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Website Exemplar

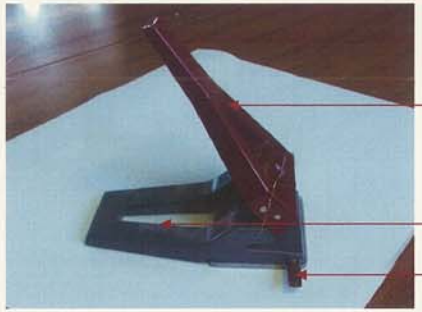
GCE D&T Resistant Materials.

Unit: 6RM01.

Topic: Hole Punch.

Product Investigation.

Hole Punch.

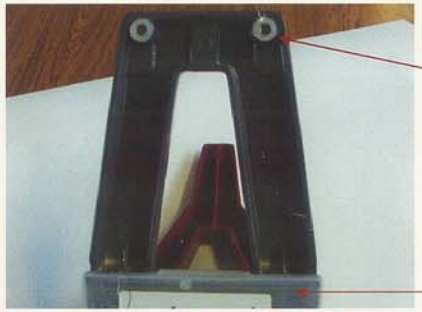


1

Handle.

Base.

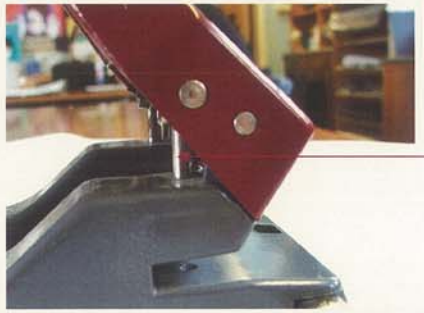
Paper size slider.



2

Rubber feet.

Plastic case for paper waste.



3

Plunge

4

Plunger support bar.

Fulcrum support bar.

Handle.

Spring.

Base.

1

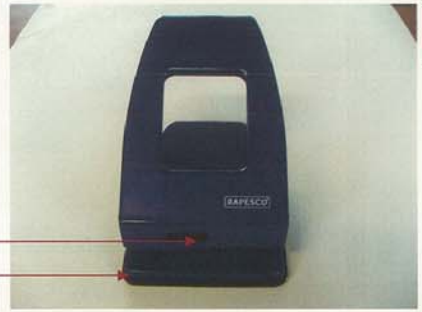
Rubber Bottom.

Paper size slider.

2

Lock.

Rubber seal.

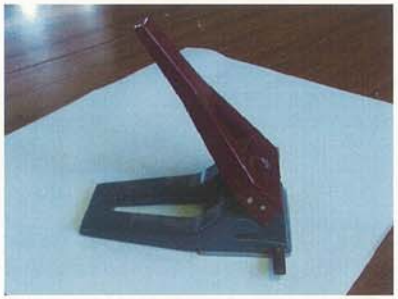


3

4

Performance Analysis.

Fully justify key technical specification points that relate to form, function, user requirements, materials and/or components requirements, scale of production and costs. Compare and contrast one other existing similar product using the technical specification.

Form	**Function**	**User Requirements.**	**Performance Requirements.**
The hole punch form is simple because it must be able to be pushed down for and pressure applied to the plungers to push holes out of the paper sheets. The handle is symmetric so that equal force is applied to both plungers. Because such a force is applied the handle must be made from a durable material. The hole punch is of 2nd class leverage and this alone dictates what shape the hole punch must be. The plunges have a very small gap between the ends of the plunger and where the paper is placed; this is so that no part of the user can get trapped between them. The edges of the hole punch are rounded for safety and ease of production.	The primary function of the hole punch is to pierce holes into either paper or card to be fitted into ring binder folders. The hole punch has to be able to pierce holes into multiple pieces of paper at one time. The hole punch must be safe to operate and not damage any part of the user whilst in operation. Also the Hole Punch must be simple and easy to operate, making the need for instructions minimal. The hole punch must accommodate all different sizes of paper so that it is versatile in an office environment.	The user requires the hole punch to look attractive, this is so that it is not an eye sore in an office environment or in the environment that it will be used in. The user also requires the hole punch to be easy to use without reading instructions, there should be no unneeded complications for the user. The user should be safe at all times whilst using the hole punch. The user should be able to use the punch for paper and card, also the user should be able to punch holes out of multiple pieces of paper at any one time. Minimal servicing.	The requirements for the hole punch are to create evenly spaced holes each time the hole punch is used. Due to this the hole punch plungers have to be made from a durable material so that they do not wear out with friction. The handle should not snap or bend when force is applied by the user, similarly neither should the base. Neither should the base slide along the worktop whilst in use. The bottom paper waste case should remain intact with the hole punch until physically removed by the user so that the paper does not fall out. **Capacity : 65sheets of 80gsm**
Materials.	**Cost.**	**Scale of Production.**	**Product.**
The materials used to produce this product are metals and plastics, the metal has been used on the upper parts of the hole punch and plastic on some of the base systems such as the plastic feet and the plastic case for paper waste. The metal has been used on the top so that the hole punch is hard warring. The plungers have a chrome plated finish so that it cuts through the paper	The cost of this product is relatively low because it has been batch produced using mass production techniques such assembly lines and robotic production. This helps to keep the cost of manual labour to the bare minimum thus reducing the final cost of the product. **Total Price: £41.33**	Batch production using mass production techniques. Assembly line. Most of this product has been die casted, this means that many moulds can be operated at the same time therefore giving a good rate of production and making the product easy to batch produce.	

Performance Comparison.

Fully justify key technical specification points that relate to form, function, user requirements, materials and/or components requirements, scale of production and costs. Compare and contrast one other existing similar product using the technical specification.

Form	**Function**	**User Requirements.**	**Performance Requirements.**
The form of both products are relatively similar, this is due to the function of the hole punch and the leverage that is needed for the hole punch to work. The handle of the products are slightly different, product 1's handle comes up into one solid bar from 2. On product number two the handle is simply a sheet of steel alloy with a hole in the middle for the users fingers.	The function of both products are exactly the same, to be able to punch holes in various sizes of paper and different amounts of paper at any one time.	Minimal servicing is required on both punches, although on punch 2 it requires that the plungers be oiled to lubricate the surface contact. On punch 1 this is not required. Both punches have the same user requirements apart from this difference. Both paper punches have to be comfortable to use and stable when in use. Also another requirement of the paper punch is that it should be of a size that is easy to store away.	The capacity of punch number one is 65 sheets which is higher than punch two which can only hold 35 sheets at any one time. Other than the different capacities the hole punches have the same performance requirements.
Materials.	**Cost.**	**Scale of Production.**	**Product. (Paper punch 2.)**
The materials used on both products are the same, this is because the specification of each products are the same and the materials chosen are chosen because they have suitable properties to carry out the function efficiently.	The cost varies between the two products hole punch 1 has been marketed at a staggering £41.33 but the second hole punch is currently being sold at £18.45. This is a large price difference this could be due to the difference in capacity.	Both products have been made using batch production with certain mass production techniques such as conveyer belts or assembly lines.	

Materials and Components.

Suggest, with reference to quality and performance, alternative materials and/or components that could have been used in the product. Evaluate, using advantages and disadvantages, the selection of the materials and/or components used. Describe the impact on the environment of using the materials and/or components identified.

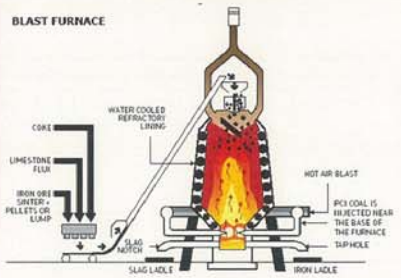
Component.	Function.	Materials	Properties.	Advantages.	Disadvantages.	Alternative.	Justification.
Handle.	The handle is the part of the hole punch that the user presses down on to put pressure on the plungers to push through the paper.	Aluminium casting alloy. 3% Copper 5% Silicon	Durable. wear resistance Light weight.	Due to the hard wearing surface of aluminum alloy the handle will not be worn now by repeated use. Aluminum alloy also relatively cheap to use as well. Bigger stronger product retaining strength and weight. Good machine ability.	A disadvantage of using aluminium alloy instead of a carbon steel is the expense of the material, steel is a lot cheaper to use and produce.	An alternative to using Aluminium alloy would be medium carbon steel	I think that aluminium alloy was used for this part because it has a hard wearing surface and will not wear during the
Base.	The base is the part of the hole punch that sits on the face of the table or surface.	Aluminium casting alloy 3% Copper 5% Silicon	Durable. wear resistance Light weight.	Due to the aluminum alloy being light weight it is easier for the user to move around.	A disadvantage of using aluminium alloy instead of a carbon steel is the expense of the material, steel is a lot cheaper to use and produce.	An alternative to using Aluminium alloy would be medium carbon steel	Aluminium alloy has been used for the base because it is light and does not increase the weight of the paper punch.
Paper size slider.	The slider is the part of the product that determines the size of the paper.	Mild steel alloy Alloys of iron and carbon 0.15-0.35% carbon.	Tough Ductile Easily joined. Good tensile strength. Poor.	The advantage of using mild steel here is that it is being pushed against an aluminium alloy therefore if a plastic was used it would wear away.	A disadvantage of using mild steel is that it will have to be coated with finish	Aluminium alloy	Mild steel has been used for the paper slider because it is tough and will not scratch or deform.

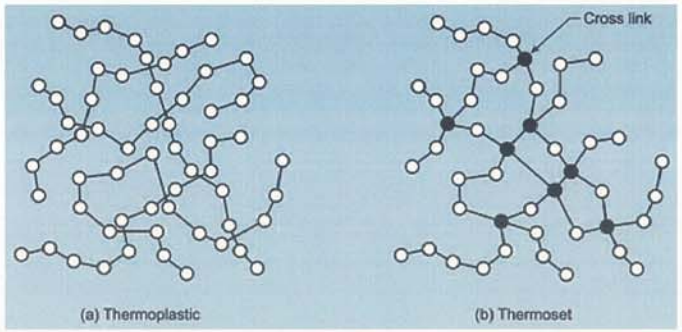
feet.	The feet provide grip for the base to sit securely on a surface.	Polyamide (Nylon.)	Hard Tough. Durable. Scratches easily. Abrasion resistant		The nylon is very durable so this helps to give the hole punch a longer lifetime.	Nylon slips on smooth surfaces more than rubber does, rubber gives better grip.	Rubber.	Polyamide has been used for the feet because of its durability this means that the feet will not wear out.
Plastic case for paper waste.	The plastic case collects all the paper off cuts that fall through the bottom of the hole punch,	Polythene.	Flexible. Elasticity. Tough Wear resistance.		Due to its elasticity the case can be clipped on and off frequently and still remain in its original shape.	Polythene slowly stretches at room temperature and this can lead to the case being unusable. PVC does not stretch or deform at room temperature.	Plasticised PVC Little more ridged Polypropylene	Polythene has been used for waste case because of its elasticity this helps it pop on and off the base of the hole punch.
Plunge	The plunge is the part of the hole punch that makes the contact with the paper and presses the hole through.	Medium carbon steel 0.4-0.7% carbon.	Durable Wear resistance Low cost. Heavy. Tough.		Because of the hardness it is wear resistant and due to the points always being in contact with the paper this is a advantage.	A disadvantage to using medium carbon steel is the weight of the material. It adds a lot of weight to the whole product.	Stainless steel or plated steel.	Medium carbon steel has been used for the plunger because
Plunger support bar.	The plunger support bar goes across the hole punch and securely holds the plungers in position	Medium or low carbon steel 0.4-0.7% carbon.	Medium: Durable Wear resistance Low cost. Heavy. Tough	Low: Tough Ductile Easily joined. Good tensile strength.	Steel is cheap to use in products and is easily manufactured.	A disadvantage of medium or low carbon steel is the gross weight of the material, this increases the weight of the whole product making it harder lift for the user.	Aluminium alloy.	Medium carbon steel has been used for the plunger support bar because
Fulcrum support bar.	The fulcrum bar is the bar that the handle, when pushed pivots around. Also this is where the return springs sit.	Medium or low carbon steel 0.4-0.7% carbon.	Medium: Durable Wear resistance Low cost. Heavy. Tough.	Low: Tough Ductile Easily joined. Good tensile strength.	Steel is cheap to use in products and is easily manufactured.	A disadvantage of medium or low carbon steel is the gross weight of the material, this increases the weight of the whole product making it harder lift for the user.	Aluminium alloy.	Medium carbon steel has been used for the fulcrum support bar because of its rigidity.

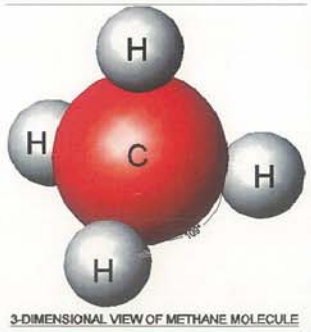
Material Environment.

Some of the environmental issues caused by the production and accuiring the raw materials are as follows;

- Iron ore is extracted using open mine technequies, although when extracted it is not pure ore it is an iron oxide compound. this causes damage to wildlefe habbitat and damage to the landscape.
- Mining leaves a chemical mark on the soil around and in the mine pit. For example the main body of the paper punch is made from aluminium alloy this is economically more sustainable than steel but the extraction is also very environmentally distructive.
- The iron ore then has to be cleansed in a blast furnace to get rid of anomalies and impurities, in the blast furnace substances such as limestone and heat are added to cleanse it, this gives off burning gas and hot air.
- The waste from the blast furnace is called slag and is used for many different things eg; tarmac and railroad balasts.
- When burning the furnace gives off a high concentration of carbon dioxide and this is extremely harmful to the environment.
- Pig Iron is created which still has impurities but is roughtly 4-5% carbon. Through oxidisation the pig iron is made in to metals such as steel and wraugh Iron.
- Steel can be recycled therefore making it an ecologically sound metal.
- Most plastics are produced by extracting hydrocarbons from crude oil.
- Oil is drilled out and pumped from underground, these pumps create a lot of noise pollution and are visually unattractive.
- Crude oil is put into a fractionising column, this is where it is seperated into diesel, kerosene,etc. this is all due to the temperature, this process is called fractional distillation. This like furnacing gives off emissions due to using energy to heat oil up.
- A catalyictic converter can be used to reduce these emissions.
- During the cracking processes methane is burnt due to its moleculular structure it is the cleanest fuel.
- Thermoplastics can be reheated and moulded therefore making them recyclable and reusable. This is because of the moleuculear structure shown below, thermoset plastics have cross-links this means that they are covalently bonded instead of the thermoplastics that are ionically bonded, this means that the thermoplastic polythene used for the paper waste case is economically sound.
- Thermosetting plastics cannot be remoulded or reheated therefore are worse for the environment because they are not biodegradeable (although this can take up to several centuries).



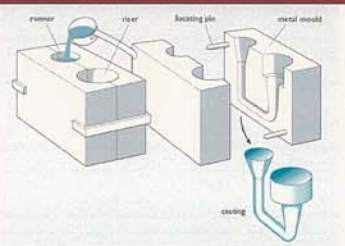
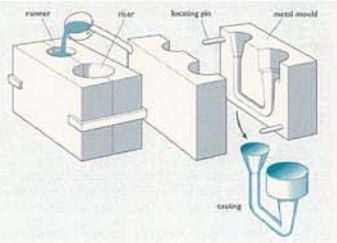
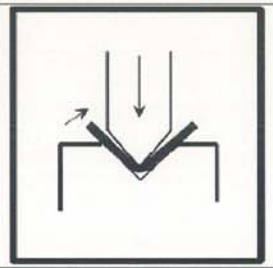
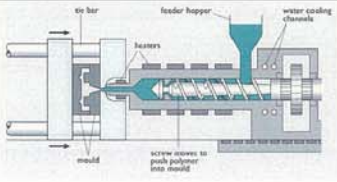


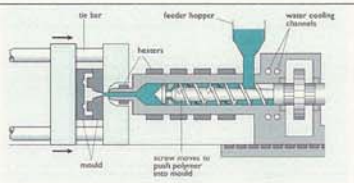
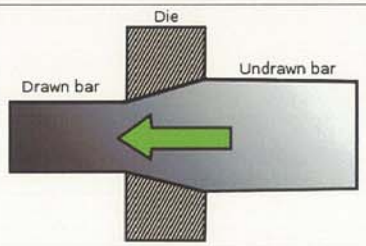
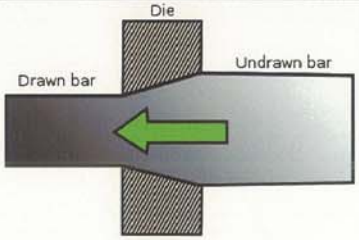
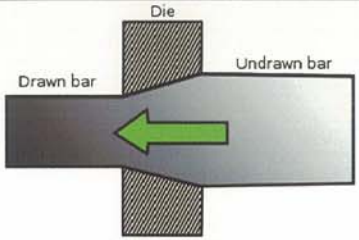


3-DIMENSIONAL VIEW OF METHANE MOLECULE

Manufacturing Processes.

Suggest, with reference to quality and performance, alternative manufacturing processes that could have been used in the product. Evaluate, using advantages and disadvantages, the selection of the manufacturing processes used. Describe the impact on the environment of using the manufacturing processes identified.

Component.	Manufacturing Process.	Procedure.	Advantages.	Disadvantages.	Alternative.	Justification.
Handle.	Die Casting.		Thinner walls can be cast Reduces or eliminates secondary machining operations Rapid production rates.	The casting weight used must be between the weight of 30 grams and 10 kilograms. The cost of the machinery is high so the initial cost is high.	Sand Casting.	Die Casting has been chosen because of the high quality finish that is produced, this saves any secondary processes taking place. Due to the fast production rate Die casting is more financially efficient because the producer can create more products in a shorter amount of time.
Base.	Die Casting.		Excellent dimensional accuracy Smooth cast surfaces	Large amounts of production are needed to make die casting a economically sound manufacturing process compared to others. The range of different metals to use for Die casting is limited to metals with a high level of fluidity.	Sand Casting.	Die casting has been chosen because the base has to be in keeping with the same finish as the handle, because the handle was die casted so was the base. Also the paper size slider and feet all have to fit in perfectly to the base and due to its precise wall dimensions this is obtainable using die casting.
Paper size slider.	Bending.		The bending process is similar to stamping although the metal is not on a sheet. Because this is a one operation process it means that it is fast and this means it is very cost effective.	Due to the force being applied it is often hard to create a perfect right angle and therefore for some parts of products that need to be exact angles this is unachievable with the stamping process.	Die Casting.	Due to this part of the product being very small not as much energy is needed to form the metal, therefore stamping is more environmentally friendly than the energy required in Die casting to heat up the metal.
feet.	Injection moulded.		Fast production rate. Because the mould can be interchanged it gives design flexibility. Because it is a machined process means less manual labour.	Moulds although interchangeable are very costly and because of this it means the process can only be used if there is a lot of production e.g.; mass production.	Press moulded.	Injection moulding is the process used for the feet because for each paper punch there are four feet and the paper punches are batch produced using mass production therefore it is cost effective to use the injection moulding process.

Plastic case for paper waste.	Injection moulded.		Fast production rate. Because the mould can be interchanged it gives design flexibility. Because it is a machined process means less manual labour.	Moulds although interchangeable are very costly and because of this it means the process can only be used if there is a lot of production e.g.; mass production.	Press moulded.	Injection moulding is the process used for the feet because for each paper punch there are four feet and the paper punches are batch produced using mass production therefore it is cost effective to use the injection moulding process.
Plunge	Drawing.		Drawing creates a constant cross sectional area with no anomalies or irregularities.	Expensive to initially purchase the machinery therefore the initial cost is high and will only be cost effective if a lot of production occurs.	Die Casting.	Less energy is used in drawing metal due to it being done at room temperature therefore the process is more environmentally friendly.
Plunger support bar.	Drawing.		Extrusion has the ability to create complex cross sections that other techniques would struggle to create.	Weaken the tensile strength of the metal when elongated.	Die Casting.	Drawing has been used instead of die casting because it can produce continuous and accurate cross sectional diameter of metal without and anomalies.
Fulcrum support bar.	Drawing.		Drawing has the ability to create a high quality finish therefore if corrosion or oxidisation is not an issue no other secondary processes are needed.	Die casting is faster than drawing metal therefore production is slower.	Die Casting.	Like Die Casting drawing gives the metal a good finish this would be a justification for using drawing as the manufacturing process.

Environmental Effect:

- A lot of energy is used for the manufacturing process because the plastic and metals have to be heated up to a state where they can be reformed. This involves burning fuels to create this energy, this leads to a high energy consumption.
- Also transportation of the machinery and materials is harmful to the environment because fuel emissions from the vehicles used are high in Carbon dioxide.
- Die casting metal creates fumes and these are toxic therefore bad for the local environment.
- Similarly like the die casting if metal is being coated with a finish fumes are exerted from the manufacturing process hence damaging the environment.
- The more processes used to create a product the higher the energy consumption and therefore more environmentally harmful.

Quality Control.

There are two main types of Quality control;

- Failure testing
- Statistical control.

Failure testing; This is done by making a trial product before the manufacturing process starts, if this doesn't happen then a sample of the product will be picked from the production line. This certain product will then be tested for failure. If the product fails a test changes will be made accordingly.

Some of the failure testing for the paper punch are;

Tensile testing for the aluminium casting alloy would be carried out to make sure that the material used for the product is adequate.

Spring deformation would be used to see how many times the spring could be compressed and released before deformation occurs and the product is no longer usable. This test is carried out so that the life expectancy of the paper punch is accurate.

The polythene elasticity will be tested to see if the material is suitable for the paper cutting case, if the elasticity is not high enough then the case will not be able to attach and detach efficiently.

Statistical control; This control is done by again taking a sample of the product from the production line and checking its measurements (height, width or length). This process is usually carried out by automated machines due to it being a standardised test. Impurities on the product would also be checked for.

The fulcrum bar diameter would be tested due to it having to fit into a certain size hole and for it to be a certain size for the spring to be coiled around it, if the diameter is more than a certain measurement out the whole production line will be stopped and the problem will be fixed.

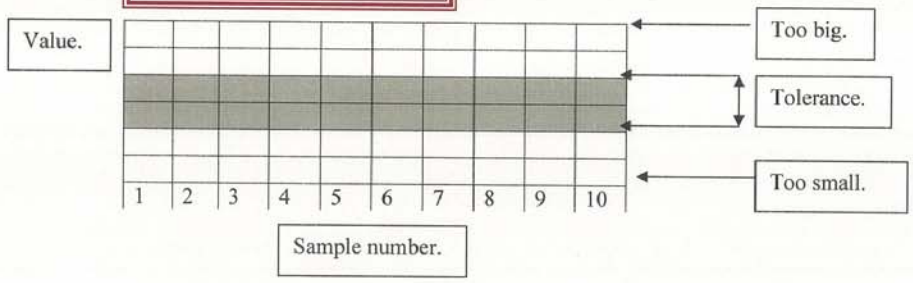
The width and height of the paper size slider will be controlled so that it still fits into the base of the paper punch, there is less than a mm of gap clearance between the base and the slider therefore margin of error will be very small, this will be tested regularly due to the error being so small.

If a problem is found using the above techniques then the production line is stopped immediately and will remain stopped until the problem is found or fixed. Some of the processes such as moulding require materials to be cleaned and lubricated before use.

Quality Control tests;

Component.	Manufacturing Process.	Test.
Base 	Die Casting.	A visual test for Die casting would just be simply look for gaps and imperfections either in the mould or the moulded object produced. A Physical test that could be used for Die casting on the base of the Hole punch would be a 'go No go' gauge to measure the diameter of the plunger holes, these would be tested to the nearest micrometer.
Paper waste case. 	Injection moulding.	Any imperfections on the surface of the plastic such as scratches and bumps will be visually tested, this can be done using photographs of what impurities to look out for and the product will be evaluated against these. If a physical test was to be used on this part of the product probes or profilometers would be used to detect these irregularities.
Plunger. 	Drawing.	The plungers have been drawn. To test whether the diameter is constant no visual check can be done so a 'go No go' gauge would be used to slide along the length of the plunger to see if the diameter is constantly within the limitation boundaries or tolerance. An alternative of using a 'go No go' gauge would be to use a micrometer.
The complete product.	N/A	A weight test would be used on the whole product, no visual test can be used to judge this property so scales would be used to measure the weight of the Hole punch.

Tolerance Sampling Chart.



Quality Assurance.

Preparation

- Raw product such as aluminium casting alloy and polythene will be purchased from reliable sources.
- Also raw material will undergo checks on every batch to make sure the material is up to high quality standard.

Processing

- Quality control checks will be made when casting the aluminium handle and base
- Quality control checks will be made whilst forming the paper size slide
- Quality control checks will be made whilst injection moulding the paper cuttings case and feet.
- Samples will be taken from these produced components and will be failure tested and statistically controlled before assembly.

Assembly

- Samples of the sub-assemblies such as the attachment of the fulcrum bar to the plungers will be taken and tested to agreed standards.
- Testing will be done to establish whether or not the product is suitable for its intended use.
- Samples will be taken of the assembled product to be statistically controlled.

Finishing

- The enamel paint used to coat the product would be tested for constant consistency and fluidity and anomalies.
- Samples of the final product (coated) would be taken and statistically controlled to assure that the thickness of the paint has not effected the mechanical mechanisms.

After-sales

- A guarantee will be given to assure the customer that the paper punch is fit for the purpose and works correctly.
- Also calculated from the working life expectancy from the weakest component a life expectancy will be given to the paper punch.

Marks of quality assurance consist of the British standards logo shown below, and also the CE mark. The British standards currently have 27,000 standards. The CE is only used in the European Economic Area. The CE mark is used on for example toy safety and machinery.

The British standards code used on the bottom of the whole punch is: **15048501** and **11./2**

Assurance

Quality assurance is the way that manufacturers are able to monitor the quality of the product throughout every single stage of production right until the end product, quality assurance also determines customer satisfaction and whether or not the product fulfils its requirements.

Standards

External standards of quality are used to evaluate and inspect the quality of each of the products and materials used. Companies and organisations such as British Standards (BS) are used for national inspection, others such as the (EN) and (ISO) are used for international use.

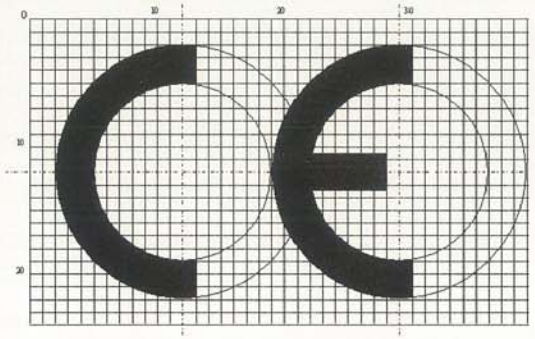
Companies

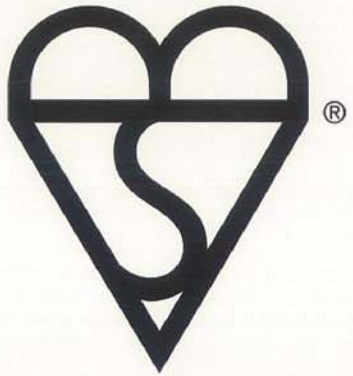
Companies and organisations use stamps of approval to mark the product as meeting these standards, this gives the product a certain level of credibility and reliability. The marks used are shown below.

Tests

Some of the tests carried out on products are the following;

- Reliability
- Maintainability
- Safety
- Strength





Introduction and design brief.

Introduction to Target Audience.

The target audience is 8+ years old. This is a large and wide range, this will make designing it more of a challenge because it has to cater for every need of each age group. People that will need this bus shelter are mostly going to be people that are too young to drive or the opposite, too old to use a car and have to use public transport. Other people that may need this bus shelter are commuters that have to use buses to get to work each morning.
At the moment in time there is no bus shelter for the users of the bus service to stand at whilst waiting. This is a problem because it provides no shelter from the rain and bad whether.

Design Brief.

Design a new state of the art bus shelter and ultimately create a scale model of the real product. The bus shelter needs to suitable to be placed outside and hold up to a maximum of ten people. It must provide proficient refuge for people to stand or sit whilst waiting for their bus The Shelter must accommodate all ages, heights or able or disabled people. Wheelchair access must be available. It needs to be easily built of the road side for easy access to the bus door.








Specification.

The shelter must hold up to 5 people (seated) and 5 People (standing).- This is because on average maximum amount of people at one bus stop is roughly ten. There should be enough room for all of them to occupy the shelter.

Must have a waterproof roof.- This is essential because people will not want to stand in winter conditions such as rain or snow.

Must be hard wearing materials.- The materials I am going to use must be hard wearing because of the everyday use of the structure such as people leaning on the poles or sides or even people accidentally hitting them with an object for example a football.

Safety glass.- I would incorporate smash proof glass into the design for safety so that for instance a person falls into the glass is will not shatter and cut the person.
No sharp edges.- There must be no sharp edges on the bus shelter so that

Digital screen (possibly touch).- An electronic screen may be in use to indicate to the people at the stop when and where the next bus is travelling too, these are already in use in bigger cities. This is more simple and less complicated than decrypting an old bus timetable.

Everything must be securely stuck together.- This is so that people cannot disassemble the product or damage it in any way, this will save cost on repairs.

Colours.- The colours need to be universal so that the bus shelter can fit in any surrounding. For example;

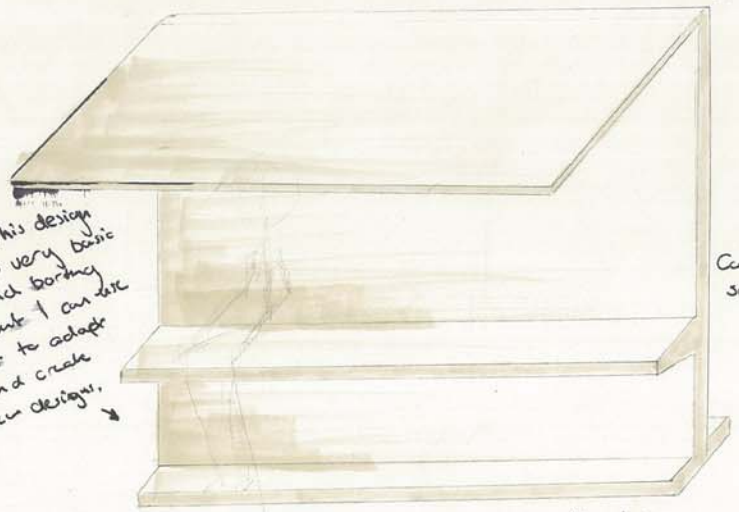
- Blue.
- Green.
- White.
- Black.

These colours may tie into the bus company's colour scheme or the councils.

Litter.- Often litter can build up around a bus shelter, so for this reason a bin must be secured to the structure of the shelter. Maybe two different compartments, one for recyclable products and one for general waste.

Design Ideas (Pg.2)

Evaluation: Design 2 is incapable of housing a digital screen.

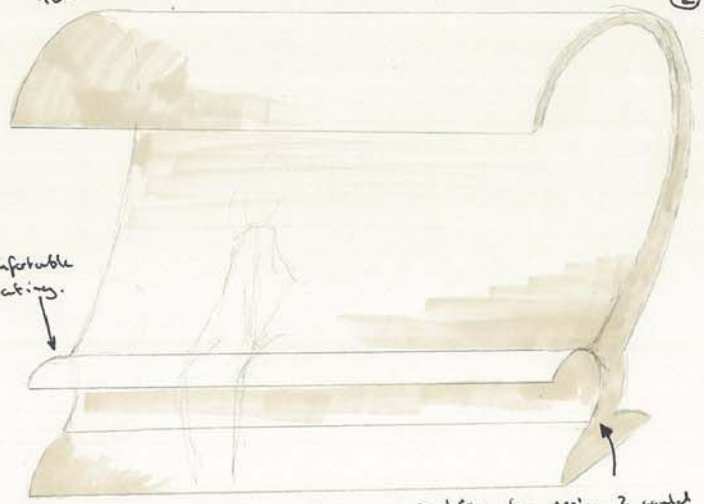


This design is very basic and boring but I can take it to adapt and create new designs.

Large capacity.

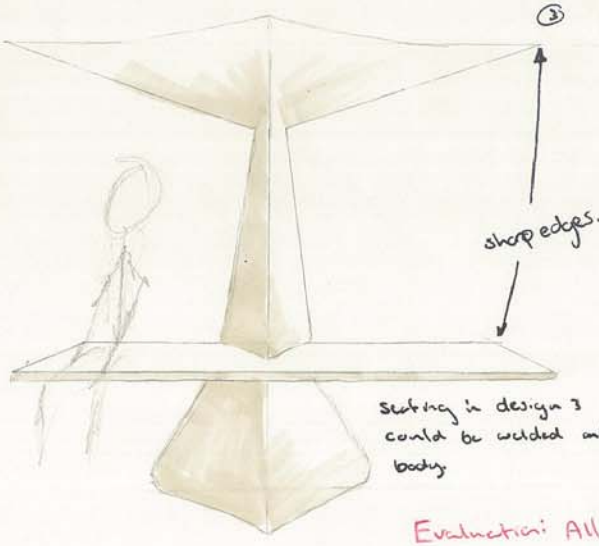
Designs 4 and 1 have the ability to have some sort of info screen.

This curved roof could be produced using a rolling technique.



Comfortable seating.

seating for design 2 could be riveted or bolted on.



sharp edges.

seating in design 3 could be welded onto body.

The bowl roof of design 4. would be hard to create using metal. But could be made from injection moulding.

Comfortable seating although very low maximum capacity.

Design 4 does not meet my specification because it will be unable to hold the right amount of users.

Designs 1, 2 and 4 all have large roofing protecting the users from whether.

Evaluation:
None of these designs have the capacity of 10.

sloped roof so that rain doesn't gather.

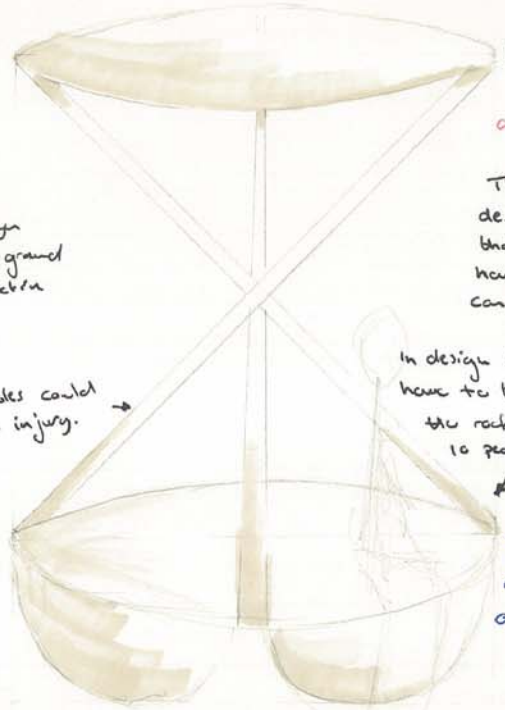
Head room may be an issue in the seats on the end.

I think that this design looks almost like a fairground ride and may be attractive to children.

Manufacturing:
The centre pole could be injection moulded.

The centre piller of design 5 would have to be injection moulded or casted to form the unique shape.

Open poles could cause injury.



Evaluation: All designs are capable of holding a litter bin.

The good thing about designs 3, 5 and 6 is that they do not have surfaces that can be vandalised.

In design 6 the seating would have to be smaller than the rest for it to accomodate 10 people.

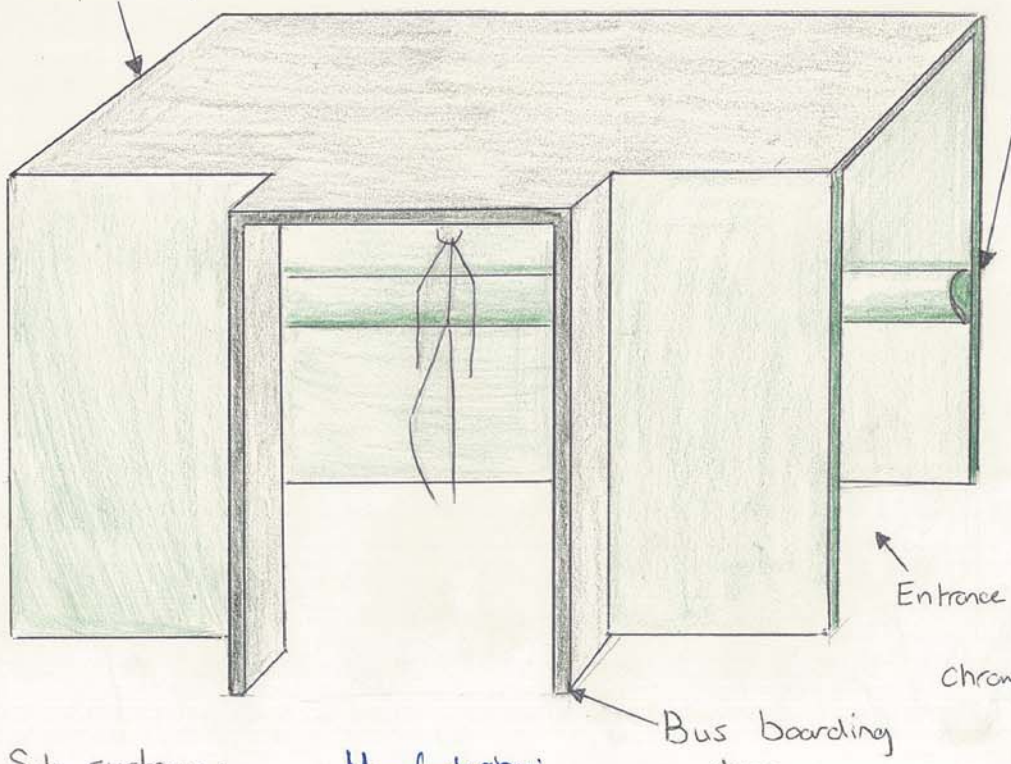
Manufacturing:
The support poles could be riveted onto the base.

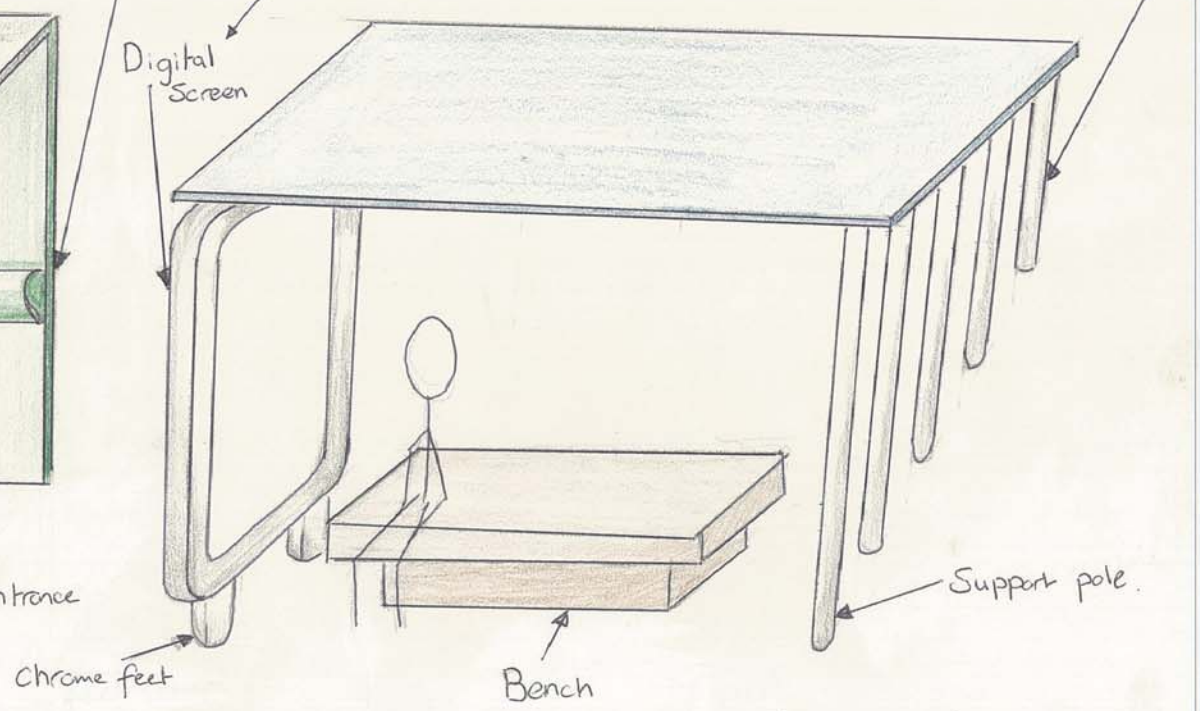
Design Ideas.

Out of the two designs on this page I prefer the design on the right hand side because it looks more modern.

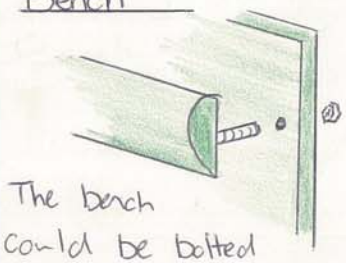
The bench in the diagram below may be MDF covered in a plastic wood look finish.

I have chosen to slope this roof so that rain water rolls off and does not build up.





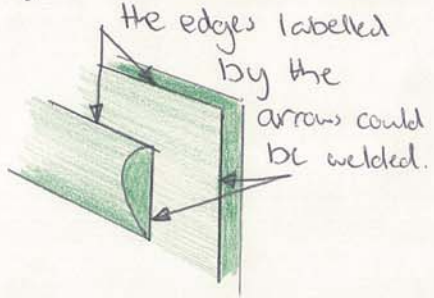
Sub systems: Bench



The bench could be bolted on through the back wall of the shelter.

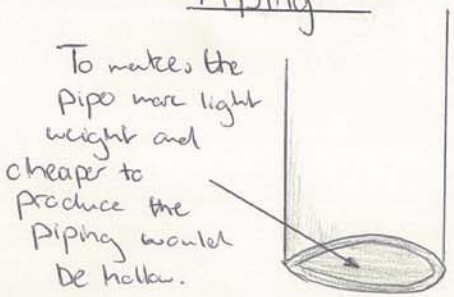
Manufacturing:

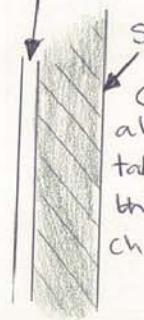
Using a MIG welder the edges labelled by the arrows could be welded.



Sub systems: Piping

To make the pipe more light weight and cheaper to produce the piping would be hollow.



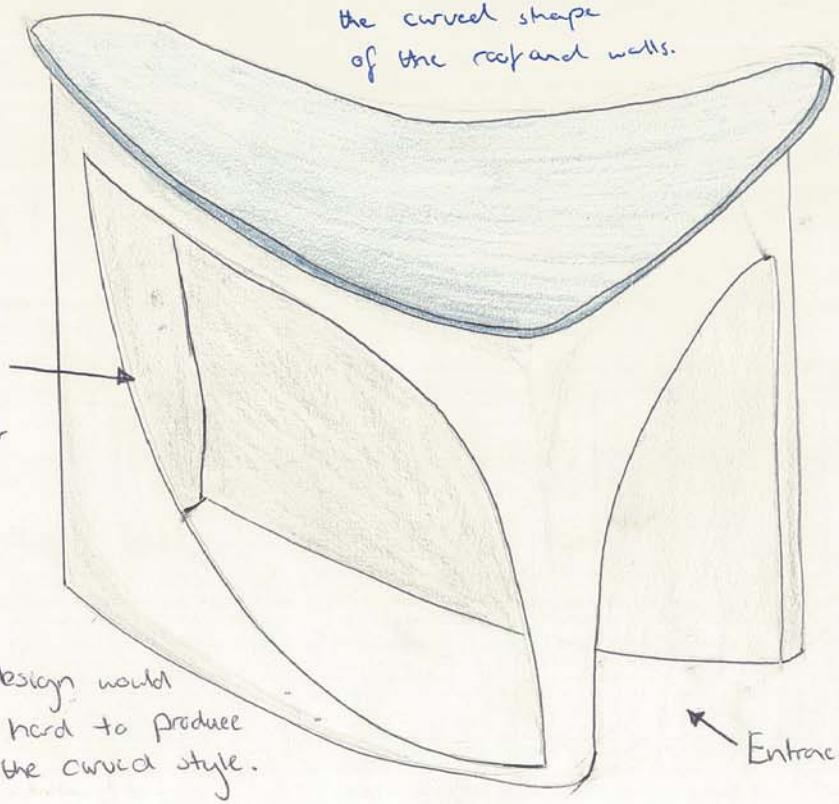


Chrome as an alloy is expensive to buy. Therefore the steel is only chrome plate.

This whole structure will be less stable than the others due to the shelter only having 3 points of contact with the floor.

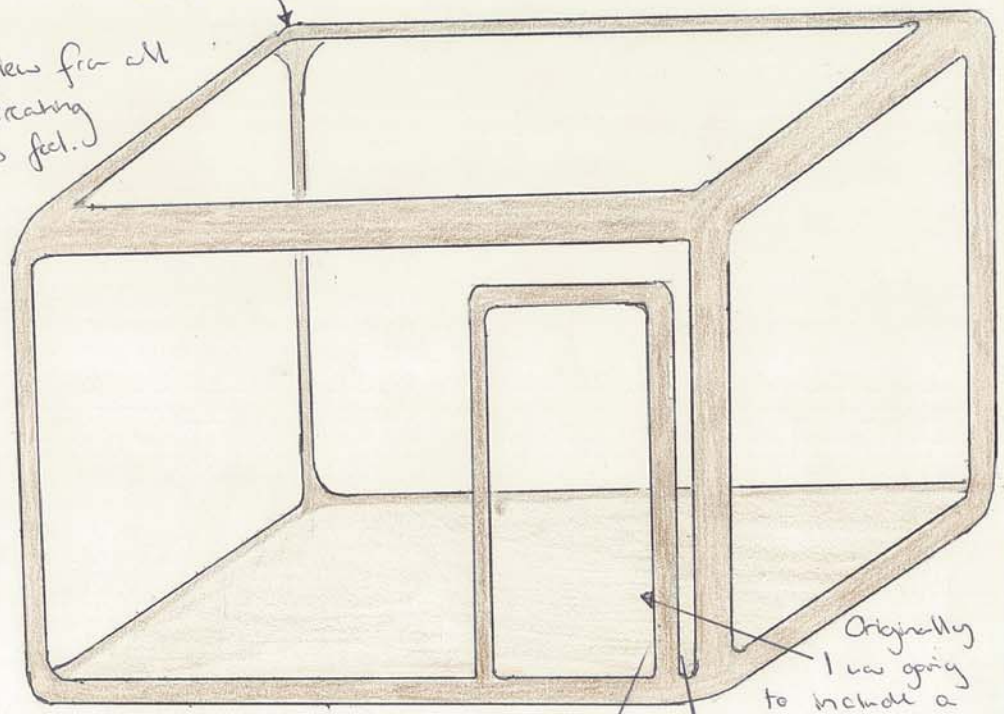
Design Ideas.

Manufacturing: Water cutting could be used to create the curved shape of the roof and walls.

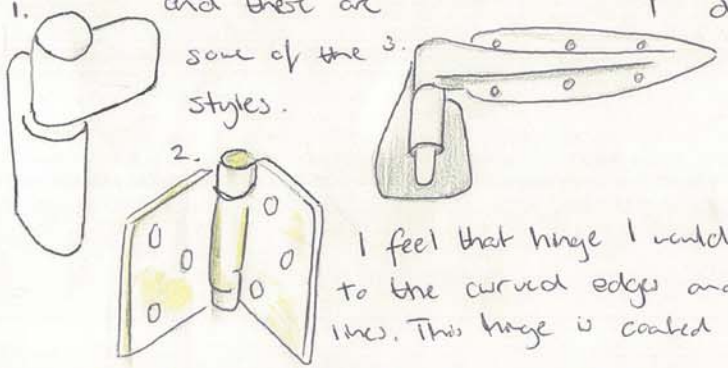


Open view for all walls creating a spacious feel.

The design below's windows are made from steel perspex.



I researched door brackets and these are some of the styles.



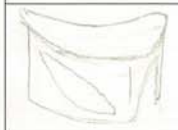
I feel that hinge 1 would be best due to the curved edges and straight lines. This hinge is coated in acrylic.

Manufacturing: Metal screws could be used and filed off to make sure no sharp edges.

Evaluation:

The four building designs are easily the best designs for meeting the 10 person capacity of the specification. Although large capacity the bus shelter how to fit by the side of the road and for this reason are not very suitable. The indoor capability means having a digital screen is made easier. I could use any colour finish on the bus stops because I could powder coat it or paint. Also due to have four walls on the indoor bus stops plenty of space is available to mount a litter bin.

Design Evaluation.

Design.	Digital screen capability.	Capacity of 10 people.	Water Proof roof.	Hard wearing materials.	Safety Glass.	Colour scheme.	Litter bins.	Secure.
	✓	×	✓	✓	× On all of the free standing shelters no safety glass is required.	✓	✓	✓
	× The curve makes it hard to mount a screen.	✓	✓	✓	×	✓	✓	✓
	× There is not enough surface area.	×	✓	✓	×	✓	✓	×
	✓	× There is only five seating positions.	✓	✓	×	✓	×	✓
	×	×	✓	✓	×	✓	×	×
	×	×	✓	✓	×	✓	✓	✓
	✓ All of the indoor bus shelters are compatable with digital screens.	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓

← This design barely meets any of the criterion

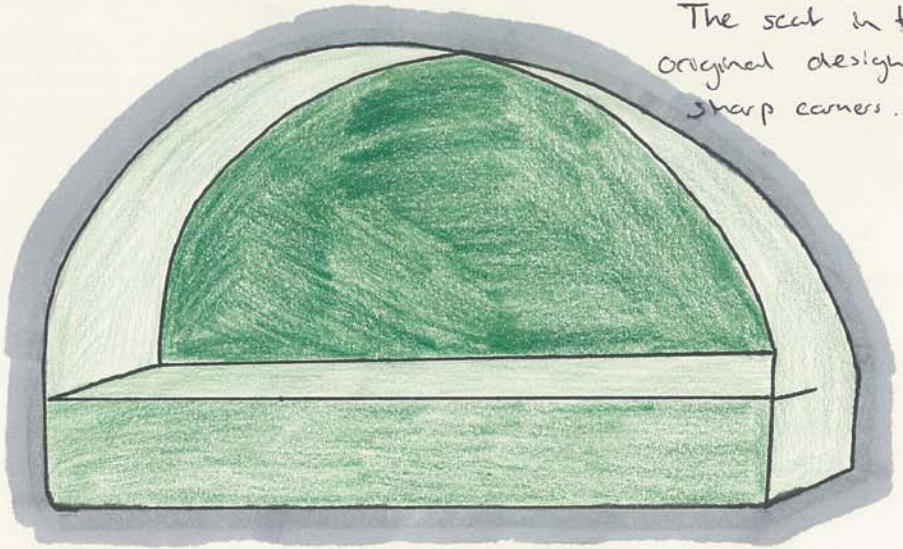
All the enclosed bus shelters tick every specification criteria. This has made me develop more on the enclosed

All bus shelters are water proof.

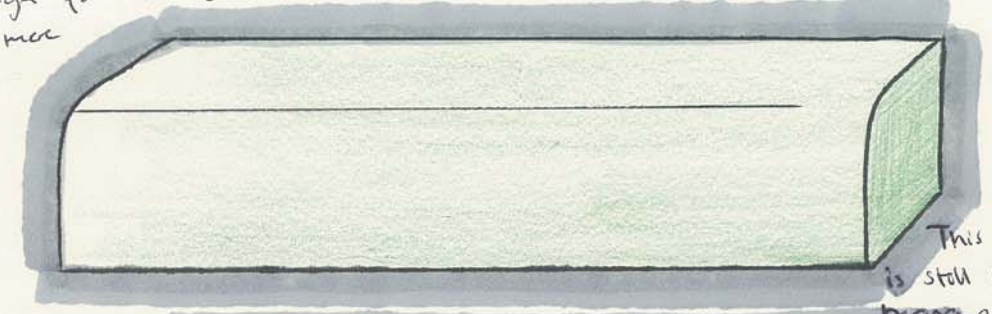
All bus shelters are either plastic or metal.

Idea Development.

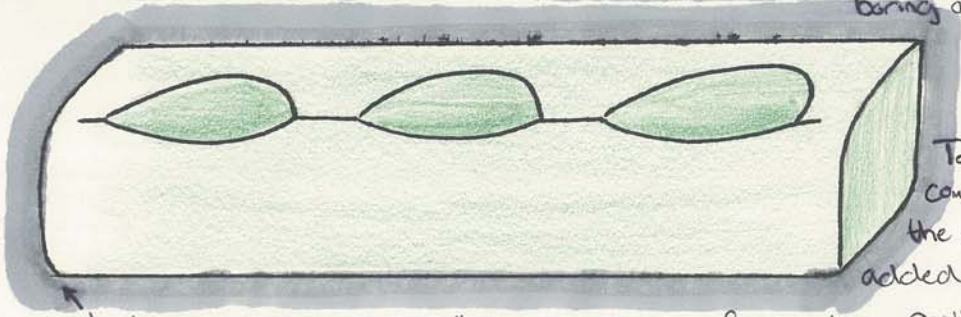
In this design for the seat I have decided to round the corners to make the bench more comfortable.



The seat in the original design has sharp corners.



This design is still pretty boring and plain.

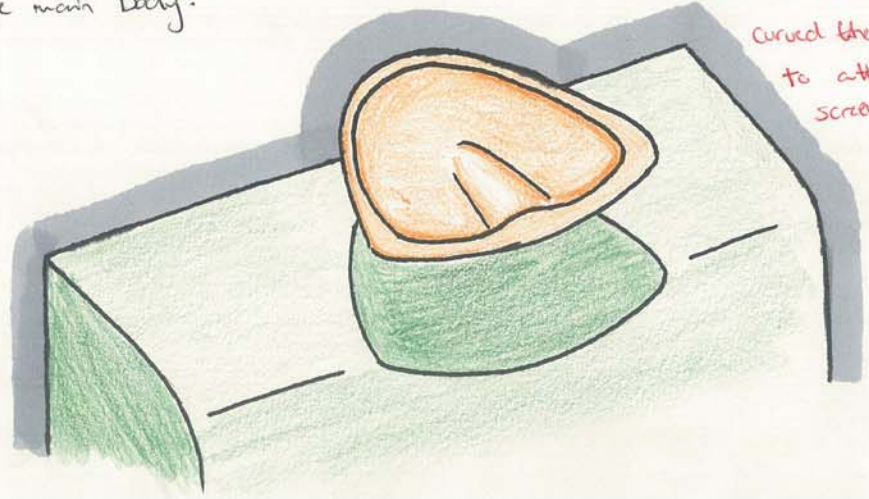


To add comfort for the user I added indents for seating positions.

I also decided to round off the corners of the bottom to keep in with the style.

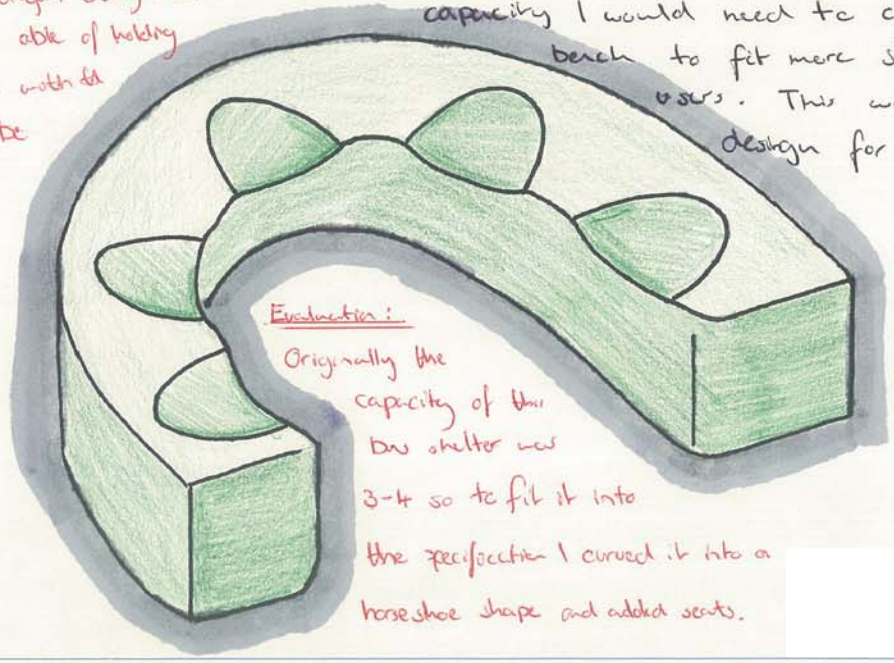
The design above is the design I have decided to carry forward and develop. I have chosen this design because it meets alot of the specification.

The seat will be set in to a groove on the main body.



Evaluation: The orignal design had a flat back wall able of holding a digital screen although with the new seats the wall will be curved therefore harder to attach a screen.

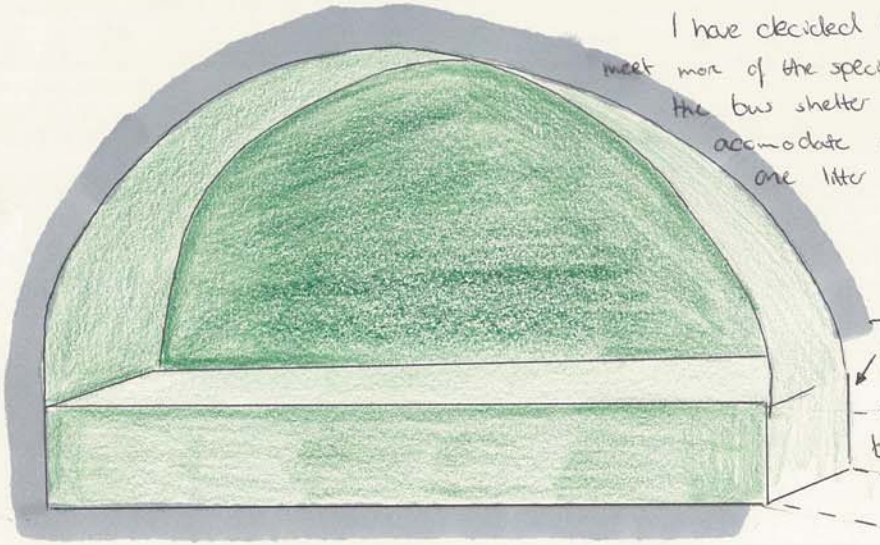
I decided to acchieve the correct capacity I would need to curve the bench to fit more standing users. This will be the design for the bench.



Evaluation:

Originally the capacity of the bus shelter was 3-4 so to fit it into the specification I curved it into a horseshoe shape and added seats.

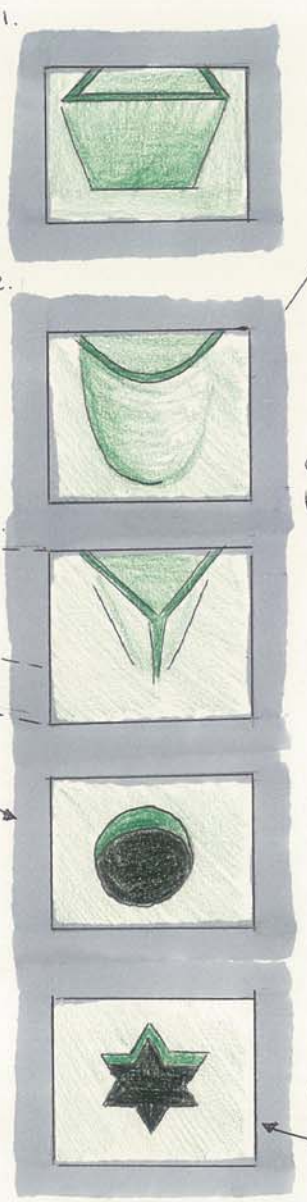
Idea Development.

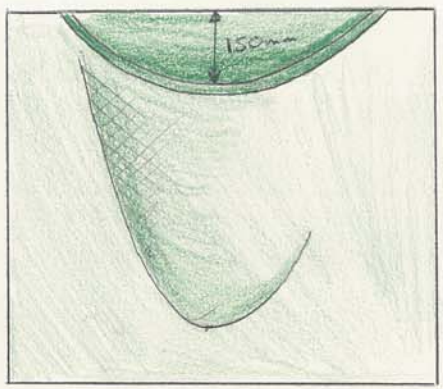


I have decided that to meet more of the specification the bus shelter must accomodate at least one litter bin.

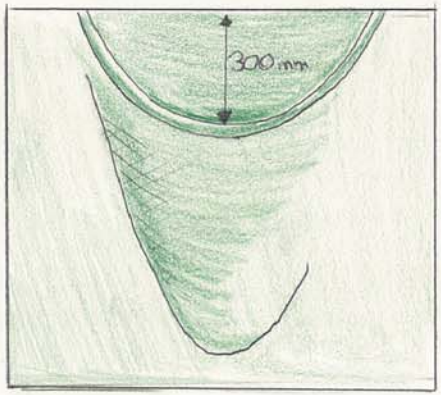
Design 2 would be hard to get a smooth finish.

The bin will be located on the outer edge of the bus step.





I have decided that the design above entrance to the bin is too shallow and needs to be wider.



This is the improved bin with a wider mouth to fit bigger items of rubbish in.

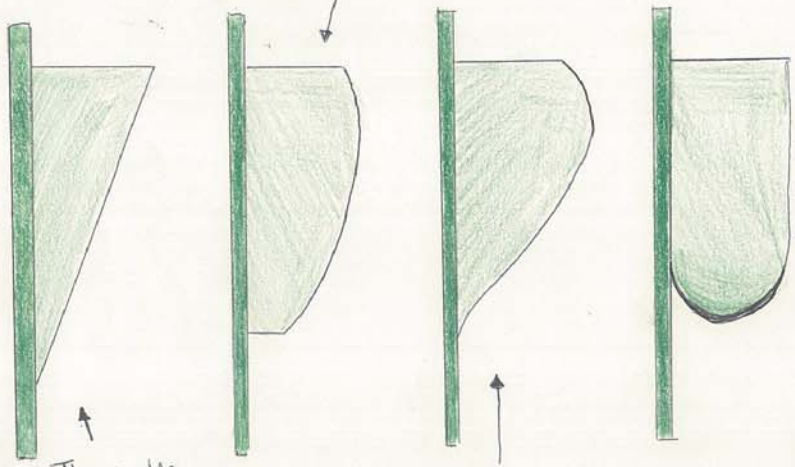
This hole could be easily pressed or punched out.

This design has sharp corners on it so is not suitable for the bus shelter.

Design 4 and 1 are ok designs but are boring.

Profile views:

I have curved the edge to make it more in keeping.



This is the standard design.

This design has been tapered down for a smooth finish.

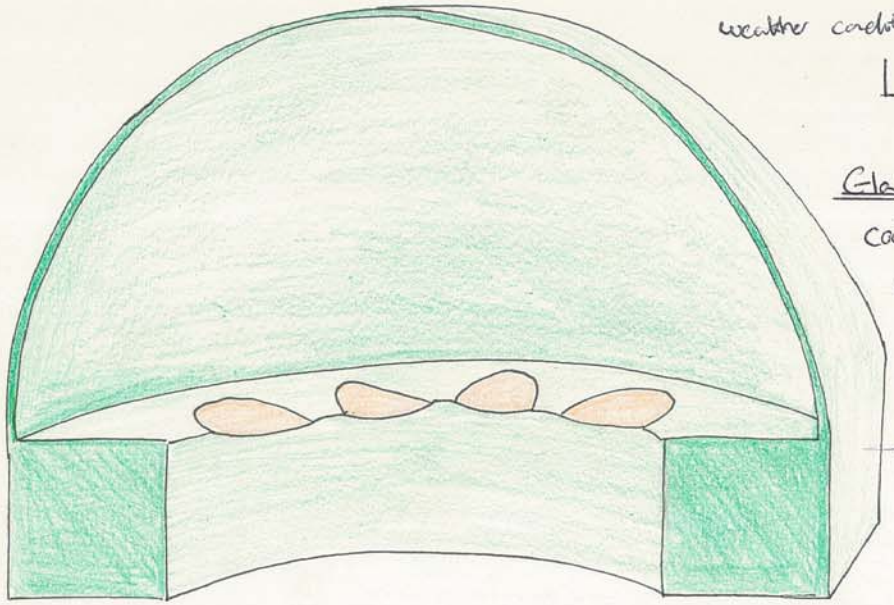
A bin that juts out from the main structure will be better because more people will be able to see it and use it.

Materials.

Steel: This could be used for the main structure of the shelter although it is very heavey and is a ferrous metal so will rust under the weather conditions.

Aluminium: Aluminium is a light weight pure metal, this means it will be very light for the structural roof. Aluminium is also corrosion resistant therefore will not rust. Aluminium needs alot of annealing during manufacture this would slow the production rate.

I feel Aluminium would be more appriate to use for the shelter.



Glass reinforced plastics (GRP): GRP can be made into any shape and coated in any colour. GRP maintains a good strength to weight ratio and is corrosion resistant. Resin used to mix in with the fibres can shatter and cause an accident. These properties make GRP the ideal material for the main structure.

Polyvinyl Chloride (PVC):

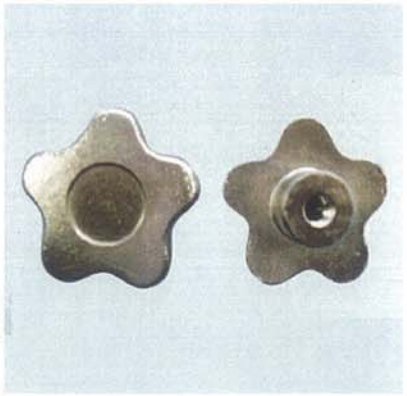
These could be used for the seats PVC is weather resistance therefore would not be damaged by rain or other elements. Ultraviolet does cause brittleness over time.

Acrylonitrile butadiene styrene (ABS):

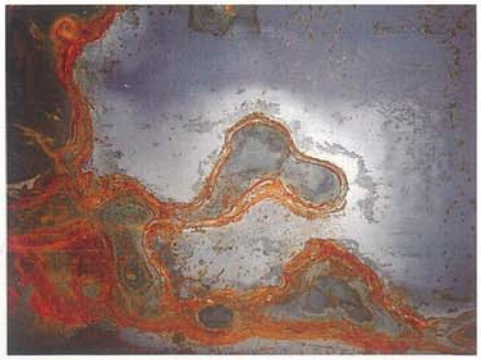
ABS is the most commonly used plastic for seating. ABS is hard and tough therefore will not get scratched. Similar to PVC it is still weather resistant although Ultraviolet light does degrade ABS.

Coating Options:

- Dip coating
- Powder coating.
- Brushed (Matt effect.)
- High sheen (Gloss effect.)
- Painted.
- Galvanized using zinc.

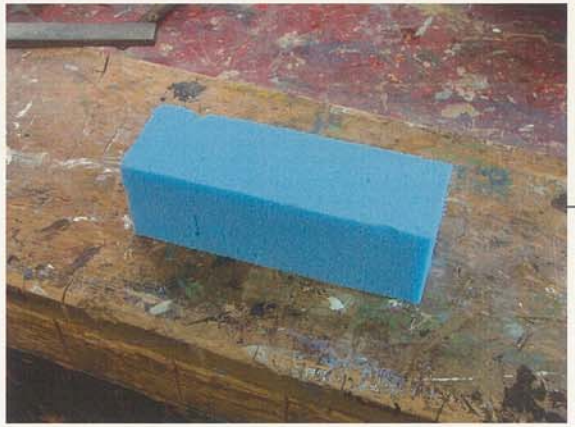


To the left is an image of zinc coated steel, as you can see there is no rust, this is because the zinc prevents oxygen touching the steel.

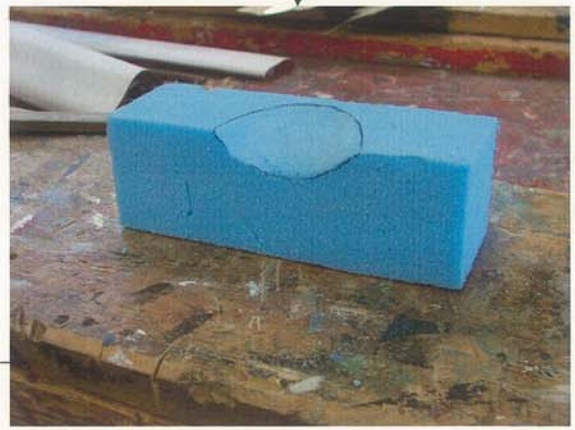


This steel has not been protected and therefore rusts. This causes a unattractive look and structurally effects the steels strength.

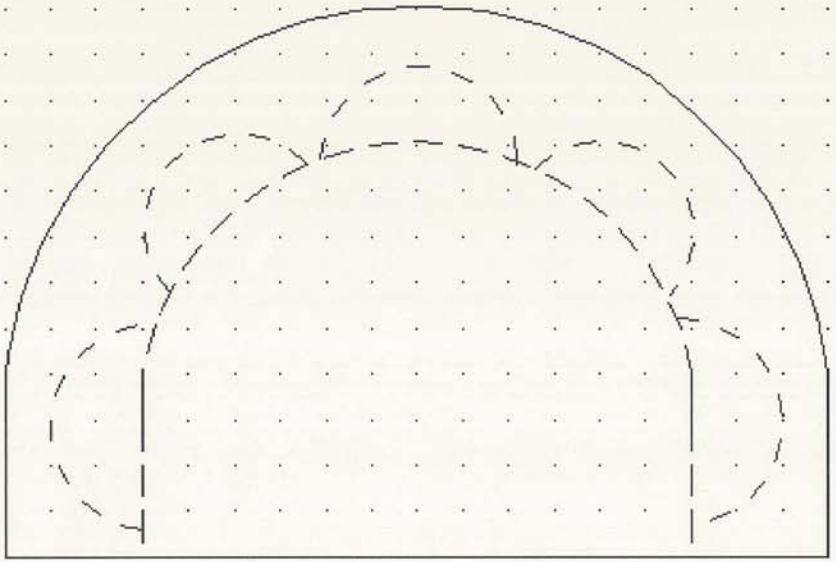
3D Modelling of seating.

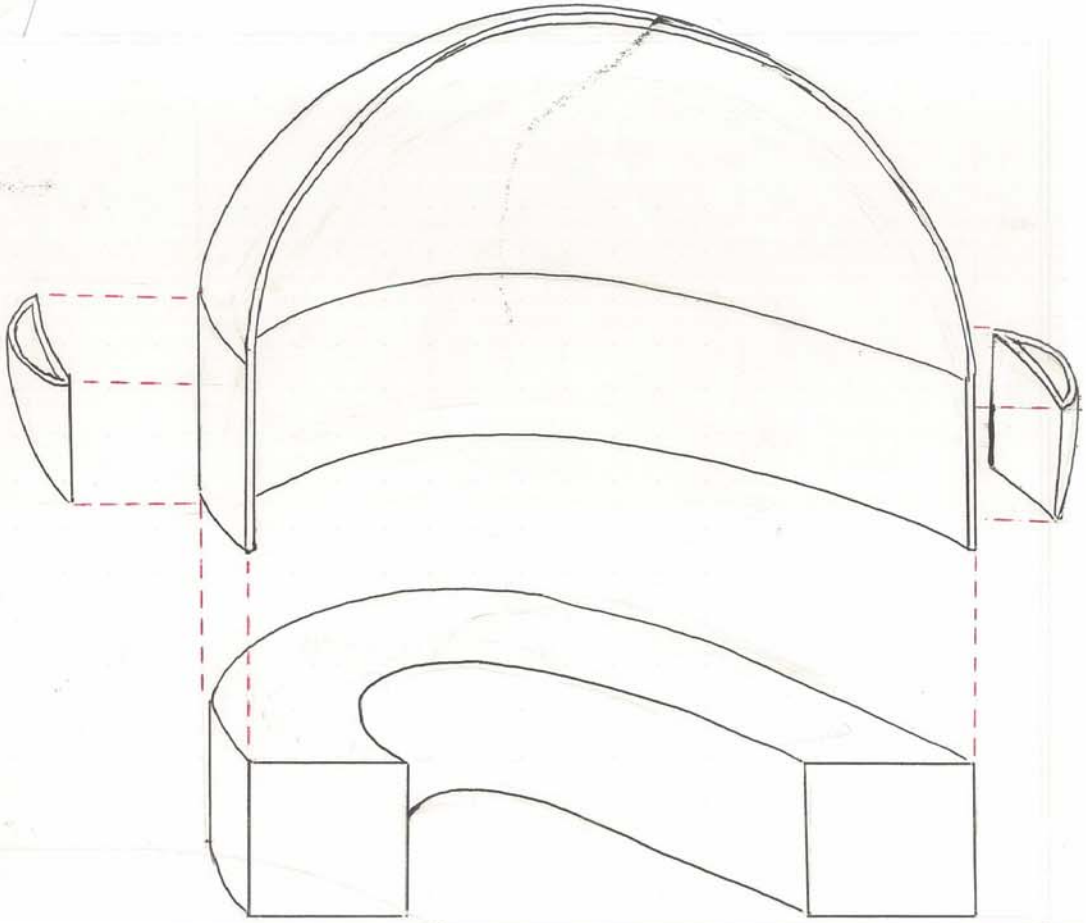


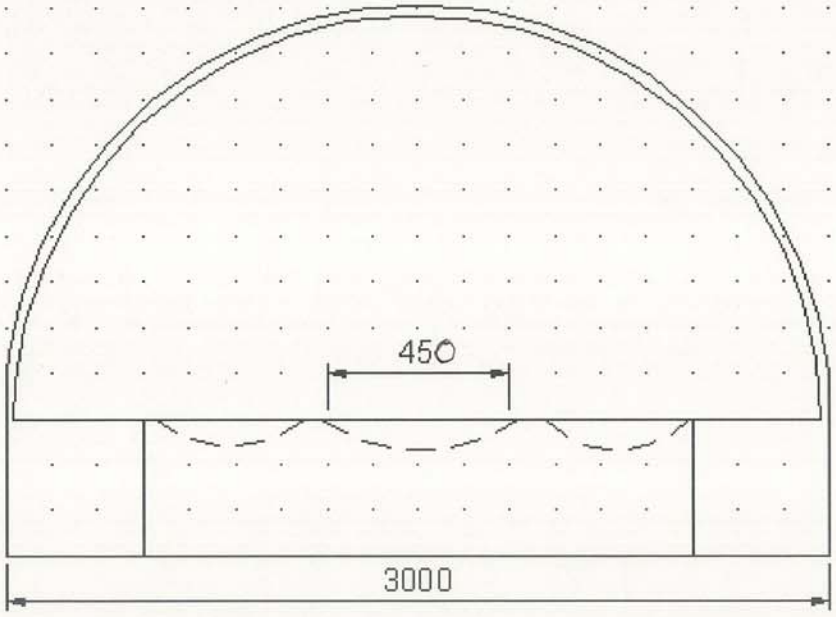
I have used 3D modelling to help assist a 3rd party in the manufacture of my bus shelter.
I have used a block of polystyrene to represent the bench of the bus shelter. Then I have marked onto the polystyrene where the seat will be positioned, I have marked on its length, width and depth. This has made it easy for me to sand away in the right position, I sanded using a curved file and a sheet of glass paper. This shows that the seat is an indent onto the bench.

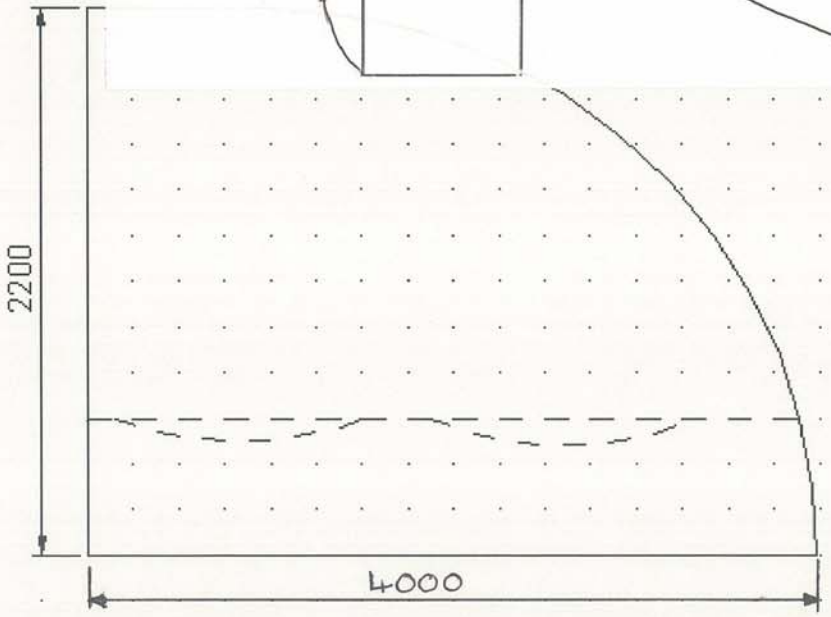


Working Drawing.

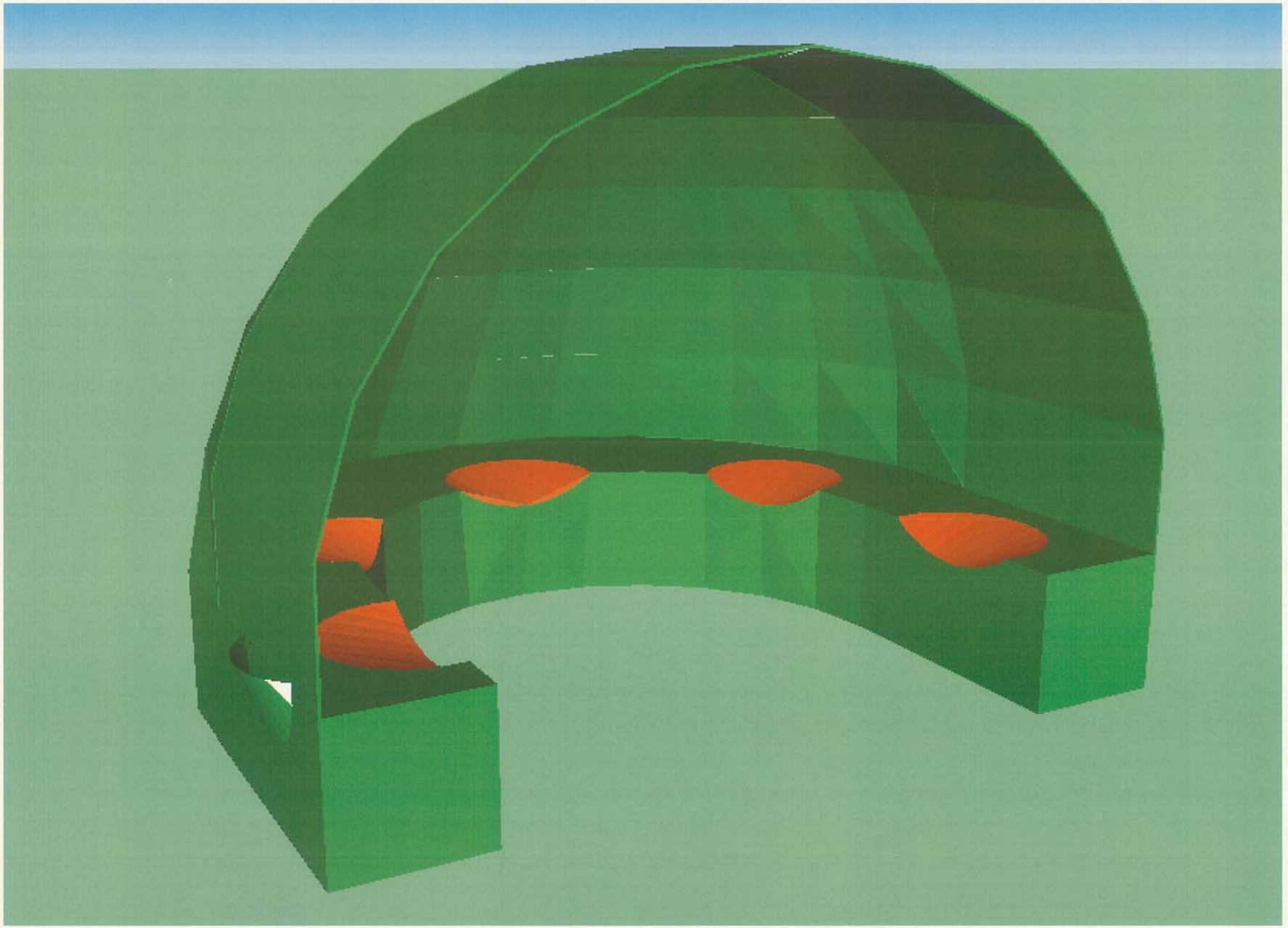








Final Design.



DT-Resistant materials.

Box Manufacture Project.

Introduction Specification.

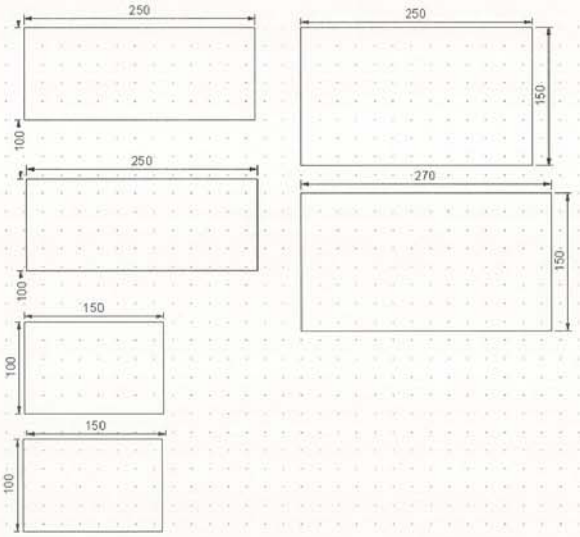
Materials;
- Cherry.
- Black Walnut.
- Plywood.

Specification.

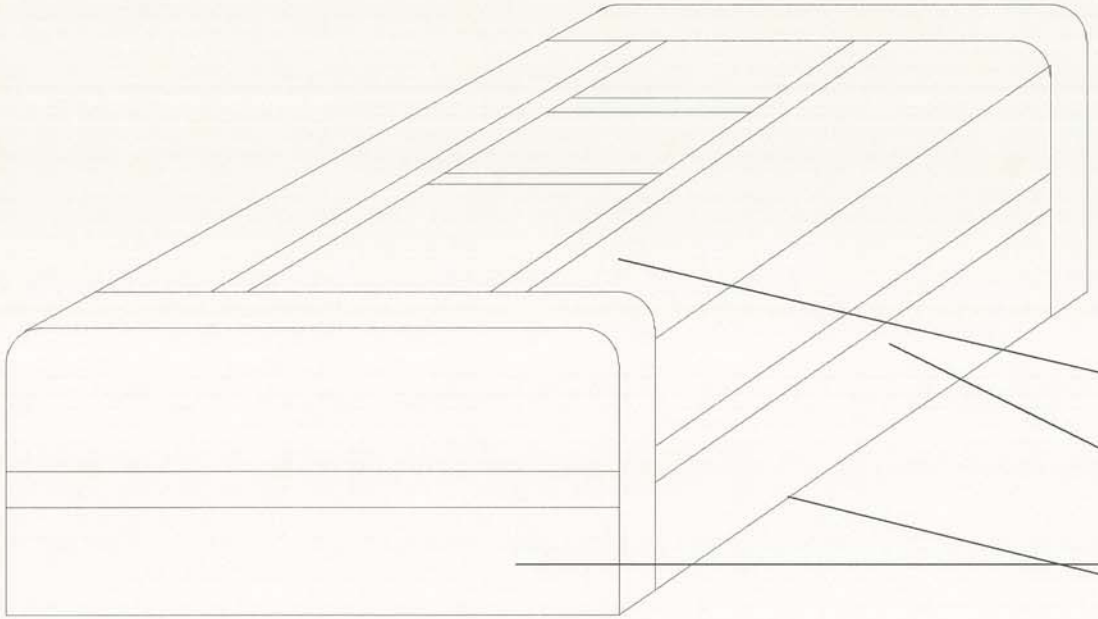
The box has to be equal to or less than the following dimensions;
250mm x 150mm x 100mm

- The box must be able to hold odds and ends such as the contents of someone's pockets, e.g.: Phone, coins and keys.
- The wood must not be warped or effected by water, or liquid.
- Must not take up to much room on worktop.
- Easily cleaned using water or other cleaning agent.
- Contents must not be damaged whilst contained or when the box is moved with the contents still in the box.
- The box must have some kind of finishing layer such as gloss or varnish. This will help protect from cleaning.
- I will replicate the top Marquetry and banding to give the box its finish. I may use real wood instead of veneering to give a good quality look.
- This box has to be easily opened and closed without any clips/catches to unlock.
- Must look attractive to all ages.

The box must be suitable for household use; this means it must be universal colours. For this reason I decided to not colour my box but to leave it with a varnish on it to protect it from stains and scratches. This box is designed to be placed on a worktop and i feel most worktops are made from wood for similar colour and grain to the ones used for the box therefore would fit in and not look out of place on many surfaces.
The box must not look 'cheap' so I have decided to use two different types of wood, Cherry and Black walnut, cherry being relatively cheap gets cancelled out by the expensive look of the dark Walnut also the colours complement each other by the contrast of light to dark.
The box must be easily opened, for this I will be using a dowel joint to connect the lid to the main body of the box this is slightly different to the original box that i am mimicking but I do not want to use metal with the majority of the box being made from wood, I feel this would distract from the colours and texture of the wood.



Working drawing and component drawings.



3 dimensional view.

The diagram above is of the finished product in 3D. it shows how each of the 2D components come together and create the final product. The arrows indicate which section goes in which position of the final product.

Material Justification.

I have chosen to produce my box from the following materials;

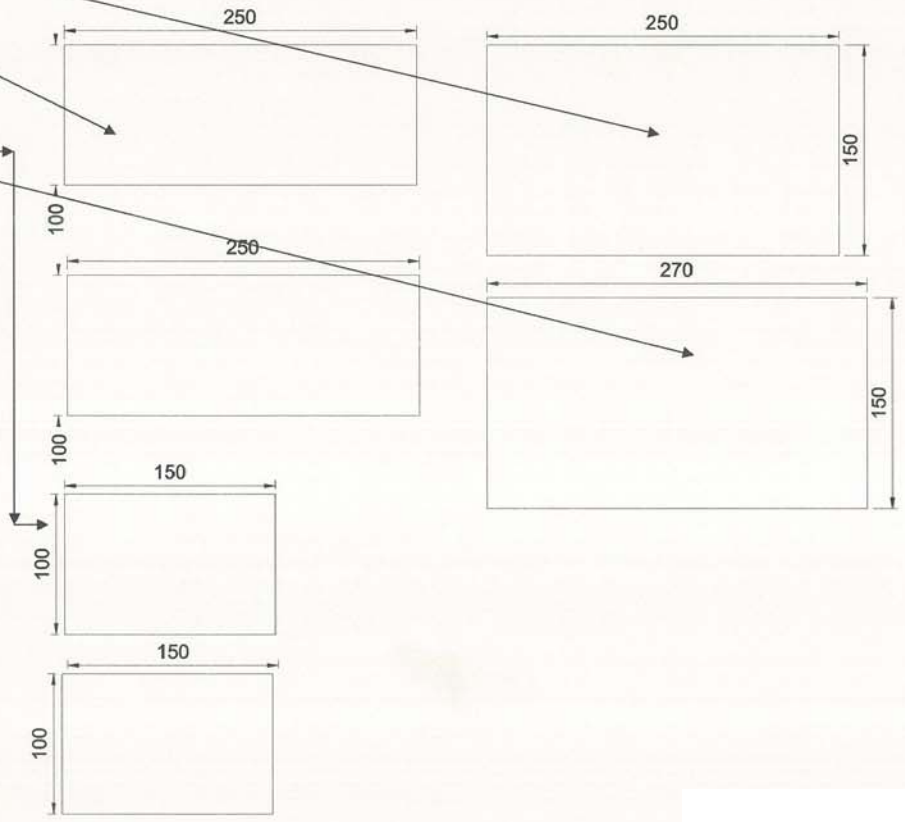
- Cherry.
- Black Walnut.

I have chosen to use cherry for the lighter areas of my product because it is a light wood that will contrast well against the Walnut. Also it is cheap to produce and purchase, cherry is also easy to sand down to a fine finish and I am able to finish the product with varnish.

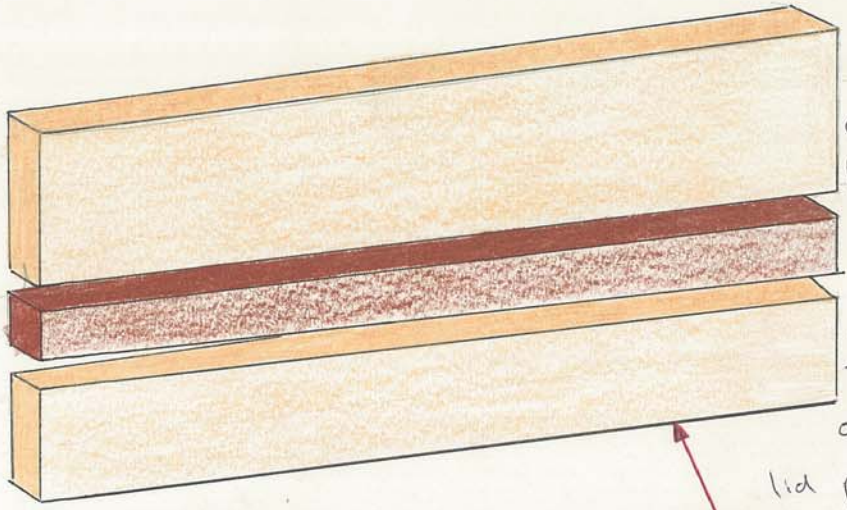
My choice of Black Walnut was because I needed a dark wood to contrast in colour and give a rich and well defined look to the box. Walnut worked well for this because of its colour and similar texture and properties.

2 dimensional components.

Below are the dimensions of the product components that I plan to assemble to create my final product. The two (250x100mm) sheets will construct as the side panels. The two panels below them (100x150mm) will be put together to create the side panels

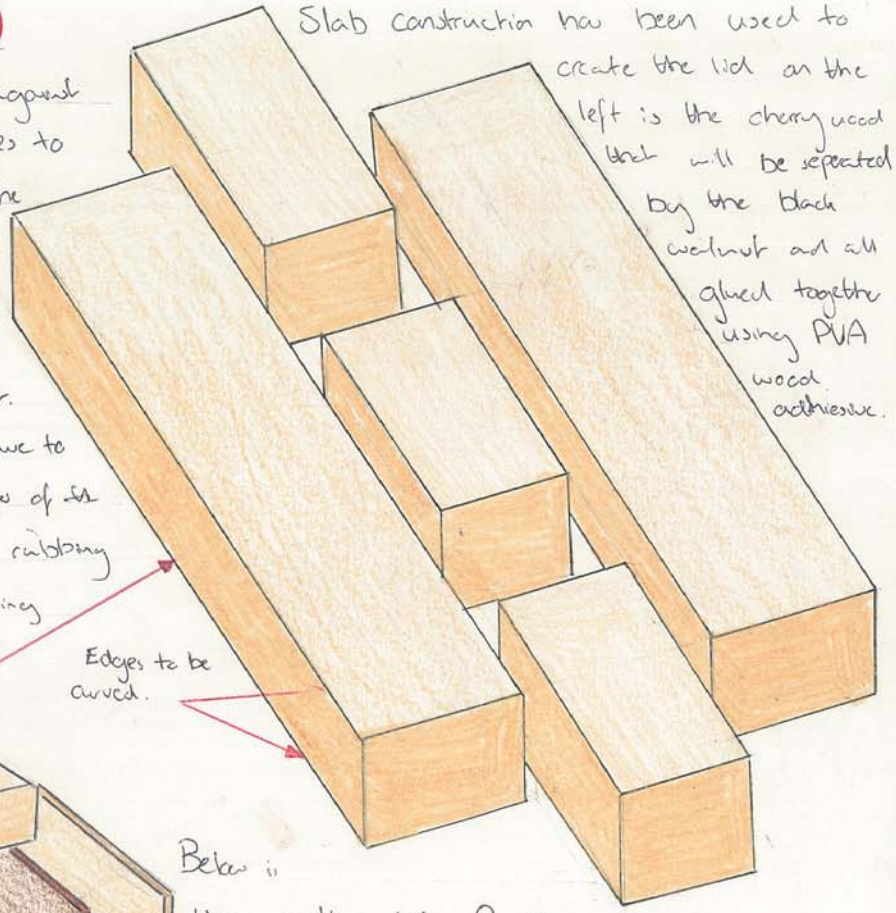


Component and Assembly drawing. (Pg.3)



I have decided against using metal hinges to connect the lid of the box. Instead I am planning on using a cherry timber dowel to connect it. This means I will have to curve one of the edges of the lid perfectly so that no rubbing occurs whilst opening and closing.

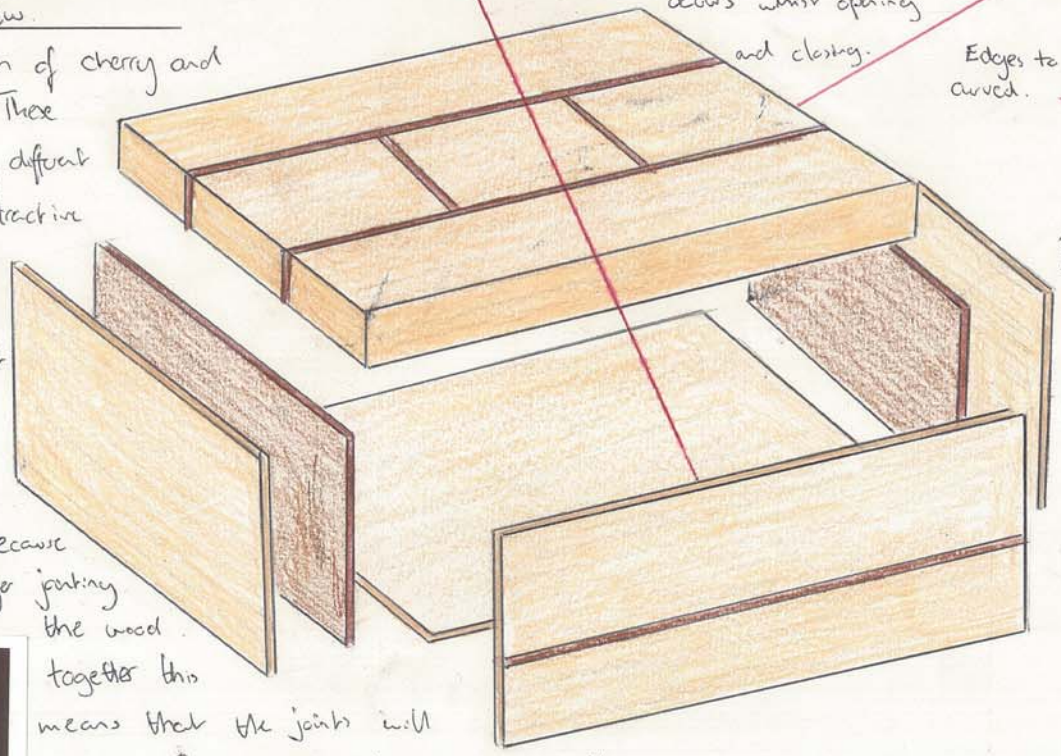
Slab construction has been used to create the lid on the left is the cherry wood that will be seperated by the black walnut and all glued together using PVA wood adhesive.



Edges to be curved.

Exploded view

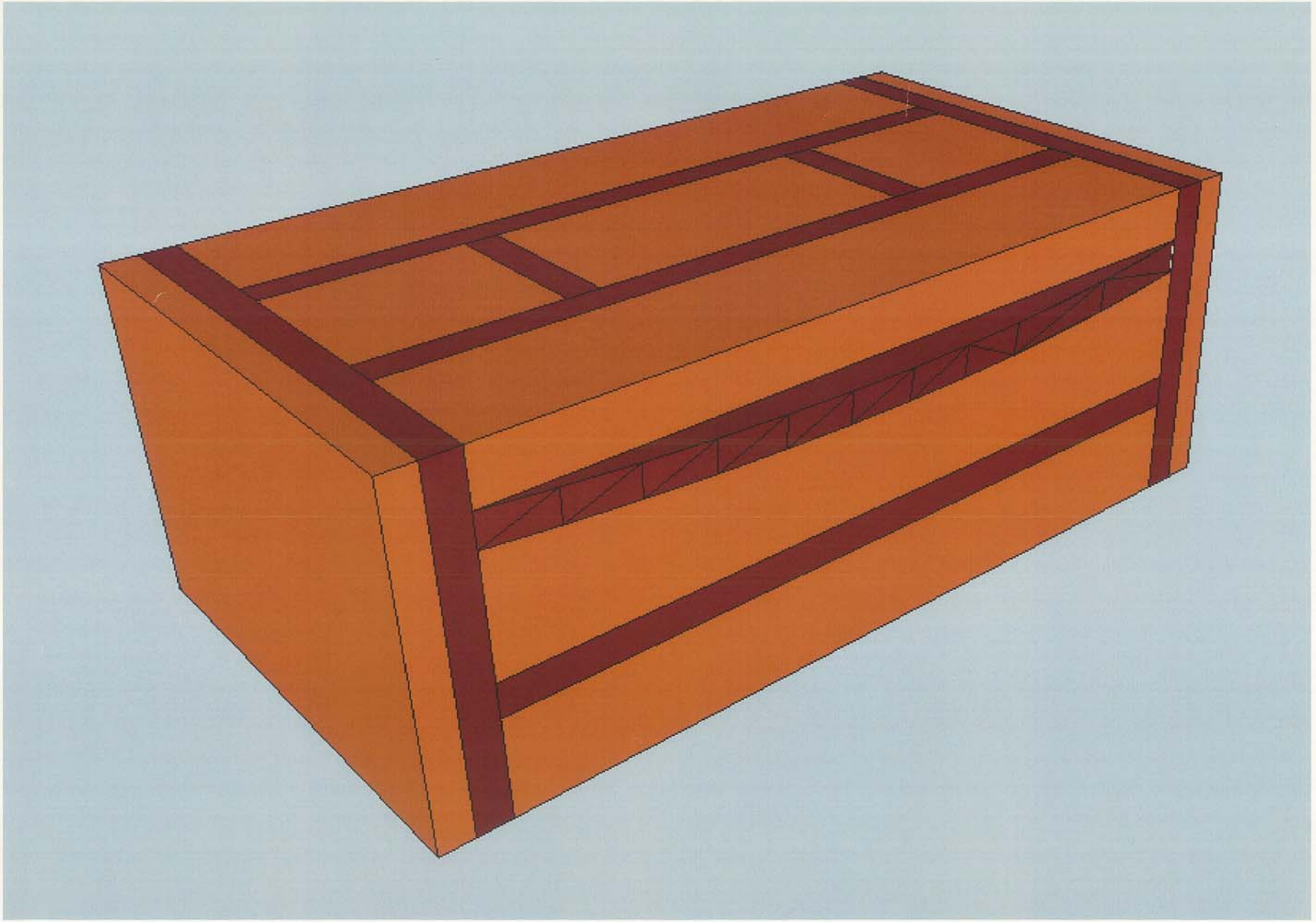
Below is a photograph of cherry and Black walnut wood. These two woods are extremely different in colour. This gives an attractive contrast. Both timbers have a straight grain that fit with the straight edges of the box. Both hardwoods give a good crisp edge when chiselled, this is good because I am planning on finger jointing the wood together this means that the joints will have to fit together tightly and will not chip or split.



Below is the cutting list for the entire wooden box. It shows all three dimension of the wood, what type of timber and how many.

Item.	Material.	Length (mm).	Width (mm).	Thickness (mm).	Number of.
1	Plywood	250	150	5	X1
2	Cherry.	150	100	10	X2
3	Black Walnut.	150	100	10	X2
4	Black Walnut.	255	75	10	X2
5	Black Walnut.	255	10	10	X2
6	Cherry.	235	40	25	X2
7	Black Walnut.	235	10	25	X2
8	Black Walnut.	50	10	25	X2
9	Cherry.	55	50	25	X2
10	Cherry.	105	50	25	X1
11	Black Walnut.	235	30	10	X1

Final Design.



Schedule.

Time	20 Minutes	20 minutes	30 minutes	1-2 hours	24 hour	1 hours	1-2 hours	1-2 hours	1 hour
Activity	Order wood and using cutting list and make sure all dimensions are correct	Check quality of wood once you have received it.	Mark out on wood where need to be sawed.	Cut wood along the marked lines. After this sand down and plane if necessary.	Glue together using Wood adhesive then clamp together over night .	Remove clamp and mark on finger joints.	Cut out finger joints on the band saw. Sand down excess to give a smooth finish.	Mark on and chisel and gent saw out the opposite end of the finger joint.	Mark onto the wood at the base of each panel a depth of 5mm. Using the router but not cutting the end cut out to the correct depth. Leaving roughing 10mm on each end of panel.
Tools	Cutting list.	N/A	Tri-square Ruler Sharp pencil.	Band saw Sander Plane.	Wood Adhesive G- Clamp	Tri-square Ruler Sharp pencil.	Band saw Glass paper	Gent saw Chisel.	Router.
Health and Safety	N/A	N/A	N/A	Goggles must be worn on the Band saw. Mind fingers on sander. Always plane away from the body.	N/A	N/A	Goggles must be worn whilst using band saw. Always make sure that nobody is in the area of the band saw before commencing use.	Goggles and an apron must be worn whist chiselling. Always chisel away from your body.	Goggles and an apron must be worn whist using the router, always make sure that the extractor fan is on before using the router and mind fingers on rotating blade.
Quality Control	Check dimensions for product, this will insure the product assembles correctly	Check for imperfections or any other damage to wood. This will help the product have a smooth finish and look professional.	Make sure marks are accurate to the closest millimetre to help the assembly fit well.	Make sure on the Band saw to cut on the waste side to avoid any product waste. Make sure edges are smooth ready for gluing.	Make sure wood is clamped in the right position and that excess glue has been wiped away to reduce dirt on the wood.	Make sure you mark accurately on where finger joints are positioned to ensure that the joints fit together snug and smoothly.	Cut on the waste side. Make sure no wood is cut out that doesn't need to be there, this will harm the joints and not let them fit correctly giving your product a amateur look and feel.	Take little bits from the joint each time and finish with glass paper to give a smooth and snug fit.	Make sure not to route all the way to the end of each panel, this will give you unwanted holes in your box, make sure of a smooth finish with no splits in your wood

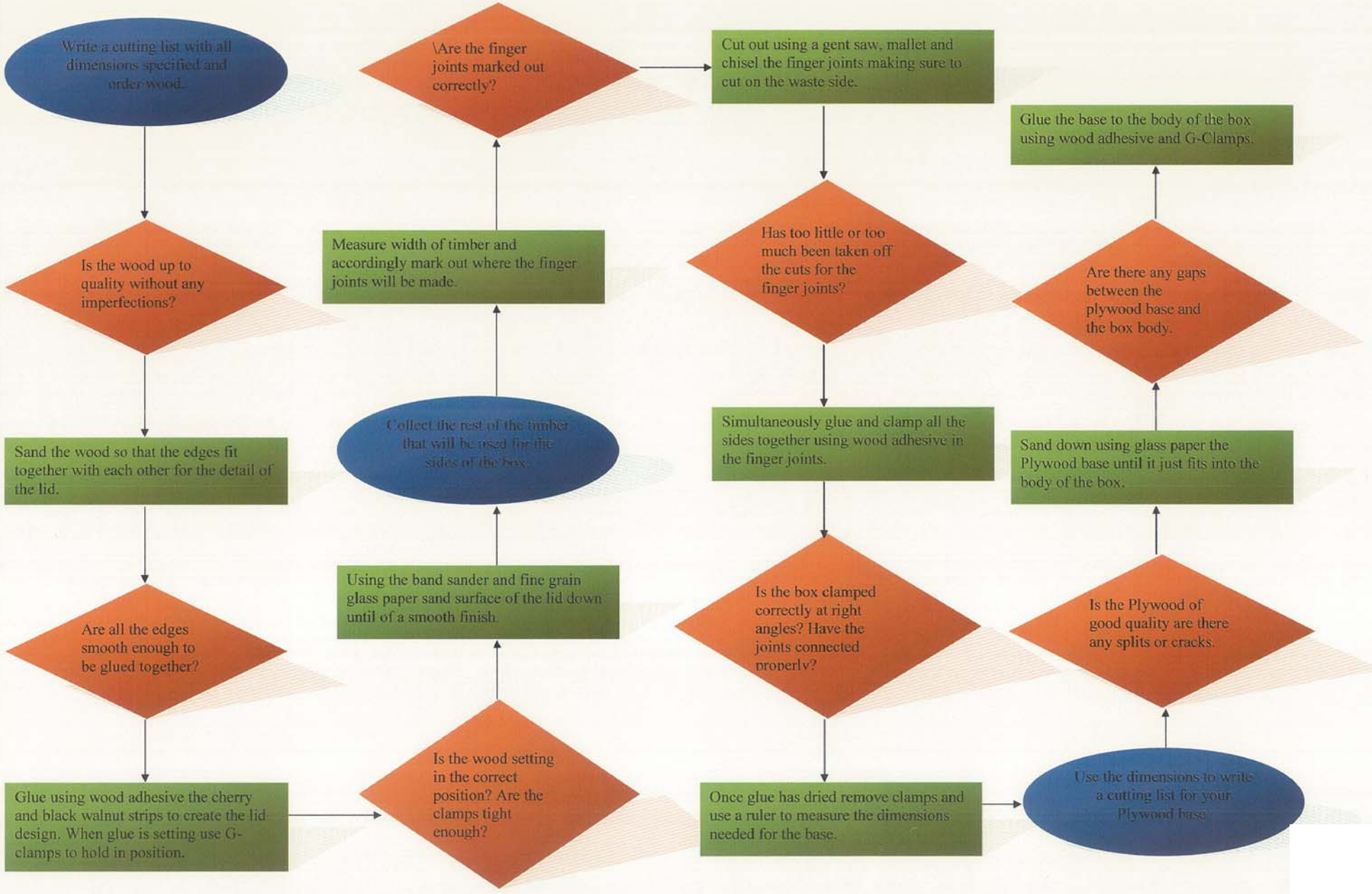
Schedule.

Time	20 Minutes	20 minutes	30 minutes	1-2 hours	24 hour	1 hours	1-2 hours	1-2 Hours
Activity	After using the router glue and clamp the box together, at this stage the box will be top and bottomless, just the 4 walls. Makes sure that the box is glued and tightly clamped at right angles.	Once dry, undo the clamps and flip the box upside down. Chisel the excess left by the router previously so that there is a 5mm right angled indent all around the inside edge of the box.	After this, use an accurate ruler to measure the dimension of the rectangular base, then select a piece of laser plywood, draw out on 2D design correctly the size of the base previously measured.	Place wood glue into the 5mm indent and position laser cut wood into the indent and clamp down.	Now that box is assembled with 4 walls and base, get the top of the box and place it on top of the box, if the lid does not fit then mark on using pencil and sand off the excess until lid fits snugly into the box.	Choose what size dowel you wish to use to secure the lid of your box to the main frame, then find a drill 0.5mm larger, place drill bit into drill and mark out on box where the whole for the dowels go on each side of your box using a tri-square and pencil. Then secure box to drill base and drill out the holes.	Glue the dowels in the holes then leave to dry.	To finish your box use a wood varnish to stain your box. Repeat the process 2-3 times.
Finish Tools	Wood Adhesive. Tri-Square. Adjustable Clamps.	Chisel.	Laser Cut. Laser Plywood. Ruler.	Glue.	Belt sander.	Drill. Pencil. Trisquare.	Glue	Varnish Clothe
Health and Safety	N/A	Goggles and apron must be worn whilst chiselling.	N/A	N/A	Goggles must be worn and extractor fan must be turned on.	Goggles and apron must be worn to prevent any injury.	N/A	N/A
Quality Control	Make sure that the angle is a clean right angle so that the box looks professional once completed and so that the other components fit correctly.	Make sure that the 5mm indent is constant and that the corners are at right angles and no excess is left, this will give the base to the box a smooth finish.	Make sure to draw accurately on 2D design to avoid any sizes being wrong and not fitting correctly in the box.	Make sure clamps are secure.	Keep checking if the lid will fit so that you do not remove too much material when sanding.	Make sure that before you drill the positioning of the mark is accurate on both sides or else the box will not pivot properly on the dowel. Also just before drilling make sure that the tip of the drill is completely in-line with the point.	Make sure all glue residue has been wiped away so that the finish is of a good standard.	To gain best finish repeat measure process and apply in fine layers evenly.

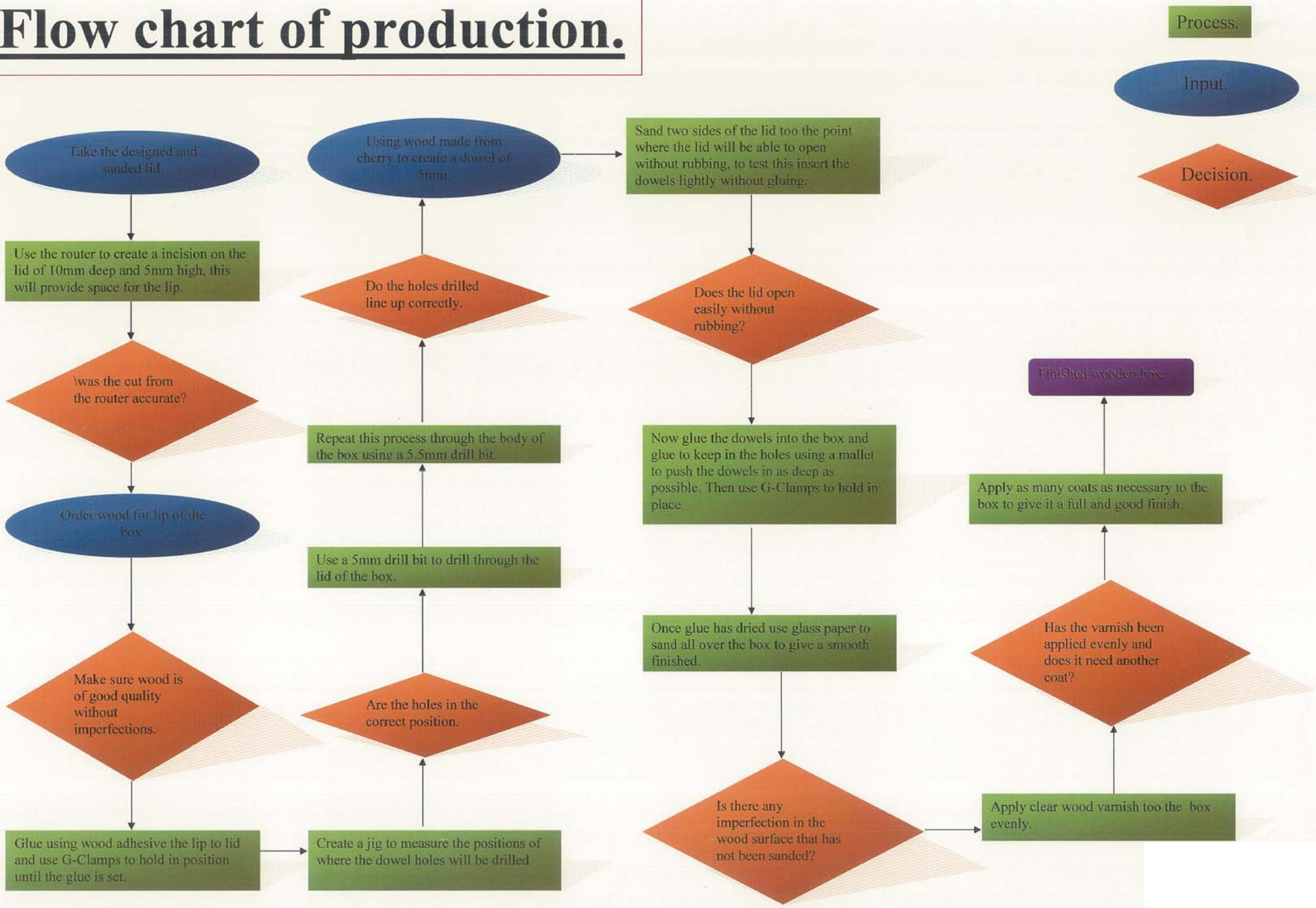
Gant Chart of production.

Task 1; Design and Research of the box that you wish to build.
Task 2; Order wood using a cutting list and quality check wood for imperfections such as knots or splits.
Task 3; Cut and sand wood to fit together for the detail in the lid, once the wood is ready to glue use wood adhesive to glue parts together using clamps to keep in place.
Task 4; mark out and cut the finger joints on each of the 4 corners. This should take no longer than 4 weeks.
Task 5; make any final adjustments to finger joints so that they fit perfectly and also measure out the size of plywood needed for the base.
Task 6; Cut plywood to fit exactly into the base and glue into position holding with clamps to secure.
Task 7; Sand lid edges until the lid fits into the body of the box.
Task 8; mark using a tri square or jig on the outside of the box body where the dowel will be positioned and then use a 5 mm drill bit to drill a whole vertically down into your box side. Insert the dowel and glue into place using clamps to secure.
Task 9; Sand 2 edges of the lid so that the curve is at the right angle so that the box lid can be opened on its dowels and not rub against the box body.
Task 10; Sand box until surface has no impurities or imperfections.
Task 11; Apply many coats of wood varnish to finish the box.

Flow chart of production.

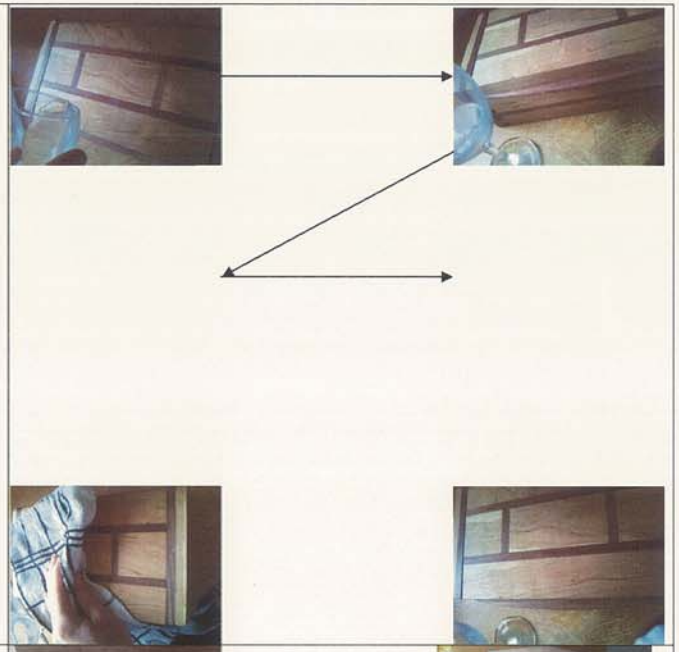
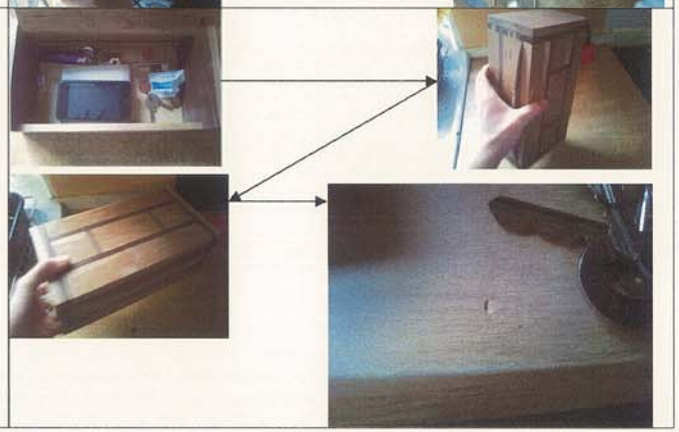


Flow chart of production.



Evaluation and 3rd party testing.

Specification Point.	Test.	Photograph of testing.
Must hold odd's and ends such as keys, wallet and coins,	I have taken all the objects that usually get thrown on the side as I walk in the door and placed them into the box and closed the lid to see if they fit in. Everything did fit in and the lid did close properly. this means that there is no need for any improvements to be made in this section. if the objects did not fit into the box I would have had to change the dimensions of the box to make it either slightly wider, longer or deeper. although too keep in with the rest of the specification I would probably make it deeper so that the surface area did not increase.	 
Must not take up too much room on the work top.	To test this I measured out the area of my worktop and measured the base area of my box, the dimensions of the worktop 0.29m² and the measured area of the base of my box was (0.04125m² this means that the area of my box is roughly 7.25 times smaller than the area of the of the worktop therefore I do not feel that the size of my box is imposing on the worktop area.	

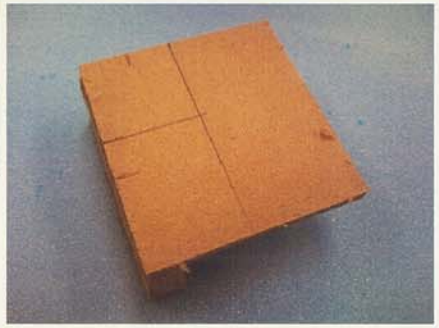
Easy to clean.	Because I have varnished my wood it has made it easier to clean. for the test I deliberately split some water onto the top of my box and wiped it up. This showed that even water does not effect the box in anyway therefore it meets the specification requirement.	
Contents must not be damaged whilst contained.	Whilst my objects were in the box I tested the box to see if the box or the objects would be damaged if I moved the box violently. From this test a few small dents were made in the wood by items such as the keys and coins, if I were to improve this section I would include some kind of lining that would protect the inside of the box from damage from hard objects.	

Easy to open without clips or catches to unlock.	I got a selection of people to test the ability and here is what they had to say to evaluate it; "The box is very easy to open, due to the lip." - Abbie Brown. "The lip helped me see where to open it from and made the action easy to carry out." - Simon Mander. "Good box! easy to use and stylish." - Kyle Robinson.	  

Photographs of Wooden Box.












Photographs of metal bowl.