



Bianca (Bee) Handel | Canberra Grammar School | Architecture - Bus Shelter

Included on the pages below, are screenshots from the portfolio I produced alongside my final design. This portfolio documented my entire design process, from initial research, inspiration, planning, idea development, evaluations and construction of the final model as well as other prototypes. I have not included all pieces of the portfolio, but have selected the elements that I feel provide the best insight into my design process, reasoning and creativity.

FRAMING QUESTIONS

After constructing my initial mindmap, which essentially allowed me to throw out many design ideas, it was important to refine my thoughts. To do this I constructed the mindmap seen to the left in figure 1.1. This mindmap deals specifically with the framing questions of the design task, and the points and approaches that I hope to consider.

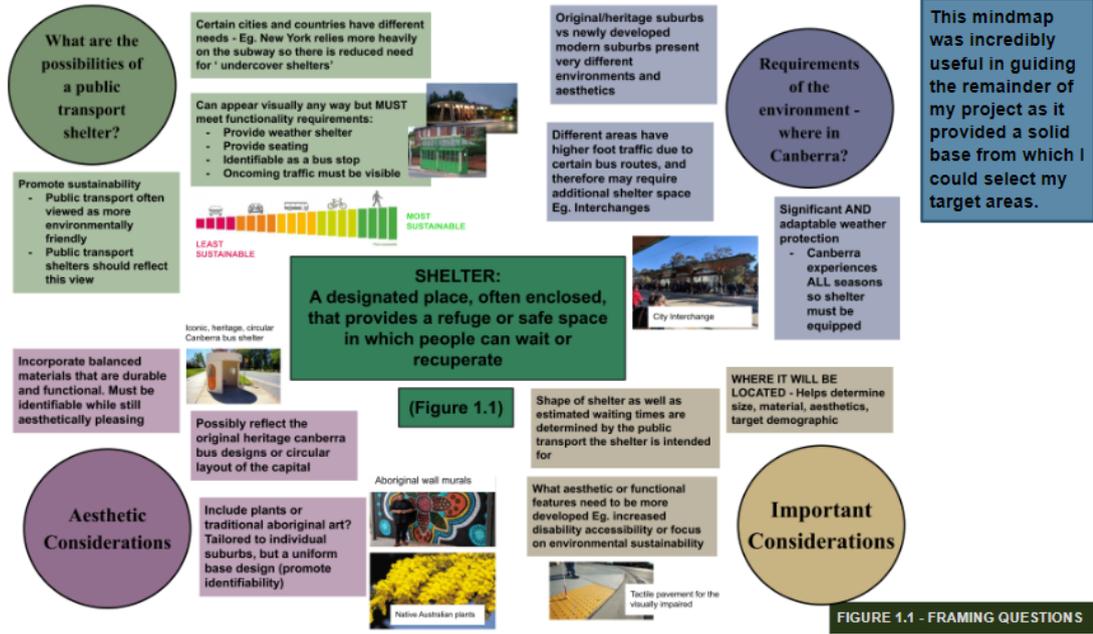


FIGURE 1.1 - FRAMING QUESTIONS

Evaluation and Analysis of Existing Bus Shelters

Chapman Bus Stop
(Figure 1.3)

Consistent colours and signage make stop visible to pedestrians and vehicles

Rainwater pipe collects water from shelter roof. Directed downhill onto grass (reduces impact on commuters)

Open windows and angled view allow for decent visibility. However, there have been concerns raised as to whether the shelter is 'too private' and may encourage crime such as rape or theft

Bench was uncomfortable and can become hot when in direct sunlight. Shelter was full of spiders and peeling paint

Shelter absorbed a lot of heat and was quite stuffy. Did not provide significant shade

Tactile pavement to mark where bus doors open. No tactile pavement by road edge or space near back bus doors

POSITIVES

- ❖ Solid protection from wind and rain
- ❖ Easily recognisable
- ❖ Durable materials

NEGATIVES

- ❖ Aesthetically clunky and unattractive
- ❖ Difficult to clean and maintain
- ❖ Limited seating or accessibility features
- ❖ Materials provide limited temperature regulation
- ❖ Lack of visibility

EVALUATION

Overall, this bus shelter is satisfactory. It provides adequate shelter from the elements, as well as being recognisable to commuters. However, this design is significantly lacking in terms of aesthetics, as well as safety features such as visibility to other passerbys

An important part of design is background research, specifically the exploration of existing designs. Critically analysing and evaluating existing designs is an essential piece of research as it is integral for effectively informing future design ideas and considerations. The images on the following pages analyse and detail the observations made while using Canberra's current public transport system, and aim to evaluate which features should be adjusted or remain the same when designing a new bus shelter.

DESIGN BRIEF



Disabled and elderly people often have restricted mobility or cognitive abilities that can impair their functioning in day to day life. As a result, they often require extra accommodations such as ramps and flexible seating in order to access services. (1.7)



Young adults and teenagers often use public transport as their primary means of transportation. This raises safety concerns, such as ensuring the shelter is equipped to protect many people from weather conditions, as well as offering a balance of privacy and security to protect young, vulnerable people from kidnapping, theft etc. (1.8)

Over the better part of two school terms, I will be designing and developing a model solution addressing some of the issues facing public transport shelters in Canberra. Ultimately, the goal of this assignment is to undertake extensive research, planning and designing in order to create a balanced, successful model that not only reflects the design needs, but also displays proficiency in the assessment requirements. Specifically, for this project I will be working towards constructing a smaller scale model of a public transport shelter suited to the new suburbs of Coombs and Wright; making use of appropriate materials and techniques to best reflect the nature of the design.

Furthermore, as with all designs, this project has some imposed parameters. For example, under the Australian Human Rights Commission, bus stops must include certain accessibility features such as level ground, enough space for a ramp to be used, clear signage and tactile pavement located near the boarding point. An additional parameter is that of road and pavement dimensions. In Coombs, the average allotted space for bus shelters is 5.7 x 3m and so my design must not exceed these dimensions, likely taking influence from existing, successful shelters.

Additionally, there are some important requirements and considerations that must remain central through all aspects of this project. First and foremost, the design must aim to effectively balance several important design criteria, specifically function, safety, ergonomics, sustainability and aesthetics. After preliminary research and brainstorming, the following features have been identified as important, possible inclusions:

- Putting accessibility needs at the forefront of the design, looking into solutions such as tactile pavements, braille and bus alert systems
- Develop a design that reflects sustainability and Canberra's position as Australia's 'Bush Capital'
- Incorporate materials that aesthetically compliment each other, while preserving durability and weather protection capabilities of the shelter
- Improve information and accessibility

Ultimately, the main goal of the shelter design is to overcome accessibility and aesthetic issues that exist with Canberra's current bus shelters, while also looking towards the future, through incorporating sustainability.

As this is a public project, it is very difficult to identify or pinpoint a specific target market. By nature, public transport, and therefore the shelters, are accessed by a wide range of groups, with proportions differing on the daily. Despite this however, this transport shelter design intends to place emphasis on the specific needs of marginalised groups who depend heavily on public transport services. These groups include the elderly, those with disabilities as well as young people. As a result the design will need to reflect features that will improve public transport services for these groups. For example, having increased information available, as well as safety features around the road and from other people, are two very important considerations.

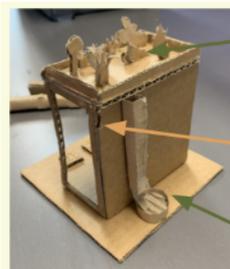
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DESIGN ONE: NATIVE PLANT SHELTER

Pictured to the right is a cardboard model of one of my very first shelter designs. This model was constructed fairly quickly, and reflects estimated measurements. As a result, it's not the best in terms of scale model, however, it was valuable to pull together as it demonstrated whether the design should be further pursued.

In constructing this model, I was able to identify that while it is perfectly suitable as a transport shelter, there are some improvements to be made to better enhance its success. Specifically, this model visually showed just how enclosed this design would be, which is not ideal when visibility is paramount. Due to this observation, my following design sketches have aimed to increase visibility and sustainability, now that functionality has been addressed.

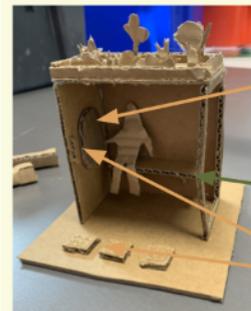
Overall, while this model is not of the best quality, entirely accurate, or the design I will end up pursuing, it was highly valuable in allowing me, as the designer, to visualise and experiment, which then enables me to make adjustments to improve future designs.



Native vegetation planted in contained garden bed roof. Reintroduces native vegetation into the ecosystem, encourages sustainability and helps to uphold 'bush capital' symbols. Also helps slow water drainage and support. Plants also add aesthetic value and appeal, potentially encouraging use.

Closed back with an open front and glass side designed to provide weather protection and privacy, while still balancing visibility and security from unsavory acts.

Potential inclusion of a rain pipe and water bowl, especially if located in suburbs. This would help with protection from significant rainfall, but also provide extra facilities to commuters and passerbys



Inclusion of an e-schedule that will detail expected busses and times of arrival. This is included to improve functionality and accessibility of public transport systems.

Bench included for functionality and ergonomics, as it offers a more comfortable place for commuters to wait, as well as specifically improving accessibility for the elderly or disabled

Tactile pavement as well as a braille information sign have been included to address the current accessibility flaws found in Canberra bus shelters. Tactile pavement is helpful for everyone's safety, but the two features are specifically considered for the needs of the disabled community.

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DESIGN TWO: INDIGENOUS ARTWORK

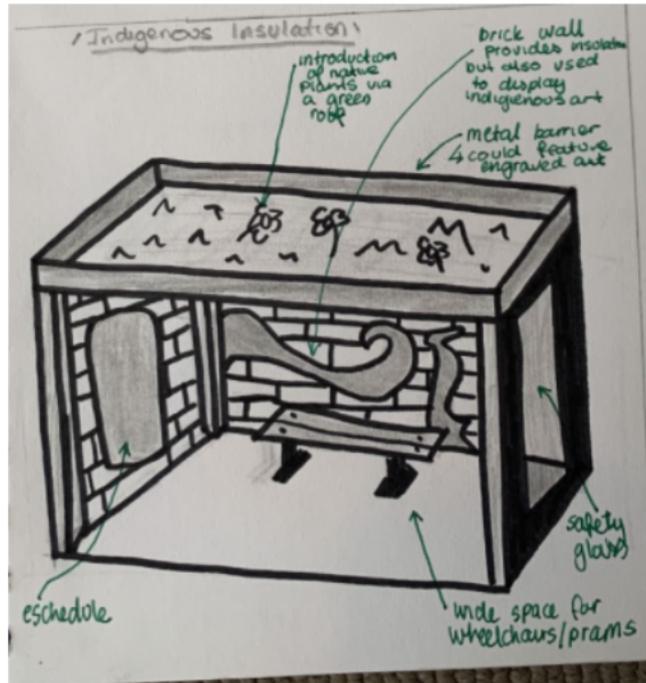
The design of this shelter took inspiration from many shelters found in rural Australia and Sydney suburbs that are gradually adorning community art, often from the local Indigenous community. The aim of including this artwork in Canberra bus shelters is to promote traditional Indigenous culture, and amplify Indigenous voices, which is an important social step towards reconciliation. Additionally, the inclusion of artwork provides increased aesthetic appeal to the shelter, and may even reduce the likelihood of vandalism occurring.

Additionally, this design provides incredible functionality as it addresses the following needs:

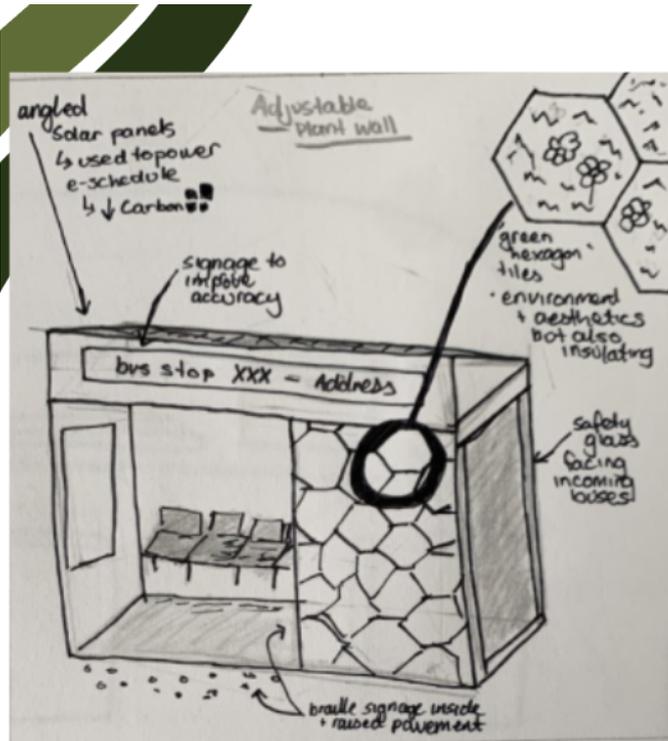
- Shelter is well enclosed, and constructed from insulative materials, which offers significant protection from weather conditions and Canberra's varied climate
- Accessibility options are provided with both the wide, flat floored space, as well as the bench. The eschedule will also improve accessibility to the transports system information
- Native plants can help with water collection and prevent overflow onto commuters, while providing elements of sustainability and aesthetic value

Despite these however, this design is not perfect. While weather protection is an important consideration, this shelter is quite enclosed, which may pose visibility and safety concerns, especially in the early mornings of winter or evenings as Canberra can be quite dark.

Overall, while this design meets many requirements, it is not the design I intend to pursue as my final model; instead some of its features will likely inform modifications to my chosen design. For instance, the inclusion of Indigenous art seems highly likely, as it is a very positive feature to include.



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DESIGN FOUR: GREEN HEXAGONS

This bus shelter design was developed as an improvement on my green roof design. The idea between this design was to develop a design that provided better insulation and aesthetic appeal to commuters. The hope of this design was that the green wall would provide additional sustainability and visual appeal, which would be enhanced by the fact they are shaped like hexagons. This could also provide the additional benefit of easier cleaning and maintenance, for example, if one plant became diseased, it is easier to remove and replace one hexagon, than an entire green roof.

Furthermore, this design looked to improve sustainability by including a solar panel on the roof. The hope with including this, is to provide a sustainable energy source for the schedule, while still retaining the ability for rain to flow away from passengers due to the slanted roof.

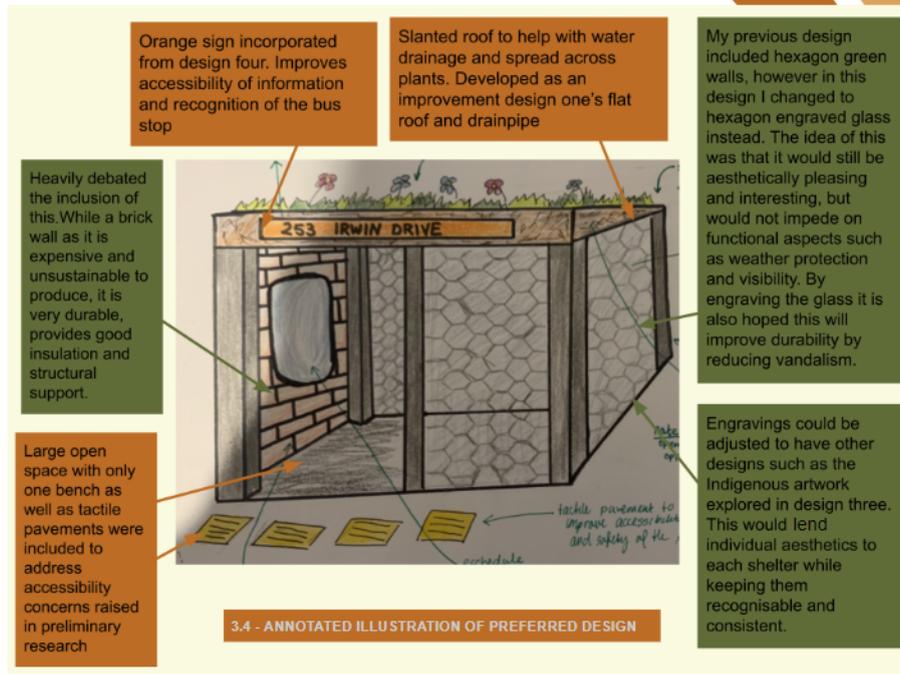
Another feature included in this design that came about from possible improvements that were identified, was the inclusion of the green wall and solid back wall. These were incorporated to provide additional weather protection and insulation for commuters. However, these may become quite messy, and also reduce visibility, and potentially safety of the passengers.

In the end, I elected not to pursue this design any further, however, it proved a great inspiration to my future endeavours. From this design, I began to play around with the idea of incorporating hexagons into the design somewhere, as well as the large sign, as I felt this would improve identification and accessibility.

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PREFERRED DESIGN

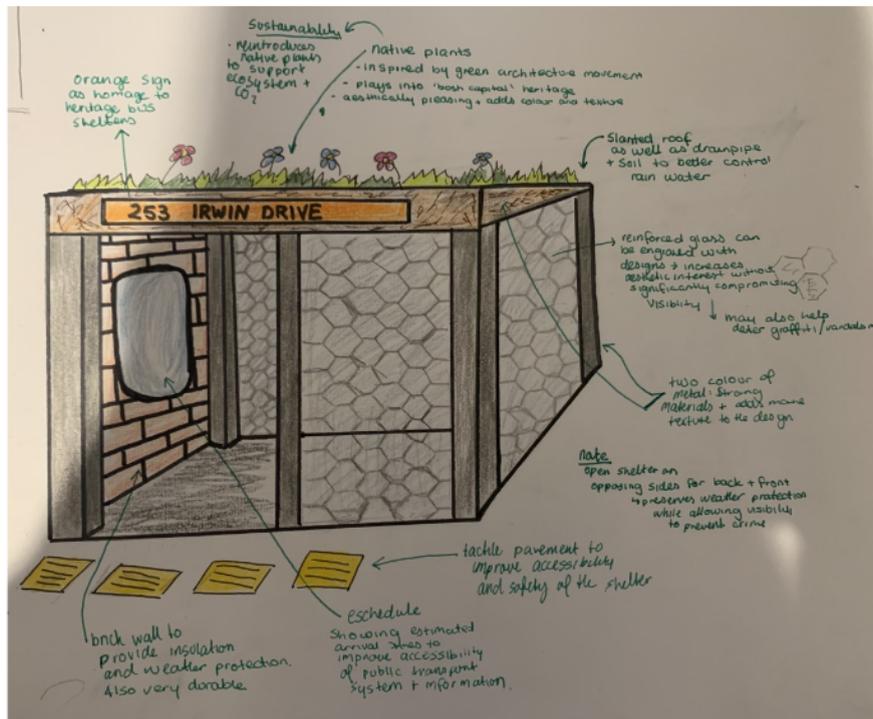
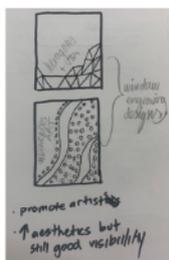
Pictured to the right in figure 3.4 is an annotated colour sketch of my preferred design. This particular figure annotates several of the shelters distinct features, specifically those that were included to address specific concerns or criteria, or emerged as adaptation from some of my preliminary design ideas. This shelter design is an amalgamation of features learnt through both research and designing, and was chosen as it balances the necessary criteria, addressing almost all identified needs.



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PREFERRED DESIGN

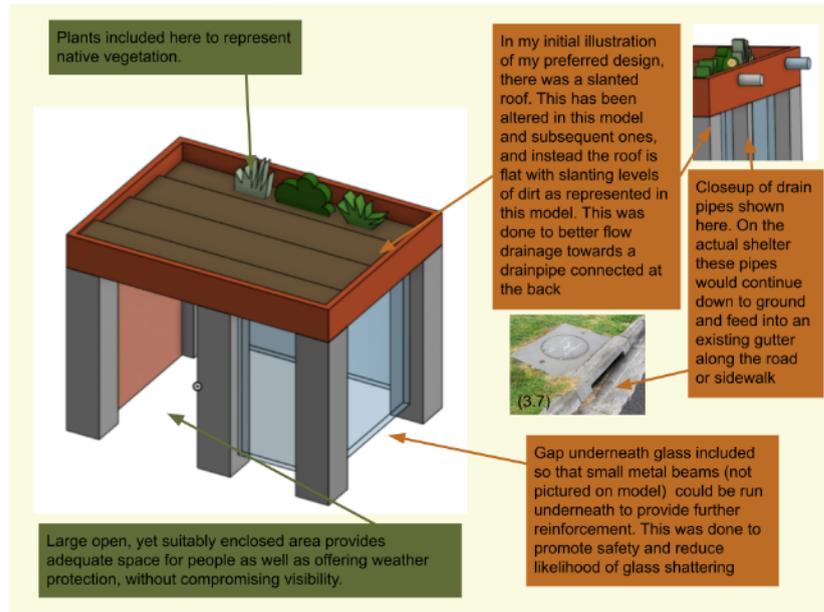
Pictured to the right in figure 3.5 is the initial annotated sketch of my preferred design. This sketch does not evaluate or identify each feature as much as figure 3.4 does, however, it notes my thought process for the inclusion of each feature.



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PREFERRED DESIGN

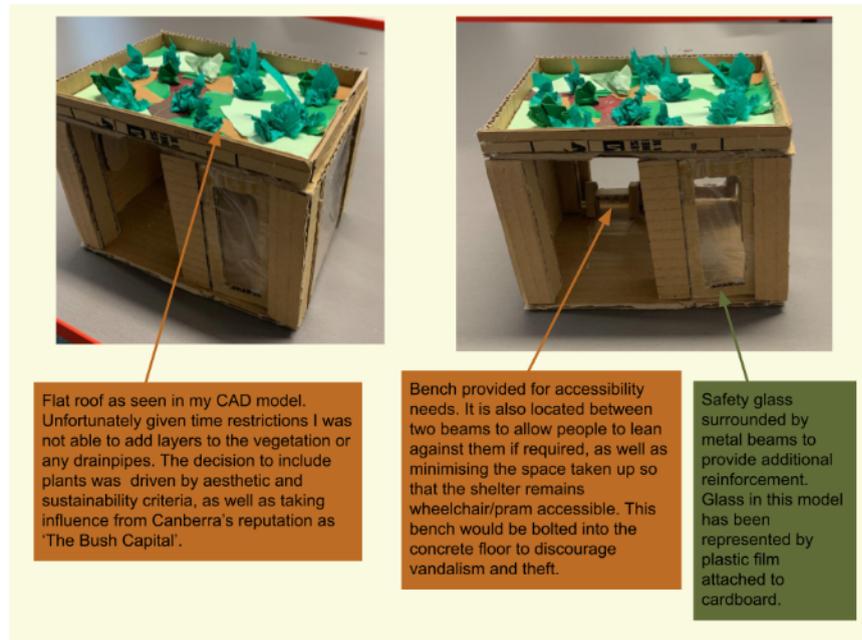
Pictured to right in figure 3.6 is CAD model of my preferred design constructed on Onshape. This model was constructed in the same 1:200 scale measurements as my later cardboard model, and was used as a means to play around with my ideas. Notably in this model of the preferred design I have chosen to move away from the slanted roof, instead using layered dirt and drainpipes to better filter rainwater away from pedestrians while still watering the plants.



3.6 - ANNOTATED CAD MODEL

PREFERRED DESIGN

Pictured to the right in figure 3.7 are some photos of my cardboard prototype. This prototype was constructed over the course of three lessons as a rough physical visualisation of my design. While this model is not of the best quality, it represents each feature of my model fairly well, which was incredibly valuable to my design process.



3.7 - ANNOTATED CARDBOARD PROTOTYPE MODEL

RESEARCH SPECIFICS

Pictured to the right, in figure 3.8, is some additional research and evaluation into some of the finer details of my chosen shelter design. During part one of this project, research was conducted into bench designs and sustainable materials (see figure 3.3 for further details) per the initial research plan. As well as this, research was done into solar powered eschedules, which have also been incorporated as a sustainable and functional element of my design.

While the general function and form of the shelter is incredibly important, the design is composed of many minute details, that should all be considered, to ensure that the best options are carefully selected.



Seat Design:

There were several reasons that influenced this particular seat design. The major contributor was that a small seat was deemed more functional as it could be placed anywhere in the shelter, and would not impede upon pram or wheelchair space. Additionally, the armrests will be curved and angled back. This is done to improve the accessibility for elderly people as they are able to glide back onto the seat. This style of armrest was initially tried as a more ergonomic design in the UK.



Corten Steel:

Corten steel is commonly used around the Coombs and Wright, and so through including corten steel into the design it not only adds another textural element, but also connects the shelter to the suburb, creating greater cohesion. This will improve the aesthetic quality of the shelter. Additionally, as corten steel is designed to rust and build resistance, it is a more sustainable option, as less maintenance is required to upkeep the shelters.



Orange Sign:

The decision to include the orange sign above the bus stop was influenced equally by aesthetics and functionality. From personal experience, it was identified that often it was hard to locate the correct stop along a road from directions, and so the hope was that a sign with the stop details would minimise this issue. The orange colour was chosen as a tribute to Canberra's original bus shelter colour scheme, hopefully offering a degree of familiarity to commuters.



3.8 - SHELTER DETAILS EVALUATION

PREFERRED DESIGN EVALUATION

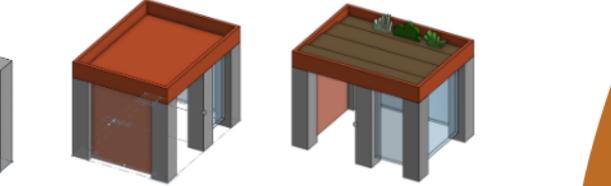
After exploring multiple designs, and developing several models of one design, I have settled on my final design. This design is a mixture of many of the features identified in my preliminary sketches, as well as several compounded adjustments on my selected design.

Ultimately, this design was selected because it met the vast majority of the design criteria. Each criterion and how it is met by the shelter design is pictured to the right in figure 3.9.

SUSTAINABILITY	AESTHETICS	FUNCTION
<ul style="list-style-type: none"> - Solar powered eschedule helps to reduce energy consumption and costs - Materials selected are durable as well as locally sourced or renewable where possible - Green roof helps to offset carbon footprint and reintroduces native plants, as well as providing filtration of rainwater reducing need for maintenance. 	<ul style="list-style-type: none"> - Native plants and vegetation provide a varied colour palette and hold aesthetic value - Shelter is constructed of varied metal and bricks that tie into the aesthetic of Coombs and Wright. This will help prevent the shelter from standing out as an eyesore - Glass will be engraved with patterns or artworks, further providing visual appeal 	<ul style="list-style-type: none"> - Wide, flat concrete flooring allows for wheelchair, walker and pram access - Large sign and eschedule provide necessary information to commuters, helping to make the transport system more accessible - Tactile pavement and provided bench further improve accessibility - Enclosed structure constructed from insulative materials provide weather protection
SAFETY		
<ul style="list-style-type: none"> - Laminated safety glass to ensure there are no glass shards should the windows break - Windows reinforced by steel beams to ensure visibility while providing structural support - Eschedule fitted with an 'emergency' help button to call authorities if criminal offences occur 		
TIME	CANBERRA HERITAGE	
<ul style="list-style-type: none"> - Design is complex enough that is able to address several identified problems, however, it is simple enough that is will accomplishable within the given timing constraints. 	<ul style="list-style-type: none"> - Glass engravings offer the potential to have Canberran artwork or features displayed - Orange signage pays homage to the iconic cylinder bus shelters - Native plants reflect Canberra's status as 'The Bush Capital' 	

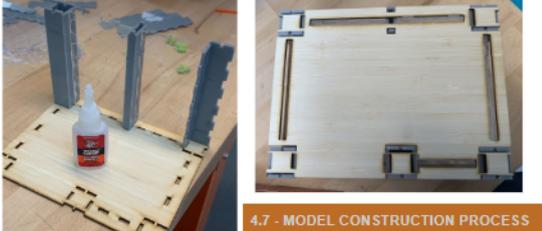
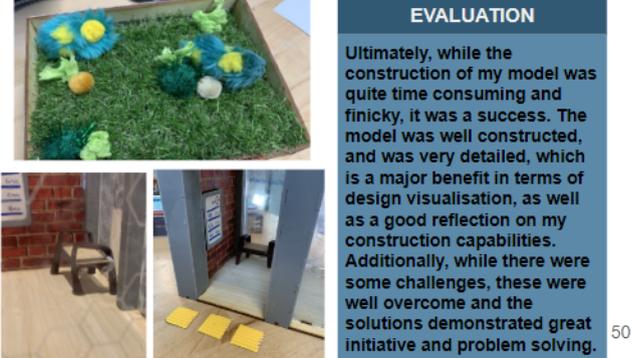
3.9 - DESIGN CRITERIA FEATURE SELECTION

3. CAD MODEL DEVELOPMENT

PROCESS	TOOLS AND MATERIALS	PROBLEMS AND MODIFICATIONS
<p>Constructing my onshape model was quite complex. While the shape was simple, there were so many sketches and pieces involved. A photograph of my feature panel has been included to show this complexity. Primarily though, to construct this model I had to use a lot of sketch faces, drawing each shape and extruding it to the correct dimensions. I found the construction line feature very useful as it allowed me to lay out features and adjust where they lay before adding in a concrete sketch.</p>	<ul style="list-style-type: none"> - Onshape - Laptop - Computer Mouse 	<p>A few problems were encountered at this step in the making process. For instance it was quite difficult to create the glass panes as they are offset from the rest of the shape. Another issue was that the shape was fairly complex and it quickly became quite confusing to manage the numerous sketches and extrusions. In order to overcome these issues I took some extra time to play around with various tool functions. This allowed me to become more comfortable with the plane tool, which in turn, enabled me to more easily create the glass panes. Labelling the sketch layers also assisted in making the file easier to navigate</p>
	TIME	
	<p>In total, my onshape model took about 2 hours to fully complete.</p>	
		
		EVALUATION
		<p>Overall, this was a very important, and successful stage in the making process. First and foremost, through successfully overcoming the presented issues I was able to develop a model that is incredibly useful for design visualisation. Additionally, it was a fantastic opportunity to refine my skills and learn new solutions. As well as this, through constructing this model I was able to identify some issues with my design measurements, and adjust and experiment accordingly.</p>
		

4.1 - ONSHAP PROGRESS PHOTOS

10. MODEL CONSTRUCTION

PROCESS	TOOLS AND MATERIALS	PROBLEMS AND MODIFICATIONS
<p>As my model is so acrylic heavy, super glue was used to secure the pieces to each other. I worked my way around the model slowly, placing small amounts of super glue onto the jigsaw joints on each piece before slotting them into the correct position. The paper towels were used to clean up any excess superglue. Once this was done I superglued the eschedule and bench into position inside the shelter. I then attached the laser cut roof piece on top, clicking it into place around the jigsaw joints. The open box roof was secured to this bamboo using wood glue as. Hot glue was used to attach the artificial turf and vegetation decorations, with styrofoam employed to raise the turf onto an incline.</p>	<ul style="list-style-type: none"> - Superglue - Paper towel - Laser cut pieces and handmade decorations - Hot glue - Styrofoam 	<p>The largest problem encountered at this stage was that as the super glue dried, it reacted slightly with the acrylic, resulting in the edges of the acrylic to fog up. Unfortunately this could not be removed, nor could new acrylic be attached. In future, to overcome this I would have to implement jigsaw joints onto the acrylic so that there was reduced contact, or use clouded acrylic to minimise how noticeable the fog is. The other encountered issue was that it was difficult to attach the bench to the base as the paper straws were hollow. To overcome this I flattened and folded some excess paper straw and placed them into the hollows, allowing the super glue to adhere better. Another major issue was that some pieces were glued at a slight angle and so would not connect with other pieces. Overcoming this was frustrating, however, with the help of some extra hands I was able to force the pieces into positions and accurately secure them in place</p>
	TIME	
	<p>Due to significant drying time and having multiple sections progressing at once, this stage took me about 2 weeks to complete</p>	
		EVALUATION
		<p>Ultimately, while the construction of my model was quite time consuming and finicky, it was a success. The model was well constructed, and was very detailed, which is a major benefit in terms of design visualisation, as well as a good reflection on my construction capabilities. Additionally, while there were some challenges, these were well overcome and the solutions demonstrated great initiative and problem solving.</p>
		

4.7 - MODEL CONSTRUCTION PROCESS



THE FINAL MODEL

Pictured to the left in figure 4.8 is a series of photographs of my model taken immediately after my construction. As these photos show, this model poses a significant amount of detail and forethought, as well as being well constructed. This success, especially in terms of visual appeal, was a direct result of the time set aside for research and adjustments. These allowed the model to be well planned and continually improve, into the solid representation it is in figure 4.8.