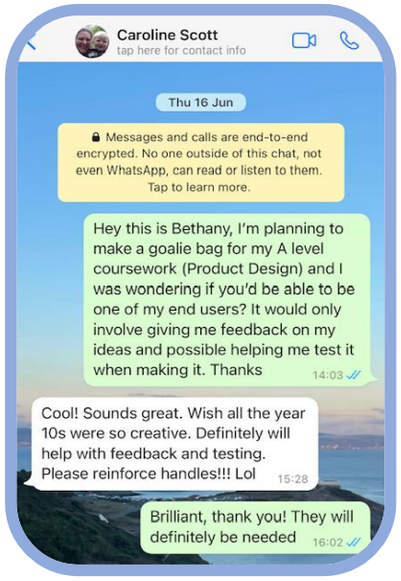
Any textbox like this is my response to feedback

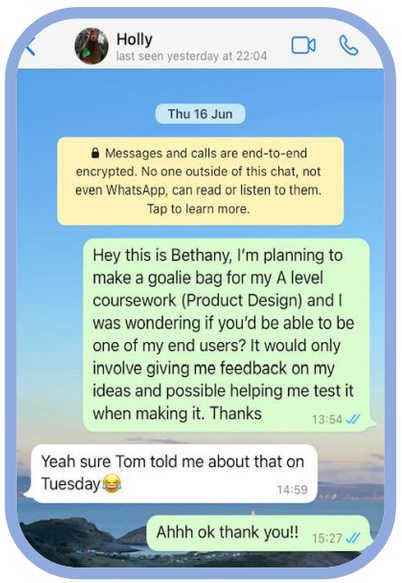
Investigation into context

To start off my project I was brainstorming **everyday issues** I have to do with my hobbies and the possible ways I could over come them with the help of a product as I thought this would help me find options for an innovative product. This gave me the best options for compromising with issues.



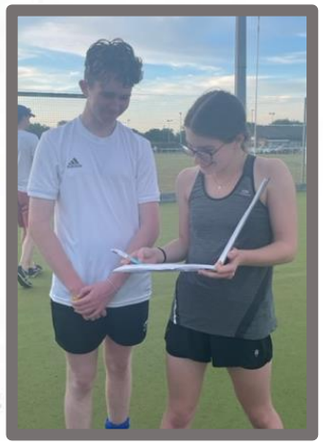
Goalkeepers are responsible for looking after lots of kit and need an easy way to transport this for both training purposes and games. As a goalie myself, I am aware of how heavy the kit can be and how uncomfortable and a lot of the current bags on the market can be expensive





Here I asked other goalkeepers at my clubs if they would be able to help me by giving me feedback and testing my product. This is how they responded.

Here I was talking to a potential end user and together we choose some good options for my project moving forward and then went on to look at the issues in more depth

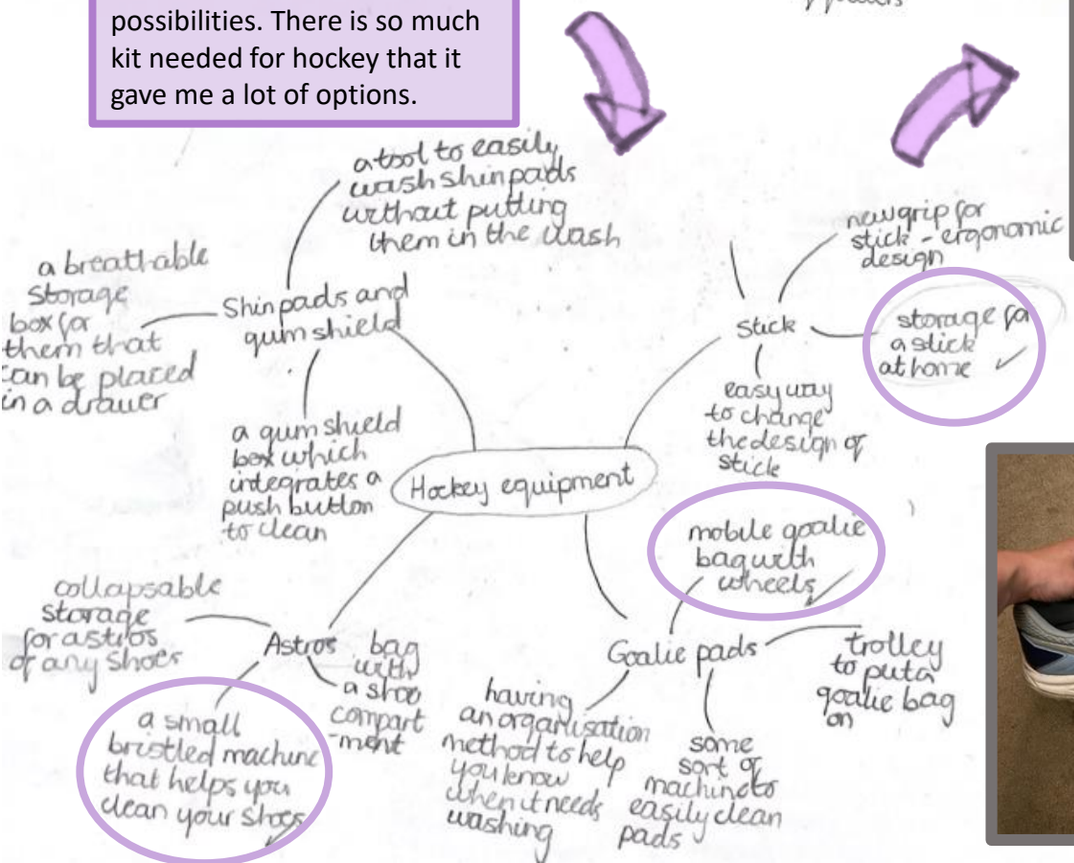


Feedback on two of the three circled ideas:

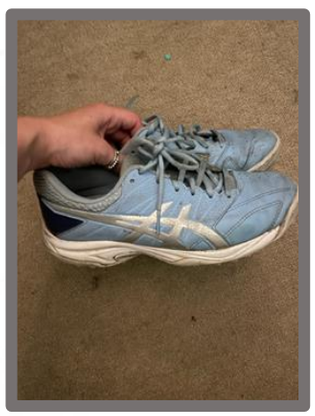
'storage for a stick at home' – I think it would be very useful as there would mean there is a set place to put your stick alongside other hockey equipment. Most people do just use their stick bag but it would keep things more organised which is helpful.

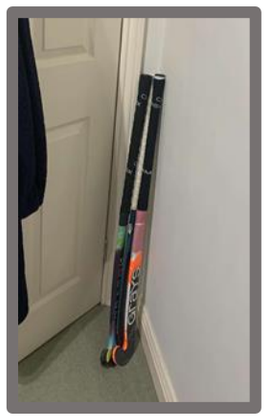
'a small bristled machine which can help you clean your shoes' – The Astro brush sounds good because mud means the shoes become less grippy however it could just be easier and cheaper to wipe your shoes with a clothe. Most pitches are kept in condition and Astros don't tend to get too muddy.

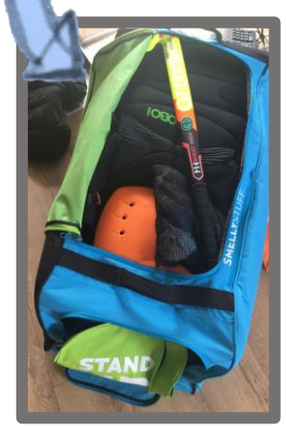
I looked into more detail at the kit goalkeepers use/need and brainstormed more possibilities. There is so much kit needed for hockey that it gave me a lot of options.



As you see below Astros don't get very muddy as people hockey players don't tend to play on grass so the 'astro cleaner' wouldn't be the most useful.







Most people use their stick bags for storage but it still would've been a useful product for a few people.

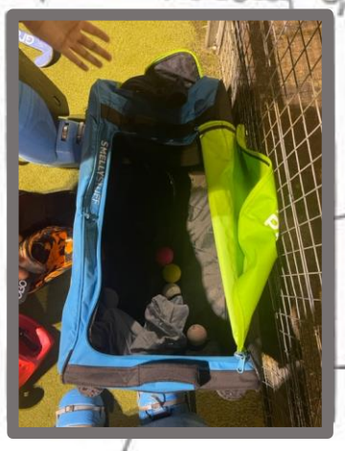
Next steps - Look specifically at the issues with a goalie bag and issues surrounding transport

Investigation into context

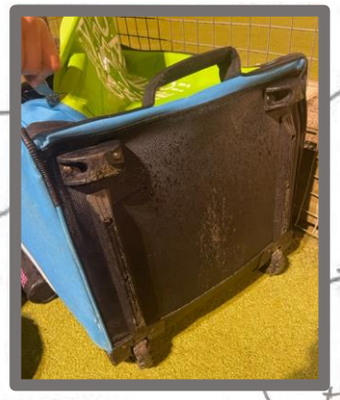
After talking to my end users, we decided that the best idea moving forward would be the goalkeeper bag as I have many other goalkeepers at my club who can help me with feedback etc. as well as posing enough challenge. I then started to have more of a think about the possible components and looked into specific goalie bag issues

the bag has alot more depth so it can fit loads into it

these stoppers can get in the way if you drop the bag



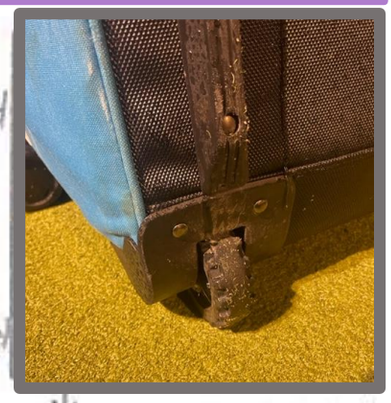
has a small handle on the end for small adjustments once the bag is on the floor



the poles give the base of the bag a sturdy and rigid bottom

only two wheels which can cause it to be unbalanced

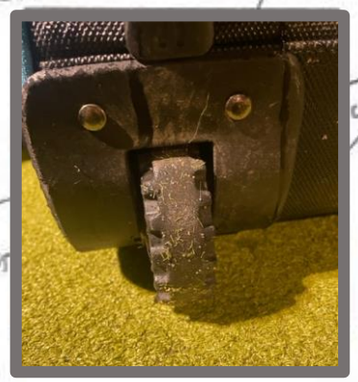
the bags tend to get scuffed by the wheels



more waterproof material / water resistant

the top of the pocket opens fully to maximise opening

rim around the bag means there is less space for putting kit in



the wheels have little grooves to make them more grippy

If I make the wheels bigger then it will be easier for the bag to move over gravel and grass

small fixings that don't ruin the aesthetics of bag

small wheels that can struggle with large gravel / sediment

lots of kit needing lots of space

one big pocket makes it hard to organise

Potential components for the bag

- One large main pocket for the kit
  - ↳ separates for middle, head and foot pads?
- a cooling pocket to keep drinks a food
- large enough to fit a stick in it
- waterproof material that is breathable
- wheels for transporting?
- multiple ways to carry - backpack straps

One of the other goalkeepers said some of the things she didn't like about her bag and together we made a list of other components the bag could have.
In the photo on the right Holly is writing the comment below....

I have to pack everything in a specific order to make it fit and the wheels are too small

Potential opportunities

some bags with wheels have a retractable

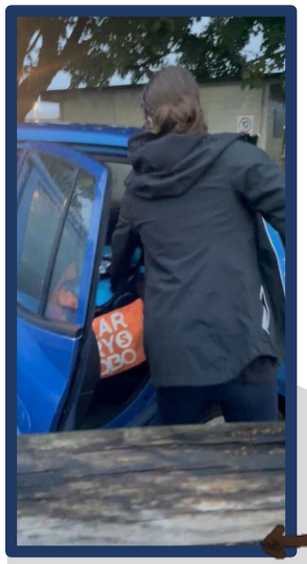
these are the main competition for my bag

there is a fairly large market however it won't grow much

they all come in similar colours so there is potential for them to be made in different colours

most of these bags have wheels as well as a carry handle

After my research and talking to end users, I have chosen to move forward with issue of transporting the kit rather than the actual bag itself!



CLICK TO WATCH

The main problem is being able to easily **transporting** a field hockey goalkeeper kit bag due to the **size** and **weight** of the contents and actual bag. As you can see in the video the bag needs lots of space around the car to avoid hitting other cars and can also be quite awkward to carry due to its size.

STRENGTHS	WEAKNESSES
• I train/play hockey three times a week – lots of time for feedback • Lots of useful contacts with other goalies	• Not many options for materials • Online resources don't allow you to look at hockey bags in much detail so it'll be harder to work out how components are put together
OPPORTUNITIES	**THREATS**
• Cost of bag – I should be able to make mine cheaper • Aesthetics and design of the bag in general – could use more colour than most bags	• Don't have the right equipment for making at school • There are already a range of bags available so it may not have much market potential

Here I started to get a few ideas about the market potential and the key components of a field hockey goalkeeper bag. This also helped me to come up with potential components as seen above. Goalie bags go for a range of prices between about £30 - £300 depending on the size and make of the bag.
Another issue I've noticed is there is such a range of goalie bags available it may be hard to place mine in the market

Next steps - introduce end users and look at key issues

Design Brief

Primary users

NAME: Tom Tyler
AGE: 17
LOCATION: Berrick Salome
INTERESTS: Hockey (both umpiring and playing), Sailing
EDUCATION: Sixth form at Abingdon Boy's school (currently doing A levels)
CURRENT TEAM(S): Men's 1s, 2s and 3s

'I've been playing hockey for about 9 years (since under 8s) and my biggest hockey achievement would either be playing county hockey or winning the club cup in 2022. The thing enjoy most is the social aspect of it and meeting people who .'

NAME: Holly Geggus
AGE: 15
LOCATION: Watlington
INTERESTS: Hockey, football
EDUCATION: Year 10 at Icknield Community College (halfway through GCSEs)
CURRENT TEAM(S): Ladies 1s

'I started playing hockey 10 years ago but have only been playing in goal for 5 of those years. In 2022, I won female young player of the year for the club which is one of my biggest hockey achievements up to date. And lastly, my favourite part about hockey is having a chance to socialise with people that don't see often (at school), just being out on the pitch and playing matches.'

NAME: Caroline Scott
AGE: 43
LOCATION: Benson
INTERESTS: Hockey
OCCUPATION: Teacher
CURRENT TEAM(S): Ladies 2s

How long have I been playing hockey?
I have played hockey since school, on pitch, but began in goal in 1999. I joined Rover Oxford in 2002 and played National League South for 9 years.
I then took 10 years out to have my family, returning to play again in October 2021.

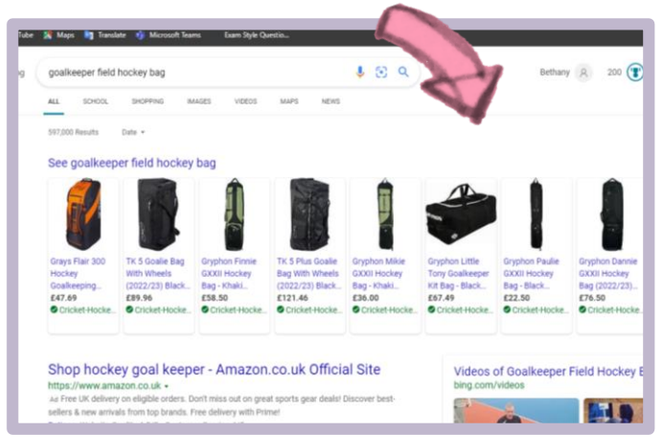
What is my biggest hockey achievement?
Playing National League hockey
Being selected to represent South Central Hockey Masters team in June 2022, and having a fab weekend playing the regional finals, keeping clean sheets.

What do you enjoy the most about hockey?
Camaraderie, being with similar minded people who love the sport and are competitive. Who can share a giggle and be with you for the highs and lows.

I will involve my primary users by asking for feedback on the majority of my pages and all the aspects of my product. For example, suggesting the materials they'd like it and what they like about their current goalie bags but also how they would improve it.

My Brief

I would like to make something that will help me to transport the a field hockey goalkeeper bag and so needs to be suitable for both Astro and gravel. The actual structure of the product needs to be strong and durable. After talking to my end users they would want it to be comfortable to use but practical too.



Marketing

Goalkeeper bags/transportation is a necessity for all keepers. However you only have one or two goalkeepers for every team of eleven. So in comparison to how many other players there are in a team, there aren't many goalkeepers. There are also a wide range of simple goalie bags which vary slightly between each design. Most having main pocket with one other on the side.

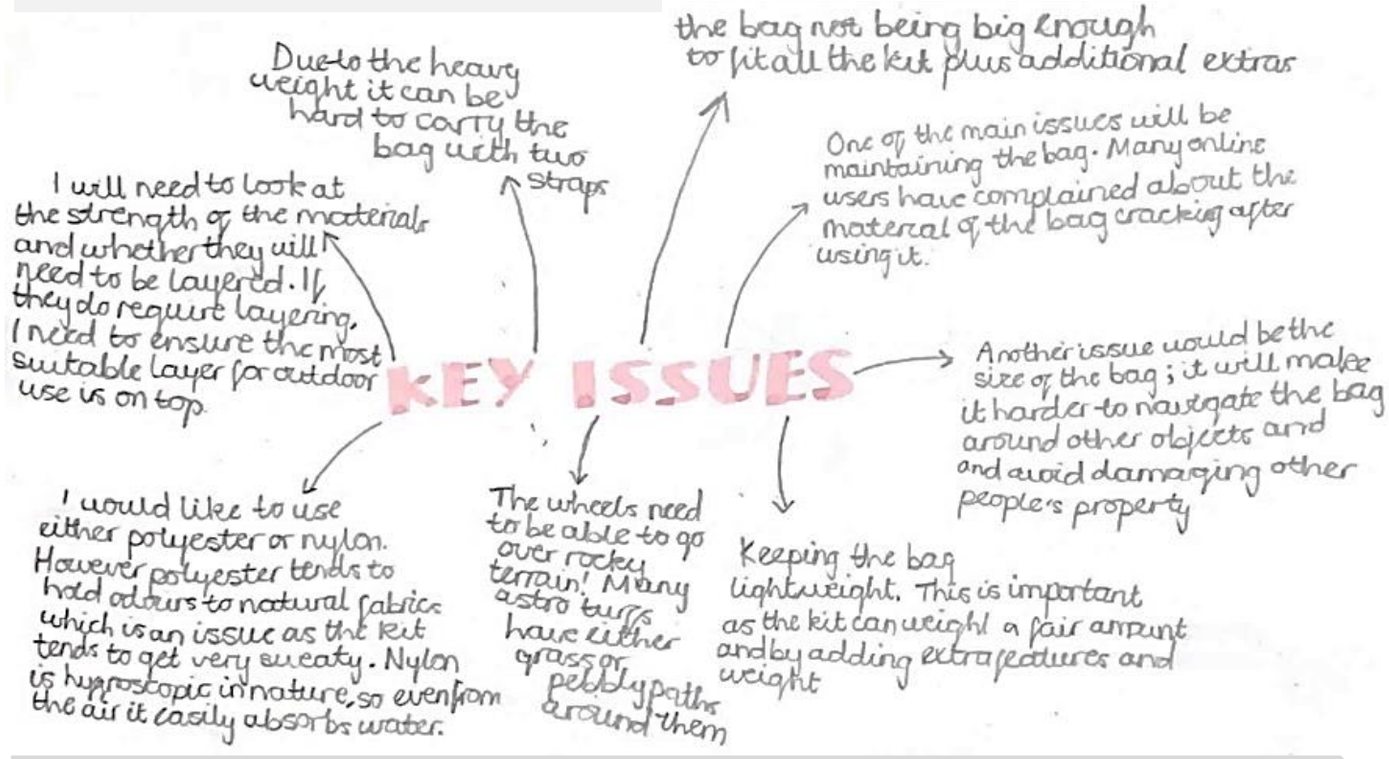
Stakeholders

- End users (Tom, Holly and Caroline)
- Other goalkeepers and club members
- Third party feedback
- Raw material extractors
- Material suppliers
- Manufacturers
- Sales platforms such as Hockey Factory shop
- Transport and delivery drivers

(the last 3 have been explored further on page 5)

Environment of use

This where the kit bag will be used



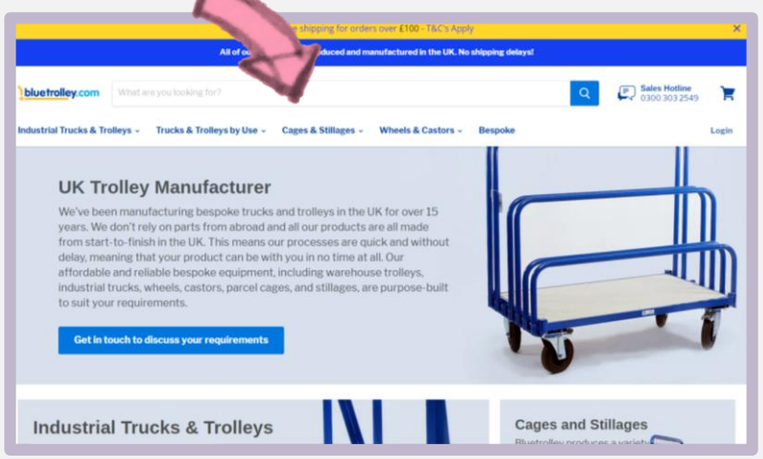
On the next page I will be looking the other potential stakeholders who could be involved in the making of my trolley.

More depth into stakeholders

Manufacturing

In the UK, there are a **wide range** of manufacturers for **sports bags** including hockey, golf and cricket (which require more equipment than other sports). OBO, as mentioned in the selling section is one of the largest manufacturing

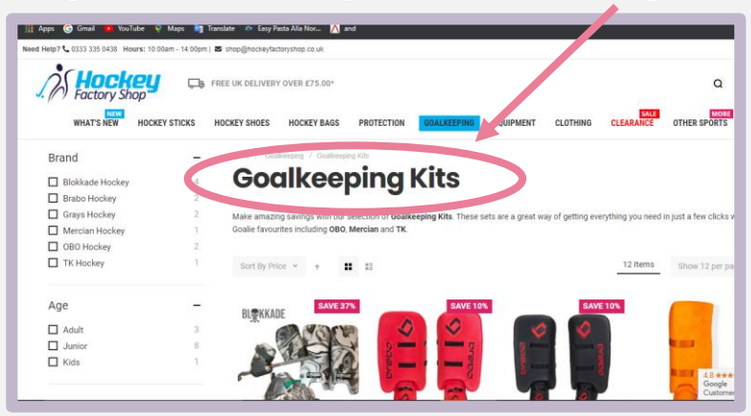
I could also possibly make a **trolley** or **device** the would allow people to **transport their goalkeeper kit**. There are lots of different manufacturers for trolleys in the UK which gives me lots options for who would be able to make them. Below I have a screenshotof the website for an example manufacturer



Selling

The UK favourite brands for goal kit are OBO, Mercian and TK however there are a large range of othe brands such as Grays, Brabo and Blockkade (who all make corresponding bags for their kit). **Many sports shops** sell a range of field hockey including sticks, bags and gloves however the **don't** tend to **cater for galkeepers** as the kit tend to be expensive and large capacity (it would take up alot of shelf space). As a chain store the limited interest goalkeeper kit/accessories would get comparatively to their products means for them it isn't seen as a worthy investment.

Goalkeepers tend to look at **more specialist places online** for kit such as the OBO shop or the Hockey factory shop which would both be suitable place for selling my product. Hockey factory shop have a specific section designated to ‚Goalkeeping Kits' as seen in the image below.

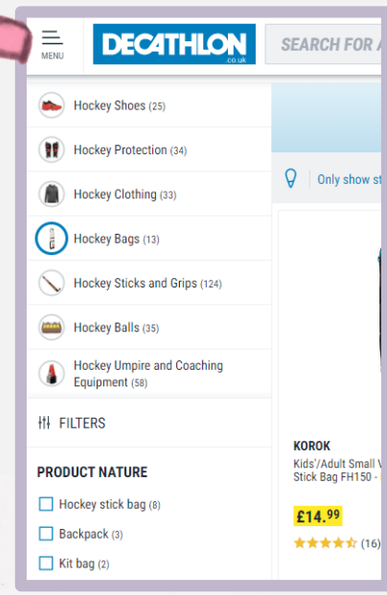


In Wallingford, there is a local sports shop called **'Runwize sports'** who specialise in there hockey equipment due to being near to the **Wallingford Hockey Club** which is less than a mile away from it. They would be a sensible place to put my product while as I am starting up and have limited stock.

Other shops who sell GK kit online include:

- Amazon
- Keeper sport
- Fanatics NHL Hockey
- Davies sport
- Cricket-Hockey.com

All of which are places I could sell my product



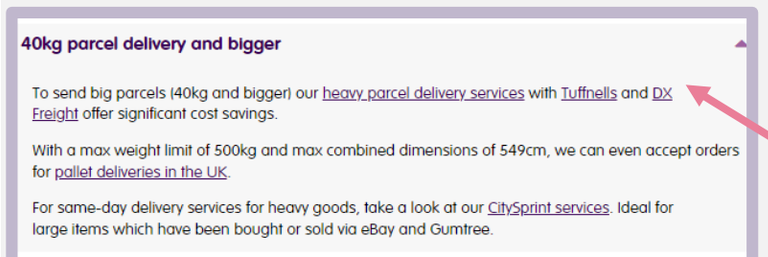
as you can see they have a wide range for other players on the pitch

many will sell them on bid as they need to get rid of them fast

There is also a large retail for goalkeeper kit/ accessories on **second hand websites** like eBay or social media like Facebook due to frequent replacement of kit for younger goalkeepers or kit no longer be needed or used. This however **wouldn't be a sensible place to sell my product** as most things are sold as a 'one-off' but I would like my product to be sold in a larger quantity. However, that being said you can still sell products in quantity if required. It could be a good place to sell the product if it was made once for my project.

Delivery

Most of the **manufacturing companies** have the **option for delivery** and it is important due to the size of the equipment.
For the example of bluetrolley.com the shipping to mainland UK would cost £15 (+ tax on the product) for wheels (or any of the cheaper products being sold) but as soon as the product costs over £100 the shipping is free



These are the prices for delivering a parcel with Royal Mail weighing 30kg (however my product may weigh more and limits the width the product can be). If that is the case then I have the options of the 40kg + delivery in the image on the left. This would include using services such as **Tuffnells** and **DX Freight**.

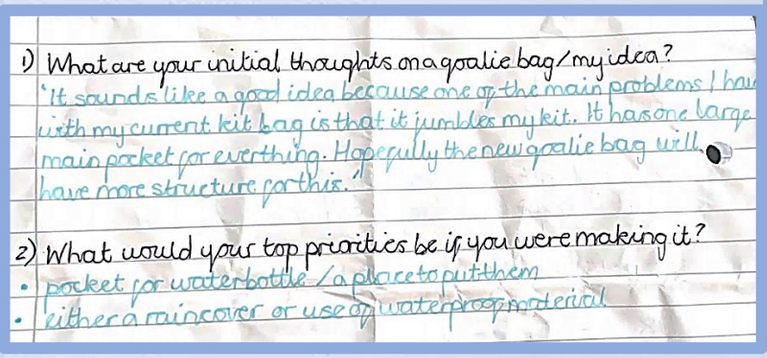
Post Office parcel sizes - UK size guide

	Max Weight	Max Width	Max Length	Max Depth
Small parcel size	2kg	45cm	35cm	16cm
Medium parcel size	20kg	61cm	46cm	46cm
Large parcel size	30kg	1.5m		3m length and depth combined

Investigations into user and stakeholder wants and needs

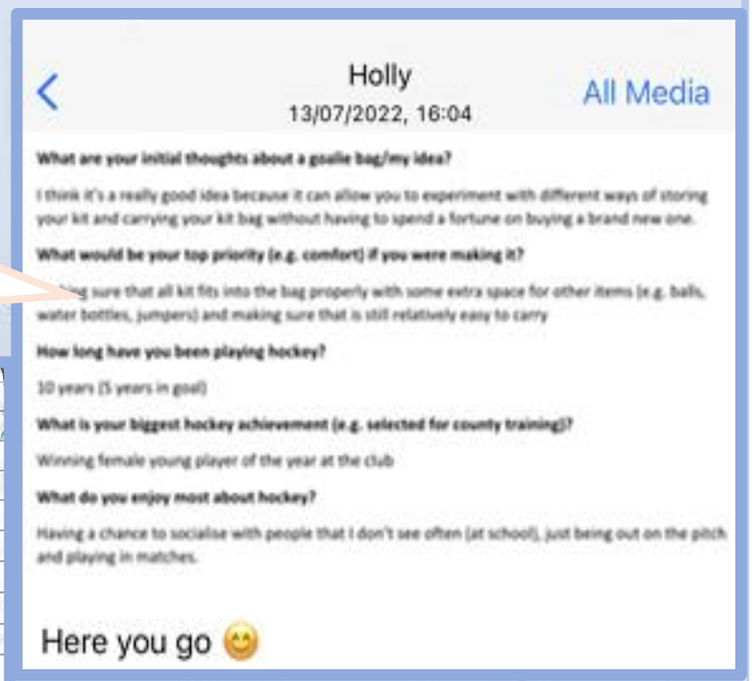
These were the initial wants of three of my end users when I first told them about my idea (‘ a goalie kit bag with wheels and a cooling pocket’).

‘Making sure that all kit fits into the bag properly with some extra space for other items (e.g. balls, water bottles, jumpers) and making sure that it is still relatively easy to carry



1) What are your initial thoughts on a goalie bag/my idea?
"It sounds like a good idea because one of the main problems I have with my current kit bag is that it jumbles my kit. It has one large main pocket for everything. Hopefully the new goalie bag will have more structure for this."

2) What would your top priorities be if you were making it?
- pocket for waterbottle / a place to put them
- either a rain cover or use of waterproof material



Holly
13/07/2022, 16:04
All Media

What are your initial thoughts about a goalie bag/my idea?

I think it's a really good idea because it can allow you to experiment with different ways of storing your kit and carrying your kit bag without having to spend a fortune on buying a brand new one.

What would be your top priority (e.g. comfort) if you were making it?

[illegible] sure that all kit fits into the bag properly with some extra space for other items (e.g. balls, water bottles, jumpers) and making sure that is still relatively easy to carry

How long have you been playing hockey?

10 years (5 years in goal)

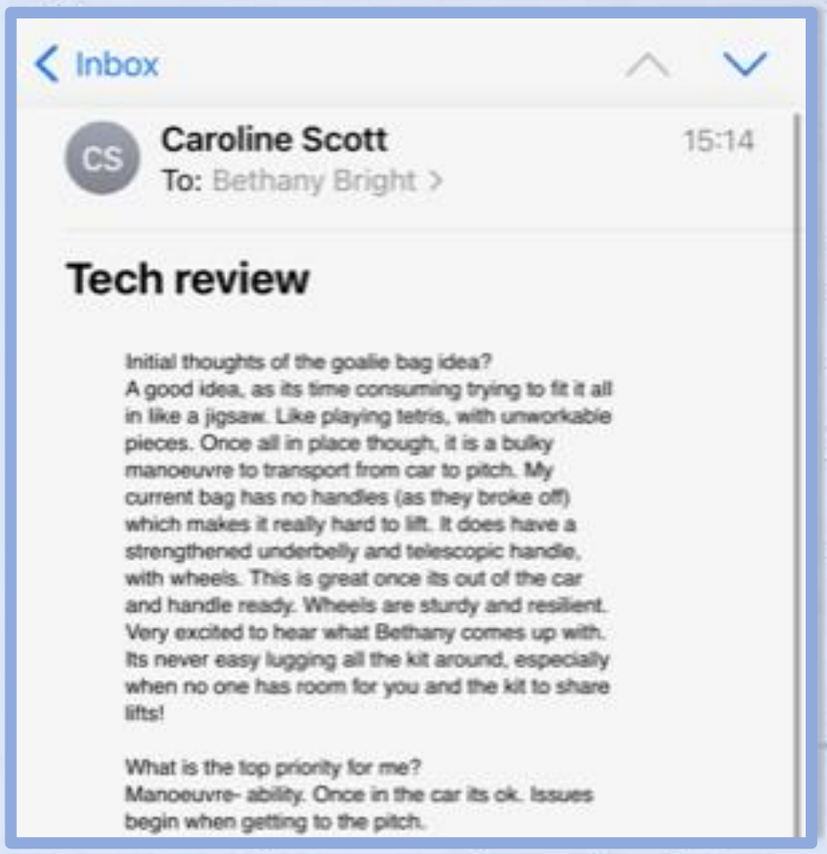
What is your biggest hockey achievement (e.g. selected for county training)?

Winning female young player of the year at the club

What do you enjoy most about hockey?

Having a chance to socialise with people that I don't see often (at school), just being out on the pitch and playing in matches.

Here you go



Inbox

Caroline Scott 15:14
To: Bethany Bright >

Tech review

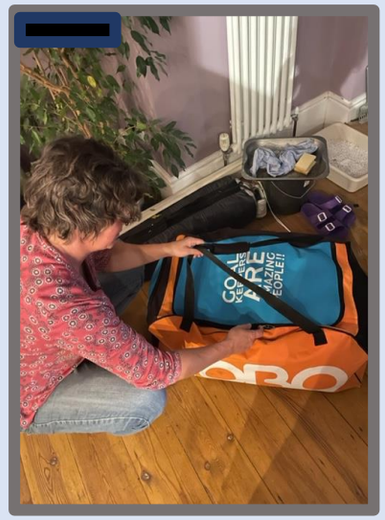
Initial thoughts of the goalie bag idea?
A good idea, as its time consuming trying to fit it all in like a jigsaw. Like playing tetris, with unworkable pieces. Once all in place though, it is a bulky manoeuvre to transport from car to pitch. My current bag has no handles (as they broke off) which makes it really hard to lift. It does have a strengthened underbelly and telescopic handle, with wheels. This is great once its out of the car and handle ready. Wheels are sturdy and resilient. Very excited to hear what Bethany comes up with. Its never easy lugging all the kit around, especially when no one has room for you and the kit to share lifts!

What is the top priority for me?
Manoeuvre- ability. Once in the car its ok. Issues begin when getting to the pitch.

Overall it sounds like many of my end users would benefit from both more organisation, extra space for smaller bits of kit and other necessities as well as, an easy way to transport their kit. Another large issue is the size of the bag making it harder to manoeuvre.

Looking specifically at Caroline's response a trolley would be more useful to her as her current bag handles have broken. A key focus for my product will be keeping it compact and having an easy way to get the bag out of the car. This may require aid equipment alongside the product.

CLICK TO WATCH →



After interviewing my mum I realised this importance of interviewing the people who help transport the kit (parents, coaches, club managers etc.). The **amount of space** that the bag takes up is an important factor for both storage and transportation. I will ensure my product has **only necessary components** in order to prevent it needing a large area in the car. If I was to do something to help transport the goalie bag, having the **ability to fold** it and making it **compact** would help.

I decided to carry out a survey to help me determine the wants and needs of my stakeholders. I asked goalies from my club, coaches and parents and carers

In order to create my survey I used Survey Monkey. My questions were limited by what was ‘free’ however the overall outcome from the survey was still very helpful

Adam Mills
Yesterday
Hi Millsey, would you be able to complete this survey for me. I'm doing a product to help with goalie kit transportation for my A level 10:34
https://www.surveymonkey... 10:34
Today
Adam Mills
Absolutely, I have shared this with Fortitude coaches too 14:36
Thank you very much! 17:54

While sending the survey out to the women’s goalie chat and the senior goalie chat, I got a response from my coach to say he’d forwarded it to other goalie coaches. Fortitude Hockey are Goalkeeper Specialists who provide coaching for goalkeepers and coaches in field hockey. It will be good to incorporate their feedback as they will know a lot about the issues and what is necessary for the product.

They would also be stakeholders for me as well as in they will be able to help me broaden my market. The main base for them is south east England but their reach does extend throughout the UK. They have worked with some of the world’s best goalkeepers like

I will look at the other survey questions and analyse them. I will also go into more depth with my end user’s responses

Investigations into user and stakeholder wants and needs

Questions asked

1) How old are you?

2) What is your gender?

3) How many times a week do you play hockey (or travel to hockey e.g. giving lifts)

4) Would a way to help you transport goalie kit be helpful?

5) What would you want in a product used to transport your goalie kit? (e.g. comfort, compact design)

6) Why would you not want transportation for your kit? (if you said 'no' to Q5)

7) What are the other reasons for not wanting transportation for kit?

8) How much would you be willing to pay for a robust trolley or wheeled product to help you transport your kit?

9) What would be your priorities for a goalie/sports trolley?

10) Any other suggestions for the trolley :) (shown in images on far right)

Analysis of response

1) The age of the respondents **varied** from under 18 to 55-64. The two largest segments (**31.82%**) were **Under 18** and **45-54**. This means I have to keep my design **simplistic** and **timeless** so that it **caters for all ages.**

2) **50%** of the respondents were **male** and the other **50%** were **female.** I will ensure that the colour I use it **neutral** and is **suitable for** use by **both genders** in terms of **anthropometrics**.

3) It ranged from 1 – 9 times in a week. By taking the mean of everyone's answer people go **on average** to hockey **3-4 times (3.44).** Therefore I will need my product to be **robust** and **durable** as it would get a lot of use.

4) **68%** of my respondents said that that it would be '**Yes**' it would be helpful. Considering I aimed the survey at my target market it shows that my product will have **good market potential** and would be **useful** for goalkeepers.

5) **'compact'** was the most common answered with **41%** of respondents answering with it**.** Other common answers include words to do with 'manoeuvre', 'fit in the car', 'public transport', 'comfort' and 'lightweight'. These will be the key aims for my product when designing it.

6) **50%** of the respondents **have wheels on their current bag** (with **3/7 answering 'No' to Q4**). I will have to ensure my wheels **differ** to the ones that come on bags e.g. **bigger** or **more robust** for the **'rough ground'** previously mentioned. **35.71%** also said **Other** which I will look at in the next question.

7) **2** respondents **leave it at the club, 2** had concerns about the amount of **space** they has available, **2** respondents say they already have a bag for transportation and **1** mentioned **additional expense**. I will try to keep my design as **compact** as possible. I would like to keep a **good quality** in my product but I won't add any components I find won't be used. Having **a large range of wheeled bags online** will be a big **problem** when it comes to selling my product.

8) The **most common** answer was **£100** and **£50** both being **19%** of the respondents answers each. I did a **mean value** from all the answers which came to roughly **£89**. I will be aiming to keep my product around this **price point** where I can.

9) **Most** of the respondents put **2 or 3** answers for this question as it was multiple select.
The top three answers (in descending order) **Function**, **Size** and **Quality** and so these will be my **priorities** for the trolley.
Function – ensuring wheels can rotate properly and it allows the user to **manoeuvre** their bag more **easily**
Size – keep it as **small** as possible
Quality – source **strong** and **potentially waterproof** materials to make it

This is the word cloud I used to help me analyse question 5 as it had a lot of responses. It was the easiest way to see a correlation with all the answers. However the differentiation in wording makes it slightly harder to analyse.

Collapsible

13/12/2022 21:19 View resp

Please for the love of god make sure it doesn't have 'goalies are amazing people' written on it

13/12/2022 14:38 View resp

Compartments for other things & needs to be waterproof

12/12/2022 18:09 View resp

Potentially being able to pack it away easily whilst playing so that it is out of the way

12/12/2022 16:13 View resp

A pocket for a water bottle

18/12/2022 21:52 View respondent's answers Add tags

Waterproof cover to for the kit bag

18/12/2022 21:48 View respondent's answers Add tags

A range of pockets to put phone, water bottle etc in.

14/12/2022 18:52 View respondent's answers Add tags

Have a fabric handle as a backup to a stowaway handle so you can still use it as a wheelie bag. Also a pocket for the goalie stick on the outside of the bag. A strong pocket to store half a dozen warm up balls.

Collapsing may be useful to fit in vehicles

12/12/2022 13:09

Wheels are good

12/12/2022 12:11

Cold section to keep food cool

12/12/2022 10:52

Pockets for extra kit always useful

12/12/2022 10:48

All of the other suggestions are good. The actual trolley will be waterproof but there is potential to make a **waterproof cover** to go over the bag. The back panel of my product may be able to have an **extra pocket** too. I will make sure the trolley has **grips** to make it more comfortable for the user and the trolley will have **wheels**.

Moving forward I will look at existing goalie bags using both primary and secondary research.

Investigation of existing products

On this page I did a product autopsy on my own goalie bag to determine what was good and what could be done better. It also allowed me to look at how the bag could be constructed.

Showerproof material to some the kit getting damp

The bag is large enough to fit in all the kit plus a bit of extra space for other equipment like hockey balls

The use of bright colours could be limiting the audience

The positive message on the top would make it more enticing for a buyer

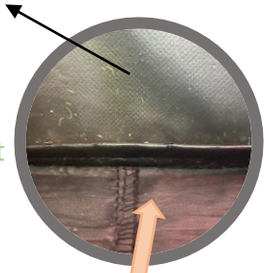
The Velcro pad can also be used to stop your hand rubbing while carrying it

The lettering remains intact (even after a lot of use)

Strong, woven material straps so that the bag can take a lot of weight before failure

The seams of the bag have been reinforced with tubing to make them stronger

The handles have padding to connect the handles so you can carry it like a carrier bag



Due to large capacity it can get difficult to carry if the bag is full

The pocket has limited space as it goes into the main frame of the bag

The seams that don't have tubing have stayed together better

The mesh allows the rain to get to the kit so it doesn't stay full dry

The mesh allows the bag to breathable and stop odours from lingering on the kit

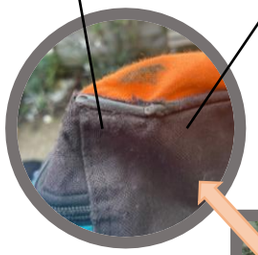
Both pockets open fully fold over so that the maximum amount of space is available to put stuff in them

The pockets have an opportunity to be bigger as they don't take the whole side of the bag they are on

The extra pocket uses thinner material as the thicker, more expensive canvas isn't needed here

PRIMARY RESEARCH

The showerproof layer of the material wears away with time



In the corners some of the tubing has broken through the material causing weakness and meaning it is less waterproof

This bag was made in New Zealand so shipping to the UK would have a large affect on the environment

What I have taken away from looking at this bag:

- The tubing isn't necessary to reinforce the seams
- The nylon works well as it is relatively water resistant
- It could use wheels so that the user has different options for transporting it
- The pockets can be added from the outside to increase the amount of space available
- The handles have padding to make it more comfortable for the user
- The extra pockets are useful but it could do with more
- Lettering / quote on top isn't necessary but a nice touch
- It doesn't need the mesh as long as I use a breathable fabric
- Reasonably good size but could be a bit wider for extra pockets

---

I then looked more in depth at the product by using a few components ACESS FM.

SECONDARY RESEARCH

Cost

The cost of a small OBO goalkeeper bag **varies** depending on the website you are buying from or whether it is a second-hand bag. It is a **relatively cheap** bag to **manufacture** as it uses **simple** stitching. Majority of the bags this style cost between **£37 – 45**. Although relatively cheap it **can cost a lot** alongside other kit as it is expensive.

Size

Dimensions: 90 x 35 x 35cm

The bag is a good size to fit in the car as it is compact as well as being large enough for smaller kit. This bag wouldn't be able to fit in a small car if it was larger and some parents wanted it to be compact (last page).

Materials

Most OBO goalkeeper bags are made using nylon with ventilation on the bottom and heavy duty zippers. It also uses **heavy duty stitching** to ensure the bag lasts a long time.

Aesthetics

The bag is **brightly coloured** which makes it more appealing to its target market of goalies aged 12 – 14. The quote on top also gives it a positive message and makes it more desirable.

Function

It was made to carry and organise goalie kit more specifically the **OGO junior ranges**.

Client/Customer

This product is designed for younger goalies who fit into the OGO Junior ranges (recommended ages 12 -14 years). This **a small target market** however it also means it is **less needed.** I know this as this is the recommended age on the OBO website. **As the age is a lot younger parents need to be considered as a client too.**

Safety

The product has a **padded handl**e to avoid injury when someone is carrying the bag (it **prevents** the strap from **rubbing**). However where the bag has worn away the tubing can be quite sharp.

Next steps - continue to look at other existing bags and what is already on the market

Investigation of existing products

PRIMARY RESEARCH

We went on a trip to The New Designer's Exhibition on the 8th July 2022 in London. It gave us a chance to see what students from different Universities had been doing and look for products that may be similar to our NEA products. I was looking for other types of bags…

'ALL ACCESS'

'The final backpack layout is very versatile and can facilitate many different outdoor activities.'

From what I could see there wasn't a compartment for food

The bag has multiple handles and ways of carrying it. A range of users will have different preferences.

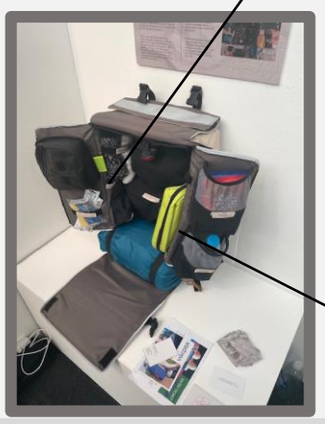
This similar to the my current goalie bag and I would like to keep this as a component

The bag is small and compact making it easier to carry on long journeys

Although it may not have the capacity for longer hikes when you need to camp overnight for a few days

As shown in one of these images it folds out fully so that it is easier to pack

The compartments are also clearly labelled

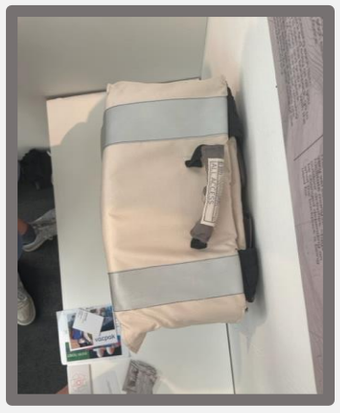


The compartments are relevant because my users also want separate places to put their equipment

It breaks the bag up into **many smaller compartments** in order for the user to have more logical places to put their kit (you can see this in the image on the left)

Neutral colours will appeal to a wider range of people

The shape of the bag does not have the most ergonomic fit (as you can see it is rectangular so it would lay flat on the users back)



'A solution to aid in the maintenance of proned ventilated patients within the Intensive Car environment'

Comfortable material that is easy to maintain sanitation

It can be deflated and compact so that it can be transported easily

If the material gets punctured then it won't inflate anymore

This isn't a bag but I thought it could work for adding compart for the user as this is a key want

From doing my research I noticed that there a wide range of bags at The New Designer's exhibition (which is small scale compared to global). I would struggle to make my product innovative as there are lots of iterations of goalkeeper bags online as well.
Moving forward I am going to focus more on being able to transport a goalie bag rather than making one.

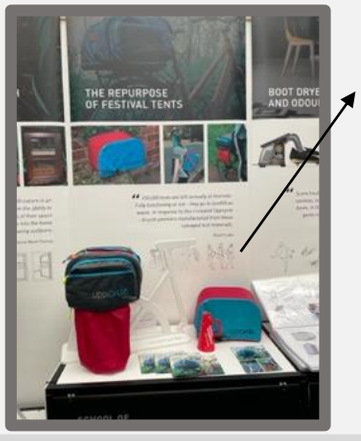
My next steps are to look into more existing products (more specifically trolleys)

'upcycle'

It uses materials that would otherwise be thrown away making it both **sustainable** and **resourceful**

It may cost a lot of money in order to make it into a bag and it will require extra components

Not all tent will be in a usable state due to damages



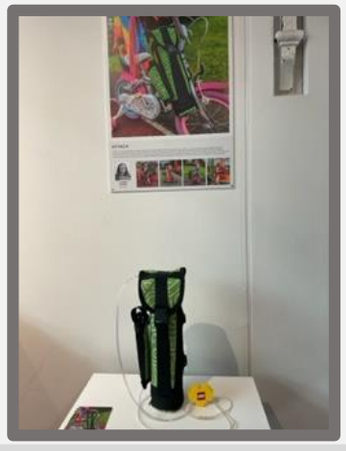
Looks like a compact and lightweight design and therefore more suitable for its function.

If at all possible would love to add sustainable materials into my bag

It solves multiple problems (the issue of tents being left at festivals and storage when you are on your bike)

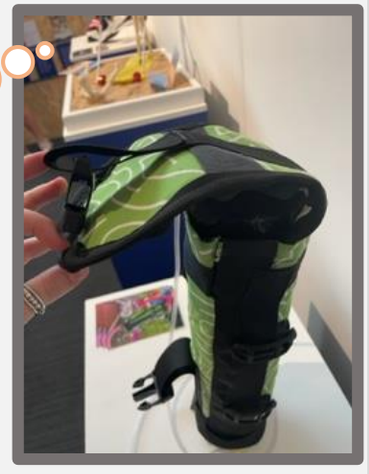
'Attach'

It has an age limit because it would not be suitable for people over age 5 (limits need slightly)



The materials used
- polyester
- Canvas
- HDPE
- cotton

Designer also looked comfort for bag



It has all the important functions to ensure the that the oxygen tank can still be used whilst carrying the bag

The bag may not have the comfort factor and therefore a child may struggle to wear it for a long time (although they won't always need to)

Trying to increase inclusivity by making aa product for people who might miss social/physical events due to having an oxygen tank

Investigation of existing products

PRIMARY RESEARCH

→ the handle has a fixed height so it doesn't give as much range for users

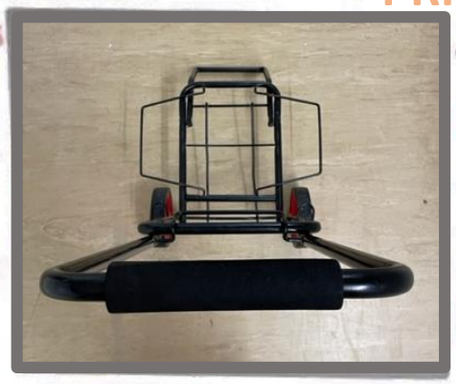
→ the handle can be folded down (longest part)

→ it has a bar that allows it to balance when not being moved around

↳ this images shows the trolley once all the extra parts are being used

the axel on the wheel is attached to the front of the trolley which means it needs to be raised off floor

↳ it is more innovative than putting straight bars across the base



→ there is alot of tubing which makes the end aesthetic more messy

→ it has a sponge handle which increases the comfort for the user

↳ the handle comes straight over the top of the trolley which restricts the height of what can be put on the trolley

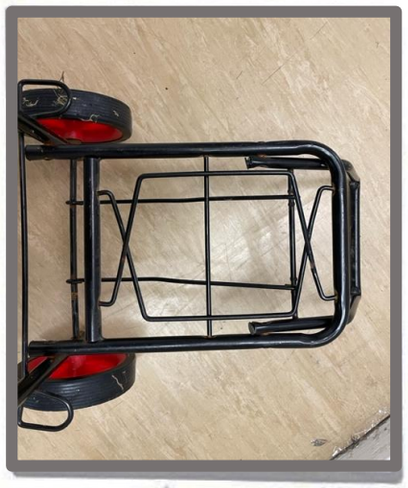
all of the metal that has been chosen to support whatever is on the trolley looks thin + flimsy

→ the wheels have added grip

→ this shows how the base of the trolley works

→ the wheels are a good size in proportion to the rest of the trolley

↳ the trolley has sides which fold out and make the base of the trolley larger



↳ this shows what the trolley looks like when it is fully folded away

← CLICK TO WATCH

This video shows that the trolley I was looking at had folding sides which allowed the base to be bigger. I found that the joints were very smooth when moving the metal away from the centre.

This would be **useful for my trolley** as my **stakeholders** said they would want a **compact** trolley but as **goalie bags are reasonably large** the trolley has a minimum size it can be.

This clip shows the range of the trolley fully packed away and then it at its largest.

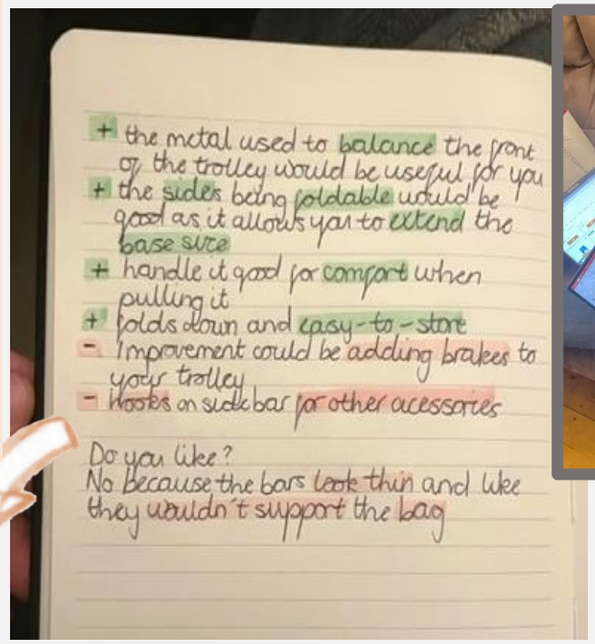
It is obvious that the trolley I make will need to be **a lot larger** but it has some important functional parts which I can **take inspiration** from.

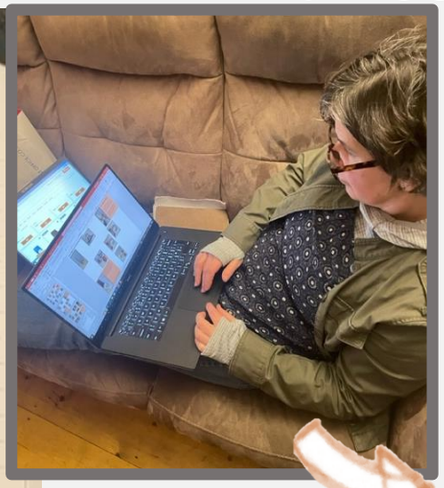
I don't think the handle that swings down would be as useful with a trolley of a larger scale.

← CLICK TO WATCH

I definitely want to make the bar thicker/stronger so they can hold the goalie kit bag weight. I think the foldability is also a good feature, but I will use this concept and simplify it as my stakeholders want a compact product at the end.

On the right are the comments I noted down when one of my stakeholders was looking at this trolley.





I got some feedback on what one of my stakeholders liked about this trolley/features which I could incorporate into my design (which I highlighted in green). And then I highlighted in pink the ways she suggested I could adapt this trolley to make it suitable for transporting goalie kit.

On the next page I look at a golf trolley which (unlike the others) has three wheels.

Investigation of existing products

↗ this image shows a braking system that has been put in to place

→ it is a useful component because it will allow the user to have more control over their kit (the kit is heavy so necessary component)

it would be especially useful where at is icey and harder to control and large amount of kit

→ the ~~breaks~~ brake pad has a smaller area for the user to press it (not as ergonomical)

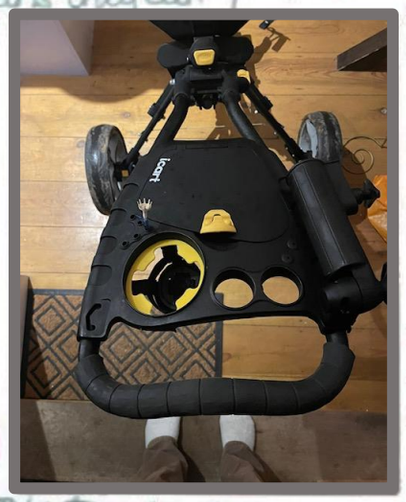
↗ this shows the grip on the wheels. They are also fairly large which means they can travel over larger sediment and avoid getting stuck in holes and dips

↳ it is a very boring colour which isn't easy to find if it is stored in a dark room

↳ people may (especially children) want colour

→ colour would allow people to be more enticed

↗ the bungee and allows the extension and therefore allowance of more space for bigger bags

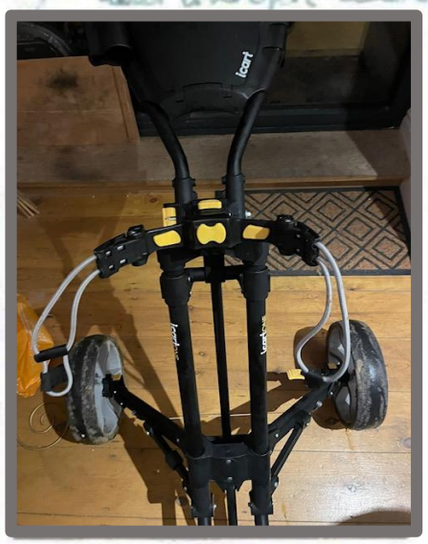


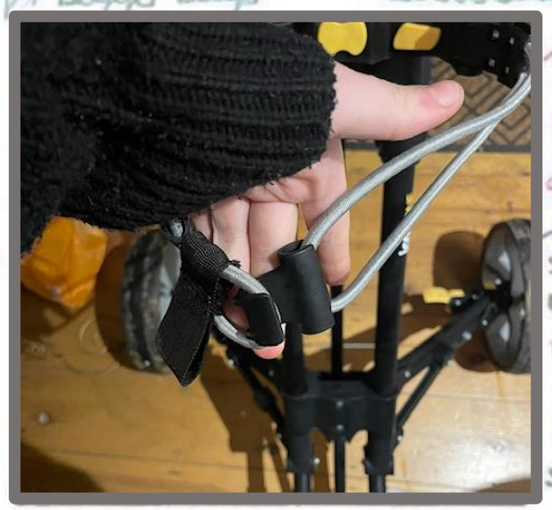
this is a smaller compartment which is being used for golf balls, tees, golf course cards etc

↗ a smaller place so smaller things don't get lost in the bag

↗ adds extra height to the trolley which will limit the percentile of people who can use it

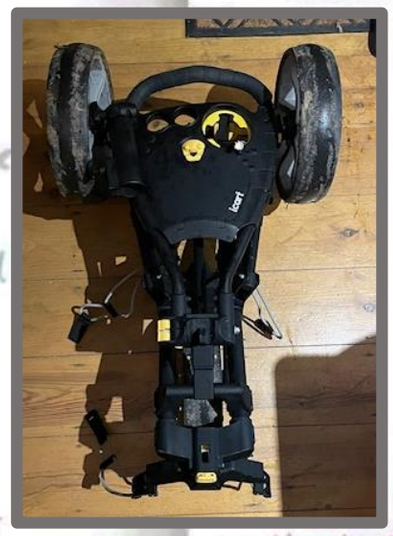
↳ this means that the tees etc are more accessible once playing





↗ the hook doesn't have much curve and so it won't have as much grip on the bungee

↗ this image shows the toggle used to attach the golf bag to the trolley (I could use something similar)



→ the trolley has many different components and functions which make it harder to manufacture

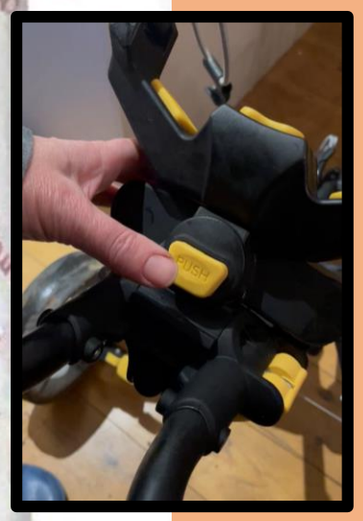
↳ the shape of the handle is curved and ~~raised~~ smooth in texture to make it a better fit for the user and comfier

→ when the trolley folds up in order to travel or fit in the back of a car/vehicle

→ this makes it more convenient for storage if you have a limited capacity

→ the handle length is quite narrow and may not be as comfortable for the user (to close for natural reach)

PRIMARY RESEARCH



Here you can see me pressing the button which allows you to fold up the trolley. It makes it both more compact and smaller therefore meaning it can be transported more easily. This is something I would like to incorporate into my trolley. From the doing the stakeholder survey I found that size (compactness was an important factor for other goalkeepers and people who may use the trolley.

It would however be more convenient if the trolley could be collapsed without the use of a button. For example using small hinges to allow certain parts to fold. The disadvantage with this is that it restricts the direction and angles at which the trolley can be made smaller.

← CLICK TO WATCH

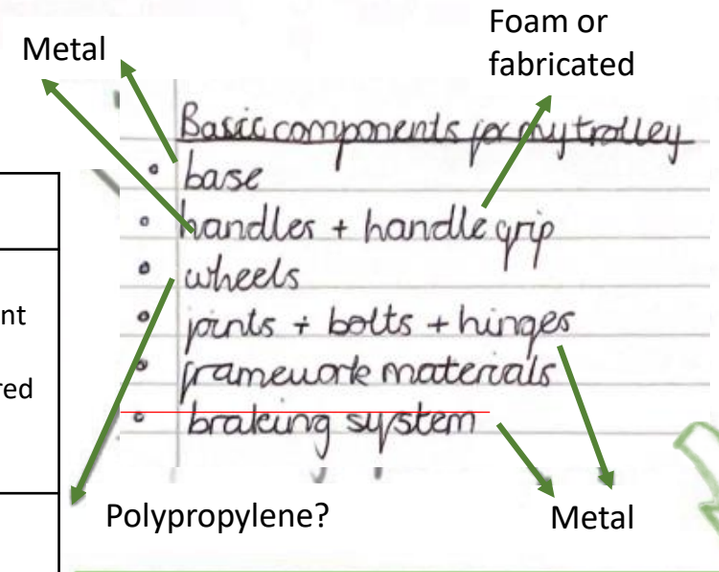
Next I will be look into the materials that I could potentially use for the trolley

Exploration of materials and possible techniques required

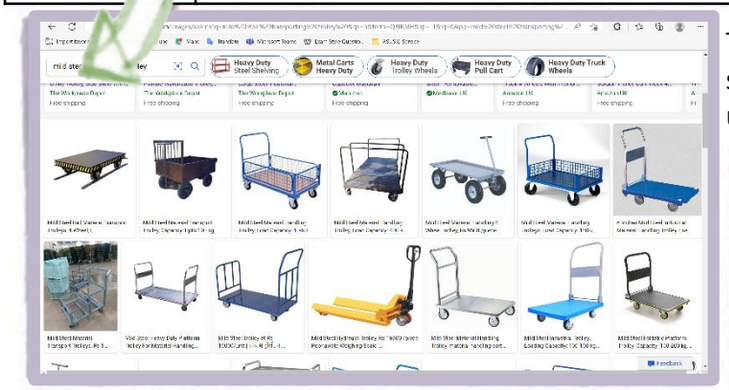
Most common materials used for industrial trolleys

From looking into existing products I decided metal was the best option for the framework of the trolley. I looked into the following…

Material	**Advantages**	**Disadvantages**
Aluminum	• Lightweight (has a weight of approximately 2.1g/cm^3) which makes it easier and cheaper to transport • Corrosion resistant - naturally generates a protective layer • 100% recyclable – it will retain all its original properties • Impermeable	• Costly – much more expensive than other metals • Welding difficulty – the material has a low melting point and tends to burn before melting • Weak – it is both malleable and ductile. When compared to steel it isn't as strong
Mild steel	• The least expensive option of all the steels - making it extremely competitive for low strength everyday appliances • Ductile – it is easier to bend and doesn't tend to break as quickly as carbon steel • Suitable for bending, shaping and welding • Environmentally friendly – can be reused and recycled multiple times	• It isn't the most strong steel • It cannot by hardened using heat treatment • Low resistance to corrosion – will require a coating such as metal paint



I have decided not to include a braking system due to time restrictions of making my product.
As you can see the most used material for my product is **metal** so it important that I choose one (or more) that are **suitable for their function**.

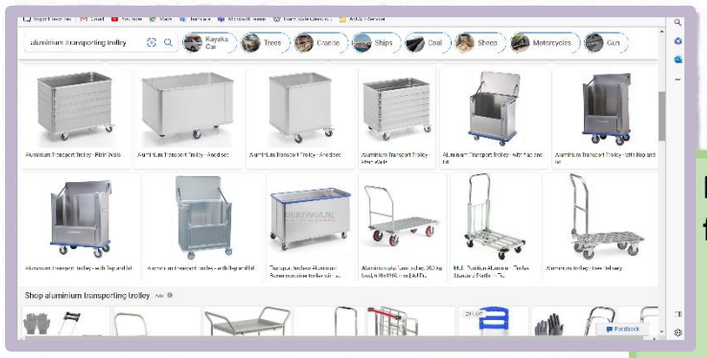


These are the mild steel options we have around school which also makes it a good option for using in my project.

there is alot of scrap metal which is better for the environment than buying new materials specifically for my project

These are the different cross sections

& we also have equipment over head for sawing. This photo shows some practice pieces



when searching 'aluminium transporting trolley' and 'mild steel transporting trolley' these are the results you get. The 'mild steel' shows more variation in what I can make out of the metal making it the more favourable choice of material.

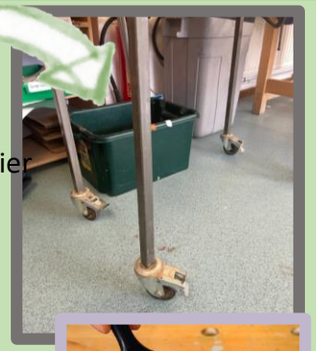
Next I will be look into the materials that I could potentially use for the trolley

Metal paint or no finish

+ looks natural
+ paint provides a barrier against corrosion
+ the paint provides a textured finish

Application:

- The metal needs to be cleaned a degreased before applying the paint
- It can be applied using a brush or spray

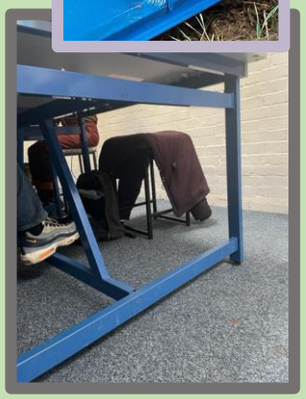


Cellulose paint

+ the paint provides a textured and coloured finish
+ provides a barrier against corrosion
+ specialist paints give graphic effects such as pearlescence

Application:

- The metal needs to be cleaned a degreased before applying the paint
- It can be applied using a brush or spray

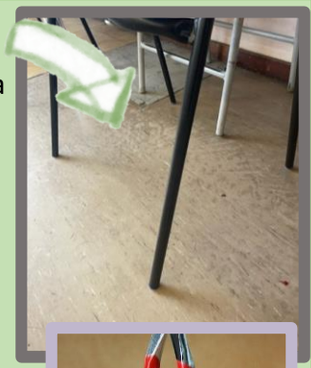


Polymer dip coating

+ provides colour and a protective barrier against corrosion
+ layer turns out alot thicker than paint

Application:

- The metal is heated to 230 degrees Celsius and dipped in fine polymer powder
- It goes through a fluidization bath (to even coat)



Exploration of materials – wheels

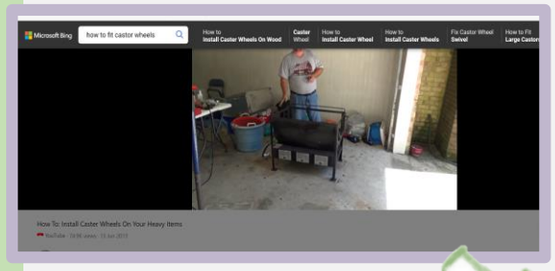



① Drill a post hole and secure the receiving cylinders inside them accordingly
② Then insert each post castor into the cylinder until it locks

↳ you may need to build up the area you are putting the castor onto

Range of school caster wheels:

- These were a range of wheels that I found around school
- Material – polypropylene and nylon
- Fixing – all three wheel come with castors and in these photos have been secured to mild steel tubing
- All materials must be cleaned and degreased (can be done with white spirit)



↳ I watched this video to give me a better visual understanding of what needed to be done

[How to Attach Caster Wheels to Furniture | DoItYourself.com]
(the link was a written guide about castors)

[Easy And Secure Caster Wheel Installation | Step-By-Step Guide | Fast Pipe - Bing video]
(this was a YouTube tutorial video explaining it step-by-step)



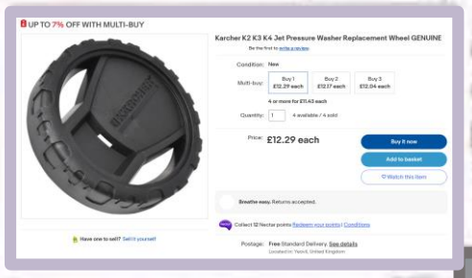
There are lots of different wheels around school. I went around looking at these wheel which either used castors or for the larger trolley's axels were used. Axels can easily be welded or brazed to the back of the handles as a cross bar. The big wheels were made from rubber and gave the trolley more grip for icy roads etc. The one in the top right corner is made from nylon (you can see the plastic is rigid, hard and shiny)



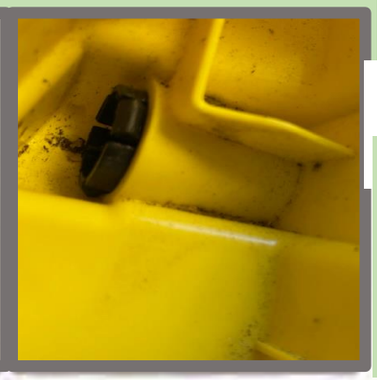


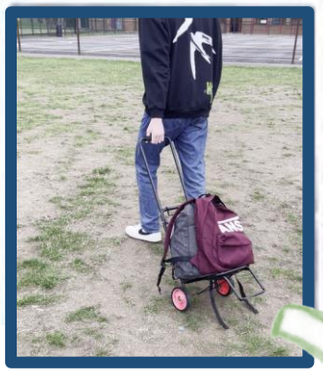
Jet washer wheels

- Material – plastic/composite
- Fixing – it uses a plastic washer which expands a fills the cylinder (hard to remove without breaking once it has been put in place)
- Plastic around it could easily snap



This type of wheel will need injection moulding to make the casing around the wheel. This requires an Archimedian screw feeder, hopper, granules, pellets etc. It is quite a complex shape to make

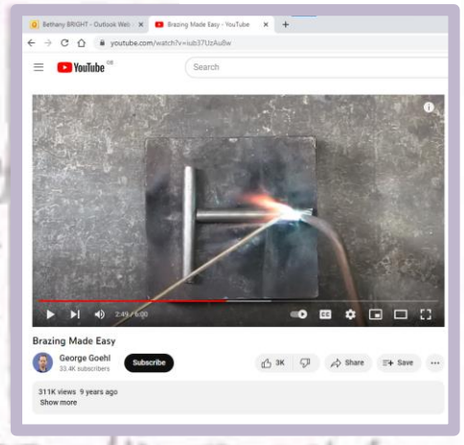



The wheels were good on smooth surfaces however weren't so good on rougher ground. At the end of the first video however the bag nearly falls off and so this shows the **<u>need for a securing bag strap due to little suspension in the trolley</u>**.

← CLICK TO WATCH

Joining metal



this video shows a long thing pulled along I used this to become the welder on rough / uneven ground. This looked sturdy

I would like my trolley to have wheels adjustable that I can suspension

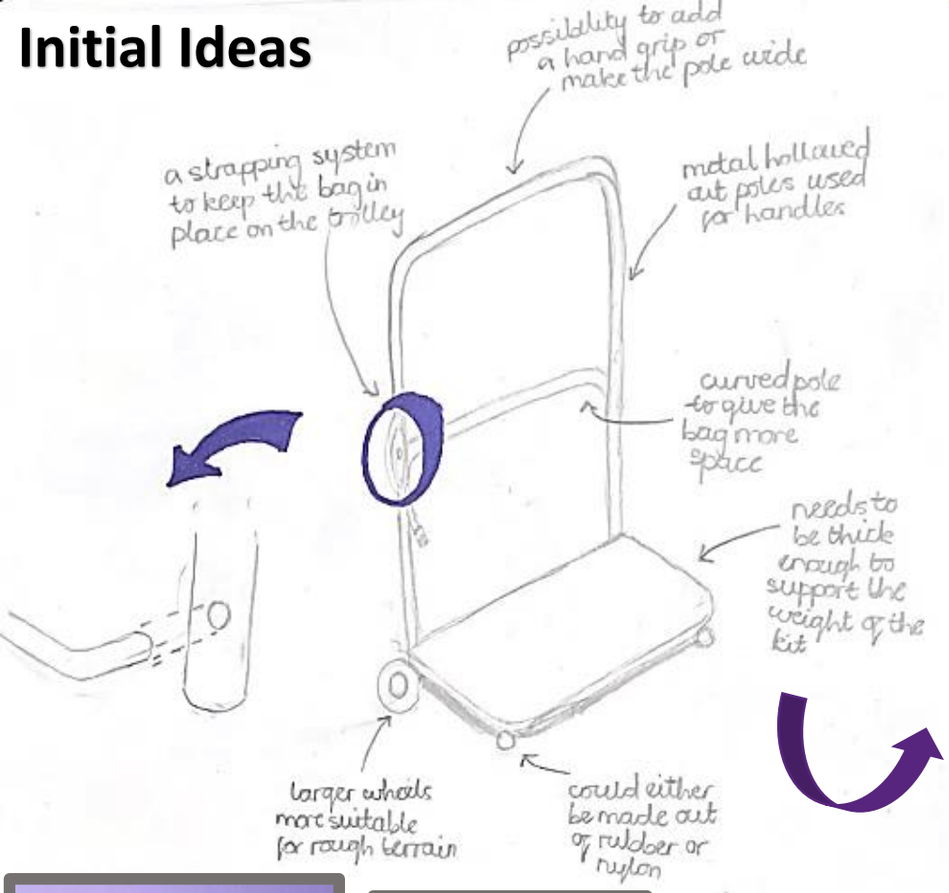
Looking at all brazing equipment we had in school I decided that this would be the best way to join metal

Here I looked up a tutorial with simple things I needed to know

① First clean degrease and file the metal that you're using
② Use the gas canister to turn on the blow torch and put it to an orange flame
③ Hold the blowtorch at an angle to heat up the metal for a few seconds
④ Take the brazing rod like a pen gently run it over the joint
↳ the metal will melt into the gap, cool

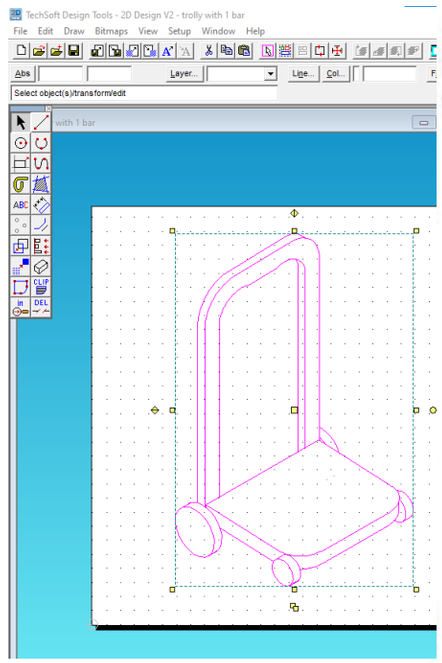
On the next page I will start to generate my ideas

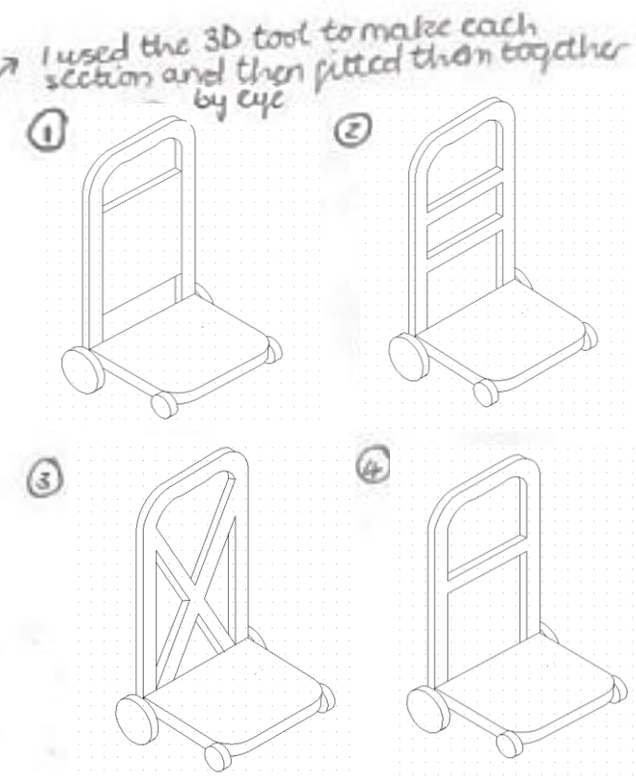
Initial Ideas



I created the basic design using CAD sketching (as you can see on the left) to see how it would look if it was to be made. then used this to explore further options.

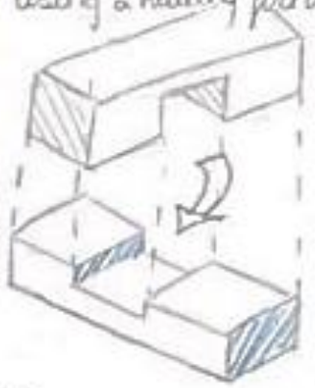
I think it would be useful for the back to have a larger surface area (design 1) as the bag can be quite heavy (although not necessary). I definitely won't the design with one bar (design 4) as it'll be put under a lot of stress from whatever it is carrying.





the base of model was the same thickness as the bars

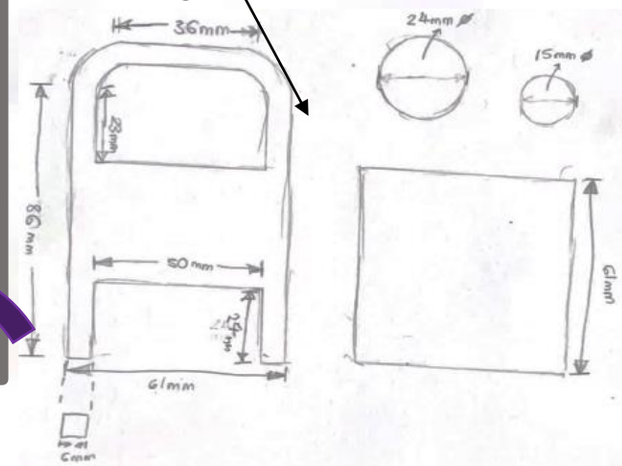
→ the planks for the cross would be interlocking using a halving joint



the smaller wheels allow you to tilt the trolley up when you come into contact with a curb

two bars along the back can withstand more force from the bag

These are the dimensions of the model with a scale drawing

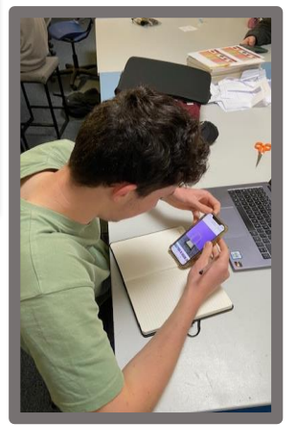


The models were made out of 4mm plywood. The base and wheel were constructed with hot glue and then I used blue tack to temporarily put the backs of each design on. It wasn't a moving model.

this design would be able to fold up for transportation

this design has the most strength as it has a larger surface area

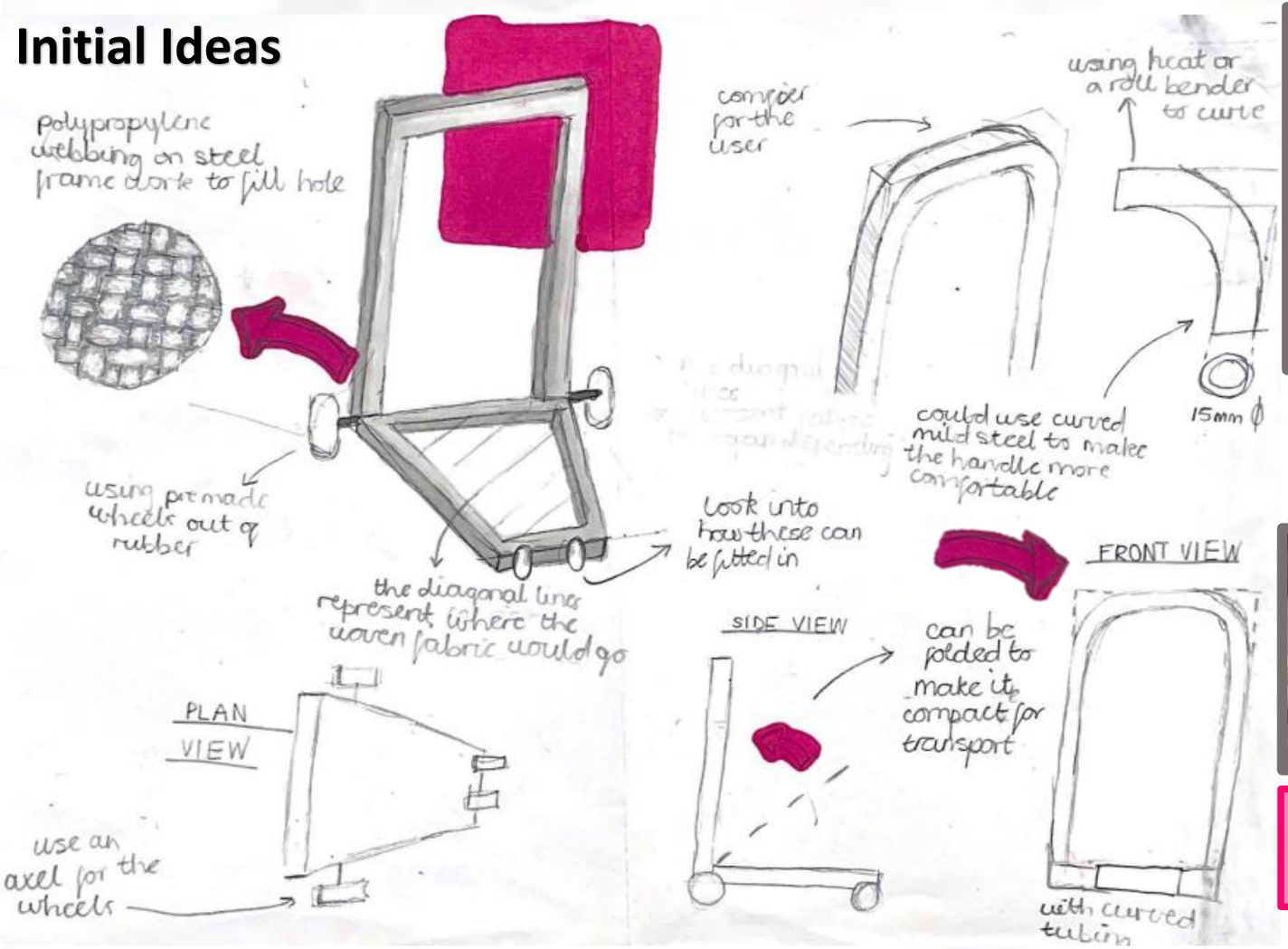
Oscar's opinion
The model doesn't have much on it, pretty bland at the moment. Could do with some more detail and things on it to make it function better. The initial design looks good though with large wheels.
To improve you could add a cage and some adjustments so that the bag stays on.



I agree that the design is **very simplistic** at the moment. I will further develop my next designs to be more **innovative** and **unique**. As I progress I will also focus more on the how the bag will be **secured to the trolley**

Next I will be focussing on adding more complexity into my ideas

Initial Ideas

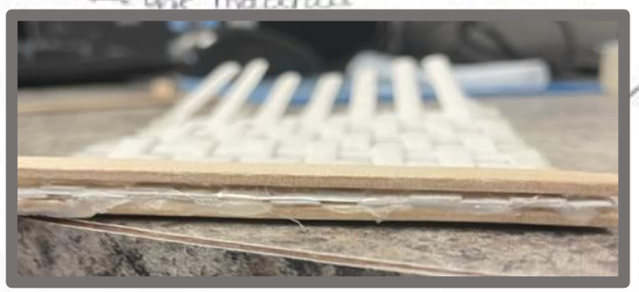


I started off by looking into more complicated material that could be used rather than a solid piece of material

one of the main issues I had with the material were the ends. Once I had woven the straws through and cut it I had to tape the ends to stop it coming undone again

the straws were also rounded so I had to flatten them in order to weave the material

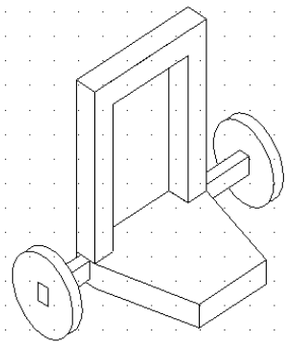
I used lollipop sticks to secure the ends and make a frame



I sandwiched the ends with a glue gun to stop the material fraying

I continued this process for the rest of the edges

I have used this model to help my understand the extra time needed in manufacture for the woven material. It is less time-effective however it increases the complexity of the design and desire for the trolley. The material will also be elasticated.

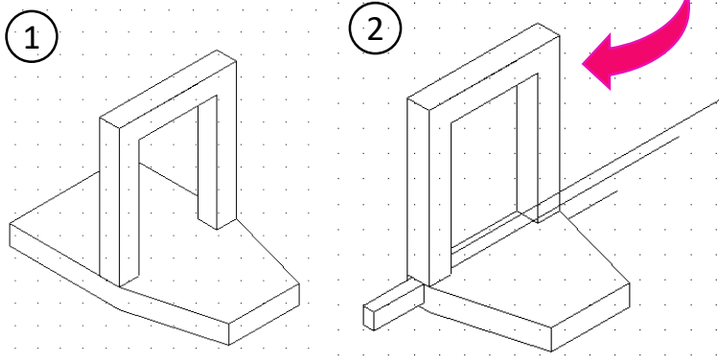


This my model with the woven material (just to show the basic outlining shape).
Image 1 shows the process of the trapezium shape. I made the whole base into a rectangle and by eye took equal lengths of each side to make a trapezium. Image 2 shows the working drawing lines to ensure the wheels lined up on both sides of the trolley. **I made the frame a bit thicker than it would be in real life.**

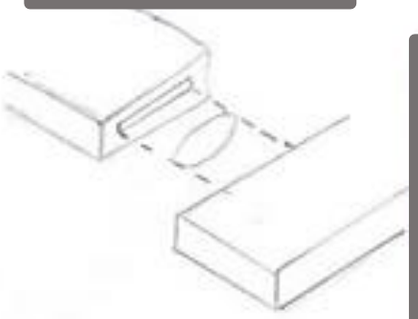
the woven part is very nice! it has the potential to be made from fabric, sustainable.

I put the wheels on a thin piece of plywood to model the axel that would be needed

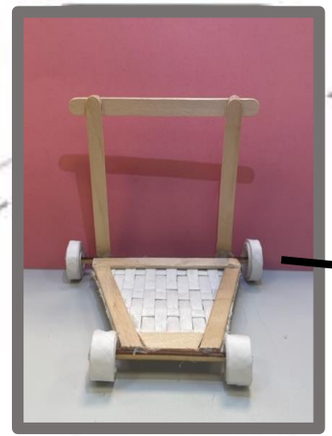
the framework would use biscuit joints



I will make sure to include the woven part if I continue with this design. Furthermore I would like to ensure the handles are **<u>curved</u>** to make the use **<u>more comfortable</u>** for the user. I will also make the framework thinner so it is easier to hold.



This is a sketch to show how the biscuit joint will work on the trapezium base

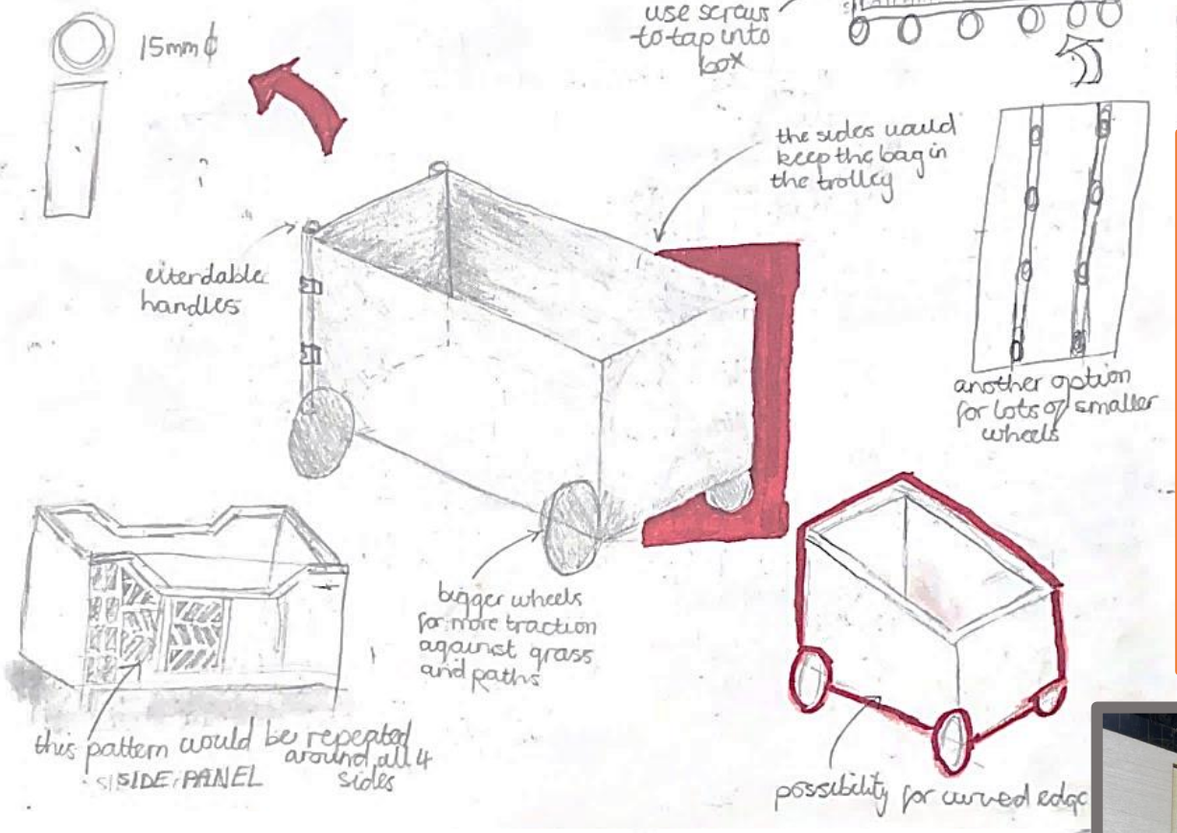


I adapted my design from having a square frame to having ~~over~~ excess material acting as handles

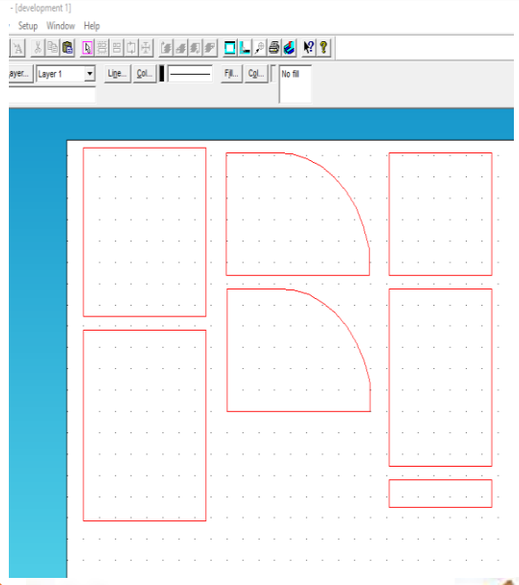
This is how I made the wheel (curling paper straws)

Initial Ideas

I will continue to use as much of the feedback I have gained so far to adapt and produce design ideas.



This design was very simple to make (as you can see on the drawings) but I thought it would help me work out how to adapt them.



This is the feedback I got from one of my end users:
It think this will be too bulky on top of the size and weight of the goalie bags we already have.
However I do like the curve used on this design. I don't think the storage will be necessary.

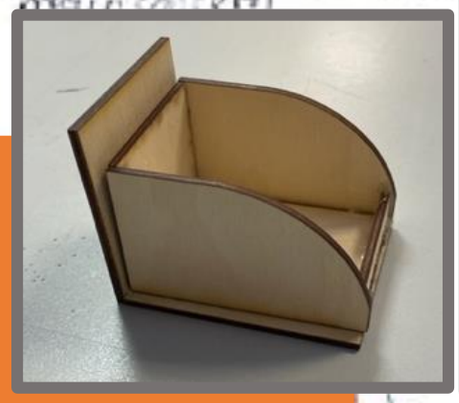
(Tom looking at my design for this page)

the curved edge allows the bag to be lifted into the product more easily and increases the functionality of it

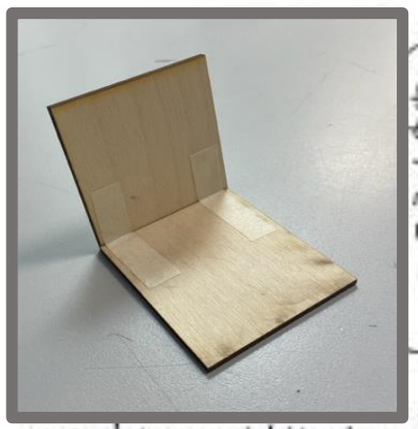
these were the pieces I cut out on the laser cutter in order to make my model

→ Still a large thing to store and my survey I did showed that safety it would be one of the

these would be the attach brackets for the wheels



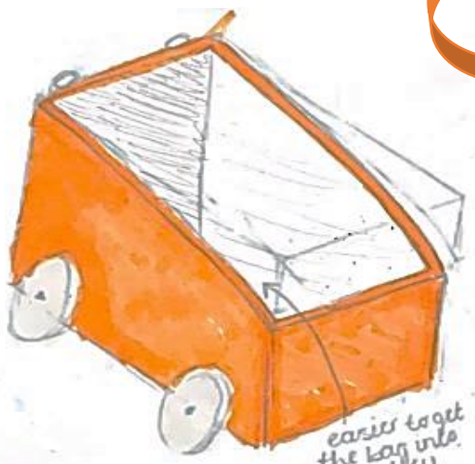
→ the edge of the box overlaps the frame



→ I used masking tape to show the hinges. They have a limited motion of being able to move forward and backwards

→ the hinges will need to be as flat as possible to the wood to avoid the bag material getting stuck

12mm ϕ mild tube steel OR 15mm ϕ



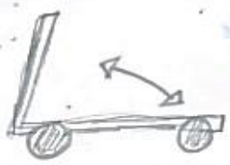
to allow handles to be different heights

could be a self tapping screw

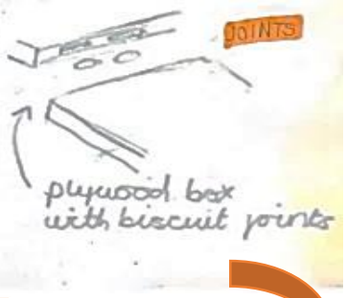
PIPE BRACKETS

wood screw for pipe brackets

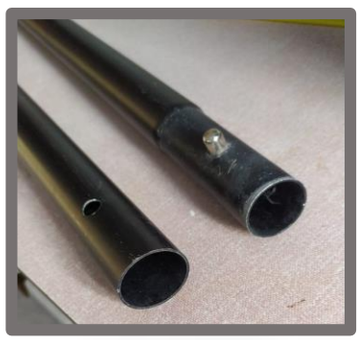
easier to get the bag into the trolley

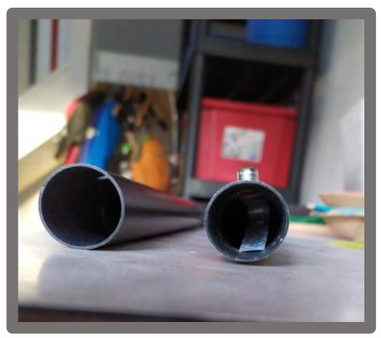


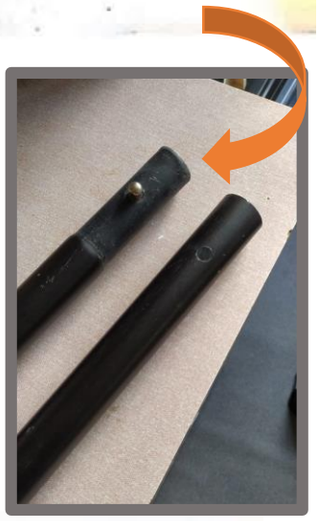
folding framework for box to rest on



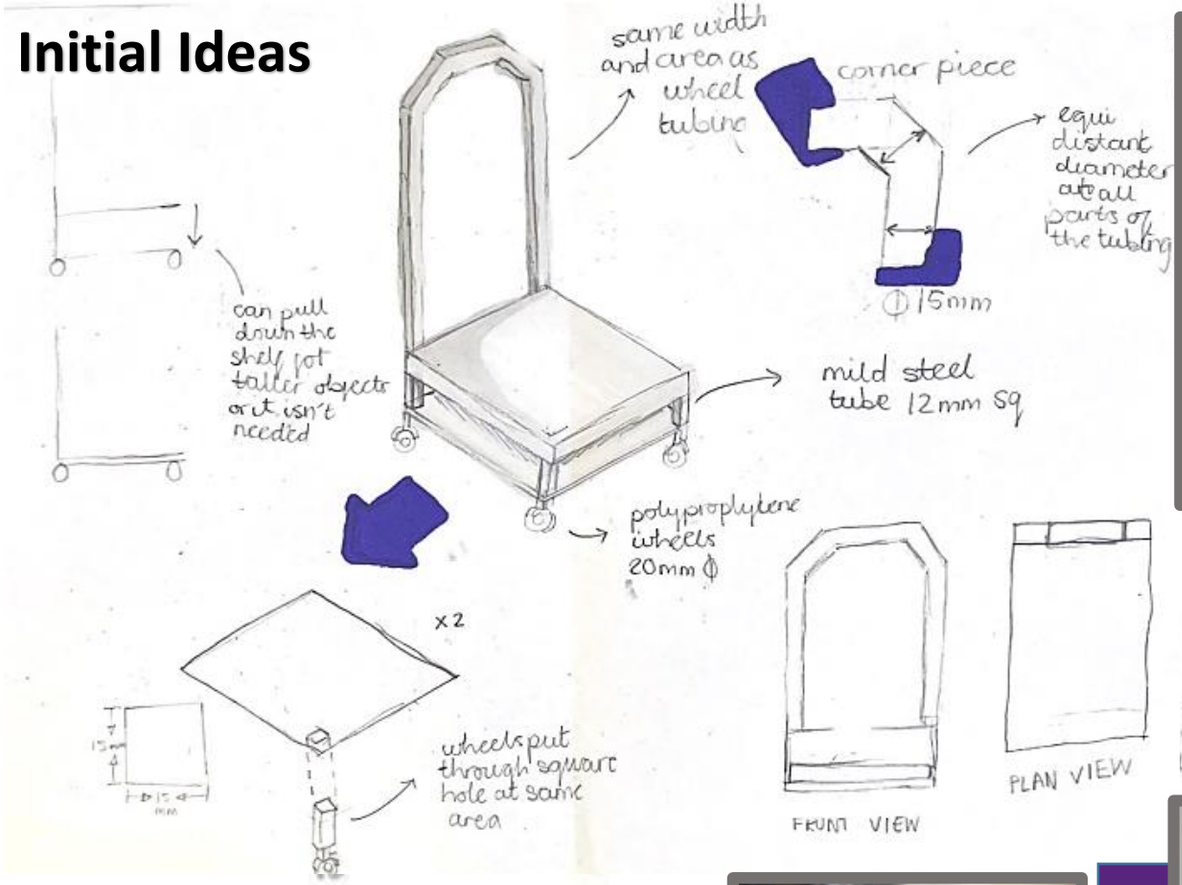
This is what I was showing in my sketch. In this example it is being used to adjust kayak paddle. I would need to add more holes into my poles so that there is more range in the height of the handles.







Initial Ideas

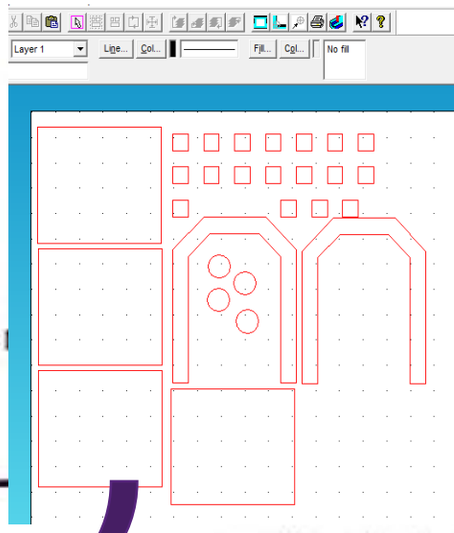


these little squares are gonna act as the links you can use to adjust the height of the shelf at the bottom

for this design I would use 50mm diameter wheel and screwing the top plate into the wood

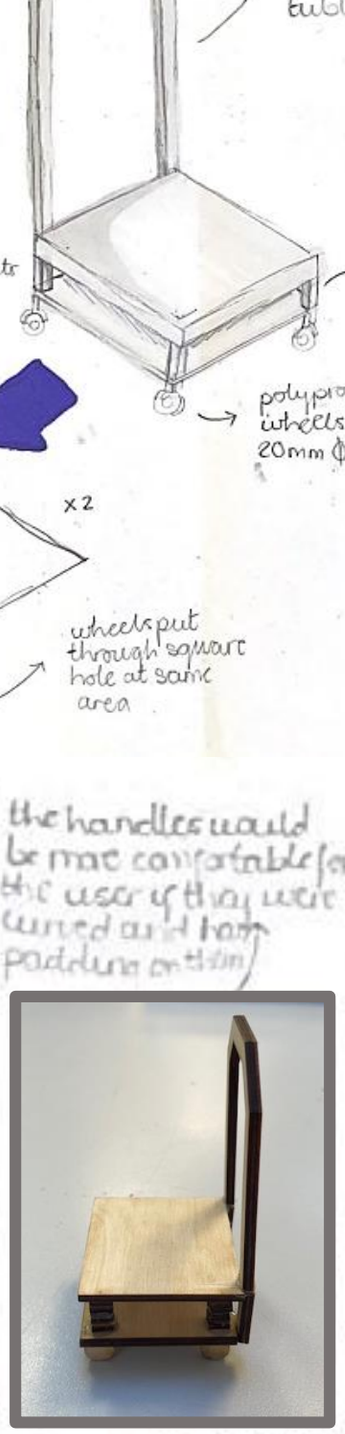
I ended up with 3 spare pieces as I was initially going to increase the thickness of the square panels and handle panels

This is the CAD design I used in order to make my model out of 3mm plywood on the right. On the other side is the model after it was cut out on the laser cutter. I put the circles into the gap to reduce waste material



alternatively a scarf joint could be used to adjust the height

the handles would be more comfortable for the user if they were curved and had padding on them



I used the coping saw to take the top bit and then use the spare handle piece I used to lengthen the top bit (attached using a glue gun)

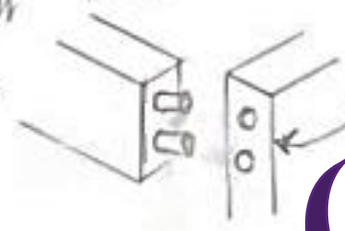
I realised that the proportions of the model were off so the handles needed to be lengthen for it to be functional

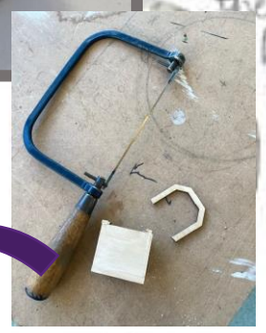
↳ OR the same joint could be made using a dowel joint

this would be the handle section

this gap would need to be alot larger but it shows the concept

The joint would also need glue to reinforce it





this design shows that the handles are better proportion and would be more comfortable the user

this is the coping saw I used for adaptation

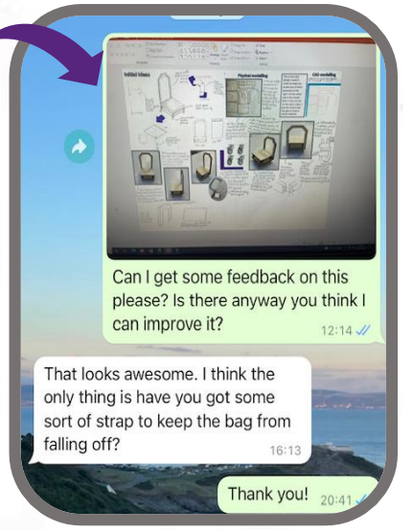
DEVELOPMENTS

use of curved handles instead

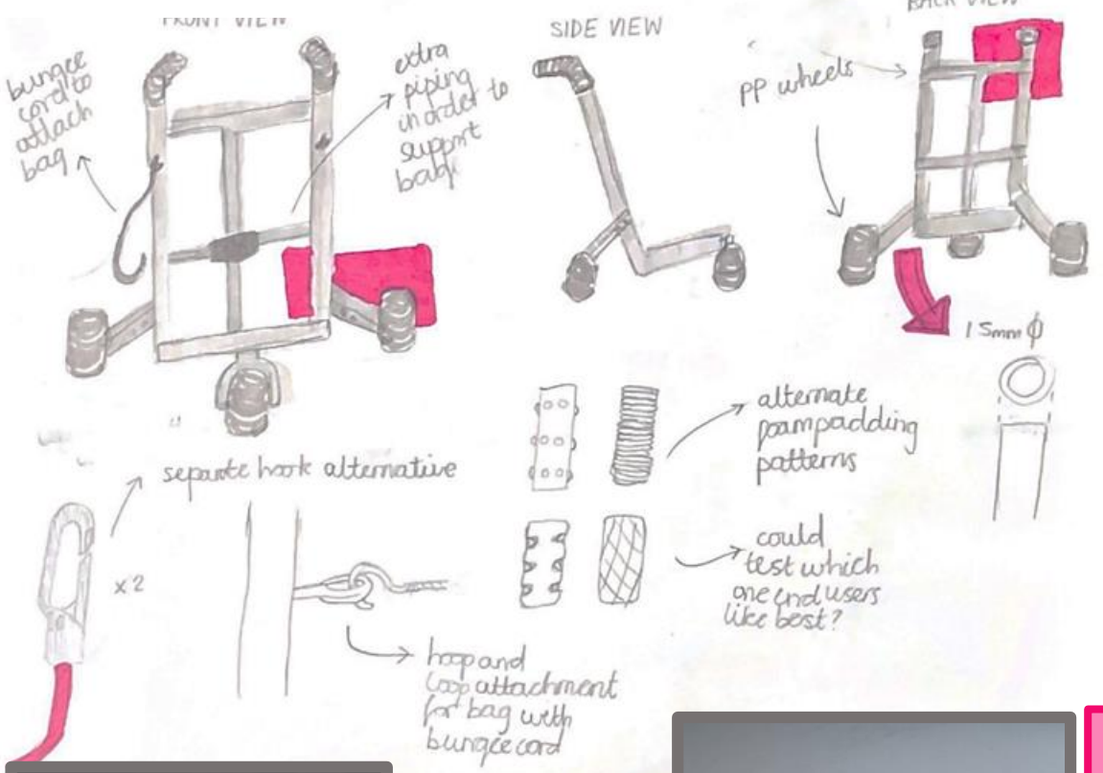
changing the base to be more rectangular

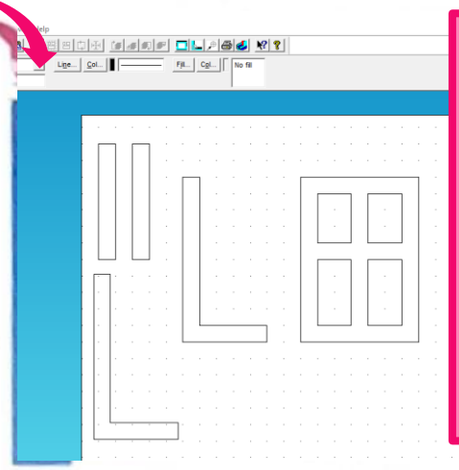
I haven't actually looked into the options for fixings for the bag as I was looking into the shape. However this should be more of a focus moving forward. My initial thoughts would be to have **hooks on the handles** and then some sort of **cord** two **secure it around the front.** Bungee cord would work well for this as it is very stretchy and would fit around the goalie bag.

My next steps are to focus is on fixings for securing the bag and ensuring the shape is a good fit for the goalie bag.



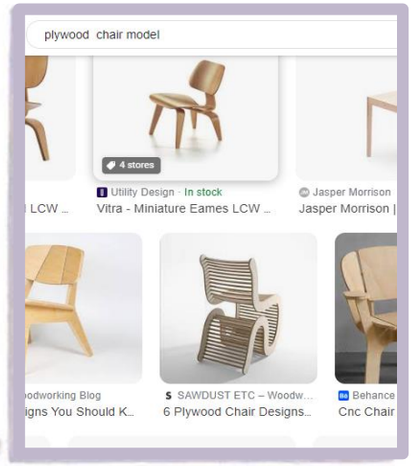
Initial Ideas

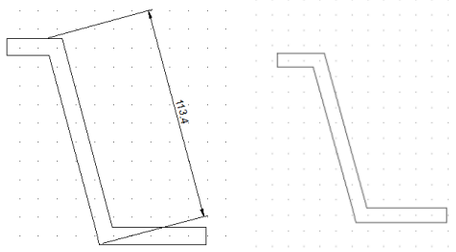


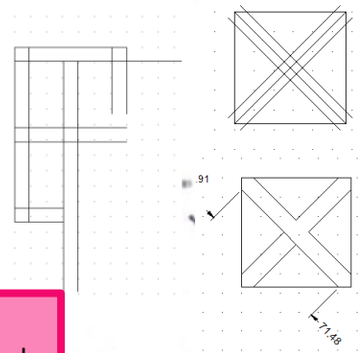


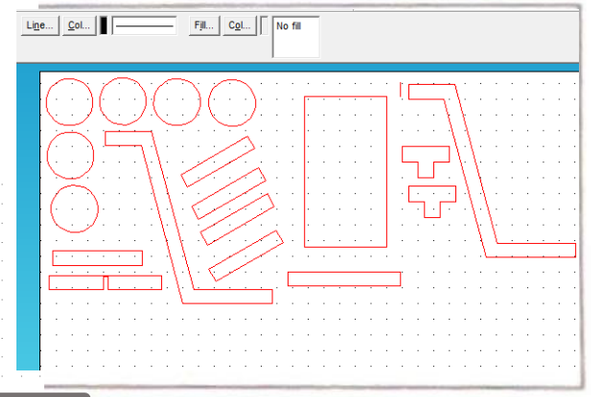
I started to make a CAD drawing model so that I could make a plywood model however I quickly realised that the angle for the side of the trolley was wrong and so I had to start again.

I then looked at plywood models online and thought this could be an alternative option. However it would vary alot from the design initially drawn









I would add some sort of padding to the handles to make it more comfy

I changed the model so that the wheels went straight back rather than to the side at an angle

I put the cross on the base to stop the bag falling through the bottom

this would require equidistant pieces joining the ~~two~~ side piece ~~via~~ rotated

I had to take the measurements for the long part of the trolley otherwise the back piece would be too small in length.

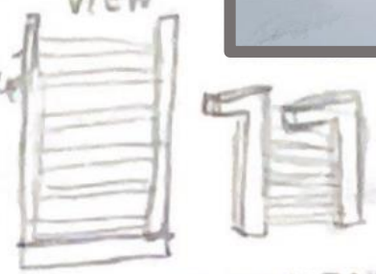
as you can see from this photo you can see that the trolley wasn't symmetrical when put together

This shows a few of the steps I went to in order to get to the final pieces I printed.

I came across an issue once I had printed all the pieces. I made the width around the cross too thick as it lines up with the depth not width of the side pieces.

I like the fact that this design has three wheels in comparison to the other ones I've drawn. I think this makes it more sturdy but more like a golf trolley

FRONT VIEW

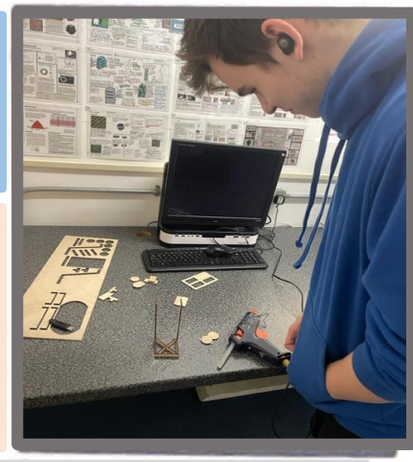


DEVELOPMENT

I made the back panel plain but to develop it I would repeat the use of the cross used for the base piece

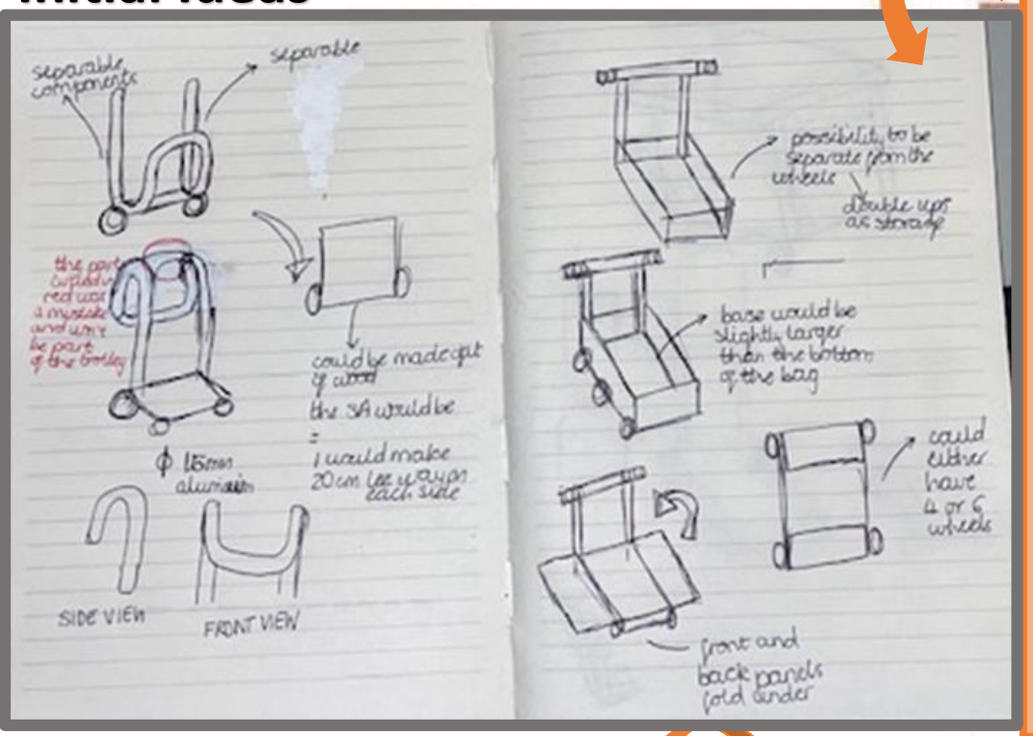
'The model doesn't look great. It is very flimsy, and I can't imagine I would be able to hold the goalie bag as a real-life product'.

I agree with Rob's comments however this model is a lot **more sturdy** than some as it has three wheels. One top of that, the two different styles of **cross** used make it a lot **less aesthetically pleasing**.



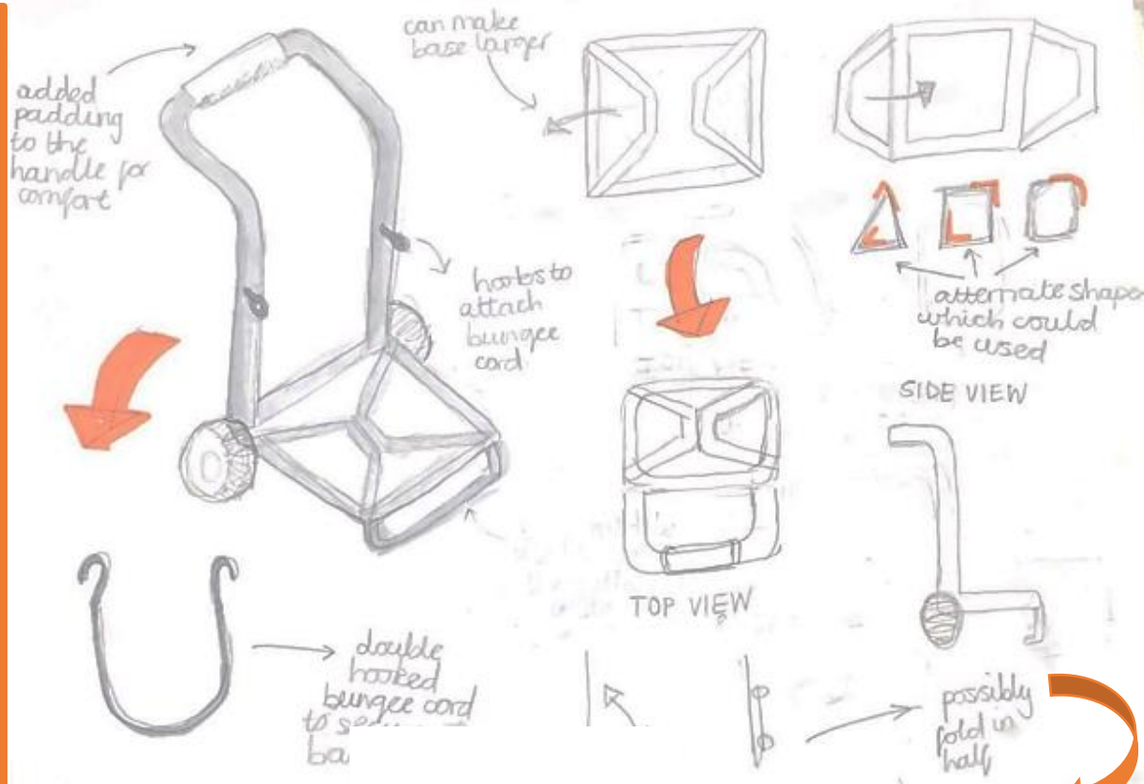
On the next page I continue to developmy last intial idea.

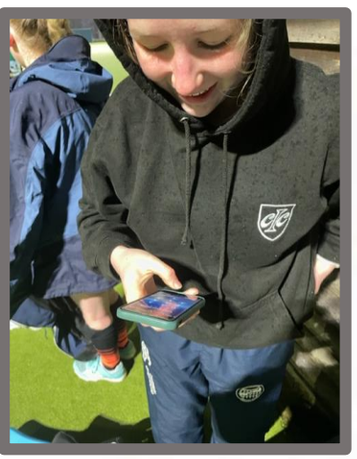
Initial Ideas

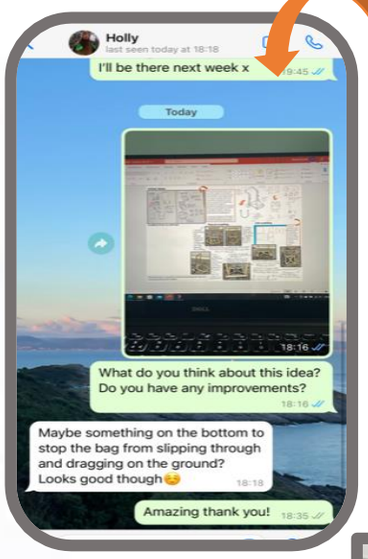


Here are some other ideas I came up with in rough in my notepad. I have decided not to move forward with the idea on the right because it is similar to another idea I did and will be too bulky for my end users on top of their original bag. On top of this during my questionnaire people were worried about size and thought it should be in my top 3 priorities. There is a possibility to expand on the left idea by perhaps simplifying it?

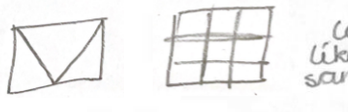
I had a go at doing so on the right. I changed the bottom part so that it was more functional and compact.





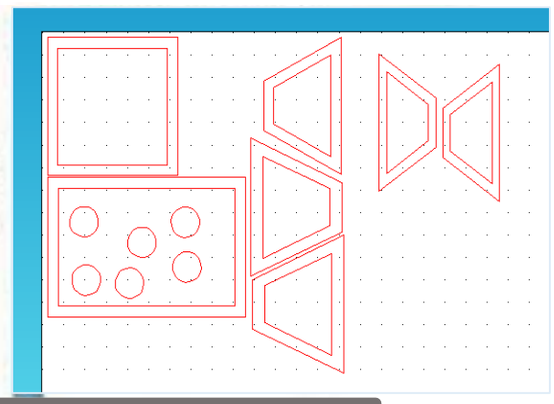


In response to Holly's comments, I will update the design and so that it has something to keep the bag from falling through the base. Here are some potential options.



I would preferable use curved metal to make it more comfortable for the user of the trolley

these heights were too small but they demonstrate the idea of lying flat



This my model on 2D Design before it has been constructed. On the right are the of the CAD drawing are the adapted parts.

↳ this shows the parts fully extended outwards to increase the area the bag is resting on

↑ to improve this design either additional wheels should be added at the front or a bar to keep it balanced.

↑ on the ground model tilted then straight on

I also worked out the wheels will need an axel to allow them to turn

↳ this model is the extra pieces overlapping (too large for the base)

It doesn't lie flat on the base meaning the product would be less secure than the close

to improve I will decrease the height of each shape

wider than handle width

Moving forward, I am going to continue developing this idea and looking specifically into handles

Design Development

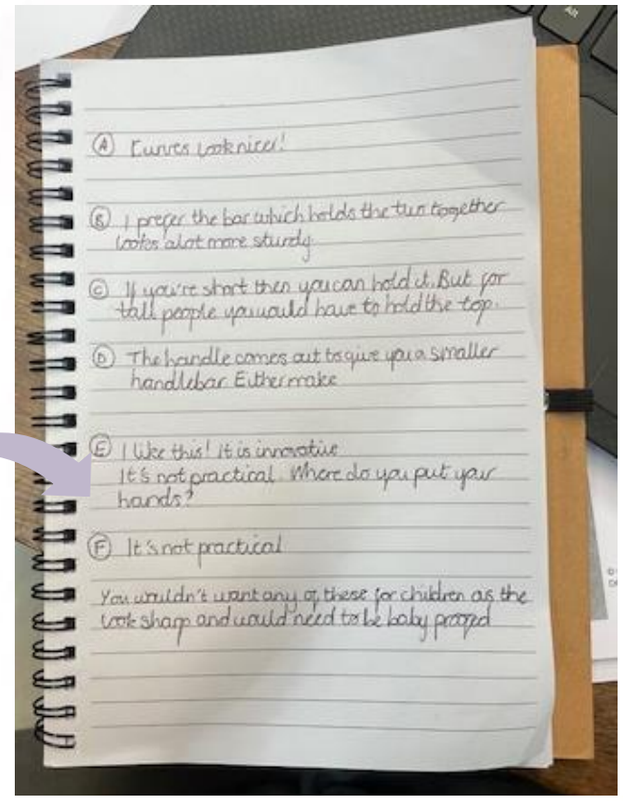
I started out with these basic handles that would use simple **brazing** and mild steel to join the separate parts of metal. The pink section was representing a handle I would include to **add more comfort**.

Thank you for all the comments and constructive feedback. I will look into handlebars D and B (depending on which on will fit better with my final design).

I'm suprised that despite all the positive comments about the curves on A that no one voted in. Although everyone preferred A to B as it was more sturdy - looking.
I agree that C isn't as easy to hold. The curve could curve out the other way which would make it easier to hold.
People liked D but I would either have shorten the sides of the trapezium or increase the angle between the back piece the part of the handle held (top of trapezium).

A	B	C	D	E	F
	IIII	II	III	I	I

These are the notes I made whilst people were observing the hand bar options:



I moved on to these more innovative options. They had a range of 'practicality' and 'aesthetic'

Most designs would use **20mm square mild steel.**

A

Curves were a lot more popular

B

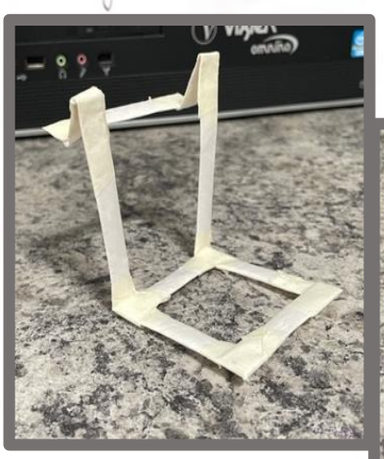
C

Curves were alot more popular with the people I asked. However the straws make the curves neater and smoother than they would look in real life. The metal makes it alot harder to get a smooth curve.

HANDLE BAR OPTIONS

Here I was looking at a range of handlebar options and got some feedback from other people on which **one or two** were their **favourites**. I modelled the handles out of straw so that I could curve the straws and well as keeping them straight.

doesn't look very strong



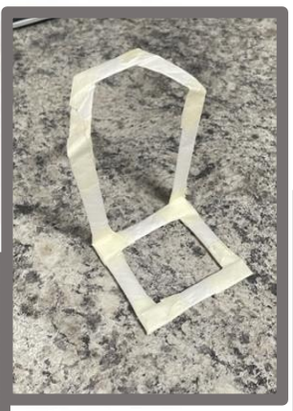
F

Next I will collect some anthropometric data for the product.

E

The initial drawing, I did wasn't actually able to be made out of mild steel

the design doesn't have a comfy place for the user to hold



D

Overall B and D were people's favourites so the final handle I will use will be D. This will allow my trolley to have sleek and timeless aesthetic.

Daisy was looking more at the aesthetics of the bag. As an Art student, she was more drawn to the unique shaped bars such as E

Anthropometric data

These measurements for all will be slightly larger as the elbows of the people I took measurements from were not at 90 degrees (larger angle at the elbow).

Hand width = **35cm**
Hand height = **86cm**

Expected measurements (with elbows at right angles)
Elbow height = **97.3cm**

Hand width = **31cm**
Hand height = **105cm**

Expected measurements (with elbows at right angles)
Hand width =

Hand width = **22cm**
Hand height = **111cm**

Expected measurements (with elbows at right angles)
Elbow height = **111.5cm**

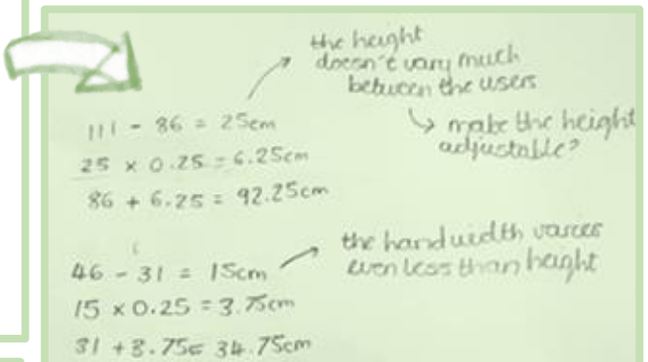
Hand width = **46cm**
Hand height = **109cm**

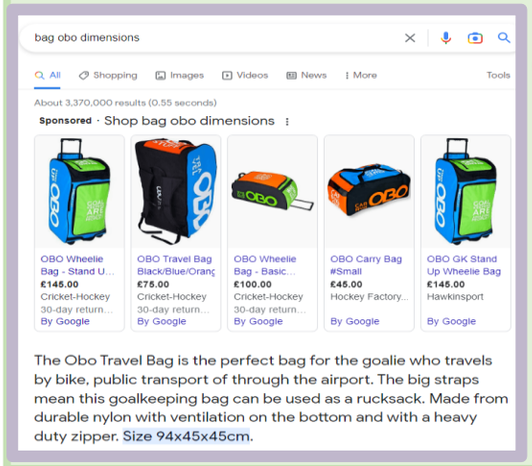
Expected measurements (with elbows at right angles)
Elbow height = **113.3cm**

Hand width = **36.5cm**
Hand height = **107cm**

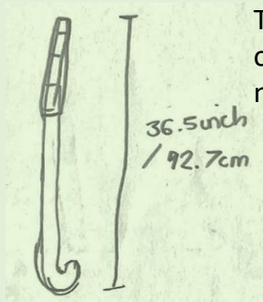
Expected measurements (with elbows at right angles)
Elbow height = **111.5cm**

Following the data I collected I decided to look at the ranges to compare…





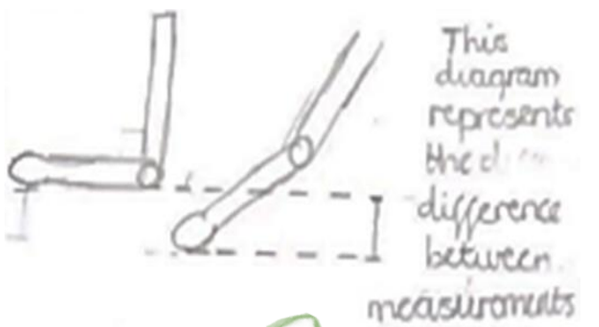
I have researched the dimensions for the largest bag that I am making the bag for. It will cater for a larger percentile as a smaller bag will still fit on a large trolley



Bag dimensions:
Length ≈ 93cm
Width ≈ 55cm
Depth ≈ 52cm

(The measurements will vary as the bag will bulge or dip depending on the kit inside it)

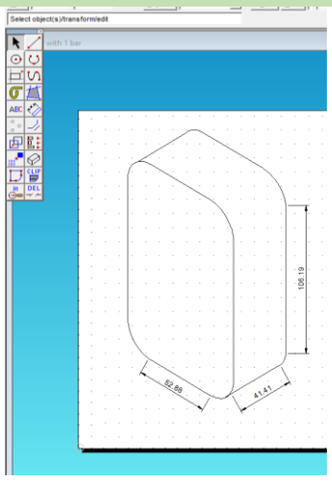
This is Holly's current kitbag from OBO. We used my stick in order to measure her kit bag and ensure that the measurements of the trolley would be big enough to fit it on.



The next page shows the final CAD drawing for my product with the dimensions drawn to scale.

I made a model to show the size of the bag which all of my end users put their kit! I can use this model to compare my working drawing to the bag

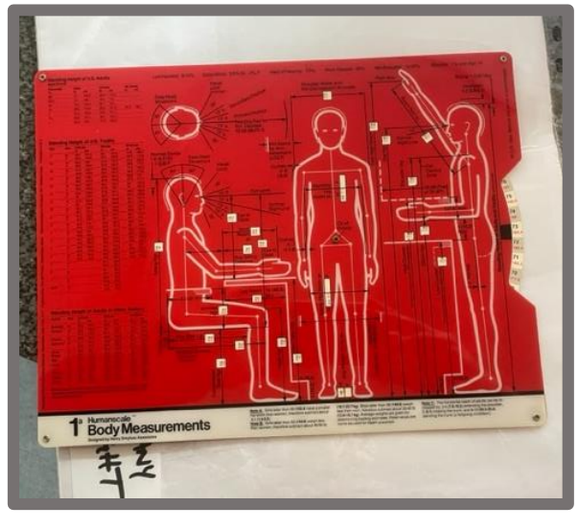
(41.41 x 2) + 53 = 136cm
↳ bungee cord will need to be at least this length



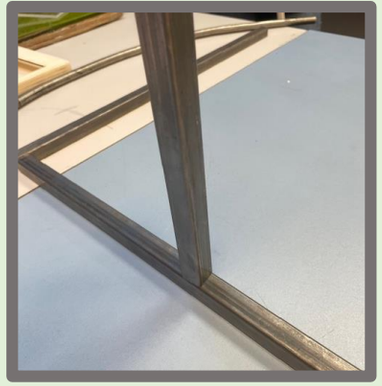
one issue would be the bag bulging more in places making it have larger dimensions This requires a bungee cord with enough 'lee way'

As you cane see the CAD measurements weren't round number because the curved lines used on the bags made the dimensions slight under measurements of the actual bag size

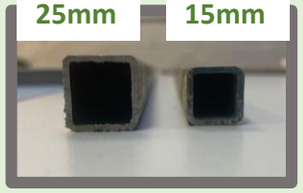
This is what I used for my expected values for each person I took measurements from This allow me to see how much their hand height varied from it being measured with elbows at 90

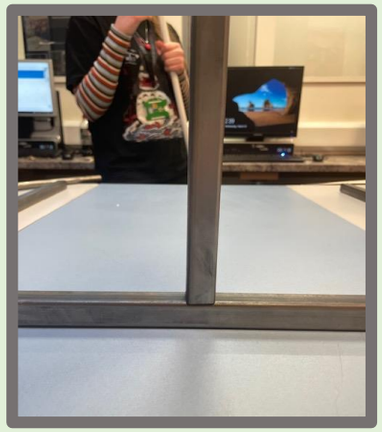


Design Development

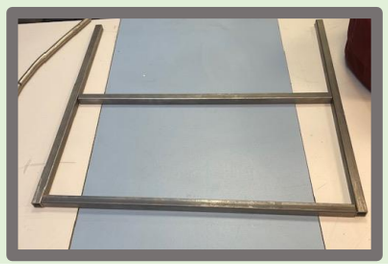


25mm 15mm

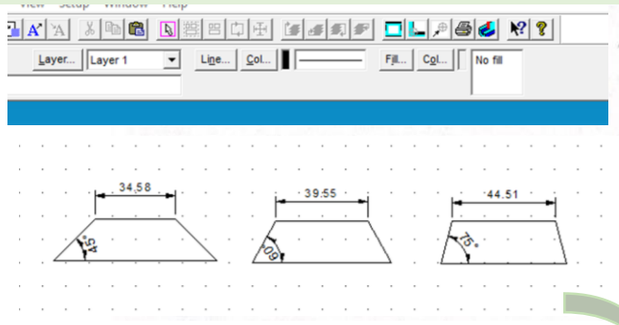




These are the two dimensions that I could potentially use for my trolley (25mm square and 15mm square). I started playing around with the tubing and how it would fit together. The bottom pieces could be the way I make the main framework pieces as they are structurally sound. I could also used triangulation to strengthen the corners of each piece.

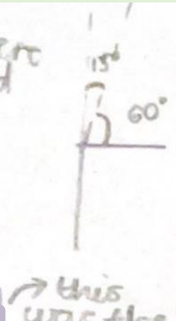


I used my initial idea and made all the curved edges straight so that it was more time-efficient and clean looking..



once the original curved trapeziums were made straight I decided to play around with different angles on 2D design V2. I decided to go for 75° as it gives the user the more space to hold

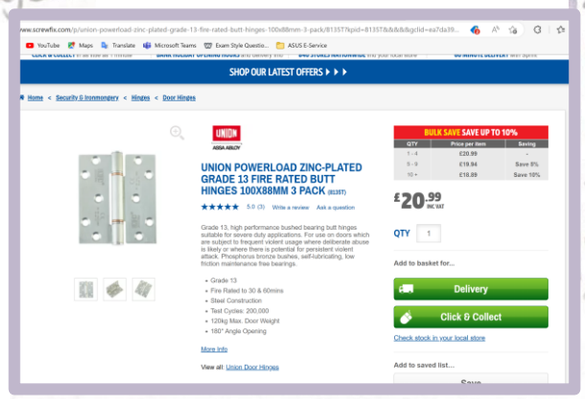
this is some research I had done for a previous project on different hinges.

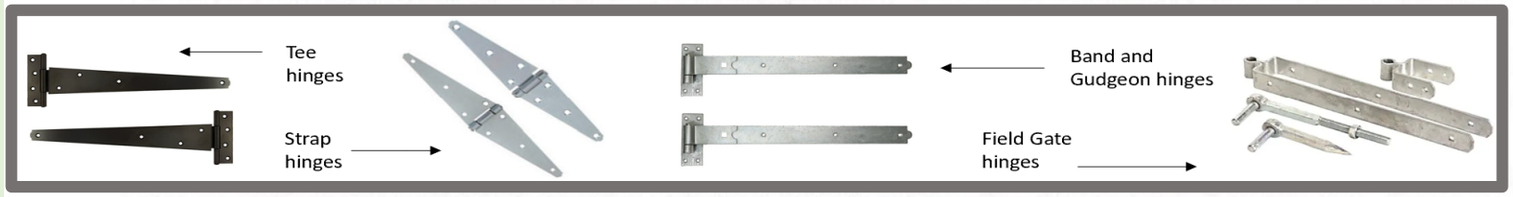


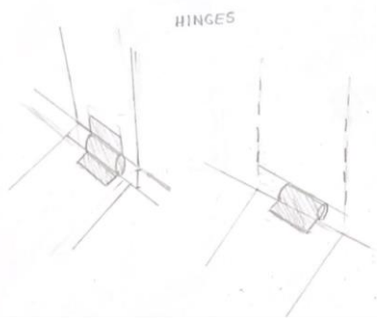
this was the hinge that I found at school

these are some photos of the different hinge types

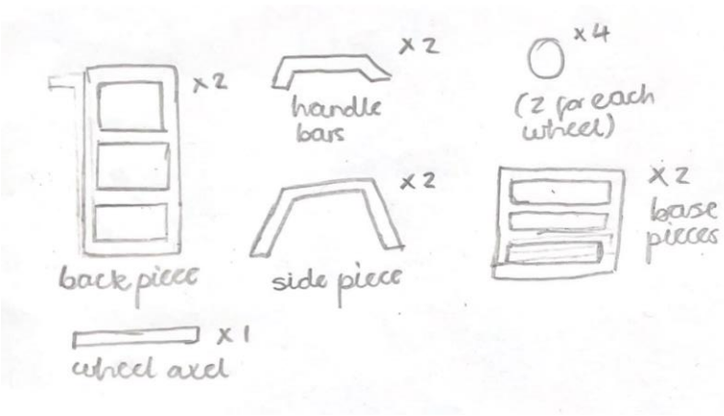
Different types	Relevant information about them
Tee hinges	- Good for lightweight gates - Has a tapered strap which is fitted to the gate - Gauges come in light, medium and heavy duty and a range of finishes (Bright Zinc Plated, Black, Premium Black and Marine Grade stainless steel)
Strap hinges	- Has two tapered straps (used for bi folds) - Has limited finishes and sizes
Band and Gudgeon hinges	- A lot more sustainable than tee hinges - Comes in two pieces: rectangular hinge plate which attaches to the gate post, and the band which attaches to the gate. The hinge plate features a hook and the band sits over this hook - Top hinge pin should be fitted upside down to avoid the doors having the ability to be lifted off
Field gate hinges	- Allows the gate to swing both ways - Wrap around the gate - The top hinge is longer than the bottom hinge (the top hinge sits on the gate stile (vertically upright) and along the top rail. The bottom hinge only has the gate stile to sit on, so is shorter







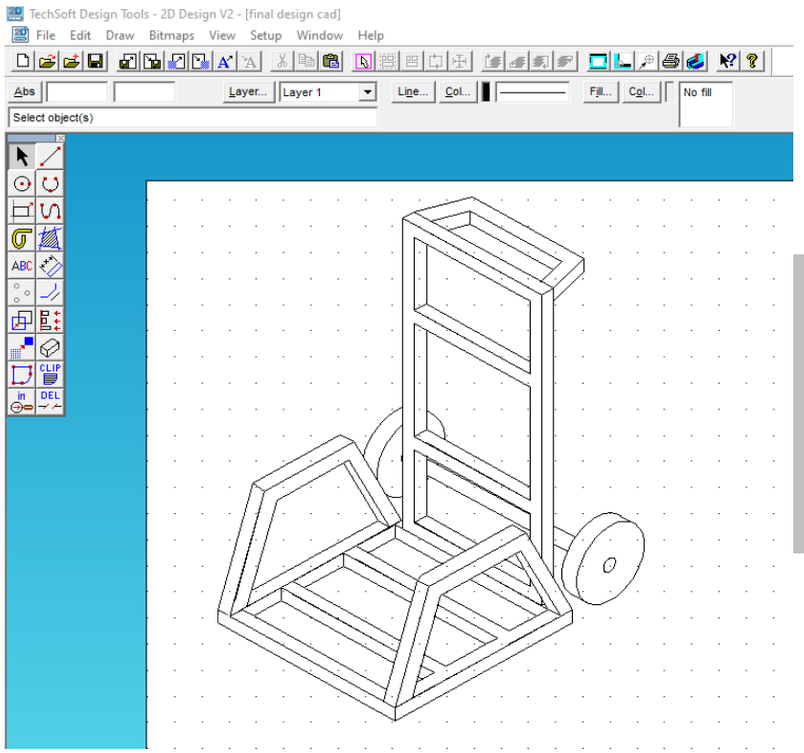
This what the hinge will look like open (on the left and closed (on the right). The butt hinge will be the most suitable on for my product as they can sustain a heavier weight due the to the thickness of the hinge and can be more secure if they are put in with removable hinges.

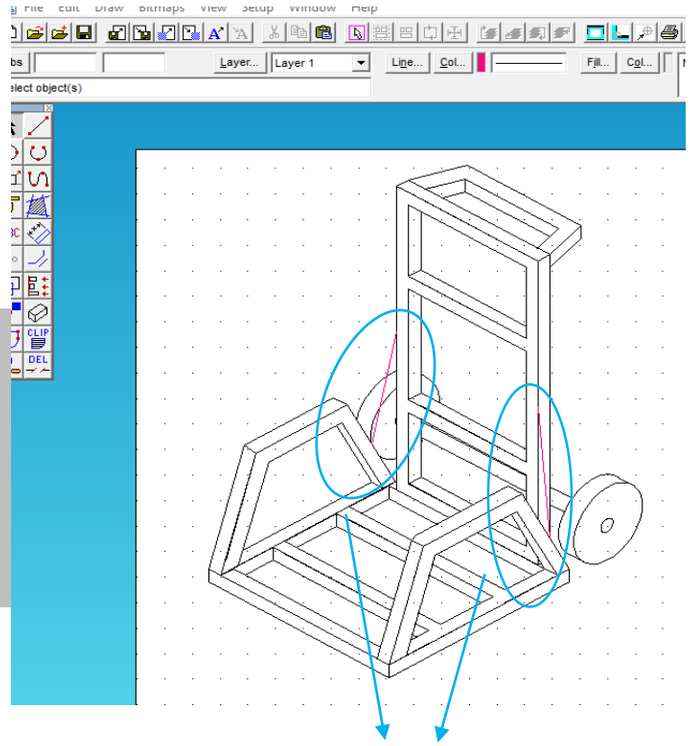


These were the pieces that I used for my CAD drawing and on the right is the final prototype for the trolleys I would like to make.

The next steps are to show my final design solution

Final design solution

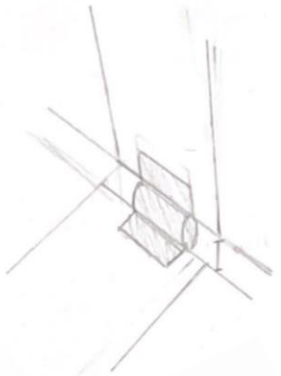


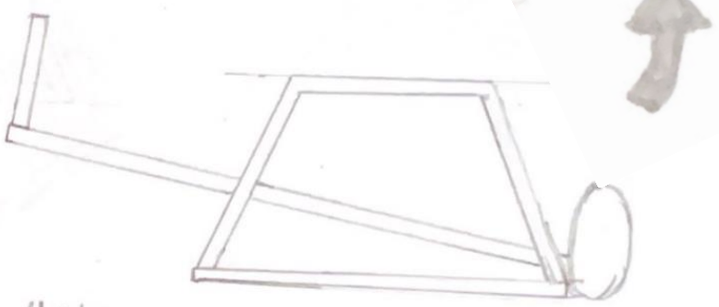


I have circled the red lines which I have used to represent the chain

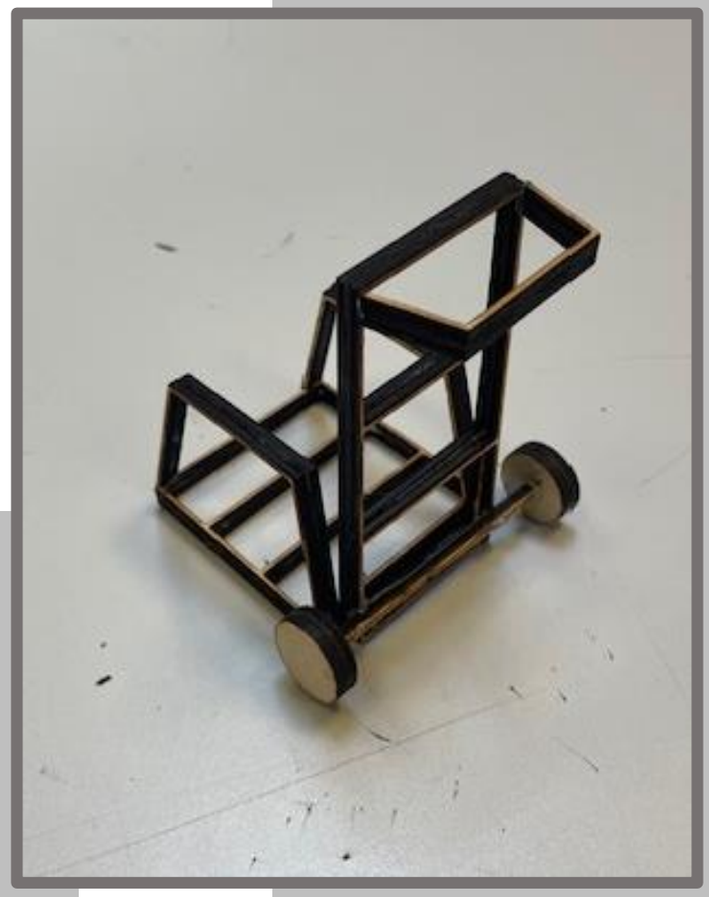
A trolley which allows a goalkeeper to easily transport their kit with side and back supports for their bag to rest on.

This is the hinge when the trolley is open



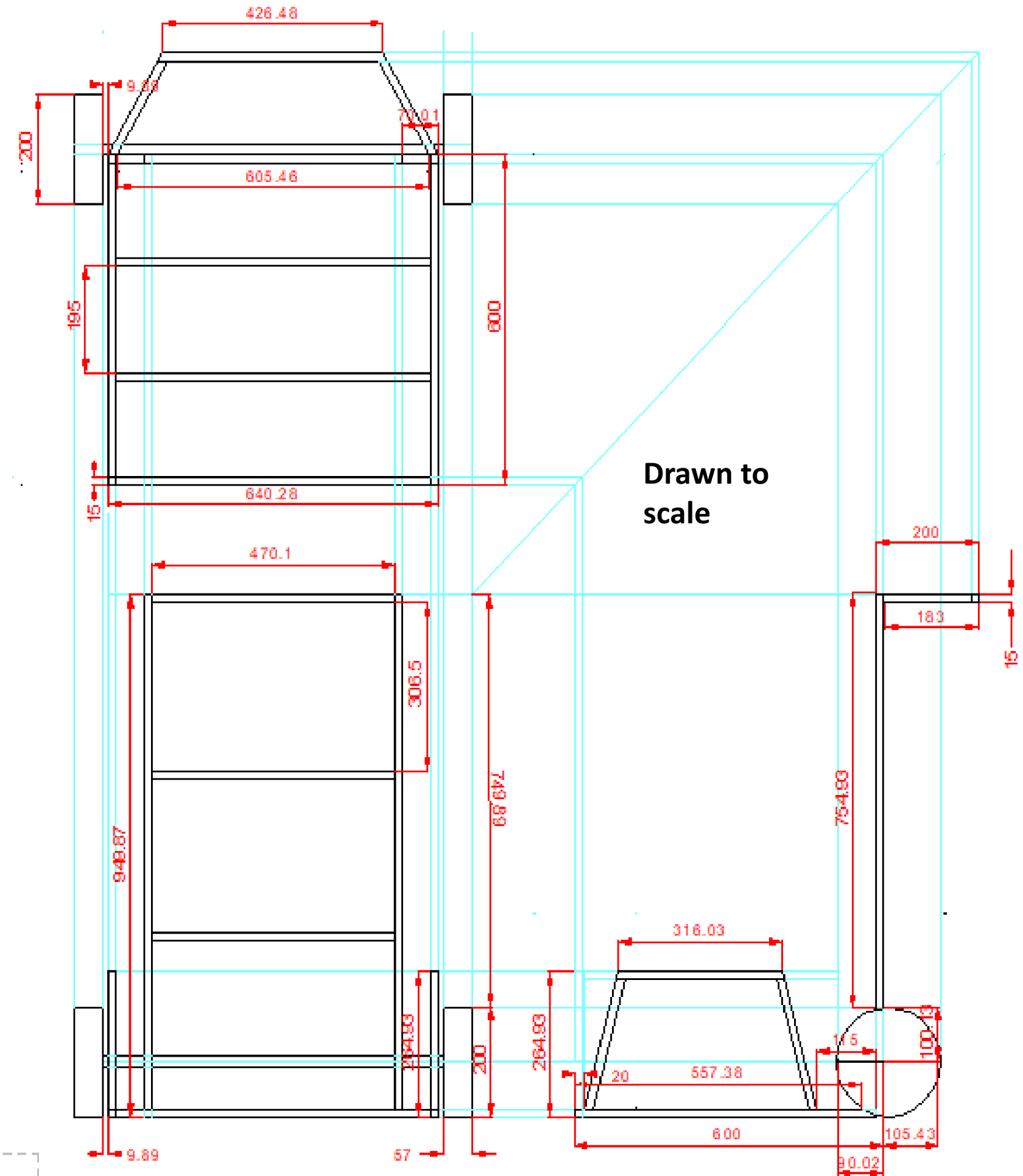


the bag can then rest on the trolley when the floor is wet



The next steps are to show my technical specification

Technical specification



Drawn to scale

On the next page I will show my plan of making

Plan of Making

1. Firstly measure all dimensions on the 15mm square and 20mm circle mild steel using a scribe. This will include using a set square. It will all be done on the circular saw.

1 HOUR

I will use a scribe to reduce the tolerances of my measurements. There will still be a degree of human error in both measuring and angle grinding.

Both goggles and ear muffs must be worn. The metal coming off the machine is unpredictable and the whole process can be very loud.

2. Make a jig using a jig board and little wooden blocks. These will be attached with hot glue and secured by hand.

You need be carful when the glue is still liquid as it can burn and blister you if it comes into contact with your skin. Make sure the turn the glue gun off and let it cool before putting away too

30 MINS

Steps in the process

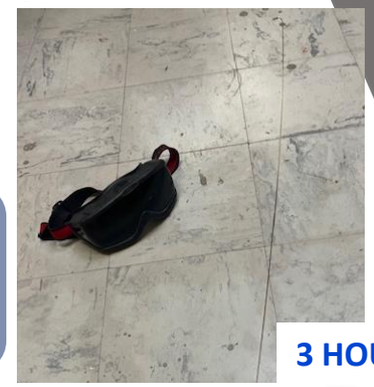
Quality control

Use tne edge of the board to line up the jig so its straight. I will make sure all the jig blocks sit flush the metal so it is more accurate after being brazed.

Health & safety

Ensure you know how to turn it off and keep our hand at a sensible distance up the brazing rod to avoid contact with the blow torch flame. Also allowing sufficient cooling time to prevent burns. Use the stone to avoid a fire

3. Next, I will use a brazing rod and blow torch to attach the joints for all the metal framework. At the same point I will attach the 20mm diameter mild steel and hinges too. Previous to doing this I will add flux to all the joints.

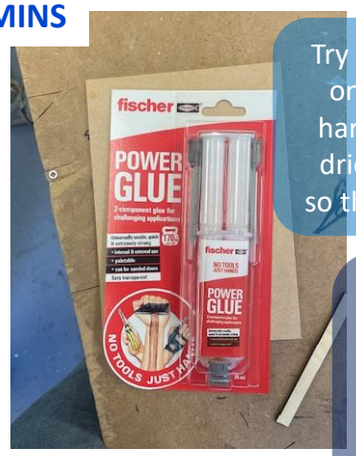


3 HOURS

By tacking my frame first I can ensure that all pieces la flat and at right angles. A Carpenter's square can be used to check this.

5. Use the power glue to bond in the wheels to the 20mm diameter mild steel (which has been brazed to the back of the back piece of the trolley).

10 MINS

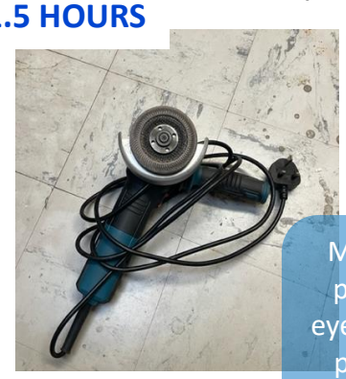


Try to avoid getting the glue on your skin because it is hard to remove once it has dried. Keep windows open so that fumes are weakened.

Make sure to mix the glue before applying it to the inside of the mild steel tube so that it actually sets and is effective in holding in the wheel.

4. Once all the brazing is done file down the joints with the angle grinder and emery cloth. This will allow the spray paint to be applied more easily.

1.5 HOURS



By tacking my frame first I can ensure that all pieces la flat and at right angles. A Carpenter's square can be used to check this.

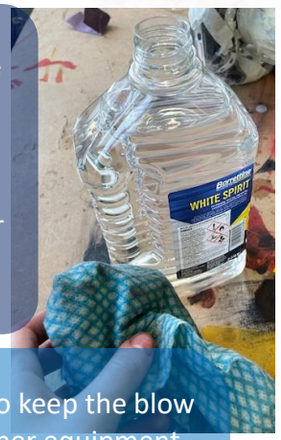
Make sure you wear google to prevent sparks flying into you eyes and keep your hands on the padded areas (designated for holding).

6. Prepare and put the chain onto the trolley. This will require a had-held drill, rivet gun, rivet, washer 6mm drill head.

Keep hair tied back as it may get caught in the drill. Also keep fingers away from the rivet gum as skin could get caught in it.

Look for the mandrel once the rivet has been secured. Test the size og the drill bit using a spare piece of steel and check the rivet fits.

7. Use white spirit the remove the grease from the metal. And then cover up the wheels with plastic wrapping and masking tape.



Check by eye to see if all the grease has been removed (or at least majority)

Make sure to keep the blow torch of other equipment that will heat up away from the white spirit as it is flammable. Avoid inhalation of vapours and contact with skin and eyes.

45 MINS

52 HOURS

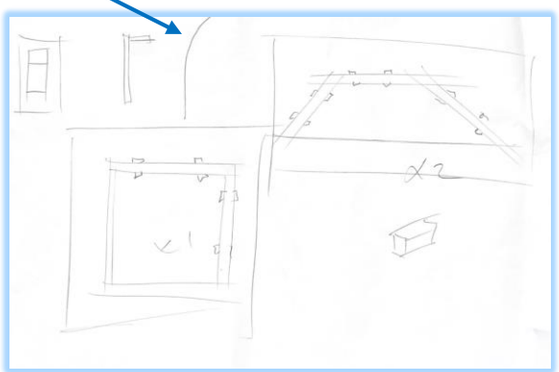
PPE is very important at this stage. Both the primer and spray paint can be poisonous to humans. I will try to keep the room well-venitilated by keeping the windows open.

8. Apply the primer and paint. They will both need at least 24 hours to dry. Between layers you should use emery paint to ensure the final finish is smooth.

I will check to see if the paint is patchy by waiting for it to dry and then assessing it.

These jig sketches were to help me plan the making

= 59 HOURS

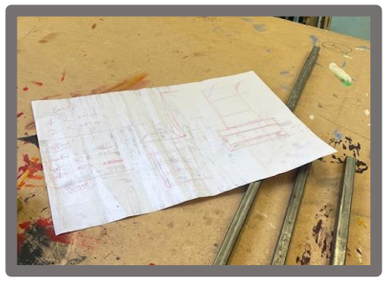


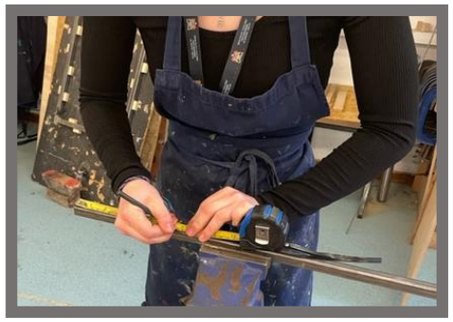
On the next page I will start to show my process of making

Process of Making

1) To start off with I did a sketch with all the measurements for the mild steel needed for the back piece and the base of the trolley.

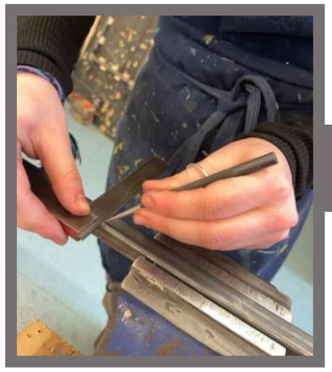
This included:
- 2 x 950mm
- 4 x 400mm
- 2 x 600mm
- 4 x 570mm

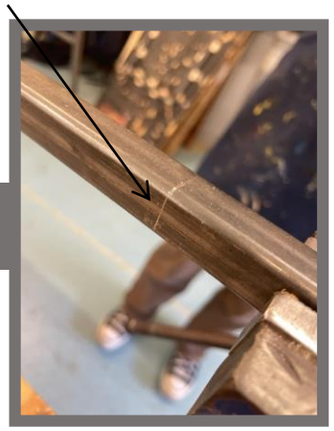




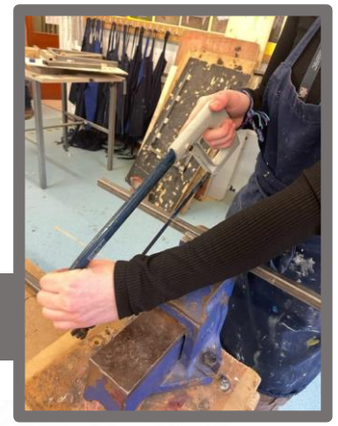
2) The mild steel came in about 5m lengths. I began by measuring out the lengths for each of the pieces I had drawn on my sketch. During this process I used a scribe to make a mark on the metal so I could later see the lengths I'd measured.

3) To ensure that the marking was at the same point all the way round the tube I used a steel square (carpenters square) to carry the marking all the way around. The picture on the right below shows the markings I made. I repeated this for each tube.



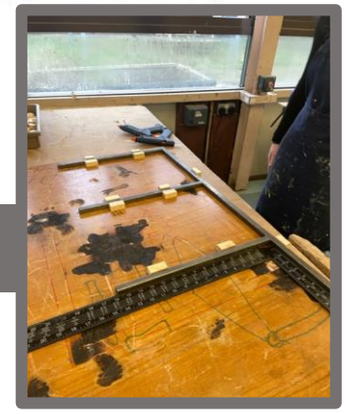


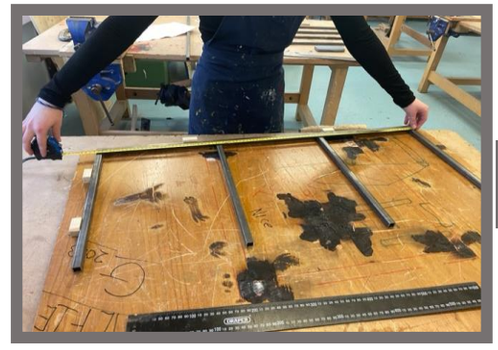
4) Once I had made all the markings, I used a fret saw to making a larger dent. Following this I use the circular saw to cute the excess material. I had be careful as this left the edges of the metal very sharp. I repeated this stage for all of the markings



this is what the metal looks like once cut

5) Then I laid out the pieces roughly to how they would be attached together. This was to check they would all fit together despite the human error that could have occurred during the measuring process. I used the angle grinder to make the ends of the tube smooth so when they were being handled didn't cut me.



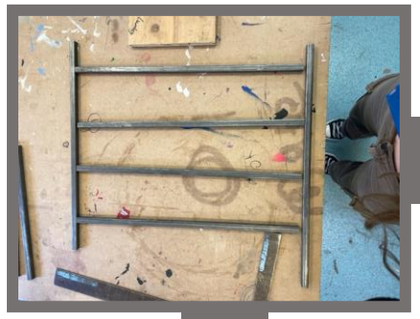


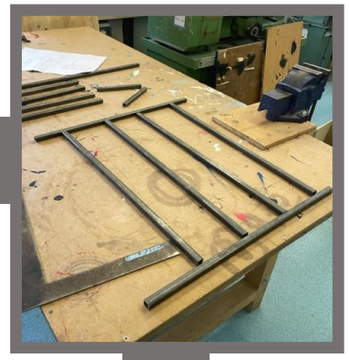
6) At this stage I realised I hadn't calculated the size of the gaps between the metal tubing.

So, I used the length of the handle pieces (95cm) to calculate the horizontal pieces needed to create the back piece which the bag would rest on and the spacing between then.

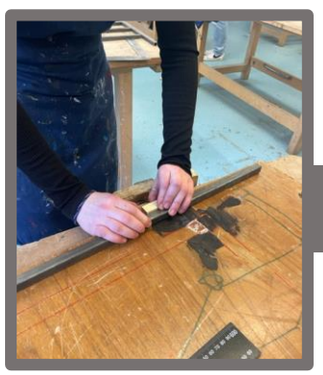
$95 - (4 \times 1.5) = 89$

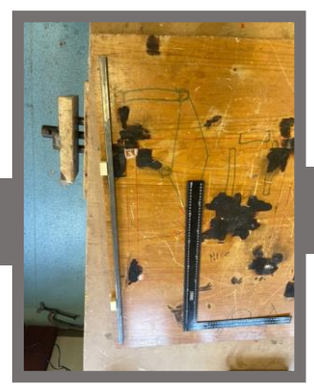
$\frac{89}{3} = 29.6\dot{} \approx 29.5\text{cm}$

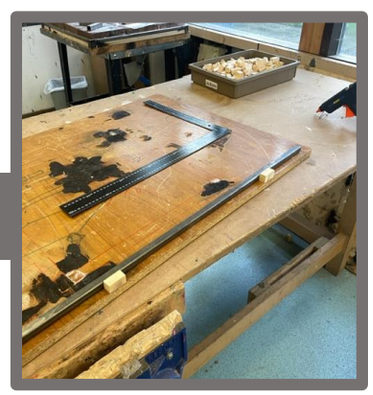




7) At this stage, I began to make a jig out of little wooden blocks. I started by putting down my long handle piece and placing it parallel to the side of the jig board. Then I secured it in place using hot glue from a glue gun on the blocks and ensuring it was straight with the carpenters' square.







8) I used the carpenters' square to put the end piece into the jig and to make sure it was at a right angle. Once I knew the second piece of steel was in the right place I put in more wooden blocks and secured them with hot glue.

Any red writing shows problems that came across during the process

9) Next, I was measuring out the distance between each of the poles on the back piece (roughly 29.5cm). Then, I used the scriber to make sure that each piece was where it should be. I followed this up with using the carpenters' square to check each of the pieces were at 90 degrees to each other and re measured the gaps to before securing them in place with the little wooden blocks.

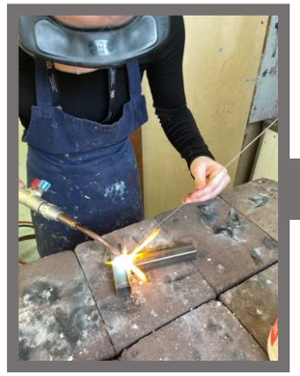
(Hot glue is very easy to remove from wood. On a few occasions The angle wasn't 90 degrees as I had moved it while gluing the blocks down. I would remove the blocks and the remeasure the angle and gap to make sure it was accurate).

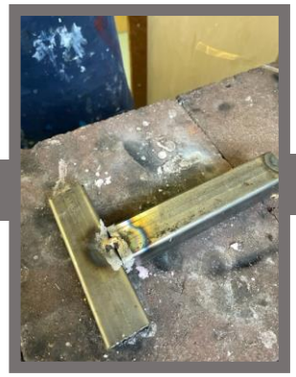
On the next page I will continue my process of making

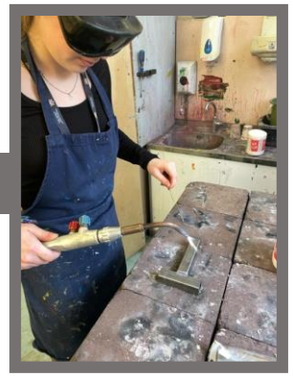
Process of Making

10) I finished the jig by adding in more wooden blocks to secure the 4 horizontal pieces I had just put down.

11) In order to attach the mild steel pieces together I will need to use brazing. And so, I had a practice go at it using two spare pieces of mild steel. Firstly, I Put pink flux onto the joint. This allows the joint to be cleaned to improve the bond with the brass



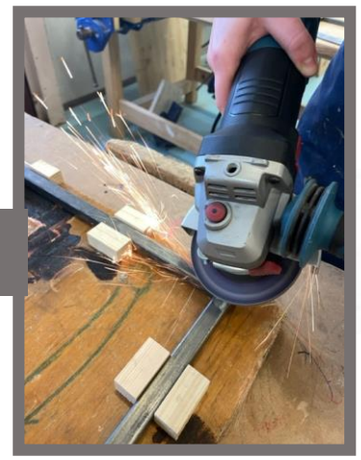


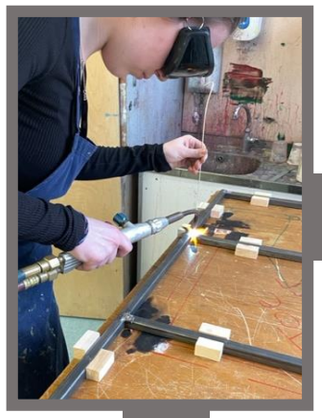


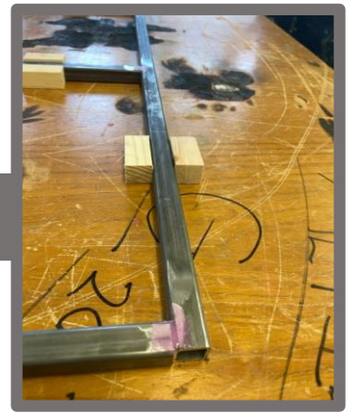
12) I had to collect the brazing equipment which included retrieving the gas canisters and blowtorch and practicing using a lighter to turn it on and turning it off using the red dial. With this knowledge and experience, I began to use a brass brazing rod to tac all of the places where two of the pieces of steel met. The blowtorch allowed me to heat up the brass and melt it over the joint.

13) Once I'd tacked one side and given it time to cool I could flip it over to braze it. This required melting more brass into the joint and made a stronger, more permanent joint

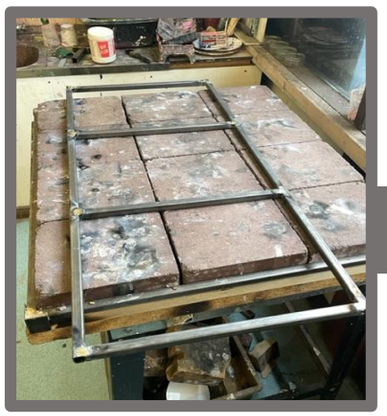
14) My practice was finished so then I moved back to the pieces I'd previously put into a jig. I started by using an angle grinder to smooth down the joints. I wanted to make sure that they weren't as obvious once it had been painted.





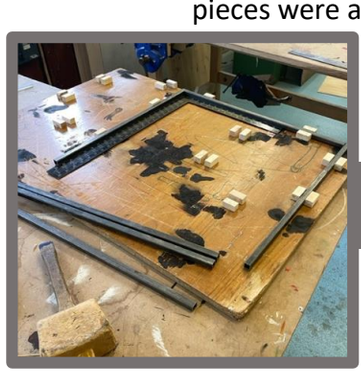


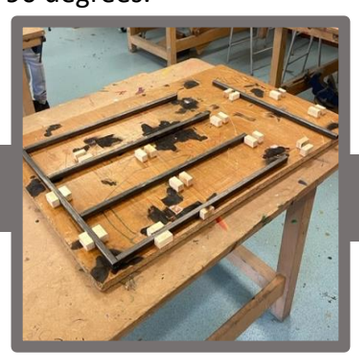
15) As I did in my practice, I applied flux to the joint. After leaving it for a few minutes, I went in with the blowtorch and the brass rod and tacked all the joints on one side. After leaving it to cool I was able to remove it from the jig. Once cooled I brazed the other side and added more brass to the originally tacked side. This can be seen below

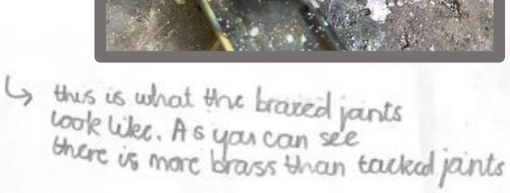


I then brazed the joints on the other side to the joints that had been tacked. Once this had cooled I went back to braze the initially tacked joints.

16) I repeated steps 7-10 (but this time I used 600mm and 570mm lengths for the base) which included laying out the pieces as they'd be attached. And measuring the distance between pieces so that they were brazed in the correct place. I added in little wooden blocks to make a second jig and again used the carpenters' square to ensure all the pieces were at 90 degrees.







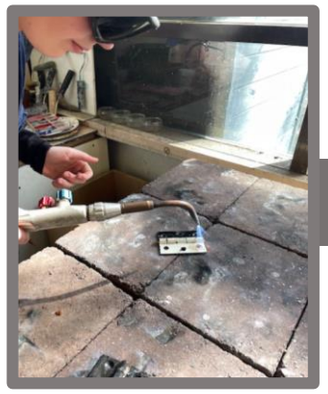
17) Once again I used the angle grinder (with a pad) to smooth the joint and remove the oil which could prevent the brass from bonding with the mild steel. Next I applied flux to each of the perpendicular joining piece of mild steel.

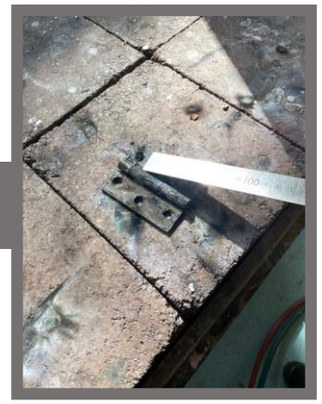
I went round with the brazing rod and tacked all the joints, waited for it to cool and removed it from the jig. Then I flipped it over and brazed the joint on both sides. This completely the base for the trolley.

On the next page I will continue my process of making

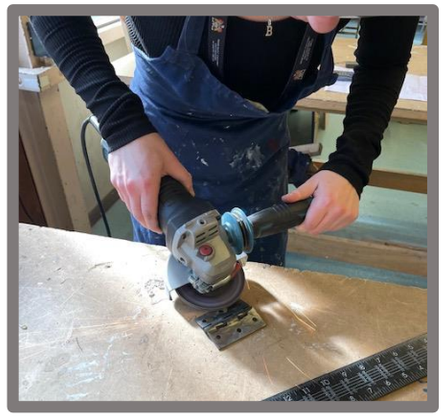
Process of Making

18) Now I had completed the pieces for the main frame I need to attach them together. I decided to use a hinge which would allow the trolley to be folded away. The hinges school provided were painted white so I started by lightly following the brazing torch over the metal allowing the paint to flake off. I did this as I didn't have paint stripper available.



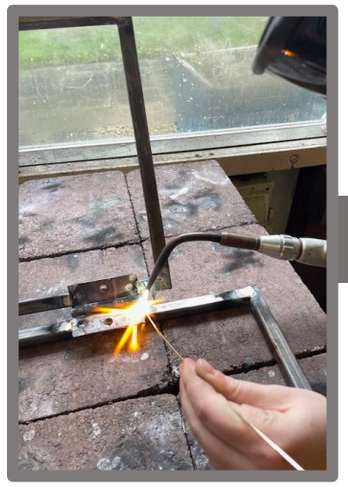


this is what the hinge looked like once I had finished taking the paint off



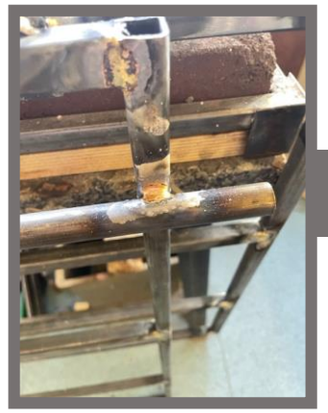
19) I decided to take off the remainder of the paint using an angle grinder. This allow me to give the hinge and smooth finish where paint could be applied more easily. Following this, I fluxed the edges of the hinger and the area I was attaching it to on the two main frame pieces.

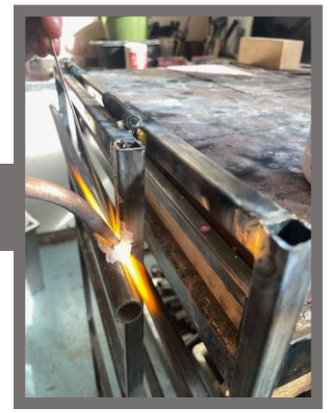
20) I realised at this point I hadn't calculated for the gap the hinge would add to my trolley. However it wouldn't affect the function of it. I then brazed the hinge so that knuckle was only just off the mild steel frame. As you can see from the photo the hinge was slightly too big.



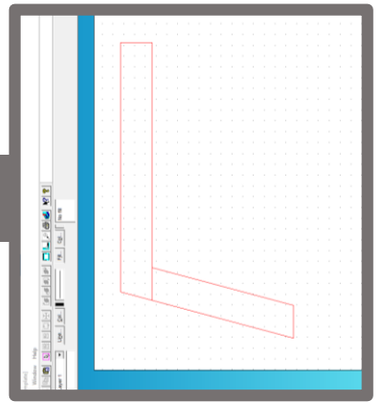
21) I then was working out where the wheels would need to be in order for the trolley to still be foldable. I need they would have to come out further than the base of the trolley. I then worked out the height the axel would need to be from the base in order for the wheels to just make contact with the floor

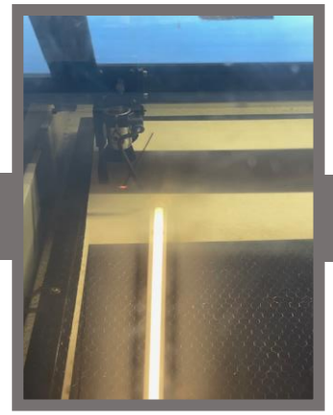
22) Once I calculated the length of 2mm diameter mild steel I brazed it onto the handle piece. This piece was about 610mm in length and allowed the wheels to be slotted in.

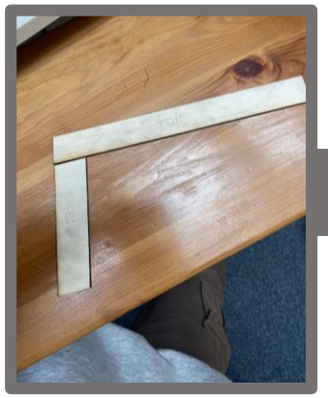




this was harder on curved material





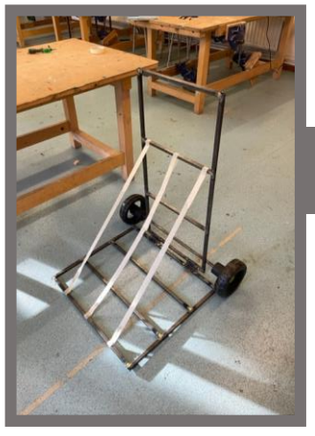


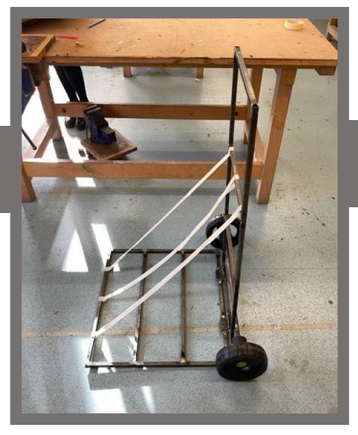
24) I started my next jig by placing the steel pieces (NUMBERS) I'd cut at an angle using the plywood

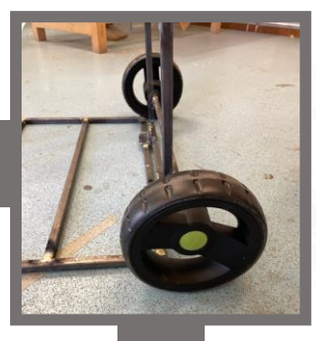
I then used the plywood template to ensure the pieces were correctly placed into the jig. I made the jig by using a hot glue gun and little wooden blocks.

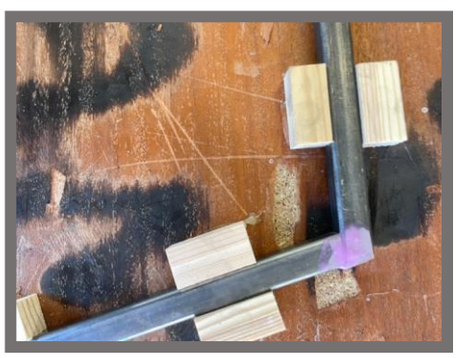
23) For the next part I made a template to help me with the sides of the trolley. I started of by making a 45 degree angle but I quickly realised this would be too large (the angle). So then I looked at a 30 degree angle and this looked a lot better and gave the trolley more space for the bag to rest on. The template was made on 2D design and cut out on 3mm plywood using the laser cutter.

25) Using a paintbrush, I added flux to the joints. I tacked the joints by adding a small amount of brass with the blow torch. I then added more brass to strengthen the joint

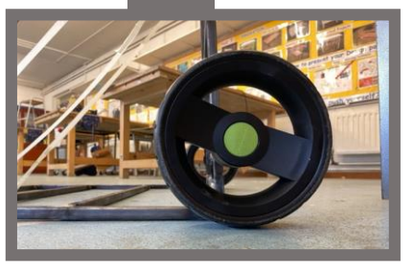


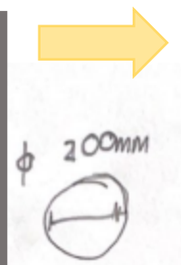






26) While I was waiting for the side pieces to cool, I started trialling my product as it was. The photos of the wheels show the concept I was working out in step 21. The masking tape was used to hold it at 90 degrees; the hinges allowed full range of motion and needed something to stop the handles falling flat to the floor.

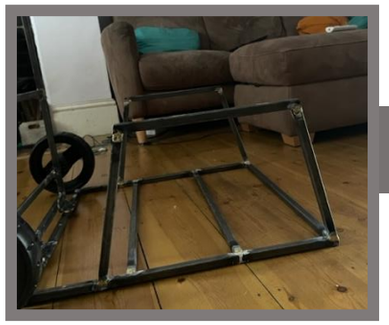


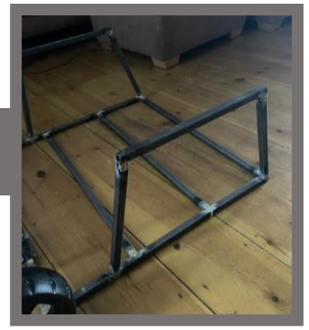


27) The blow torch was used once again to heat up the metal. This allowed the brazing rod to metal into the joint and hold it together. While it was still hot, I angled them slightly outwards to give more space for the bag (when kit is packed in they bulge on the sides)

On the next page I will continue my process of making

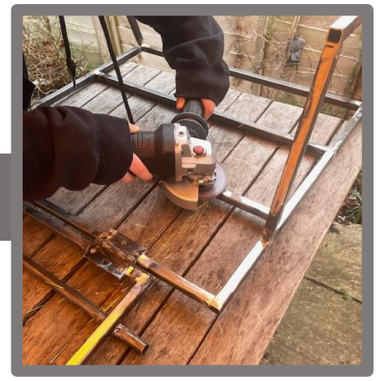
Process of Making





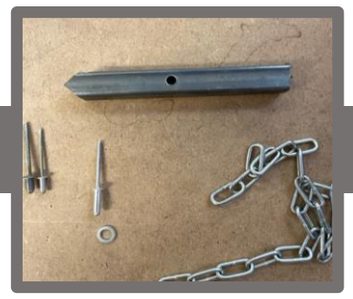
Here are some more photos to show what the sides pieces looked like once they had been brazed on. I took it home to continue working on it over the weekend. I also bought the chain needed to replace the masking tape form Halfords.

28) I used the time to use the angle grinder. This made sure that there wasn't excess brass sitting on top of the mild steel. During the process, it started raining so I had to put up a gazebo (at this point it hadn't been treated for outdoor use, so the metal was tarnishing and rusting).



29) I then moved forward by making the handle using the same technique I have used previously (brazing). Once I had brazed the two joints, I used the angle grinder to smooth the joints (the before and after can be seen on the right). Then followed this by brazing the handle onto the top of the back piece.

31) For the next stage, I was testing how the pop rivet would work and how to use a rivet gun. I used a 0.75mm drill bit on the hand held electric drill. Once I'd placed the rivet into the hole following the chain link I secured it in using the rivet gun.

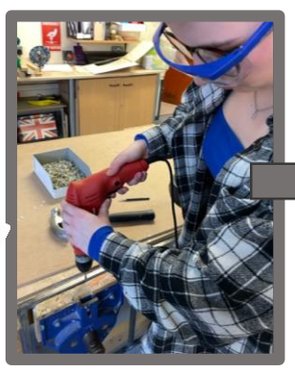


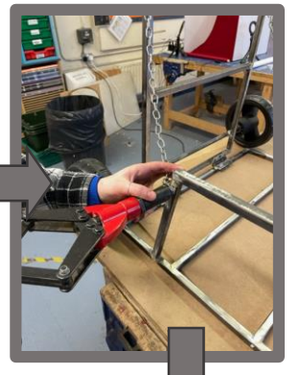
32) Like in my practice I used the hand-held electric drill to make the holes in the steel. I had previously marked them in step 29. I then used the rivet gun once I had put the chain with the rivet and washer on. The washer allows the rivet to be secured to the mild steel by dissipating the force of the rivet.

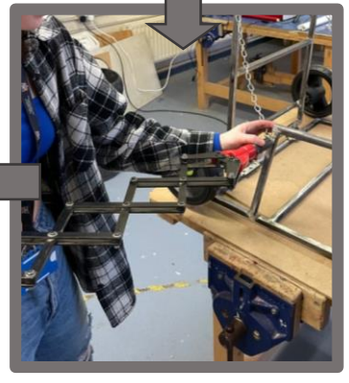
The two parts of the glue were very thick and so I had to mix them

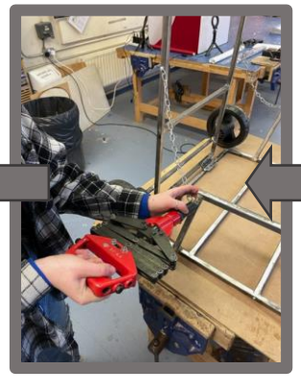
30) I then marked out where I wanted the ends of the chain to sit on the trolley on the side pieces and back pieces (roughly halfway along the steel lengths of mild steel). I then bonded the wheels to the tubing with power glue. It came in two parts which I had to squeeze out and mix together before applying it to the inside of the mild steel tube and the wheel adjoining part.

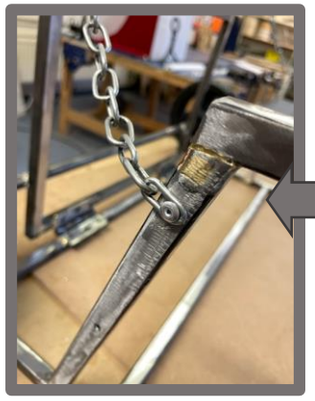
This photos show a step-by-step for using a rivet gun. You use a pumping motion to get the rivet in.



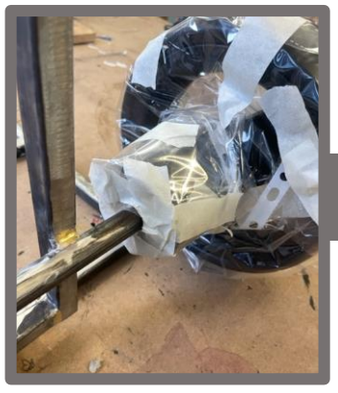


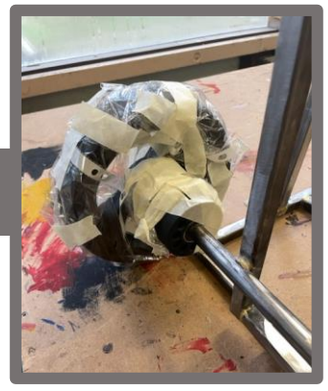






33) The first two photos show the hinge being too big for the trolley. In order to improve this, I swapped the I changed the grinding pad to a cutting pad on the angle grinder. This allowed me to remove the excess material from the trolley. To give it a smooth finish I swapped the pad back and made sure the edges weren't sharp.





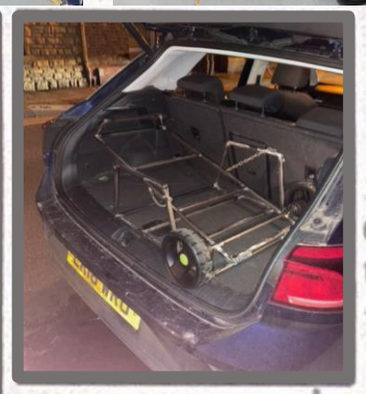
34) My next job was to paint the trolley. Since I had bonded the wheels, I needed to cover them to stop them being spray painted. I used some plastic and making tape. To start off I had left gaps around the pole. I went back over it with just making tape to seal them.

On the next page I will get some feedback at the current stage of the trolley

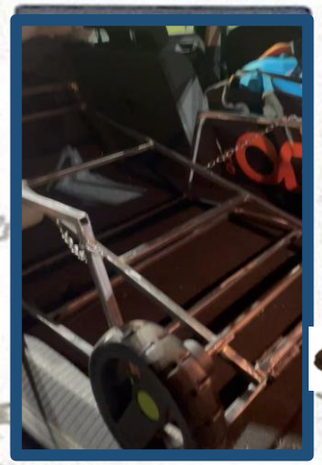
Evaluation – initial interaction

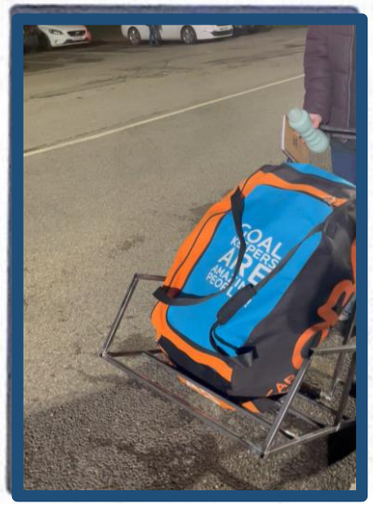
This was part of the evaluation I did before my product was fully finished as I needed to take it to my last hockey training session before the end of season

This was what my product looked like before it was painted. I started trialing how easy it was to use by putting the bin on it. I found that the chain (as expected) worked a lot better than the masking tape as it could keep the tension on the trolley. I didn't have to make up for the lack of tension when wheeling it making it a lot nicer and easier to manoeuvre up the school hallway.

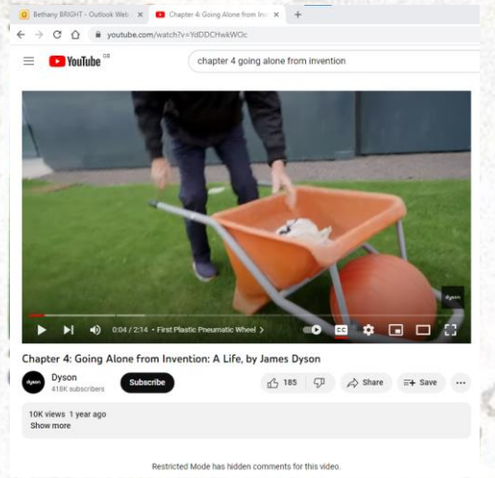


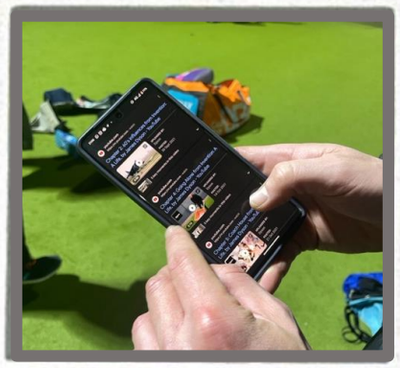
this video shows me wheeling the trolley in the hockey car park. It was very smooth and made it easy to take to the pitch





← CLICK TO WATCH
→ getting it out the car





↳ My coach recommended I watch this Dyson video. It shows a wheel barrow Dyson design which is a big round front wheel that makes it safer for use. It allowed the barrow to roll more freely in mud without getting stuck.

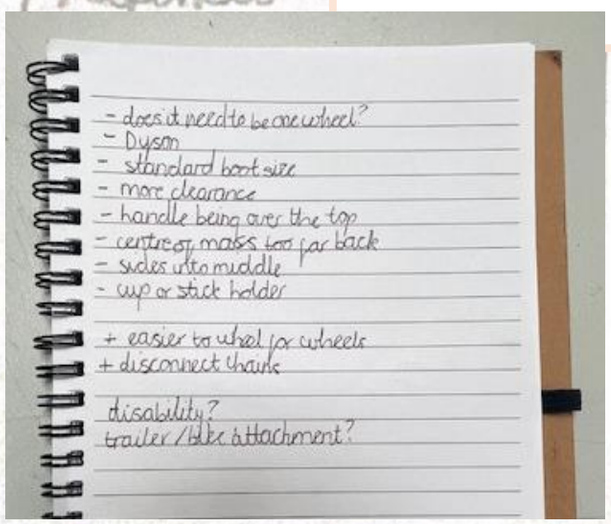
→ this is what the trolley looks like from the perspective of the user if pushing forward

→ the trolley is actually slightly too wide for the car. As you can see from the photo it's only very slightly

↑ these are the responses

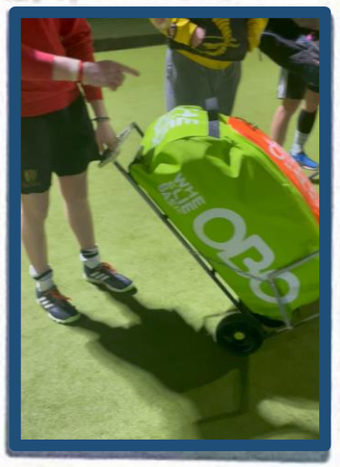
I liked all the suggestions so thank you! I thought the concept of having just one wheel was really cool however I it probably would not fit with the aesthetic of the trolley and may be harder to design that it was for the wheelbarrow. I would definitely look into a stick holder with further research as they don't tend to fit in the usual bags.

As an expansion using the same design but for people with disabilities would be something I would be interested in looking into.



These wheels make it easier to maintain the bags as it doesn't get dragged along the floor. Normal bags get ruined around wheels

→ Here Joe is modelling the trolley with a larger bag. Fits perfectly

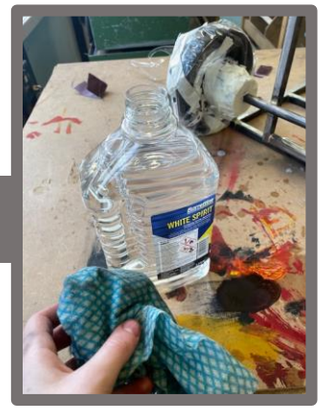


↑ CLICK TO WATCH

On the next page I will continue the process of making for my bag

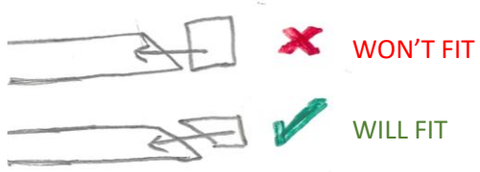
Process of Making

35) Next I cleaned the grease off the metal by using white spirit and an old clothe. It is useful because you can remove the grease without damaging the metal. I repeated this a few times, removing the residue between each time of doing it.

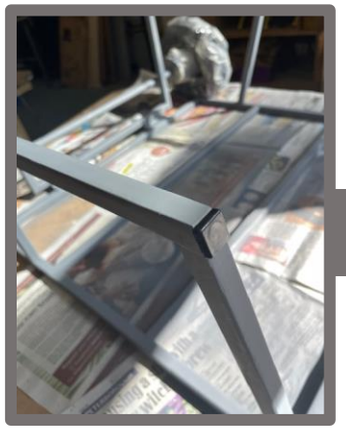


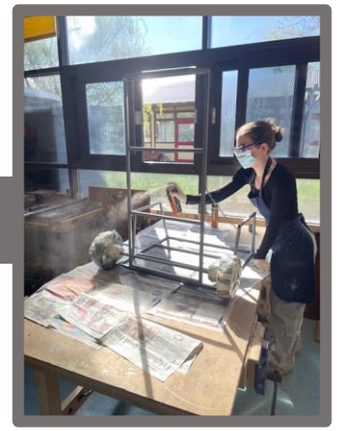
37) I let it sit for 15 minutes and then went back to fill in any patches I had left from the first time around.

While, I was waiting from the primer to dry, I started thinking about how the bungs wouldn't fit. I could take off some of the material and make it fit more easily.

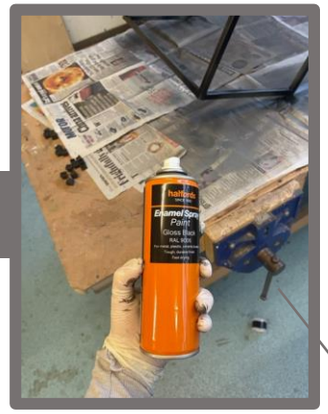


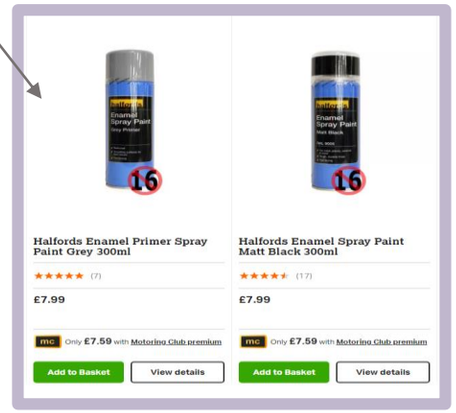
36) When I was in Halfords there was a suggestion on the can to use grey primer before applying the black paint(this allowed the application of the black paint to be a lot smoother). While, applying the primer I wore goggles, gloves a mask and kept the windows in the room I was using open. I had to hold the spray paint at about 20cm to avoid it dripping/adding too much to one area. Here are some photos showing the trolley once The primer had been added. The lighting sometimes made it more difficult to see the gaps in the paint and so I had to get a second person to check my painting. This helped me to ensure the trolley was fully primed



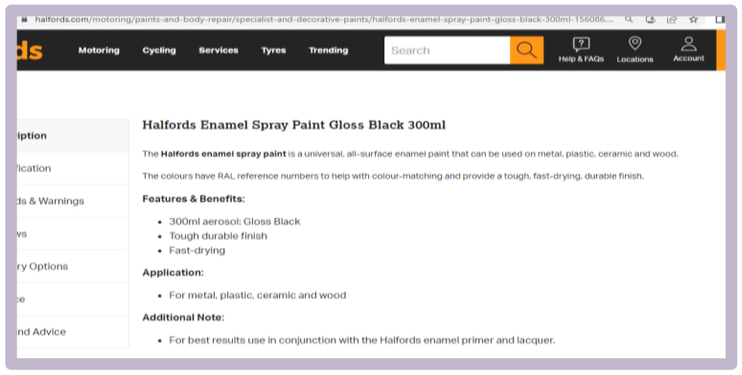


37) Following the primer, I used the same technique the applying the black paint. This time it was more important to keep the can at the right distance because it was the top coat(what people will see when they look at the trolley. However this time I found the one can of paint was not enough to cover the whole trolley and had to go back to get another two cans of paint from Halfords. As you can see from the photo the paintwork is patchy so I had to follow it up with another two coats.



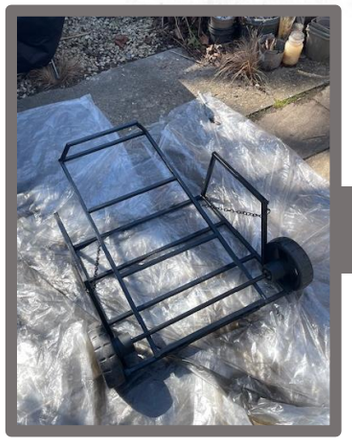


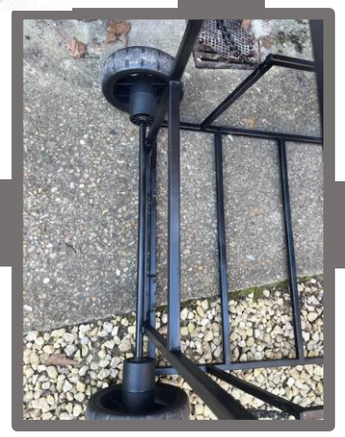
These were the options on the Halfords website and what it said about the back gloss paint

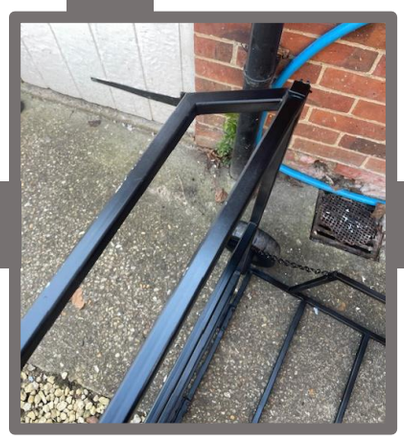


At this stage I took my trolley home to finish then evaluate

I used some old plastic covering we had to protect the paving from the paint







38) I had to complete the painting at home using the same PPE. When doing it in the garden I found that I had the same problem with the light (although this time hard to distinguish)and it made it look as if some of the black was grey. I took these photos to help meto identify the parts of the trolley not fully covered in paint. This lead to my finished product.

On the next page I will show my final product

Evaluation

Name: Andy

1) Would you use this trolley? YES, IF I WAS A GOALKEEPER

2) Would you say it serves it's intended function 'to transport a goalie kit'? YES

3) What is your favourite part of the trolley and why? light weight / easy to move Simple design

4) What is your least favourite part of the trolley and why? Support straps

5) Is there anything you would change about it or add to it? NO

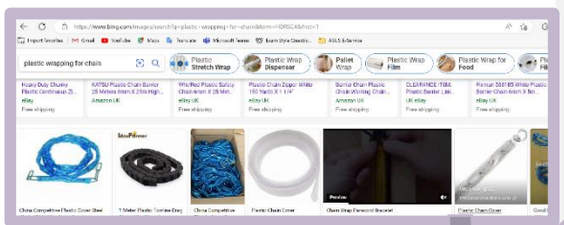
6) Do you like the texture of the handle? Is it comfy? Yes, simple but works

One of my hockey coaches

Answer analysis

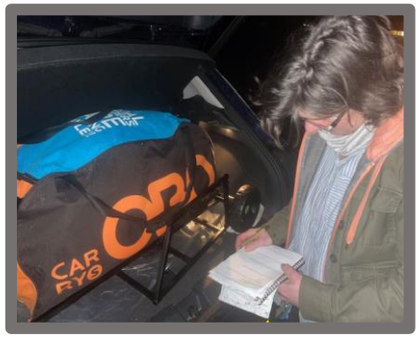
- neutral coloured? Yes it is!
- compact? -
- useful? yes, as a GK
- easy to move + lightweight? yes (favourite part)
- comfortable to use? yes, it is simple but it works

After initially saying he wouldn't change or add anything to the trolley Andy then mentioned **<u>plastic wrapping for the chain</u>**. I searched it up on the internet and found that it would be nice to not only make the chain more **<u>aesthetically pleasing</u>** but it would also protect the chain for weathering (and therefore increase the **<u>longevity of the trolley).</u>**



I asked my stakeholders a survey on page 7 and used their response to make this I summarised non-technical specification for my product:

- **Neutral coloured**
  I will have both a male and female audience so in order to appeal to them both I will avoid bold colours.
- **Compact**
  The main though was so it can be stored more easily and that it would take up less boot space
- **Useful for stakeholders**
  Will they actually use it? Does it provide a significant improvement?
- **Easy to manoeuvre and lightweight**
  People wanted the option to be able to take it on public transports with them.
- **Quality and strong material used**
  This will increase the longevity of the bag and give It more market potential
- **Bigger wheels**
  This allows it to move the bag more easily (built in wheels tend to be small)
- **Comfortable to use**



- compact? sorta, folding is good but could have a narrower wheel base
- useful? yes
- easy to move + lightweight? yes, although doesn't quite fit in the car (more awkward)
- neutral coloured? Yes it is black
- comfortable to use? yes, better than holding the steel bar
  has option to rest on and keep bag off wet pitch

Answer analysis

- neutral coloured? yes, but would prefer it to be coloured
- compact? -
- useful? Yes
- easy to move + lightweight? Yes, easier to move over surfaces
- bigger wheels? Yes, better than my OBO bag (aka current bag)

Name: Sue Bright

1) Would you use this trolley? Yes.

2) Would you say it serves it's intended function 'to transport a goalie kit'? Yes

3) What is your favourite part of the trolley and why? I like the folding → this then keeps it off the floor & stops it getting wet pitch side.

4) What is your least favourite part of the trolley and why? The width of the wheel base which just doesn't fit into the boot of our car (by 1inch!).

5) Is there anything you would change about it or add to it? Slightly narrower wheel base

6) Do you like the texture of the handle? Is it comfy? Yes it is comfy - better than the steel bar.

Name: Granny Light

1) Would you use this trolley? Yes

2) Would you say it serves it's intended function 'to transport a goalie kit'? Yes

3) What is your favourite part of the trolley and why? Lightweight + makes kit easy to transfer to pitch

4) What is your least favourite part of the trolley and why? takes up more boot space

5) Is there anything you would change about it or add to it? Could it be slightly narrower

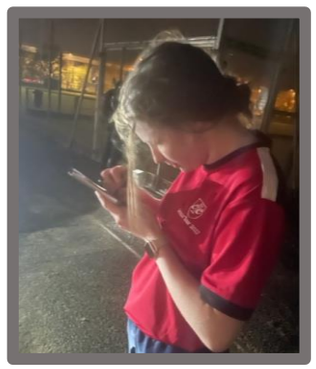
6) Do you like the texture of the handle? Is it comfy? Yes. Very comfy

- neutral coloured? -
- compact? no, the base is too wide for the car
- useful? Yes, as a GK it would be
- easy to move + lightweight? yes (favourite part)
- bigger wheels? yes, but may take up too much space
- comfortable to use? yes, very comfy

These are the questions I produced the following

1) Would you use this trolley
2) Would you say it serves its intended function 'to transport a goalie kit'?
3) What is your favourite part of the trolley and why?
4) What is your least favourite part of the trolley and why?
5) Is there anything you would change about it or add to it?
6) Do you like the texture of the handle is it comfy?

← CLICK TO WATCH



Name:

1) Would you use this trolley? Yes

2) Would you say it serves it's intended function 'to transport a goalie kit'? Yes
The wheels make it easier to take over different surfaces

3) What is your favourite part of the trolley and why? The wheels They are much better than the wheels on my OBO bag

4) What is your least favourite part of the trolley and why? The colour. I want it to be blue to match my kit

5) Is there anything you would change about it or add to it? straps to keep the bag on the trolley

6) Do you like the texture of the handle? Is it comfy? Yes

Has my product met the specification?

Easy to manoeuvre+ lightweight? YES
Bigger wheels? YES
Comfortable to use? YES

Neutral coloured? YES
Compact? NO
Useful? YES

On the next page I will evaluate my strengths weaknesses and improvements

Evaluation

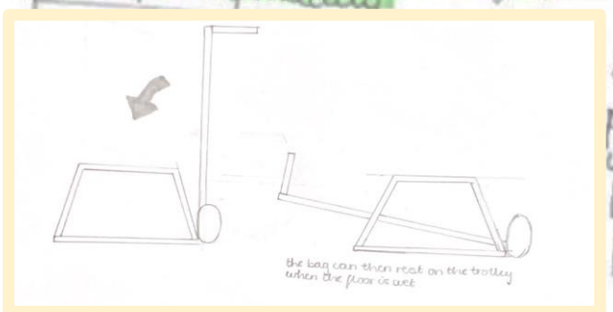
On the next page I will evaluate my products against existing products

Strengths

+ The trolley has wheels which are alot bigger than the wheels you would get on a normal goalie kit (they come and are attached to the corners of the bag)

+ These wheels allow the user to have more control over the trolley as well as being able to travel more smoothly over rough surfaces

+ It gives the option to be used as storage both pitch-side and at home. For example, when the pitch is wet it can be used to keep the bag off the ground and stop it getting muddy



↗ this is a little diagram previously used which shows how the trolley folds down

+ The trolley can be folded so that it can fit into smaller spaces

+ The handle has been covered in foam so that it is more comfortable for the user. In hockey season (winter) it will retain heat better and will stop the user having to touch freezing metal.

+ I placed the wheels on the trolley so that they were in contact with the floor when upright and gave the trolley balance.

+ The chain provides the ability for the base and back piece to be held at right angles and ensure the hinge doesn't shut when not wanted

+ The shape of the handlebar allows a more unique and innovative design which compliments the sides

+ It could easily be made on an industrial scale due to using primarily mild steel

Weaknesses

- The trolley's wheel base and width in general doesn't quite fit in the car as I found out when I first tested and took the trolley to my goalie training

- The handlebar makes the length of steel which is held shorter and therefore making the range of hand widths slightly smaller

- The length of the back piece is actually shorter when it is in use (as it gets pulled back) than at rest. This means some of my taller end users didn't find it as comfortable when they were pushing it around

- All of the edges are straight which could make the trolley more dangerous for people below a certain age. It also makes the trolley alot simpler aesthetically.

- I painted the trolley black which is quite a generic colour and would make it harder to stand out in marketing for example on an advert.

- The handlebars, base and the angle of the side pieces to the base aren't adjustable meaning that smaller kit bags have the potential of falling off the trolley

- The trolley will always require extra boot space and storage capacity

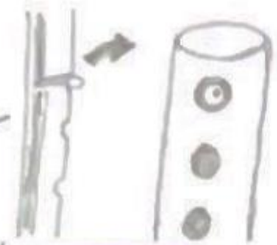
- The colour will heat up very quickly and may be too hot for people to touch in summer. It could be left out in direct sunlight for a long time during a game.

- I've found (from the short time of being able to use it) that the enamel spray paint I used chips and scratches relatively easily

- The wheels have been bonded onto the trolley so if they needed replacing more materials would be needed than just the wheels.

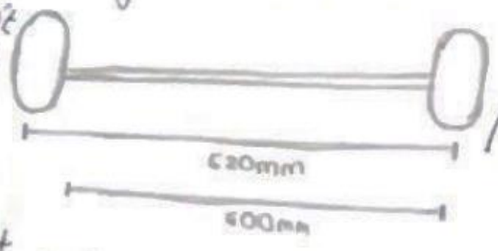
Improvements

- One of the improvements for my trolley would be having adjustable handles and potentially an adjustable base with the sides



- Another good addition to my trolley would be added in something that could be clipped onto one of the side bars to hold a hockey stick

- It would be extremely useful to make the wheel base shorter so that the trolley could fit more easily in someone's car



I would also have make the base of the trolley slightly smaller

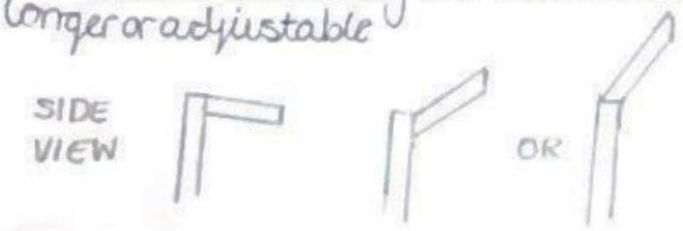
- There is an option to have a customisable grip which could be taken with clays moulds and then incorporated into a gel mould

- As an expansion on the trapezium I have used for this prototype I could use a range of other shapes

- As mentioned early by Andy, adding plastic covering / wrapping which can be vacuum sealed onto the chain (and giving it a smoother finish).

- You could make the trolley in different colours so it appeals to a larger audience (hopefully make it a more enticing product for younger keepers)

- Make the handlebar tilt upwards as an alternative to making the handlebars longer or adjustable



Evaluation – existing products

To continue my evaluation, I did some research and observed three other bag/products which have similar features to my trolley and could be classed as 'competitors'. This will mean that I will be able to come to a valid conclusion on how my product would sell in a competitive market. The sites include **Screwfix**, **Kitlocker.com** and **Manutan**.

In terms of handle this trolley and the one which I made are very similar

this product has a extra part on the handle to make it more comfy

my product has foam on each which makes sure the user isn't holding bare metal

this product has been described as 'lightweight'

my product was also described by multiple people as being lightweight this has been identified as needed to be a key feature for a trolley

SCREWFIX

trade rated

FOLDING SACK TRUCK 80KG (1209P)

4.2 (221)

Write a review Ask a question

Lightweight, aluminium sack truck with variable height adjustment.

- Fixed Wheels
- Aluminium
- Lightweight Aluminium Frame
- Folds Down for Easy Storage
- 480 x 250mm Footplate

More Info

View all: Essentials Sack Trucks

The shape of this trolley is very innovative as it has multiple bars going down the middle and doesn't use a simple axel as most of the trolleys do

This wouldn't be a necessary component for the trolley as all bags have straps

this product has straps for the bag

In terms of size, these two bags/products are very similar

this product has the wheels and bag as product as it makes it simpler (all-in-one)! The actual bag is alot bigger and will take up space

my trolley can be used for people who don't have wheels or need larger ones to transport kit

KITLOCKER.COM

Wheelie Kit Bag

£93.95 £70.46

-25%

Select a Colour

NAVY

Select a Size

-- SELECT --

ESTIMATED DELIVERY TIME

View size guide | View description

Extended returns

1

ADD TO LOCKER

Wheelie Kit Bag

Introducing our new 100% Polyester 600D Wheelie Bag available in Navy or Black.

This strong and durable bag comes with a heavy-duty base panel, shatter proof wheels and an extendable top handle converting it from a simple sports bag into portable luggage.

Sizes: 76L x 46W x 43H cm (150Ltr)

my prototype has a fixed handle which I would like to adapt and improve by making it retractable

this product has a retractable handle unlike the trolley I made (my prototype)

In terms of the handlebar the bag from Kitlocker.com is available in multiple colours this was something I really liked

In terms of components for the trolley, the two products will have very similar features

My product will also have a handlebar. However mine will come back further.

this product has nothing to stop something which is resting on it from falling

in terms of functionality product is better and more reliable

In terms of the handle, it looks as if this product uses hard plastic over foam.

My product will have a handlebar with sides to stop any objects falling off

Manutan

All you need. With love.

Both products have a handlebar which allows people to bring their hands together at the top of the trolley. The back piece does not have support at the top meaning it may end up not becoming an unnecessary feature of my trolley

Both trolley's also have a part where the used handle has more material on it

my goalie bag has an extra carry handle

In terms of wheels, mine are bigger

The front piece of the trolley will be retractable and allows for a multitude of bag sizes to be carried

High Quality Aluminium Foldaway Trolley

This product has 4 wheels that are reasonably small. This throws the trolley off balance

My trolley has two larger wheels making it more balanced (this) one has the potential to raise axles

my product has two bigger wheels which results in the bag not being damaged or worn out

In terms of the wheels my trolley is alot more useful

In conclusion, My trolley is very innovative and stands a good chance in a competitive market. Firstly no one has ever made a 'field hockey goalie kit bag trolley' and when looking online there isn't anything sold under the name. Also the trolley has a chain which is key to the function of the trolley but it is something I Haven't seen on other trolleys being sold on the market.

Individually I think the biggest competition for my prototype would be the Kitlocker.com bag as it all comes in one and people will see this as being more convenient when carrying round their kit. Although from looking at the images the bag looks very bulky. I I could make my smaller then my bag would have more market potential.

On the next page I will show my final product with and without the fieldhockey goalkeeper bag on it.

Final Product