

Cambridge International AS & A Level Design & Technology 9705

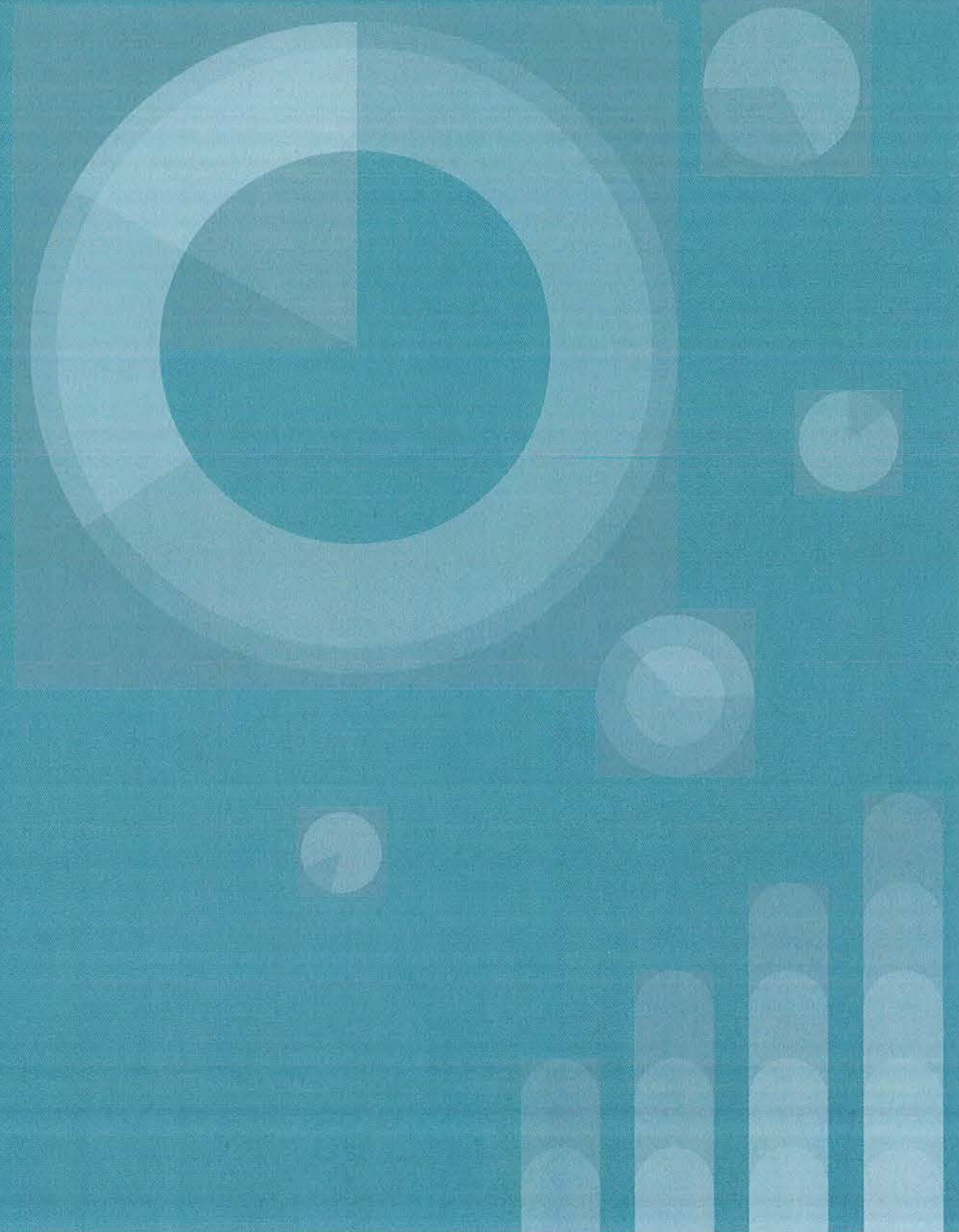
Component 4: Project 3

General comments

This is the continuation of an innovative AS level project submitted earlier. The design folder is fairly easy to follow, and the final product is shown successfully in use.

Criterion	Comments	Mark
Product Development [10]	There is evidence of material and design function testing, but apart from material selection and finish to some extent, there is limited consideration of the development of other aspects of the chosen design. Production development is simply the stating of machines that might be used.	6
Product Planning [4]	A parts list and sequence for the production of most parts is provided, but the working drawing is lacking in detail.	3
Product Realisation [20]	The final product, which is quite extensive, has been produced to a high standard with appropriate finish applied. It appears to suit the environment in which it is to be situated.	18
Testing and Evaluation [6]	The product is shown in use and operates as intended. As a result, the evaluation tends to be very positive, although it could have been somewhat deeper in approach. There are suggestions for modification and improvement.	4
Total [40]		31

A2 Product Design



Section 5

Product Development

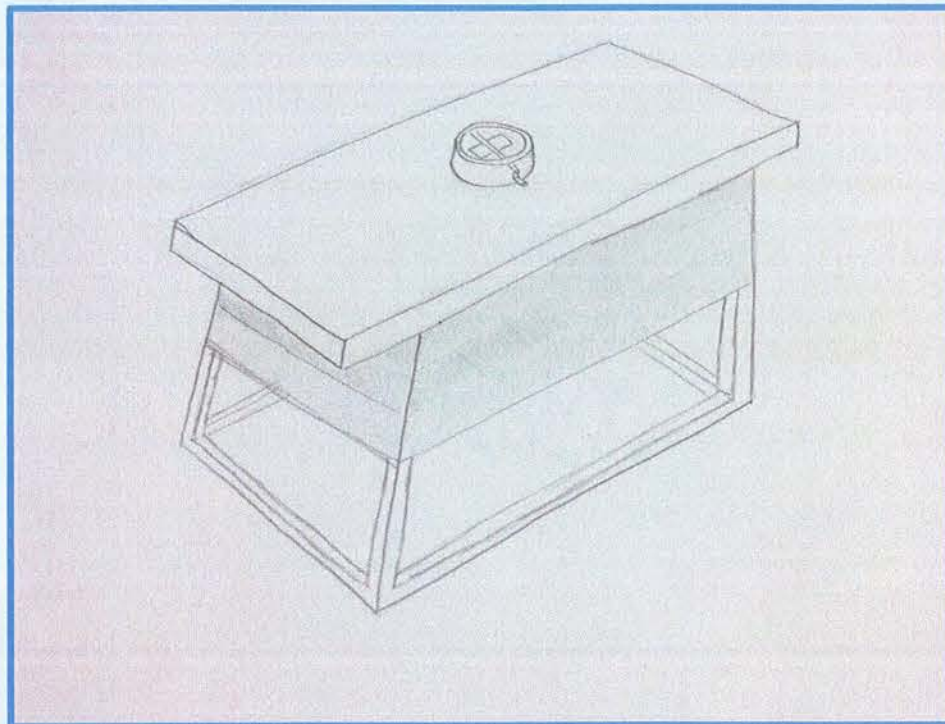
(10 MARKS)

Introduction

I have decided to continue with the development of my product from last year. I'm designing a unique bar leaner which provides comfort and ease of use to the user. The main feature of my bar leaner will be a drinks dispenser in the middle of it, making it easier to get cold drinks. My original idea for creating this was to have a vertical conveyor belt moved by a crank handle, however that was too complicated so we moved to the idea of a wheel with lots of slots in the wheel to fit drinks. While my idea needs to be functional, I still need to make it aesthetic, so with a creative use of my materials I will give the top a good finish, and make sure to close in the drinks dispenser so that it doesn't become an eyesore.

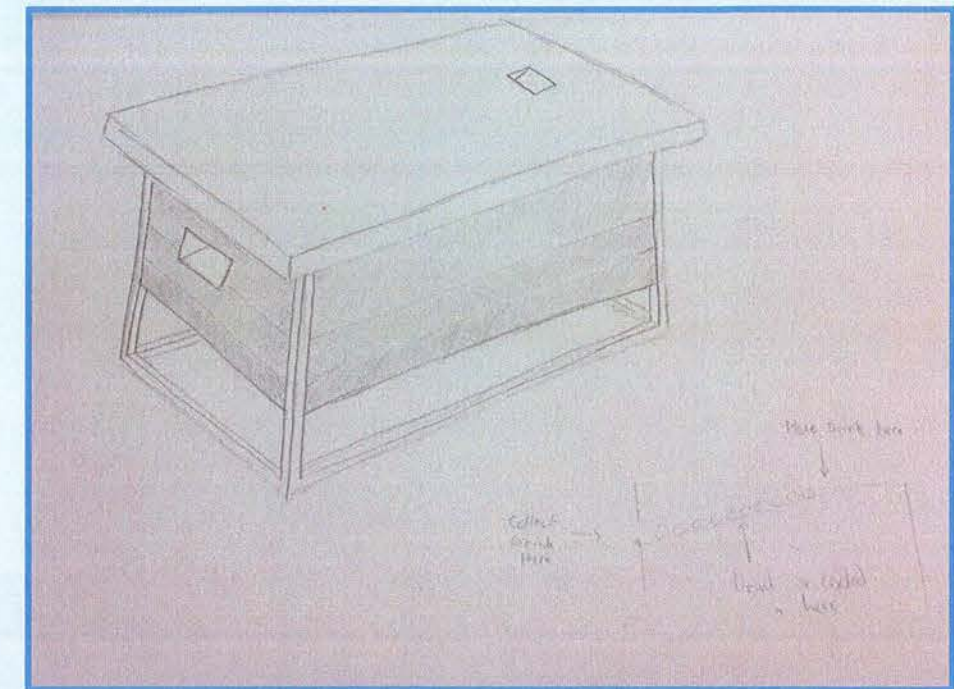


Design Development



Design 1

This variation of the design is compact and lets the user use more space on top of the bar leaner for drinks and other things. The design is very modern looking and easily used. The drinks dispenser may look bad as it sticks out of the leaner and making it will prove very difficult.



Design 2

This variation is very different as instead of taking the drinks from the top you place them in the top and take the drink from the bottom. As the drinks go in the top they get chilled before they get to the bottom with ice. This design is easy to use however not very practical for the user.

Materials Development

Pine Decking -

- Very easy to obtain, very affordable
- Would easily dent when drinks are put down
- Requires almost no maintenance
- Very easy to stain to your liking
- Won't be good enough for a table top as it needs to be hard, however could be okay for the bar sides



Kwila Decking -

- Naturally tough, organic oils that protect it against the environment, meaning the leaner can be left outside
- Very durable and strong, table top won't get dented easily
- Needs to be screwed down and not nailed, will cause splitting
- Aesthetically pleasing to look at
- Easy to work with, with the tools we have in the workshop
- Can leave oily patches if stained or painted



Garapa Decking (Brazilian Oak) -

- Most Aesthetic colours
- Scratch resistant, 1.5x harder than oak
- Very affordable
- Can lack stability, however can be improved with kiln drying
- Naturally resistant to mould and decay which will help when the leaner is placed outside



Final Choice -

I will be going with kwila as it has a nice dark colour to it, it's very durable and will last a long time outside. Although there are a few things I will have to work around, like avoiding nails, however I believe it will give my leaner the best look and a great finish.

Materials Development

Two potential metals I could use for my bar leaner frame are Steel and Stainless Steel



Steel

- More malleable
- Can be galvanised to avoid corrosion
- Much cheaper than stainless steel
- Easier to work with
- Easier to weld
- Is not hard on machinery, which is good for the equipment we have at school to use.

I will be using normal low carbon steel to use, as it is easy to work with, a lot cheaper and can be galvanised to avoid corrosion and rust. The steel will provide a strong frame and will be very steady. I believe this is a good decision as steel is still a very strong material and will be rust resistant which is important as it will be an outdoor piece.

Stainless steel

- Corrosion resistant - contains chromium, can be left outside
- Harder than normal steel
- Less brittle
- Harsh on machinery



Production Development

MIG Welder - I will have a lot of steel framing that will need to be securely joined so that my leaner is secure, stable and strong. Operating the welder means I will have to use a welding mask, protective gloves and an apron for health and safety reasons.

Cold Cut Saw - All the steel I'm going to use will need to be cut to different lengths and a cold cut saw is the easiest and most efficient way to get the job done. I am very experienced with this machine and know that I will have to use an apron, ear muffs and protective glasses to keep safe while using this.

Band Saw - The top and sides of my leaner are going to be made of kwila decking and the best way to cut this is with a band saw. The band saw needs protective glasses, and apron to keep safe as well as always keeping hands clear of the saw when pushing timber through it.

Drill Press - My leaner will require a lot of pre-drilled holes in order to work properly and for accurately placed holes the best machine for this is the drill press. The health and safety is very similar to the band saw, wear an apron and protective glasses.

Health and Safety - I will have to follow all the health and safety rules of King's College, this includes wearing all the protective equipment and going through all necessary procedures to ensure that myself or anyone else is not hurt or injured.



Cold Cut Saw



MIG Welder



Drill Press



Band Saw

Finishes

Steel - I will firstly galvanise the steel to make sure it is made rust resistant so that it can be left outside. Then I will use a black hammer paint to make it look better but at the same time will help it last longer in the weather



Plain Steel



Galvanised Steel

Kwila Decking - I have experimented with three different finishes on my decking. Dark outdoor stain, shellac wood finish and outdoor furniture oil. I believe the most aesthetic finish is the stain as it darkens the wood and seals it so that it doesn't get water damaged.



Top layer - Outdoor furniture oil
Middle - Shellac
Bottom - Outdoor wood stain



Without any finishes

Trialling and Testing

This is my model of the frame. It shows the mitre join that I will use to join the top of the frame to the sides using the MIG welder and then finishing it off with the angle grinder to make sure the top is flat enough for wood to be screwed on the top.



Trialling and Testing



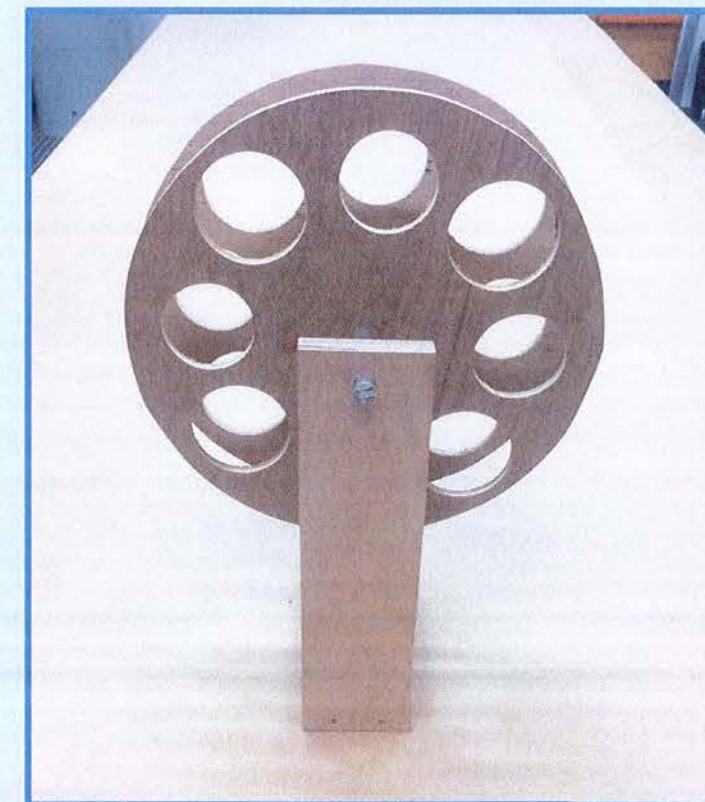
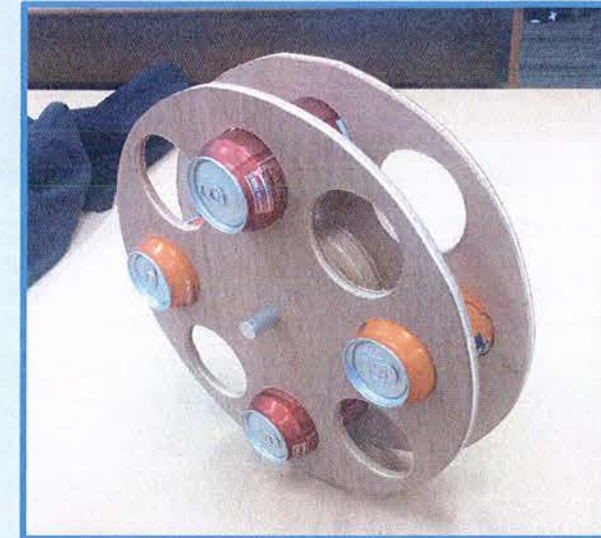
This is how I will do the side of my bar leaner. The decking is screwed directly into the steel after being pre-drilled with the hand drill. I used a piece of angle iron to space the decking out evenly as I screwed it down to account for any shrinkage or play in the wood. I then tried different types of screws and found that countersunk 10gx40mm were the best fit.

Trialling and Testing

This is the wheel that will hold all the drinks. The wheel is made of two pieces of marine grade plywood separated by three pieces of plywood glued together. I used a 65mm hole saw drill piece and sanded the inside to get an exact fit for a can of drink. And then used a 110mm hole saw piece to get the size of the hub separating the big bits of plywood. We then cut through the centre of it all with a 16mm drill bit and put an aluminium rod through middle to hold it.

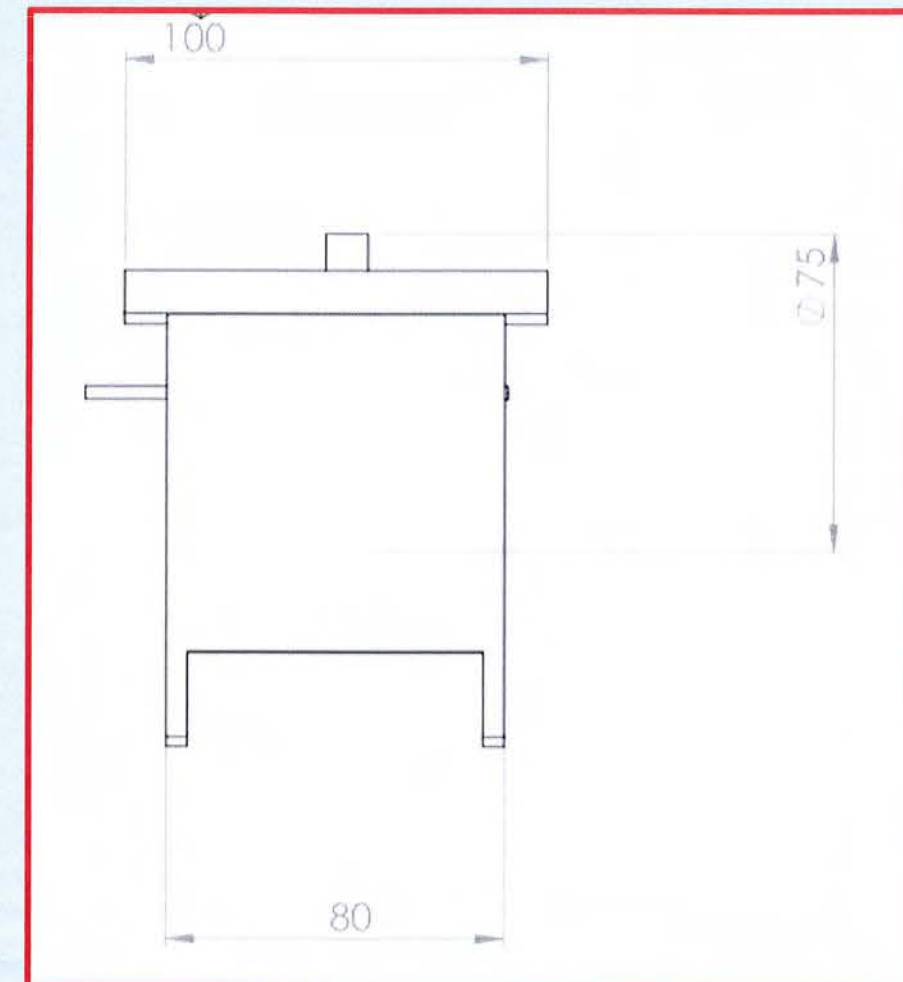
The axle -

I will be using aluminium for the axle as it is lightweight and relatively frictionless so will work well.



Anthropometrics and Ergonomics

Anthropometrics is very important to designing my bar leaner as it will need to be at a comfortable height for people to lean on and put their drinks on. The average height of a bar leaner is about 1000mm however I believe this is too short for comfort and will be raising the height to 1150mm. I will also need to ensure that the corners of the table are not sharp and that the tabletop is nicely sanded to make sure that the user has the nicest feel of the bar leaner





Conclusion

Materials -

I have found that Kwila decking is the best option for my bar leaner. This will be used on top and on the sides as well. Kwila is a very durable and strong decking timber meaning that the leaner will be able to support people's weight and won't get dented when someone puts their drink down. As well as this, Kwila is also very aesthetic timber to look at because of its natural dark colour that will be enhanced with the right finish.

For the frame I will be using Galvanised steel as it is very strong so it will easily be able to support a lot of weight. It is also very easy to work with as it is able to be easily cut, sanded and welded with the tools in the school workshop.

Finishes -

For the decking I have decided to go with an outdoor decking stain. This will protect it from the weather as it will be outside and will also stop the decking from being affected by any drink spillages.

For my Frame I will be galvanising the steel and then spray painting it black. This will ensure that it will not rust in the weather and that it looks aesthetically pleasing.

Design -

I will be designing an open end bar leaner, 1150mm high 1800mm long and 800mm wide. This design allows for people to comfortably lean on my product while allowing lots of people to socialise. The width allows people enough space to put drinks down while not separating you too far to stop socialising

Section 6 Production Plan

(4 Marks)

Parts list

Material	Size(mm)	Quantity
Steel S.H.S	40X40X2.0 X 1110	4
	40X40X2.0 X 1800	6
	40X40X2.0 X 800	8
Kwila Decking	100X20X1800	20
Marine Plywood	1000X1000X10	2
Aluminium rod	Ø32X720	1



Parts List

SHS 40x40 steel - 18200mm

Kwila decking - 40300 mm x 90mm x 20mm

Marine Plywood - 2 sheets of 1000x1000x18

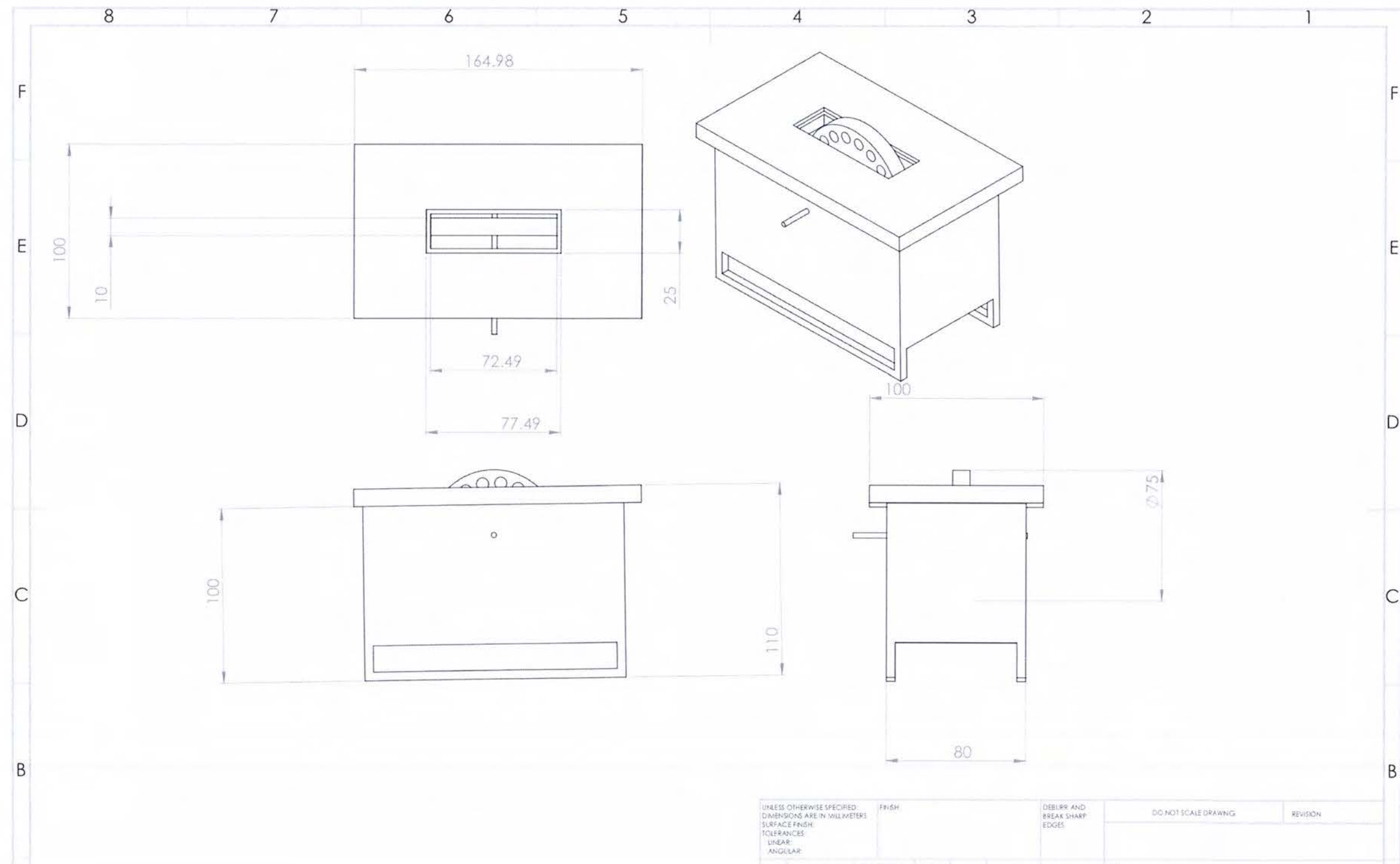
Aluminium Rod - 720mmx32mm

Carbothane

Black Epoxy Enamel Paint

Timber Screws

Working Drawing



Production Plan

Lessons	Task	Materials	Tools	Health and safety	Quality Control	Comment on completion
2	Cut steel for frame, and de-bur.	40x40x3 mm steel	Cold Cut Saw, Linisher	Wear an apron, safety goggles, keep hands away from moving parts.	All cuts need to be exact, within half a mm. all sharp edges must be finished off.	Easily done, Was accurate to within $\frac{1}{2}$ a mm and everything fit together well.
1	Tack the top of the bar frame then weld.	The 40x40 steel	MIG welder, clamps, engineers square	welding mask, heatproof jacket, thick gloves, light screen covering my work	Every piece needs to be welded at exactly 90° and on a level surface	This was tricky, as we had a big frame to do and hard to find the space & level surface.
1	Tack on legs, then weld	40x40 steel	MIG welder, clamps, engineers square	welding mask, heatproof jacket, thick gloves, light screen covering my work	The legs need to all be 90° and checked by measuring the diagonals at the bottom of the legs, this needs to be done after tacking it so that it can be put right before welding	The legs were done well. They were tacked on then bent into 90° before welding it into place.
1	Tack on cross supports, then weld	40x40 steel	MIG welder, clamps, engineers square	welding mask, heatproof jacket, thick gloves, light screen covering my work	The supports all need to be flush with the frame so a piece of metal can be clamped to the outside as a stop for the piece that is being welded	Easily done, clamped pieces of steel underneath to give it a level finish.

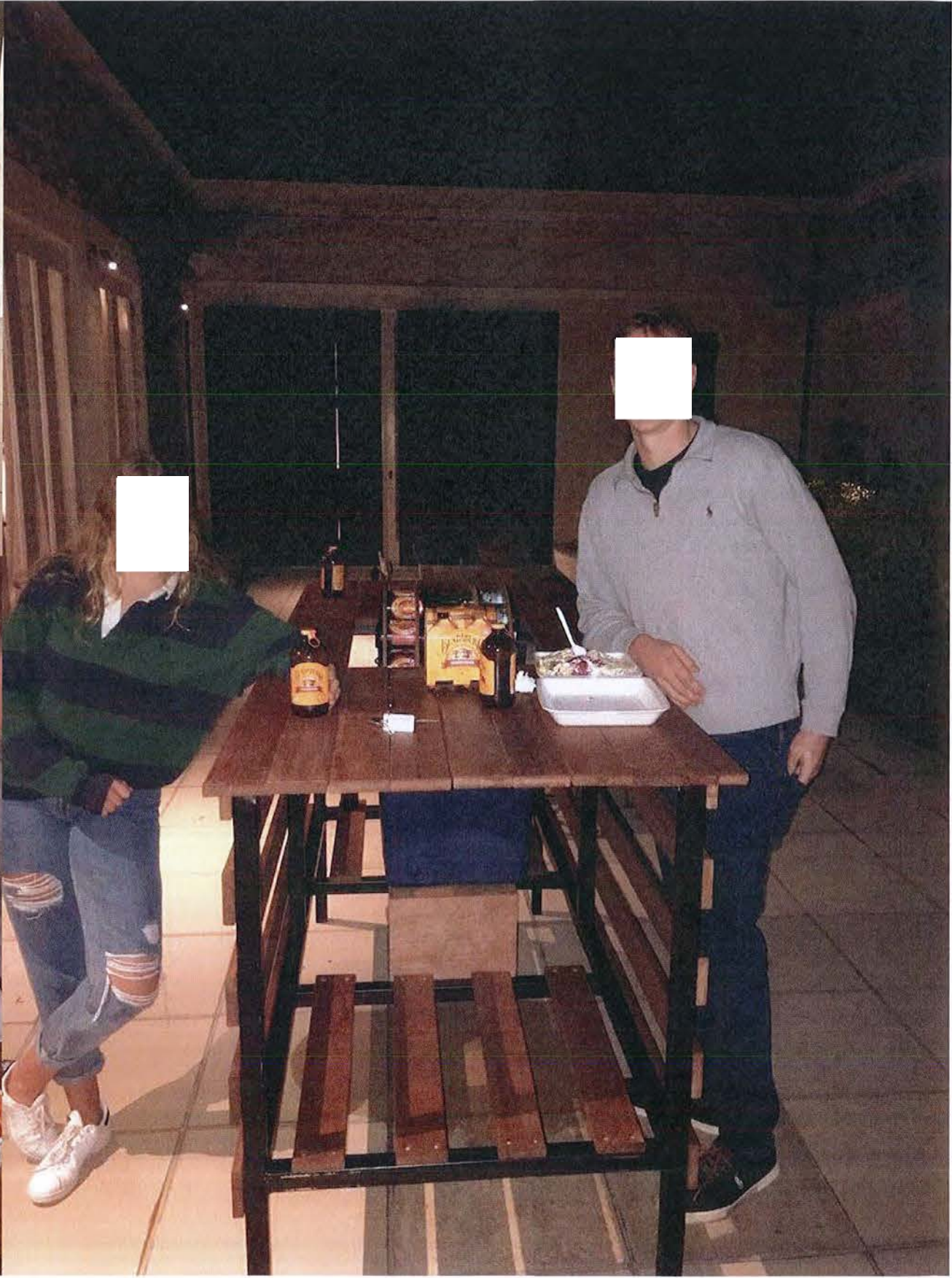
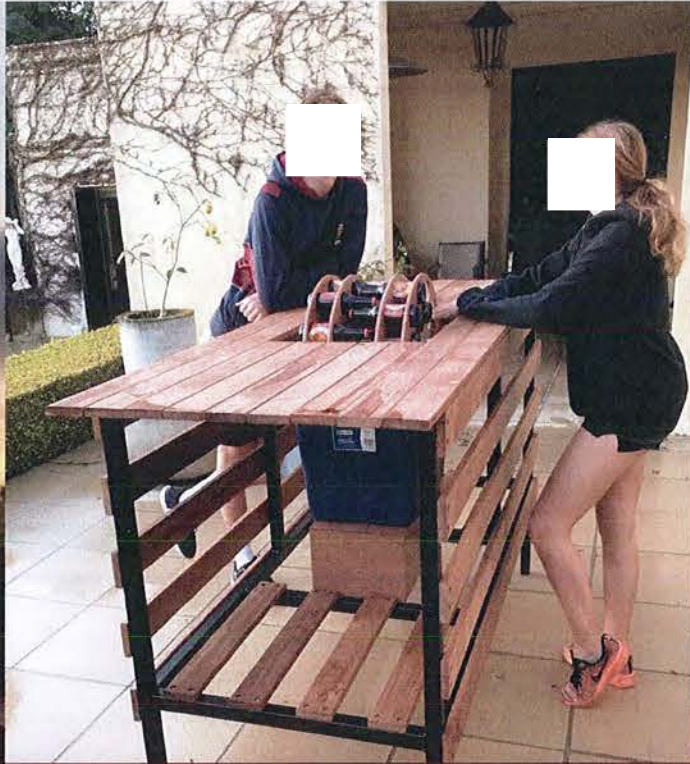
Production Plan

Lessons	Task	Materials	Tools	Health and Safety	Quality Control	Comment upon Completion
1	Cut out the Bar wheel	Marine plywood	CNC router SolidWorks Program	-	Sand all the cut edges and get rid of splinters from the plywood	This was simple, I had to CAD the design on SolidWorks before sending the file to the computer.
1	Sand and Chamfer the wheels	Bar wheels (Marine Ply)	Orbital sander Spindle sander Hand Router	Apron, safety goggles, Keep hands away from moving parts.	Make sure every edge has been sanded and chamfered, no loose splinters.	This was very time consuming but gave it a good finish, unfortunately it took 2 periods to do properly
1	Polyurethane coating on the wheels	Bar wheels (Marine Ply) Carbothane	Paint Brush	Keep the carbothane off skin	Apply one layer, sand, put on another layer. Coat inside every hole and edge.	This also took longer than expected as I had to wait a few lessons to let it dry.
1	Cut pieces for the bar wheel hub	aluminium tube, threaded stainless steel rod	cold cut saw, linisher	safety goggles, apron and keep hands clear of moving parts	every piece needs to be cut exactly the same length, threaded rod needs the edge grinded smooth	This was well done. Took a short time and worked well into my design

Production Plan

Lessons	Task	Materials	Tools	Health and Safety	Quality Control	Comment upon Completion
1	Cut out Kwila decking timber	Kwila Decking Timber	Drop saw	Need teacher to cut wood as I am not qualified to use the drop saw	Edges need to be sanded to get rid of splinters	I couldn't do this myself as I wasn't qualified, but was done well.
2	Galvanise Frame	Zinc	-	-	Grind off any sharp drips with a grinder, use dust mask.	This turned out messier than I thought but I cleaned it up and is now weatherproof.
2	Paint Frame	Black Epoxy Enamel Paint	Paint Brush	Wear mask to stop fumes	Turn upside down, do the underside first then flip	Covered the whole frame, paint started chipping so I put 2 more layers on.
1	Screw on the Timber	Kwila decking, galvanised self drilling screws	Drill, clamps, spacers, hex driver			This was quick, tidy and efficiently done. Finishing off my product.

Section 7 Product Realization (20 marks)





Section 8

Testing and Evaluation

(6 MARKS)



Evaluation against the specifications

Aesthetics

Should be a modern design that looks good outdoors

I thought the aesthetics of the bar leaner turned out a lot better than expected. The colours of the wood worked really with the surrounding environment and had a welcoming and friendly look to it.

Materials

Should be made from suitable outdoor durable materials

This product is exclusively made from steel and kwila decking. The steel provided a strong and stable platform and once it was galvanised it was weather proof as well. The kwila worked really well, was easily worked with and weathered nicely.

Function

Should hold a minimum of 24 drinks and keep them cold

The bar worked well and was a good height to lean on. The wheel also worked well as it turned nicely and kept 48 drinks cold.

Cost

This was an expensive product to produce however because of the quality of the material and quality of the build, it would be profitable.

Manufacturing

Needs to be made using the equipment available at Kings College

The bar wheel was easy as it was CNC router cut. All the steel had to be welded and the holes could be cut with a drill press. The only difficult bit was attaching the wood to the steel as this required a cordless drill.

Health and Safety

This product should be safe to make and interact with.

The product was well designed as there are no sharp edges and is safe to manufacture. The only downside is the weight and is difficult to move, however with a few people this problem is easily solved.

Environment

Needs to fit in well in an outdoor environment.

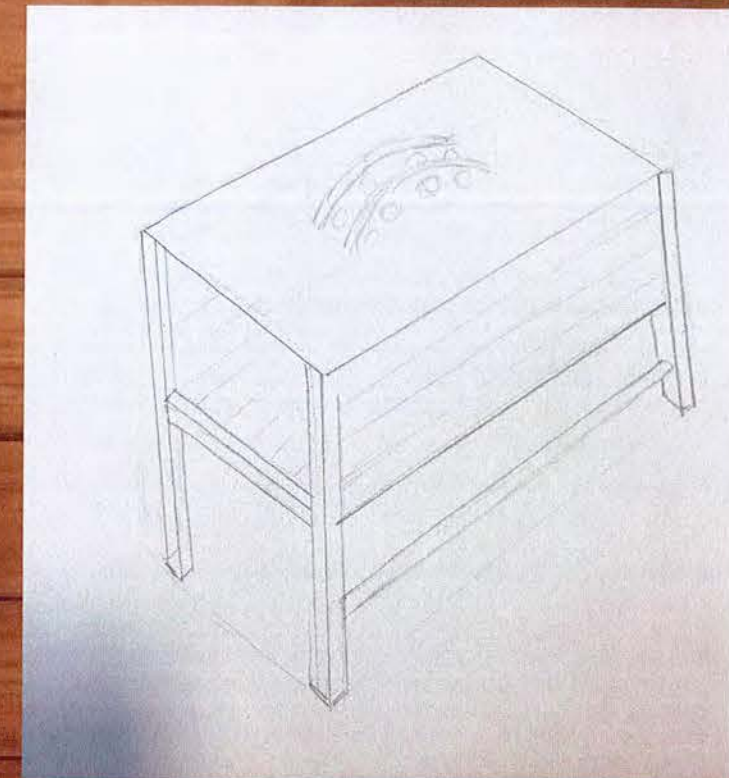
This product fits nicely into most environments, such as outside on a lawn where it is weather proof and aesthetically pleasing to look at. It also works well in other outdoor environments such as patios and barbeque areas.

Modifications and Improvements

Through extensive testing I have found that the Galvanising and paintwork have made it sufficiently weatherproof as is the kwila decking.

I think I could improve the overall look and function by adding in a rail at the bottom as a footrest. The bar leaner used too much material creating a storage space at either end which was good but unnecessarily big and the space could be reduced.

If I could modify it, I would add an easier way of putting in the ice bucket. I would also add adjustable wheels on one end for easier mobility.



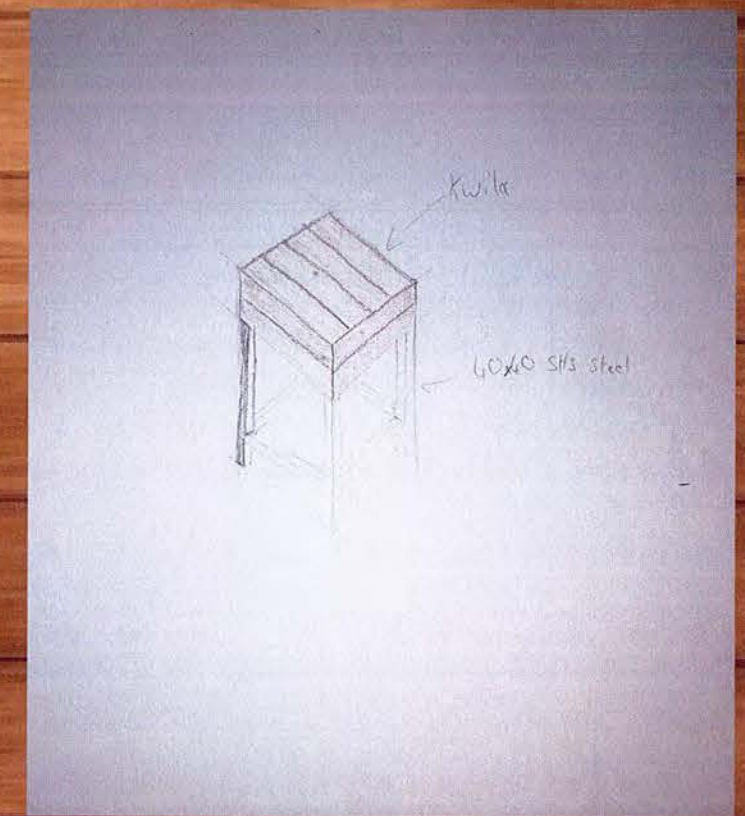
Example of a foot rest added. This could be done by welding a bar to the frames legs.

Expansion of Concept

My product is great because there are so many opportunities that go with it, these include:

- Making interchangeable wheels of different sizes
- Creating a line of chilly bins to go with the wheel
- Producing a line of barstools with the same aesthetics
- Making different size bar leaners for different spaces and different environments.

These are all ideas that tie in with my overall project and take it beyond a one off build.



This is an idea of a barstool that could go with my bar leaner, using the same materials to match the style