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Rental Bike Design for the New Zealand National Cycleway

A thesis presented in partial fulfilment of the requirements for the degree of Masters of Design in Product Design at Massey University, Albany, New Zealand, 2010.

ABSTRACT

This project seeks to find a product solution to increase user access to the proposed national cycleway throughout New Zealand. This is achieved though the design of a self-service bike rental system to be placed at points along the proposed cycleway track.

Various possible bike rental systems precedents were analysed for the national cycleway. Included in this were three short films that documented cycling conditions on New Zealand roads and the current bike rental systems that operate in New Zealand.

A practical approach was taken wherein a significant amount of testing in full scale via 3D model making techniques. To complete the process, a full-scaled ergonomic/usability test rig was built. Following this, a full-scale design model could be developed. The resultant proposed solution features an innovative bicycle and locking system with distinct and unique styling. The bikes are styled to convey a fun and user friendly aesthetic. The risks of vandalism or theft of the bikes has been mitigated by a unique parts system whereby nothing on the bikes would be usable on any other frame if stolen.

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1.0 INTRODUCTION

Initially, this research project began with the aim of developing a checklist to help designers create more environmentally sustainable products. In review of the literature however, it became clear that the original aim was not an option within the given time frame. A more achievable goal was seen in the proposal of the New Zealand national cycleway to encourage a lucrative and sustainable cycle tourist market.

Before formulation of a specific goal, it can be identified that it is highly likely that people using the cycleway will purchase a bicycle with the intention of using it regularly. However, research suggests that the bicycle would only be used a few times and then discarded or stored. This is inconsistent with the traditional approach to product design where products have been developed with the premise that sole ownership will result. Consequently, the identification of a rental option presented itself as the perfect product design opportunity to propose a bicycle rental system that will increase the use of a product and the cycleway.

Gmachl and Wingfield clearly describe, "It is interesting to experience how the meditative quality of making can allow us to extend a way of thinking into the act of making and vice" (Gmachl & Wingfield, 2007) the experience of making things can help identify what will and will not work. This was very true throughout this design research project where a practical approach was taken to problem solving and analysis. The process of making mock-ups, test rigs and a final full-scale design model proved to be crucial in this design, this process was implemented to establish new information. This was subsequently used as feed back into earlier research and design phases.

1.1 THE NATIONAL CYCLEWAY

At the outset of this project, the cycleway had just been confirmed and not much was known as to the shape the cycleway would take. In March of 2009 New Zealand Prime Minister John Key announced fifty million dollars (NZD) would be devoted to the construction of a national cycleway. The cycleway would begin with "great rides" through New Zealand's best scenery and would be eventually linked through a network of tracks and infrastructure. Due to the lack of firm information available the decision was made to make assumptions regarding the form the cycleway would eventually take and use these as guidelines to design to. These assumptions are as follows:

- The cycleway will be a series of loops throughout New Zealand.
- The loops will be varying distances between 20 – 60km in length.
- The loops will eventually connected to form a complete national cycleway.
- The tracks will predominantly be smooth on road concrete type surfaces however some may include gravel/off road surfaces.

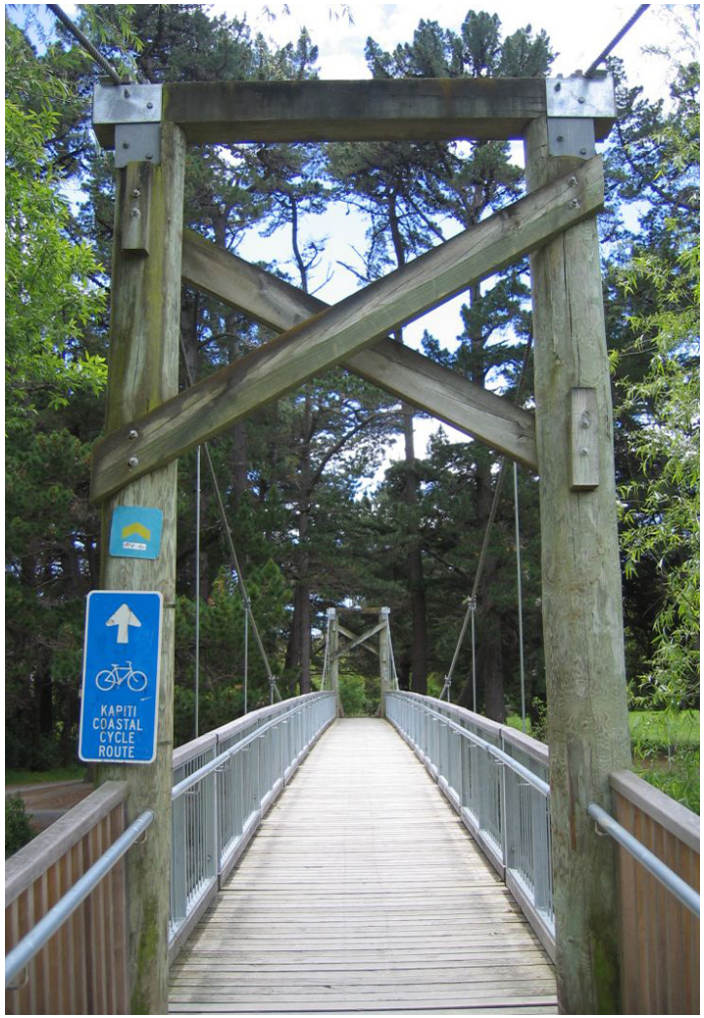

Fig 01: Cycleway visualisation.

1.2 RESEARCH QUESTION

How would a sustainable cycle tourism strategy that ran alongside the New Zealand national cycleway be encouraged via a product design outcome?

1.3 AIM

Design the bikes and locking points for a self-service bike rental system to be placed alongside the potential New Zealand cycleway.

2.0 LITERATURE REVIEW

To give equal balance to written and visual components of this design research report images and written sources have been cited throughout this section. This section will review three main research topics: Sustainability in Product Design, Existing Bike Rental Systems and Bike Design. Literature from Victor Papanek, journal articles, and literature from Mike Burrows are reviewed.

2.1 SUSTAINABILITY IN PRODUCT DESIGN

An Initial review of sustainability literature commenced with William Mcdonough and Michael Braungart's Cradle to Cradle. This text proved very inspirational and empowering discussing srategies through case studies and metaphor. However, this fell short of offering any practical solution for product designers. For this reason, Victor Papanek's Design for the real world was used as a more grounded departure point and sole literature for this section. Although the focus has been shifted away from the object of sustainability as a motive it did influence my subsequent process. One fundamental idea was taken from initial research that the designing of products for lease rather than for sole ownership could embody a sustainable, outlook and practice.

With technology rapidly developing, products quickly become obsolete which drives consumers to upgrade to the latest improved versions and discard the old as trash. With this in mind, Papanek discusses the idea of designing products for lease rather than sole ownership. "Leasing and lowering the prices combined with the customers' investment recovery through meaningful trade-in or model-swapping" (Papanek,1984). The problem with this method, and perhaps a reason why it still is not widely implemented, is that it requires a completely new way of thinking about product ownership, something not all consumers are ready for.

This being said the idea of leasing products has much more merit when applied to short-term rental situations. This approach to product design targets sustainability on a much smaller scale addressing the way product design should begin honing the aim of the design to encourage sustainable practices by end users not just in materiality. A bike rental system that provides bikes to consumers for a short term at a minimal charge reflects this idea. The bikes would provide an alternative means to use the national cycleway as opposed to the purchase of a bike that may be discarded and eventually end as trash. Due to the short-term nature of the bike rental system, consumers would be less likely to form a feeling of ownership toward the bikes. This also has a great impact on the design of the bikes, as they need to reflect a universal aesthetic. As consumers are unlikely to view the bikes as they would a product they would purchase for themselves the styling would need to convey these motives.

2.2 EXISTING BIKE RENTAL SYSTEMS

In this section, rental systems in operation around the world will be discussed using journal articles and conference papers. A brief history will be given to establish where the systems have developed from, followed by an outline of the present state of the systems. Followed by a conclusion which assesses how certain elements from these systems could be used in the proposed design.

Bike rental or bike sharing systems have been around in some shape or form for the past 45 years. These systems can be split into three generations. The first can be found in Amsterdam, this system saw "ordinary bikes, painted white and provided for public use"(Demaio, 2009). The system allowed people to find and ride bikes at their leisure. This system however lead to bikes being vandalised and thrown into canals. The reason for this was that the system relied too heavily on the users to take care of the bikes.

The second generation was found in Denmark in the early 90's, but still on a small scale "26 bikes at 4 stations"(Demaio,2009) the bikes saw many improvements such as solid rubber tires. The bikes could be picked up and dropped off at certain locations around the city. The bikes still experienced theft and vandalism due to the fact that the bikes were paid for via a coin deposit: the system had no way of identifying the user or to hold them accountable for damage (Demaio,2009).

The third generation system used technology in the form of electronic locking mechanisms (GPS, RFID). This system allowed for easier tracking and retrieval of stolen bikes. This technology increase has led to a large increase of bike-sharing systems around the world (as illustrated in fig 12) Paris' bike-sharing system has expanded from its initial 7,000 bike fleet to 23,600 bikes (DeMaio,2009).

Fig 02: Velo 'V third generation bike sharing system.

The distribution of the bikes is an important factor to be considered in making a bike-share system effective and efficient. “Staff moving bikes from areas of high supply/low demand to areas of low supply/ high demand areas is time consuming, expensive and polluting” (DeMaio,2009). This will be an extremely important point to consider during the design process as the bikes are likely to be much further apart at a track environment as opposed to a cityscape. A modular system where stands could be added and subtracted could prove a viable solution.

Much of the literature regarding urban bike rental systems can be carried over into this research. The impacts of the bike sharing system however, will differ from the examples around the world. The main point of difference from the systems and bikes discussed and the bikes proposed is the environment in which they are used. The proposed bikes will be placed along side a track rather than in a cityscape. Impacts such as a potential improvement in public health and decrease in greenhouse gases could still be seen. However, the impacts seen with increased transit use through “improving connectivity to other modes of transit due to the first/last mile solution bike-sharing helps solve” (Demaio,2009) is not as significant in the track-based scenario. The impacts a cycleway rental system is most likely to be seen is through a potential tourism increase through providing a unique and fun way to see New Zealand.

Fig 03: Second generation bike.


Fig 04: First generation bikes, Witte Fietsen.

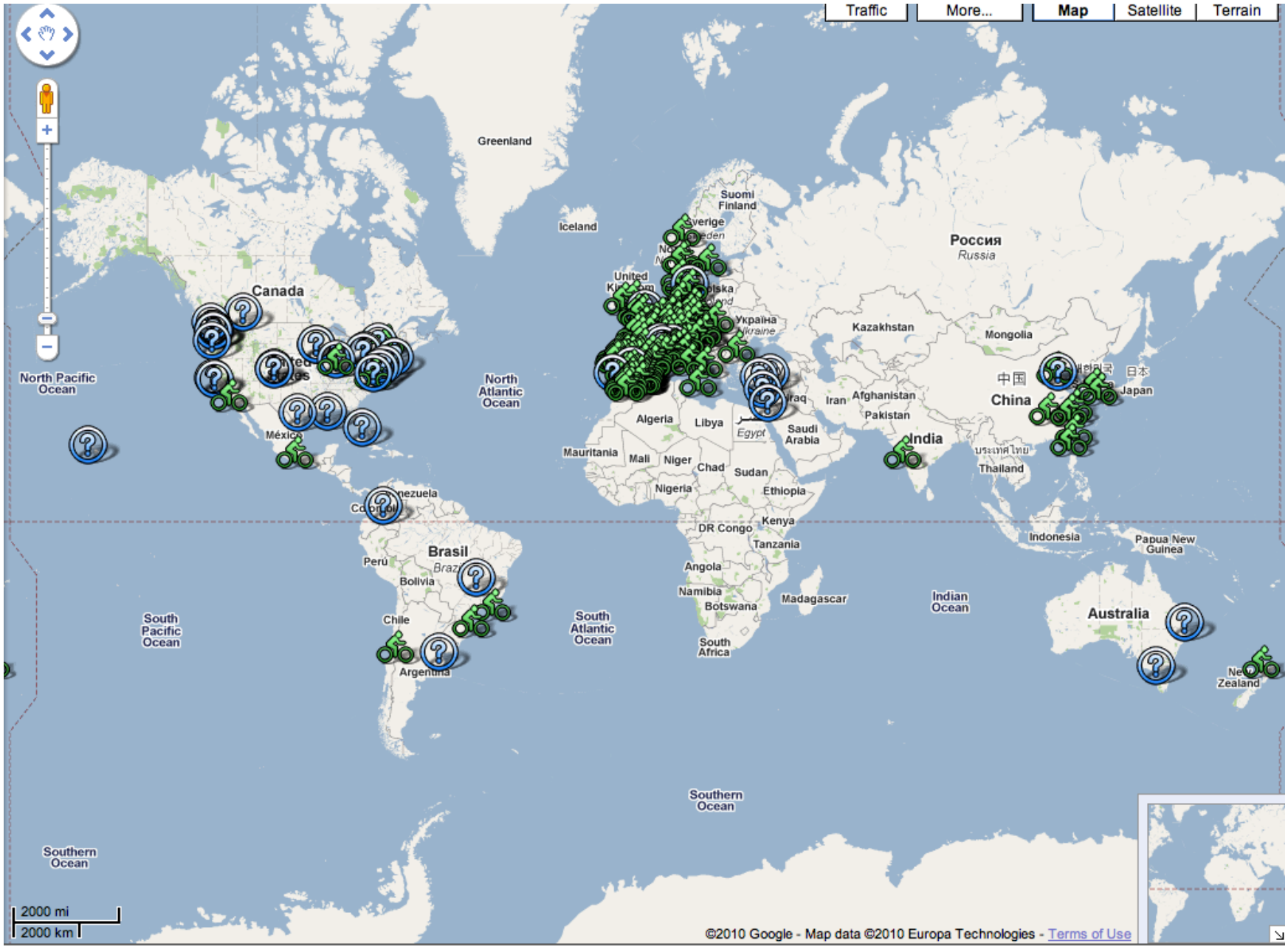

Fig 05: World map illustrating scale and distribution of bike sharing systems throughout the world.

2.3 BIKE DESIGN

This section discusses the literature of Mike Burrows book Bike design; the masterwork by the world most famous (and irreverent) cycle designer. This text has been the main source of information in this section as it provides a comprehensive overview of all aspects of bike design. Due to the direction of the project looking into bike rental systems the lack of specific research in this field became more apparent. The basics of how a bike functions is important, however literature regarding how to make a racing bike faster, lighter, and more aerodynamic was irrelevant within the scope of this particular brief.

Mike Burrows is a bike designer/engineer who has had experience working with bikes for over 30 years. He has designed bikes for the worlds biggest bike manufacturer: Giant. Where he designed the compact racing bike ridden by ONCE cycling team. Burrows was part of the team that developed the world's first carbon fibre monocoque-racing bike. He has been part of many of the largest modern bike design developments. This experience makes him an authority on the subject of bike design, However, he is also an active cyclist and has an engineering background so this could give an insider bias that is worth noting.

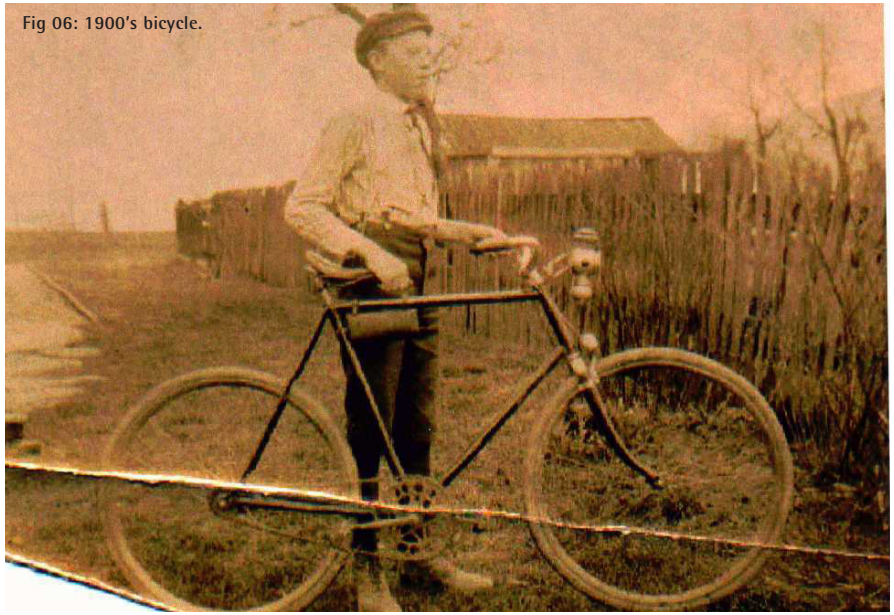

Fig 06: 1900's bicycle.

Fig 07: 1981 injection molded bicycle the Itera.

ERGONOMICS

The ergonomics of a bike are dependent on the style of riding for which that bike will be used. For short trips, an upright position can be very comfortable, however if the bike is to be ridden for long periods of time then an upright position will not make sense ergonomically nor aerodynamically. Burrows states there are scientific formulae that can tell a individual how they should ride a bike, however every rider is different and will find a position on a bike that is best suited to them. This is especially true in a rental bike situation as it is up to the rider to decide on the bike set up. Burrows does however, offer advice on certain dimensions that have the greatest effect on the ergonomics of the bike.

"The most critical dimension for the rider of the bicycle is the pedal-to-saddle distance" (Burrows, 2008). Formulae exist that help calculate this but they only generalise, it is only important to make sure that the riders foot can be fully outstretched at the bottom of the pedal stroke. The rental bikes are not racing bikes nor will professionals adjust them. It will be crucial only to make sure the bikes have enough seat height adjustment as to allow riders of both the upper and lower height range to ride with a fully extended leg.

Seat tube angle plays a large role in determining how relaxed or aggressive a particular bike is. Shallower angles and larger saddles provide a more comfortable ride during shorter trips and in a cycle touring situation. The shallower angles between 68 and 70 degrees allow riders to sit more upright and also make it far easier to put a foot down to. In a touring situation these angles are also commonly used.

A hint of cynicism is felt as Burrows explains adjusting the handle bar height "Lower is more aerodynamic, higher is more comfortable. You pay your money..." (Burrows, 2008). Bike ergonomics need not be as complicated as people tend to make them, unless the rider is a professional athlete riding a high performance racing machine in which case the process and detailing can be complex.

The literature reviewed indicates the ergonomics of a bike in general are extremely individual for every rider. There is no set formula.

The ergonomics of a universal rental bike need to be even further generalised, as there is no way of knowing who will ride the bikes. A strategy to address this issue would be to make sure the bikes have enough adjustment in seat height and handlebar height and reach to cover the upper and lower percentile of riders.

Fig 08: Time trial racing position.


Fig 09: Upright relaxed riding position.

MATERIALS

Many materials exist that are used in bike manufacture; differing grades of steel, aluminium, titanium, composites and plastics. Plastics have not commonly been experimented with in bike design. Burrows give an example of a plastic bike designed in 1981 the Itera he describes as "what design can do for any otherwise excellent product"(Burrows,2008). The Itera is a heinous example of a bike that may have scared other bike designers away from using plastic. Given a well-developed concept plastic may prove to be a viable alternative to traditional materials.

FORM

The diamond frame still sold today has remained unchanged since its birth in the 1890's, this is not due to lack of trying. Burrow's describes the bike as "virtually perfect, so by any definition any large change is bound to make it worse" anyone who has tried to radically change the bike design has failed because of this. I believe Burrow's is to some extent correct in this statement the diamond frame is hard to fault especially when producing a high performance-racing bike. However, when producing a bike with far less technical demands I feel there is room for movement especially when the main motivation for the bike is to create something completely new and with mass/tourist appeal.

Fig 10: 1927 diamond frame bicycle .

Fig 11: 2009 diamond frame bicycle.

2.4 RESEARCH QUESTIONS

Progressing on from the initial research question. How would a sustainable cycle tourism strategy that ran alongside the New Zealand national cycleway be encouraged via a product design outcome? The following are a range of research questions developed to give the research project direction and definition.

- How do I create a distinct, unique and recognisable styling for a rental bike?
- Is there a bike size that will fit a wide enough range of people as to be sustainable as a rental bike?
- What is it currently like to cycle on New Zealand roads?
- What are the features and aesthetics of current bikes that people relate to in terms of ease of use and enjoyment?
- What is currently available in terms of bike rental in New Zealand?
- How do the systems work and what are they like to use?
- What materials and production methods would be best suited for a rental bike?

3.0 RESEARCH METHODOLOGY

This section will detail the methodology used while designing the bikes, why each method was used and how the method was used and resulted.

3.1 EXISTING BIKES

A selection of existing bikes was chosen and used in a number of research methods throughout the design process. Those included discrimination maps and surveys. The bikes chosen represented those of bikes typical of what is currently available on the retail market.

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Fig 12: Images 1-7 existing bikes.

3.1.1 DISCRIMINATION MAPS

A range of different bikes were selected and reviewed against set criteria. This mapping process provided a visual representation of how they compare and where the designed concept bike should fit within the current market.

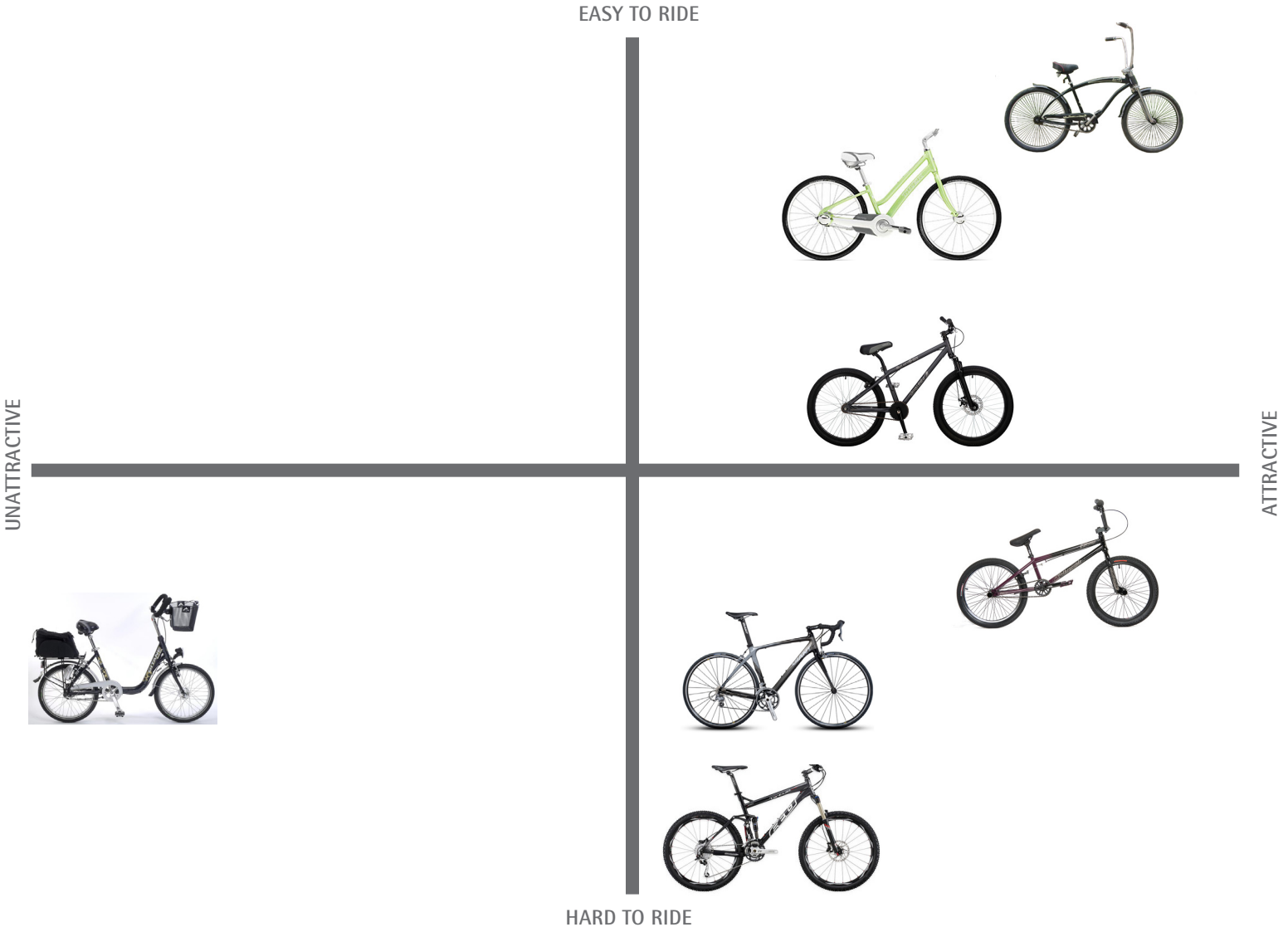


Fig 13: Discrimination map, ease of use vs attractiveness.

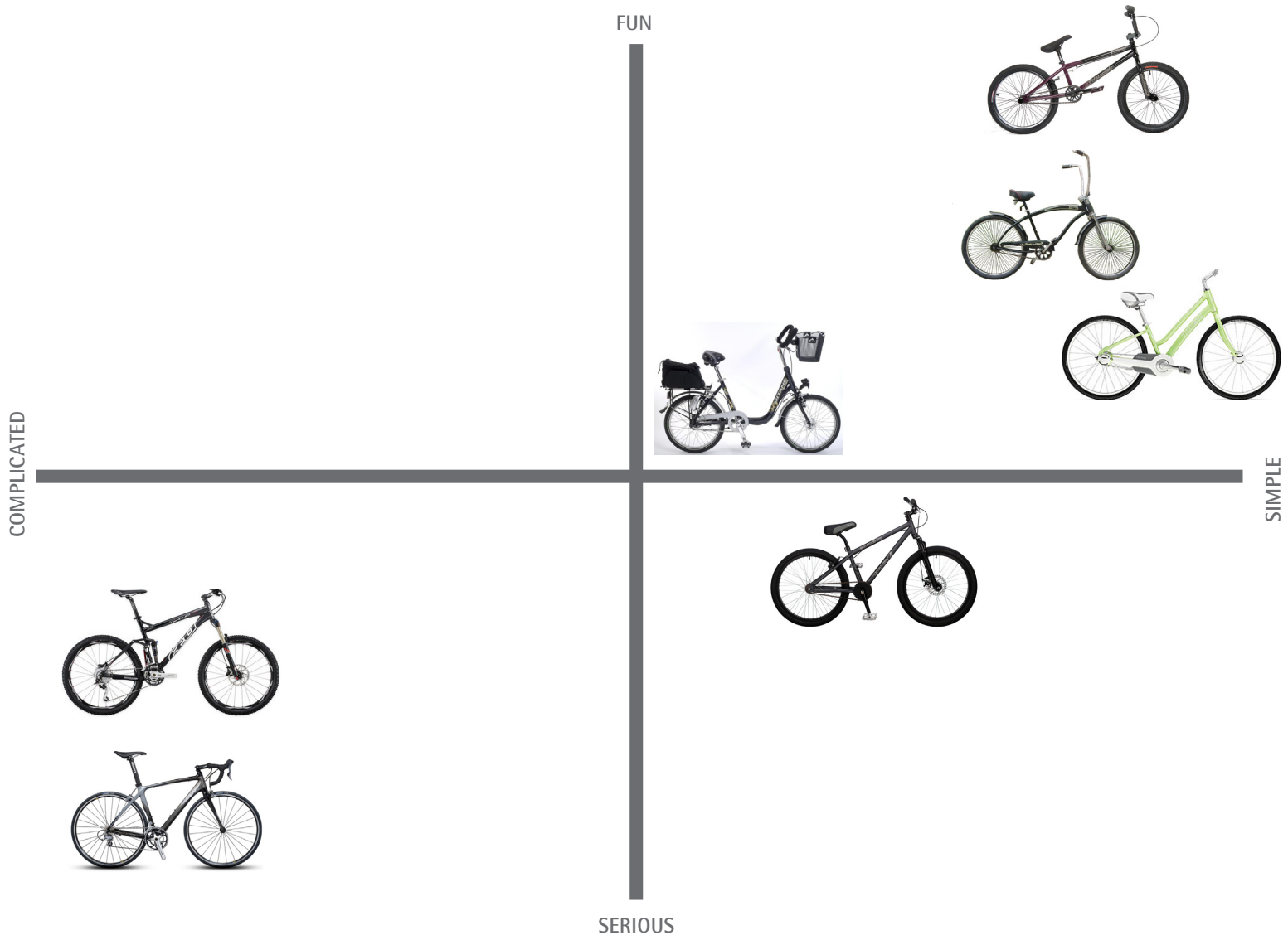


Fig 14: Discrimination map, complexity vs simplicity .

3.1.2 GEOMETRY COMPARISON

The bikes that most demonstrate the riding and handling characteristics desired in the concept bike were taken and their geometry compared. Those characteristics are that of a very stable, relaxed and non-aggressive ride. The aim is to design a bike that is fun to ride - not a racing machine. Referring back to the research completed in section (*2.4 Bike Design)* it is noted that the most important angles that effect the riding of a bike are the steering, seat-post angles and the rake given to the front forks. The more relaxed these angles are made relates directly to how relaxed the bike is to ride.

Trek lime

Trek lime womens

Giant Sedona

Cannondale Comfort

Cannondale Day tripper

Avanti Metro

Specialized Carmel

Trek Portland

GT Timberline

Fig 15: Series of bikes used for geometry comparison.

Bike	Frame size	Wheel size	Head angle	Seat angle	Top Tube	Chainstay	Bottom Bracket	Rake	Wheel Base
Trek Lime	S -15in	26x1.90"	69	68	585	445	282	50	1050
	M -18.5in	26x1.90"	69	68	608	445	282	50	1072
	L - 21.5 in	26x1.90"	69	68	635	445	282	50	1098
Trek Lime Womens	S - 13.5in	26x 1.90	69	68	561	445	282	50	1025
	M- 17.5in	26x1.90	69	68	602	445	282	50	1066
Giant Sedona	XS-14.0	26x1.95"	71	73		432	285	45	1020
	S - 17.0	26x1.95"	71	73		432	285	45	1051
	M -19.0	26x1.95"	71	73		432	285	45	1065
	L - 21.0	26x1.95"	71	73		432	285	45	1077
	XL- 23.0	26x1.95"	71	73		432	285	45	1090
Cannondale Comfort	S- 14	26x2"	71	75	544	432	290	46	1034
	M- 15	26x2"	71	74	559	432	290	46	1044
	L- 17	26x2"	71	73.5	584	432	290	46	1069
	XL -19	26x2"	71	73.5	610	432	290	46	1095
	Jumbo - 21	26x2"	71	73.5	630	432	290	46	1123
Cannondale Day tripper	S - 420	26x2.125"	69	65	648	485	290	46	1130
	M - 420	26x2.125"	69	65	648	485	290	46	1130
	L - 420	26x2.125"	69	65	648	485	290	46	1130
Avanti metro	S - 295	700x40	71	73	550	445			1046.4
	M - 365	700x40	71	73	575	445			1071.8
	L - 430	700x40	71	73	600	445			1097.3
Specialized Carmel	S - 343	26x1.95"	68.5	67	615	500		40	1130
	M- 406	26x1.95"	68.5	67	625	500		40	1140
	L- 470	26x1.95"	68.5	67.5	640	500		40	1160
	XL- 533	26x1.95"	68.5	67.5	665	500		40	1184
Trek Portland	XS - 500	700 x 28	71	74	525	430	279	45	1008
	S - 520	700 x 28	71	74	535	430	279	45	1013
	S - 540	700 x 28	71.5	73.5	550	430	279	45	1019
	M - 560	700 x 28	72	73	565	430	279	45	1024
	M - 580	700 x 28	72.5	73	575	430	279	45	1030
	L - 600	700 x 28	72.5	72.5	585	430	279	45	1034
	XL - 630	700 x 28	72.5	72	595	430	279	45	1038
GT Timberline	S - 15	26 X 1.95	71	73	543.56	424.18	305	25.4	1019.302
	M- 17.4	26 X 1.95	71	73	580.14	424.18	305	50.8	1055.878
	L- 18.9	26 X 1.95	73	73	598.17	424.18	305	76.2	1074.674

Fig 16: Geometry comparison chat.

3.2 CASE STUDIES

3.2.1 VELO V
Lyon, France

Stations are positioned all over Lyon with bikes for hire. An access card is first needed which requires manual set up. Each station has a central interface unit. Scanning the access card followed by entering a pin code identifies the user. The user now has the choice of the free bikes to select and use. Once the bike has been selected the bikes lock will release for forty-five seconds. Pulling the bikes brakes and pressing a button will release the bike and it is ready to be ridden. The bike has a built-in lock so can be parked temporarily somewhere other than stations.

When finished with the bike it can be returned to any station with a free locking post. When the bike is coupled up and locked to the post its lights will flash and beep so the user knows they have done so correctly. A receipt can be obtained from the central interface by swiping the access card.

Different card options are available depending on the intended duration of the bike hire. On all options the first half an hour is free.

The system seems to have a very extensive range of payment options to suit the different types of users. Use of the system becomes cheaper for people who use it more often and links in well with other public transport systems.

The Velo'V has 340 stations across Lyon. Each station has approximately 25 bikes. The Velo'V system has Almost 4,000 bikes in total.

A manual team who check the bikes on a regular basis maintain the bikes. Users can also alert the maintenance team of a bike fault by swiping their user card at one of the stations.

Fig 16: Velo'V bike sharing system.

Fig 17: Velo'V, scale of the stations.

The bikes have a very quirky look to them reminiscent of an antique/ collectors' women's bike. The top tube is virtually missing which makes mounting the bike very easy especially for elderly people and people wearing clothes not suited for bike riding. The aesthetic is very relaxed and unintimidating.

The bikes include a number of features that make them very functional as everyday bikes to get around the city. Kick stands and locks make it easy to stop somewhere quickly without having to find a station to store the bike. A small amount of storage space is provided by a small basket on the front of the bike, this is however, too small to take anything substantial. The position of the basket off the handle bars seems as though it would cause some steering issues when loaded. The geometry of the bike seems very relaxed and would provide a very comfortable ride. Quick adjustment of the seat height allows the bike to be suited to a wide range of people. The rear wheel guard serves an important purpose of protecting users' clothes from the spinning wheel and the mechanical elements. However, it is not an overly refined aesthetic feature. Casings cover most of the exposed mechanical parts making the bikes cleaner and less susceptible to tampering.

The system uses technology smartly to be automatic and unmanned. An interactive interface allows the user to select a bike and automatic bike posts will unlock the bike. The system uses technology that deducts money for however long the bike is used. Theft is difficult as it can be traced back to the user who is then held accountable.

Fig 18: Velo'V, the bikes .

Fig 19: Velo'V bikes in use.

3.2.2 SMARTBIKE DC

Washington DC, United States of America

The system first requires the user to sign up online for a membership. Once this is done the user will receive a membership card to use when using the bikes. This system also has one main interface per station. The user swipes their card in front of the card reader, selects a bike to use, that bike will unlock from the station and is free to be used. The bike can be returned to any of the stations in the area with free space. Lights are used to give feedback to the user as to whether or not the bike has been returned properly. A green light flashing means that the space is free. When a bike is placed in that spot the light should turn steady. If the light is red and flashing an error has occurred and requires further action.

One annual subscription of $40USD allows the user to rent the bike whenever they like for up to 24 hours. If the bike is not returned in that period the bike is assumed stolen and the user will be charged $550USD as a replacement fee. This pricing structure is very simple and clean but does not accommodate for the short time user. People such as tourists and people who just want to try the system have to sign up for a lengthy membership.

The system consists of 10 stations at this point with each having between 10 – 15 bikes, approximately 150 bikes in total.

A mobile service team monitors the condition of the bikes and the stations. Small repairs can be made on-site in the service truck, larger repairs are made at the Smartbike workshop.

Fig 20: Smartbike DC bike sharing.

Fig 21: Smartbike DC bikes in use.

This bike has a more traditional look and resembles a beach cruiser that is commonly seen in South America and California. The style and position of the rider is very laid back and relaxed. The bike looks like a very cool, fun ride. Again, a rear wheel covering is used although it seems to suit the style of these bikes more than the Velo'V bikes. The colour scheme of red and white is very simple yet distinct and works very well throughout the brand.

The bikes use a relatively small frame size and use a large amount of seat height adjustment to make the bikes fit a large range of people. As opposed to racing bikes, these bikes are not going to be put under a huge amount of stress, hence this system should work very well. Front rear wheel guards protect the users' clothes from the elements and the rotating wheels as well as a chain guard to protect from greasy parts. The front mounting piece also serves as a small storage rack, however, positioned on the handle bar I question the practicality as it could greatly effect steering. No kickstands or locks are provided with the bike to make it practical to make temporary stops without having to find a station.

Similar technology to the Velo v system is used. The stations are fully automatic other than maintenance. Radio Frequency Identification (RFID) cards are used to identify users and the stations use an electronic interface to interact with the users.

Fig 22: Smartbike DC, the bikes.

3.2.3 BIXI

Montréal
Stations are positioned all over Montreal. Each station has a pay station with an interactive interface used to select and pay for the bike. The pay station will produce a ticket that contains a number. When the user has chosen a bike to use they enter the code on the ticket, the bike will be released and is free to be ridden. Users can also subscribe for either a year or 30-day membership. This makes use of the system even easier. Users simply go directly to the bike they want and insert their card and take the bike from its dock. Bikes can be returned to any station with a free dock, by placing the front wheel into the dock and waiting for visual confirmation in form of a green light.

It is interesting that the stations are deigned to be seasonal. They are installed in the summer months and removed as winter arrives and the weather becomes harsh. This makes sense in Montreal as the harsh weather in the winter makes using the bikes impractical and would also severely damage them.

The system seems to be geared up to be easy for people to get around the city: short trips to and from places.
300 stations with around 3000 bikes citywide.

Fig 23: Bixi bike share system, Montreal.

The Bixi bikes have a strange scooter aesthetic caused by the lack a top tube and integrated bottom tube and chain stays. Although the aesthetic is not personally pleasing, it works well in making the bike very identifiable and distinct. The bigger tube sections and colours give the bike a much more robust look.

The lack of top tube mean the bikes are very easy to mount. The gearing system has been simplified down to 3 gears, which is all that would be required around the city. The brakes have been moved inside the hubs making the whole bike clean and easy to operate. The front and rear wheels have guards to protect the users from the them spraying up dirt and water. The chain-stays have an integrated chain guard, which looks very clean and keeps the mess away from the user. The bikes have thick but smooth tyres perfect for getting around the city. A small luggage rack in positioned off the front forks.

Very similar technology is used in this system to the last two systems. This system seems to be a little more sophisticated as if you have a user card you can insert it at the bike dock. There is still the central station interface if the user is not a member. Lights in the seat-stays illuminate the entire time the bike is in use.

Fig 24: Bixi bikes.

Fig 25: Bixi bikes in use.

3.3 USER SURVEYS

3.3.1 PARTICIPANTS

Twenty five people between the ages of 18 and 65 participated in the survey. Participants were chosen at random and were evenly split within the aforementioned age bracket. Selecting participants evenly from such a wide age bracket was imperative to the validity of this study. For the reason that, the proposed rental bikes are used in a Self Service rental system and will be available for adults of any age and gender.

3.3.2 SURVEY SPECIFICS

Predominantly, the survey was developed with a specific focus upon understanding the view held by bike users on current aesthetics. In the survey, participants were asked to evaluate a range of different bikes against set criteria. The criteria consisted of: how fun or serious, simple or complicated, how easy the bikes looked to ride, how attractive, and the extent to which participants thought that they would ride the bikes.

In addition, participants were asked if they considered themselves to be cyclists. For the purposes of this research, a cyclist is defined as *an individual that rides competitively or, more than for leisure*. For the proposed project however, the target audience are people who would cycle a minimal amount. This is because one of the primary goals of this research was to ascertain the views on how accessible and useable the cycleway is to those who would not usually consider riding a bike. For the sake of validity, those participants that considered themselves to be cyclists and completed the survey were excluded from further analysis. This is because cyclists have different views on what constitutes a rideable bike and would therefore skew the results of this survey.

3.3.3 RESULTS

Interestingly, it was found that participants were more likely to want to ride the bike that they determined was the most: "fun" and "simple" in style. In addition, participants who said that they would not use the cycleway indicated this because they either: viewed it as a hassle or did not own a bike. (This suggests that the proposed bike rental system at the cycleway would be popular because the cycleway is being built on the premise that it reduces hassle to exercise and people would be able to rent bikes to use it).

In retrospect, it can be seen that in some areas, the survey was flawed and did not obtain results that were as reliable as they could have been. In further analysis of the results, it can be concluded that participants found the aesthetics of the bikes difficult to measure. In future, more accurate results would have been yielded had the participants been given the opportunity to evaluate real life samples of the bikes. In this case, the researcher would be able to take notes about the reactions the participants have to different bikes. This would limit the amount that participants produce socially desirable answers. In addition, the survey was too long. This was evident by observations of participants who skimmed over the questions and answered them immediately. Consequently, all of the responses obtained may not have been a true account of the participants perceptions of the presented bikes.

3.4 VIDEO DOCUMENTARIES

Three video documentaries were completed as part of this research project. All were targeted at experiencing what it is currently like to ride on New Zealand roads. Each documentary focused on different types of riding. The first was to experience what it is like to train on New Zealand roads as a cyclist. The second focused on what it is like to tour New Zealand on a touring bike with luggage. The third focused on the experience of renting a bike from New Zealand's only bike rental system in operation.

The documentaries used two different cameras. The first used to speak into and point out events and things as they happened. The second was a small handlebar mounted camera to record what was happening from the rider's perspective.

(Edited versions of the documentaries can be found in the appendix.)

3.4.1 RIDING ON NEW ZEALAND ROADS

As a cyclist, this documentary recorded one of my training rides. Using a specialised road bike with a handlebar-mounted camera. The training ride set out from Orewa and completed a 40km loop out to Wainui then to Dairy Flat and back. The roads are a mix of urban and rural roads. As a cyclist riding on roads, this practice becomes second nature. As a result, many events and hazards are processed without realisation. For this reason, I thought it imperative to record the rides that I completed. In review of the recording sections, the footage was quite revealing. As follow:

- New Zealand roads are very rough especially rural roads; by the end of the ride I had grease and mud all over my legs and back.
- Changeable conditions; half way through the ride it clouded over and became very dim. Visibility became an issue, mainly being visible to other cyclists and cars. Lights would have been ideal in this situation.
- Several close calls with cars were noticed.
- As soon as I rode out of town into a rural area the terrain undulated and was difficult to ride.

Fig 26: Video documentary 1 begining of the ride.

Fig 27: Video documentary 1 during the ride.

3.4.2 CYCLE TOURING

In this documentary a specialised touring bike was used. Pannier bags were loaded with everything needed for a weekend touring. A camera mounted to the handlebars and a camera in the pannier bags to note events that happened throughout. The trip planned; Orewa to Whangarei, 127km, one day.

POINTS FROM THE FOOTAGE

- New Zealand roads can be very dangerous. Sludge on the side of the road riding up the Brynderwyn ranges caused the wheels to slip out from under me and slide into the middle of the road in the path of on coming traffic. A very scary experience and potentially life-threatening situation.
- Conditions in New Zealand can change very quickly. A beautiful sunny day turned into a nasty rainy windy day very quickly.
- The terrain and roads in New Zealand is varied and undulating. I needed and used all gear I had available. This shows that I could not have packed any less gear than I had done.
- 127km is too far for an inexperienced cyclist, I am an untrained experienced cyclist and this ride was one of the hardest rides I have ever done.

Fig 28: Video documentary 2, half way.

Fig 29: Touring bike used during the touring documentary.

3.4.3 NEXT BIKE RENTAL SYSTEM

For this documentary I wanted to put myself in the shoes of the average person wanting to take a bike out for a ride. At the outset, little information about the system was known other than that the system would run in Auckland city and a rough idea of how the bikes would look. This documentary proved very valuable in gaining an understanding of the exact bike rental process.

FINDINGS

- The bikes were a little difficult to find as they are locked to Auckland cities public bike stands. Commonly, non-rental bikes were mistaken for rental bikes.
- No distinct branding is used for the bikes, the bikes have billboards inserted into the middle of the frame and this dominates over the Next bike company branding.
- The bikes in my opinion did not look as though they belonged in a New Zealand city, more a South American beach.
- The seat height of the bikes was easily adjustable but did not allow for any reach adjustment.
- The bike was rented via mobile phone and used credit card details to charge. The person and automated voice was very hard to understand and hear in the centre of the city. This would be very difficult for a user for whom English is a second language.
- Once the bike has been rented a code is given to undo a manual cable lock. When the bike is finished with, the bike is locked back up and the number is called again to stop the charges. There is nothing stopping someone remembering the combination to that lock, coming back later at night and loading the bike into their car.
- The helmet looks like a design after-thought and is not integrated into the system at all; it loops through the lock and hangs there. This is due to the system being designed for elsewhere in the world where laws do not make use of a helmet mandatory.
- The billboard enclosed bike frames make for a very disconcerting and unstable ride with any sort of cross wind.
- The internal hub gears were a pleasure to ride; they changed without a hitch and allowed for gear changes with zero chain rotation.
- The front basket made the bikes embarrassing to ride and had little to no use.

Fig 30: Next bike rental system bikes.

Fig 31: Test riding the next rental bikes.

3.5 ANALYSIS OF FINDINGS

- With such changeable conditions in New Zealand lights are needed on the bikes.
- The bikes will require mudguards, as there is no control over what people using the system will be wearing.
- Internal hub gears will work perfectly for the bikes as they have no lateral movement meaning the chain cannot jump off and allows users to select gears without pedalling. They also allow the chain to be completely enclosed eliminating any chance of chain grease getting on the riders legs or clothes. The 3 speed units used in the Next bikes were far to few gears for the undulating New Zealand terrain. 8 speed units would be better suited.
- Branding and colours will be an important feature in making the bikes stand out from private bikes.
- Anything over 30-40km will be too far for the average rider. The bikes should be suited for distances within these limits and the stations should be placed no further apart than these.
- Helmets need to be better integrated as a cohesive part of the bike.
- Using a mobile phone to hire the bikes worked well. However, a text message system would be more simple and cost efficient.

4.0 DESIGN METHODOLOGY

This section will detail the methods used in designing the bikes and explain why these were the best suited to this research project. The design process used in the research project has been extremely practical and has involved a continuous feedback loop between research, drawing, mock-ups, 3D computer modelling and final modelling. In some occasions certain parts of the bike were designed three to four times before being finalised. Keeping feedback loops open rather than following a linear design process allowed this to happen.

4.1 SCHEMATIC DESIGN

The following schematic design is a visual representation of the brief developed for the bike design.

AESTHETICS

SIMPLE
FUN
DISTINCT
VISIBLE


1


2

3


4

END USER

16-70 YEARS OF AGE
MALE AND FEMALE
TOURISTS
NON RIDERS


5


6


7


8

FUNCTIONALITY

8 SPEED INTERAL HUBS
INTEGRATED HELMET
INTEGRATED LIGHTS
MUD GAURDS
INTEGRATED CHAIN
& CABLES


9


10

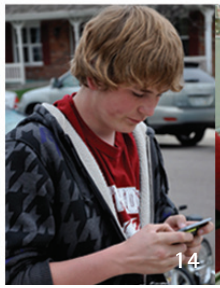

11


12


13

USER INTERACTION

TAMPER PROOF
SIMPLE SEAT ADJUSTMENT
HANDLEBAR ADJUSTMENT
SELF SERVICE RENTAL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15


16


17

Fig 32: Design schematic, Images 1-17.

4.2 PACKAGE DRAWING

A basic package drawing was developed using Geometry research completed in section *3.1.2 geometry comparisons*, combined with the literature discussed in section *2.4 Bike design* and anthropometric data obtained from Henry Dreyfuss *The measurement of man and woman: Human factors* (2002). The bike was given a relaxed seat and head tube angle for a comfortable and non-aggressive ride. The bikes are designed to fit as wide range of people as possible, 1st percentile female and 99th percentile male anthropometric data was used when establishing the package drawing. The package drawing provided an underlay to begin sketching over.

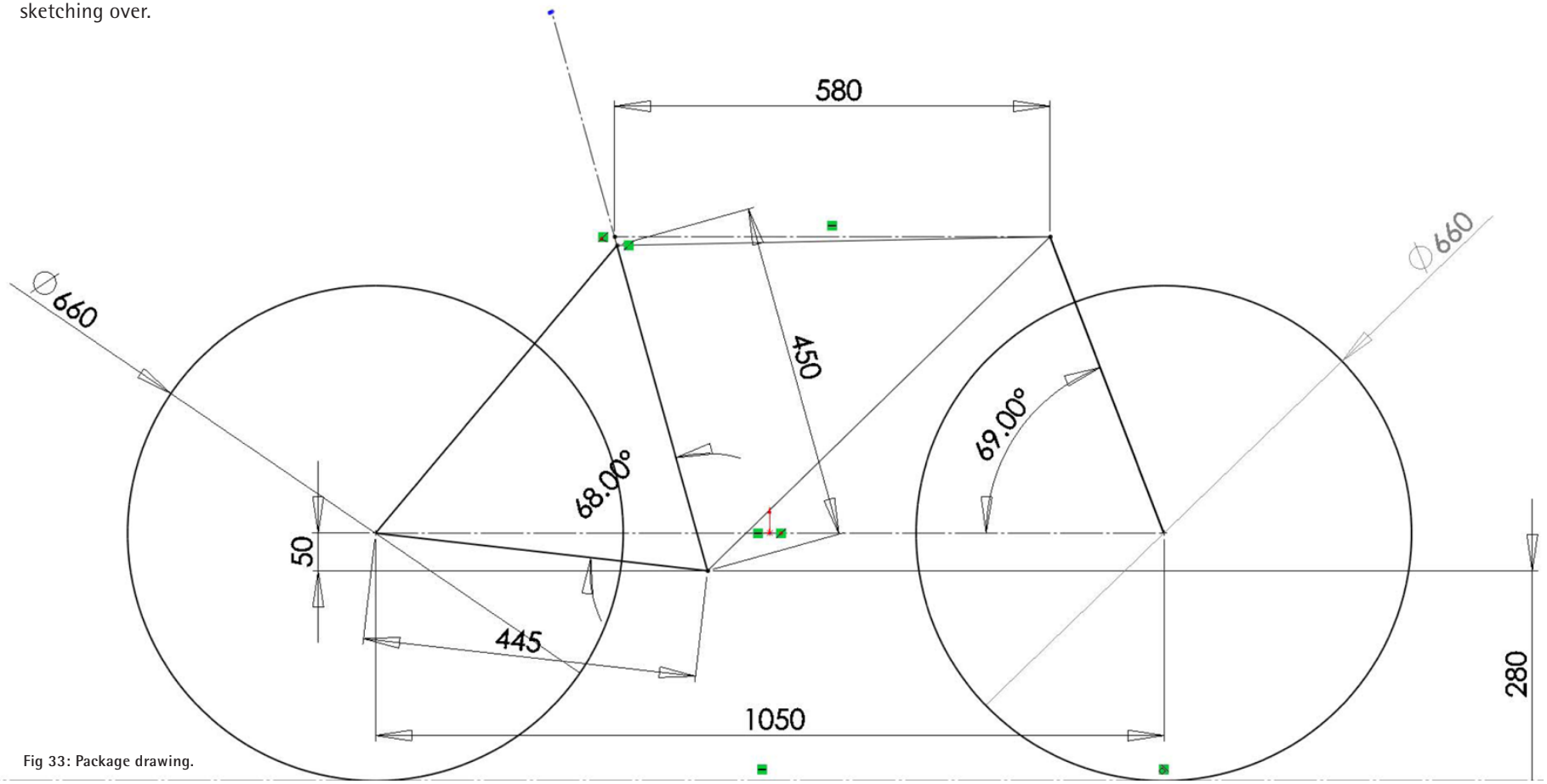

Fig 33: Package drawing.

4.3 CONCEPTS

The first stage actual design for the bikes consisted of developing a range of concepts. Simple side view elevations were used as they provided the most detail while remaining simple and quick to draw. Using a perspective style drawing added little detail and proved difficult and time consuming to produce. The following are a range of concepts produced in this early stage.

4.3.1 BIKES

The main initial drive for the bike was to create something new and distinct while staying within the bounds of what people can recognise as a bike. I did not want to create something so extremely distinct and different it would scare users into thinking it was too complicated they could not ride it.

Another conflict worth noting in the concept phase was making the bike gender neutral. Many of the rental bikes discussed in section *3.2 Existing rental system reviews* removed the top tube to allow riders to easily mount the bikes. However when this strategy was applied to the concepts they instantly became very feminie. It was established that lowering the top tube and creating a smaller frame with more seat adjustment was the best solution to this problem.

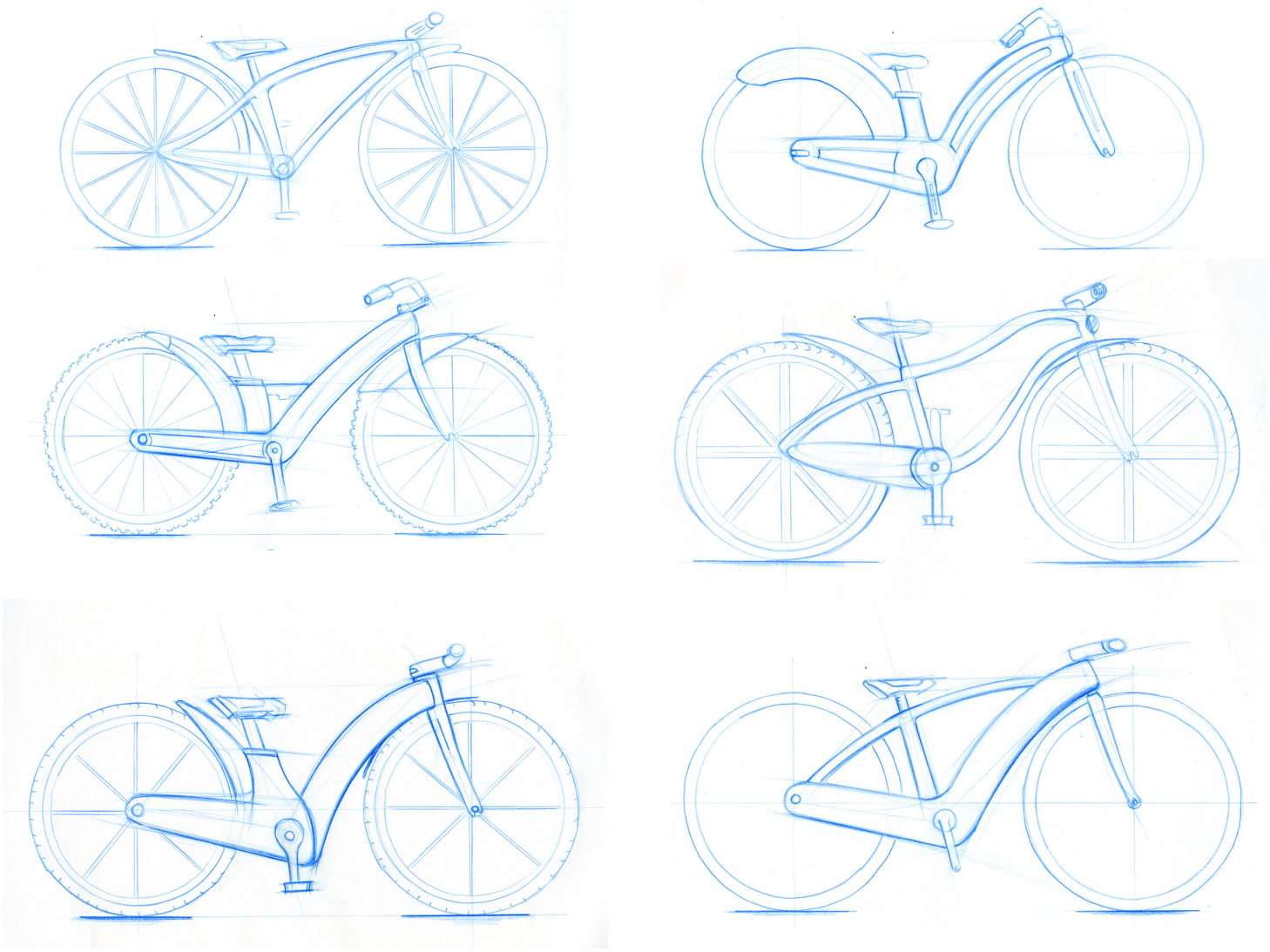

Fig 34: Initial concept drawings.

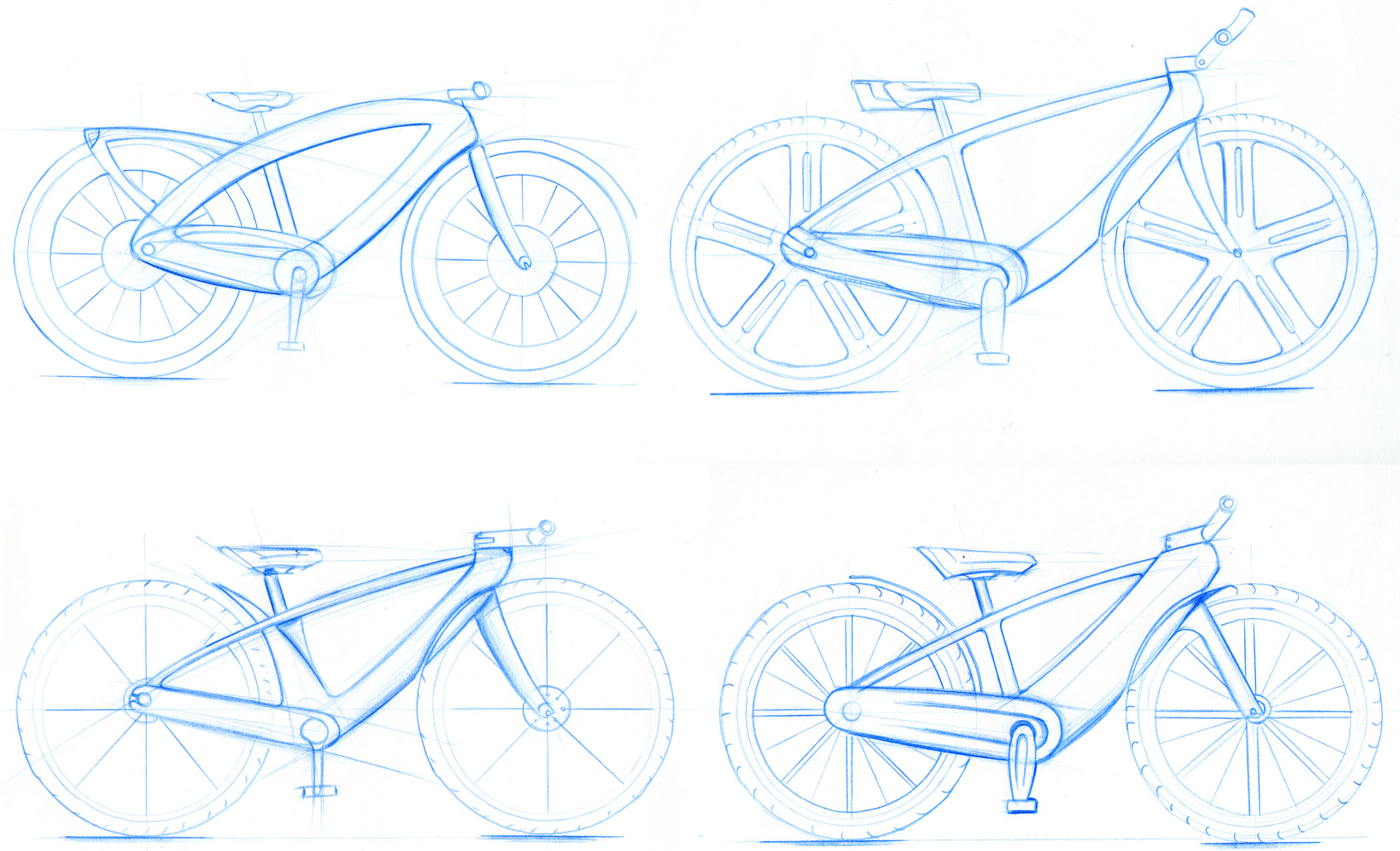

Fig 35: Initial concept drawings.

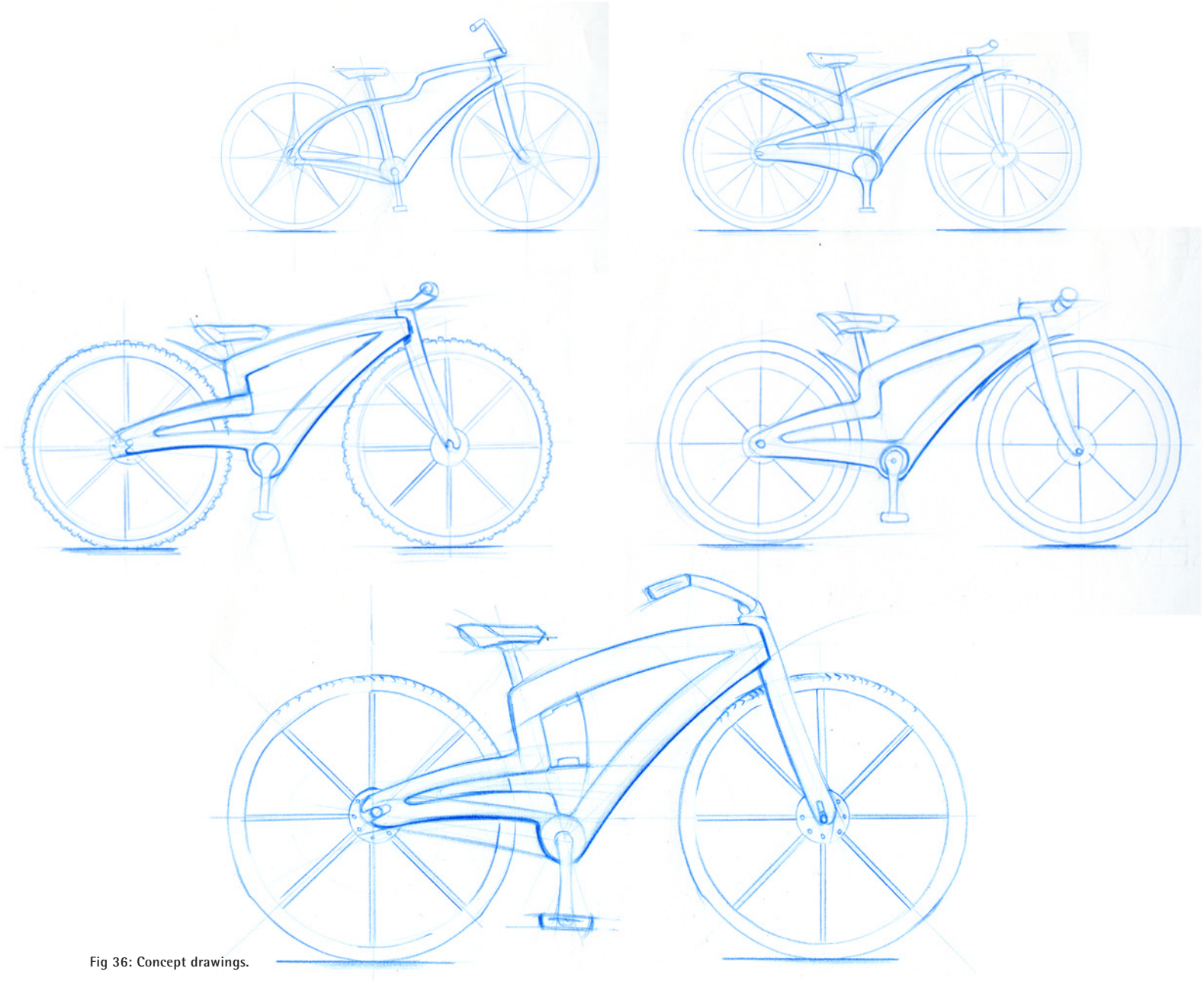

Fig 36: Concept drawings.

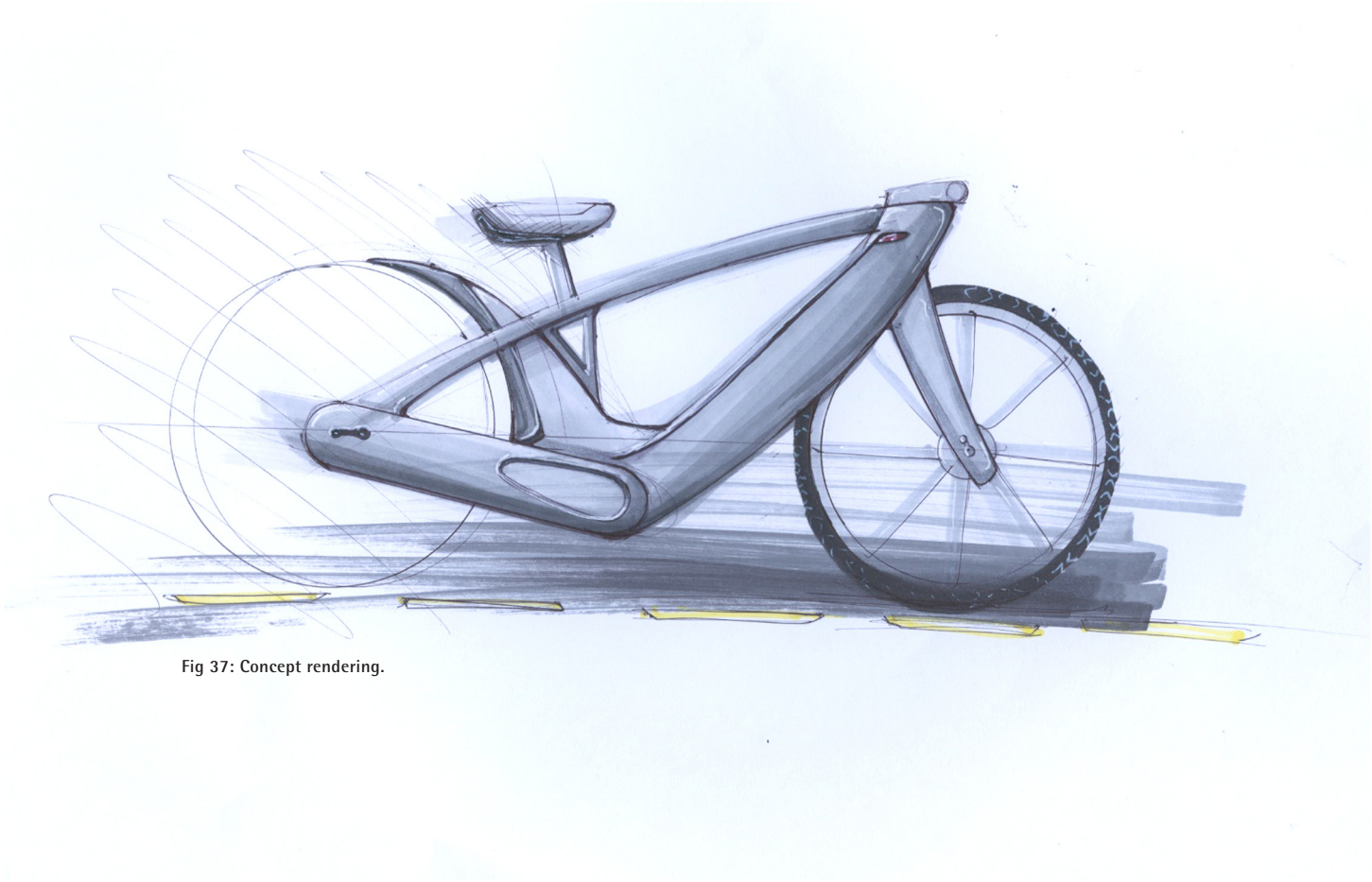

Fig 37: Concept rendering.

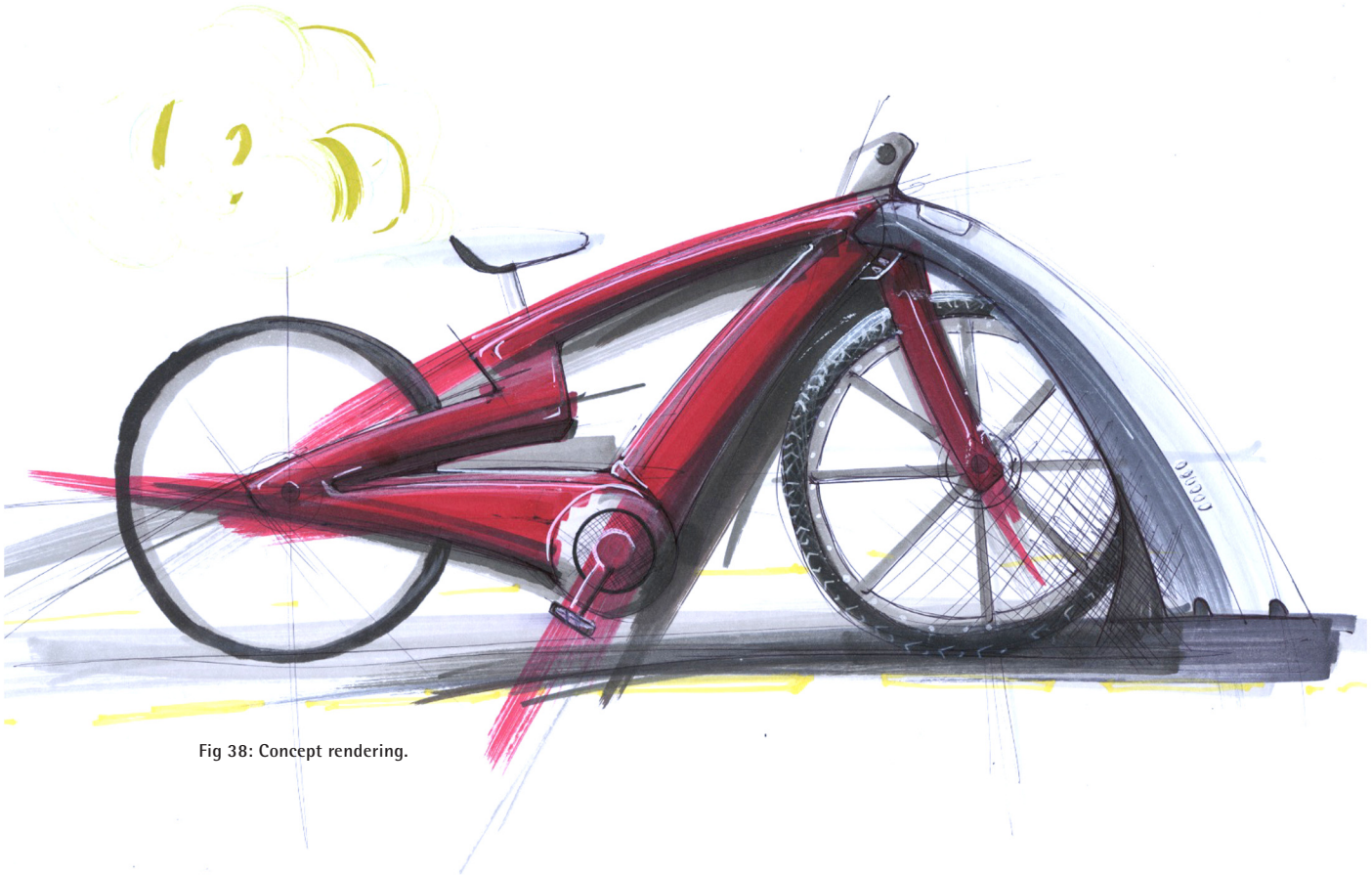

Fig 38: Concept rendering.

4.3.2 SCALE MOCK-UPS

Concepts were produced and ideated with Massey School of Design staff and final year Industrial Design class and narrowed down to 3 main designs. These were modelled using styrene foam in quarter scale as a way of testing forms.

These also provided a valuable resource when further establishing designs, they added essential realism to the designs and allowed people to establish a stronger opinion on their favourite designs.

4.3.3 CONCEPT IDEATION

Using the mock-ups produced in *section 4.3.2 scale mock-ups* 3 designs were ideated with the goal of narrowing then down to one design to further develop. The ideation however, did not indicate one particular direction, rather showing very contradicting opinions on the aesthetics. Some would have the opinion that a particular bike looked dynamic and the other bikes heavy. Interestingly, a different person would have the complete opposite opinion.

4.3.4 CONCEPT DIRECTION

Due to the conflicting opinions discussed in *section 4.3.3 concept ideation* design 3 was chosen to develop as I felt the more aggressive lines and unique shape better suited the ethos of the cycleway.
A big point of difference that separates these rental bikes from those currently available overseas is that they are designed to go alongside a cycleway rather than in a cityscape. I feel it is important that the aesthetic language of the bikes reflect this. I feel the other two designs look better suited as city bikes and do exhibit a unique enough aesthetic to truly stand out.

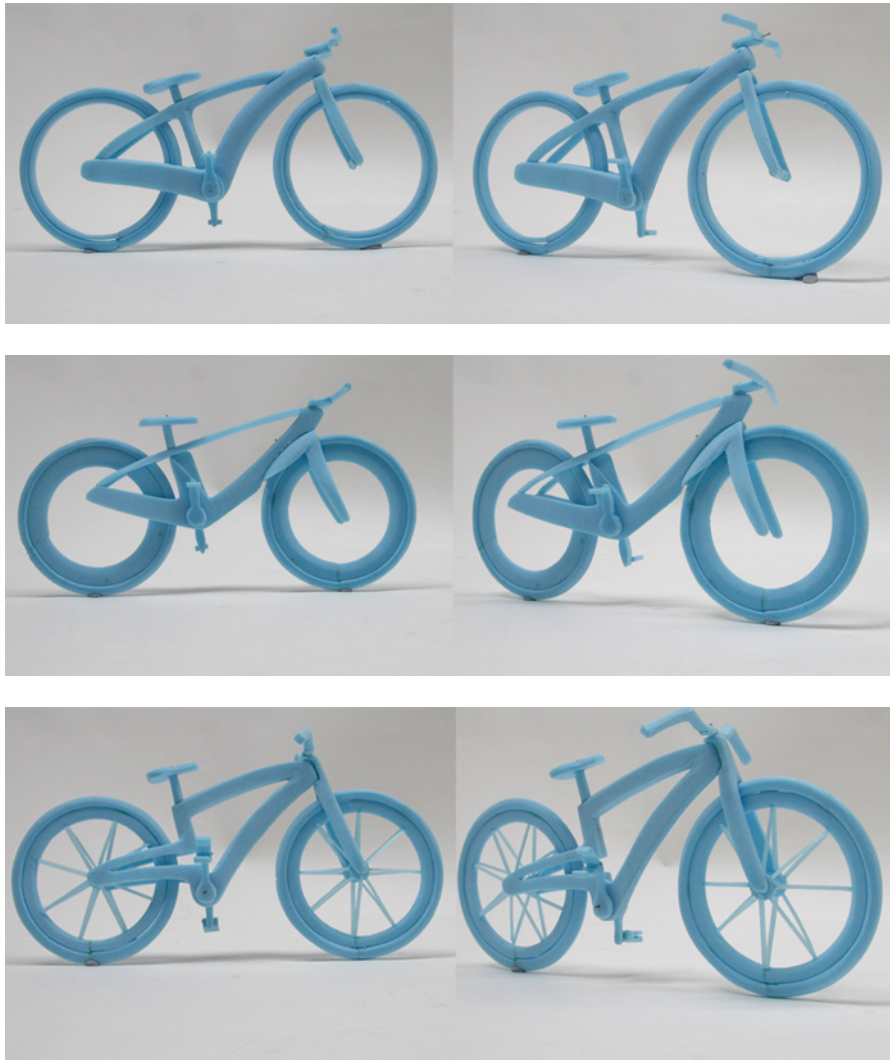

Fig 39: 1:4 scale mock-ups.

4.4 DEVELOPMENT

With a defined concept direction established the design was developed. The use of two dimension side elevations of the chosen scale bike model as underlay, proved to be a fast and effective way of quickly developing form and details. Hundreds of different variations of the chosen concept design were narrowed down to two then to a full-scale foam mock-up. Although the development stage began here it continued until the completion of the project, as the design progressed necessary changes became apparent. The following are a range of development images produced.

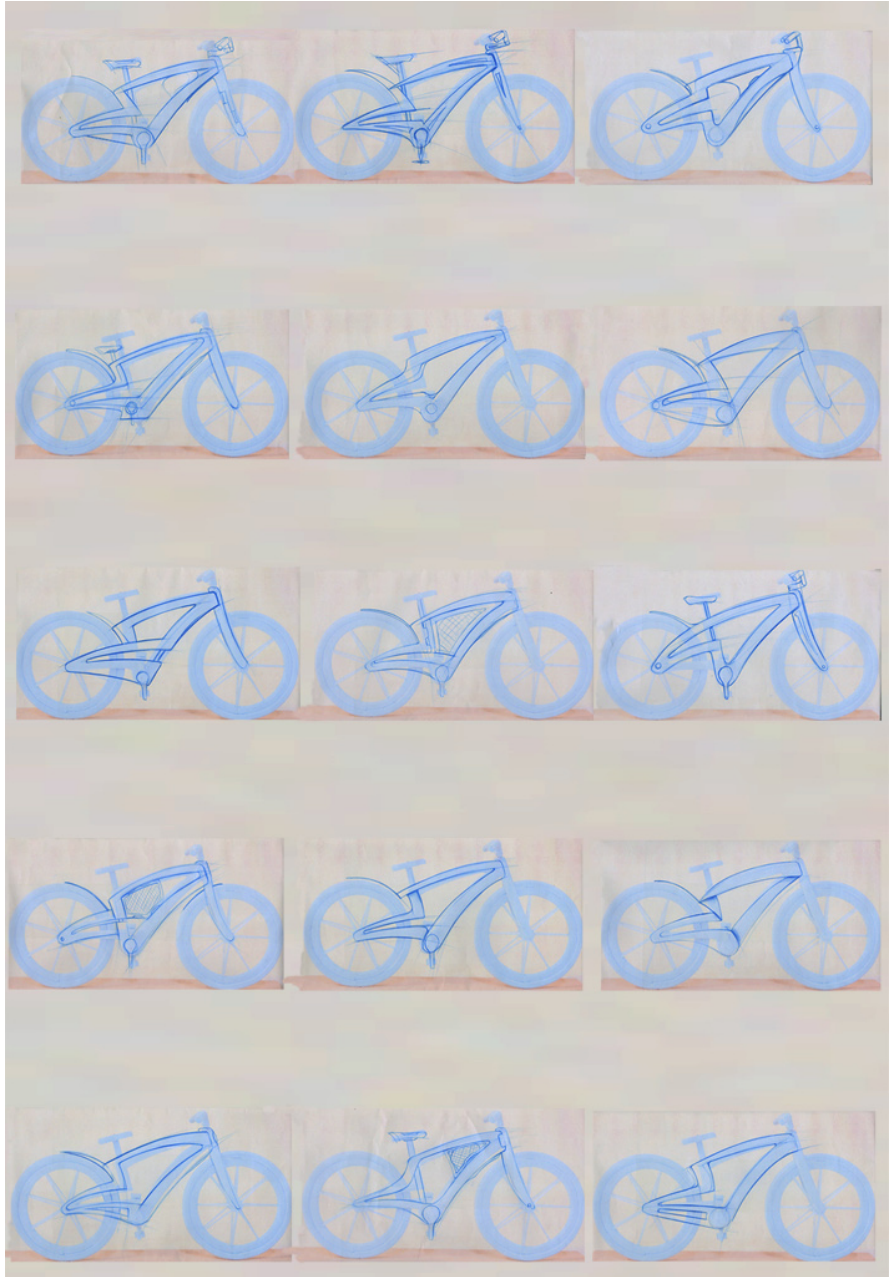

Fig 40: Development trace over.

4.5 EXPERT INTERVIEWS

Two experts were interviewed throughout this research project. The first, Chris Tuckey is a traditional bike frame builder. The second Garth Galloway is the CEO of Galloway International rotational plastic moulding. These interviews were crucial in progressing with the project as they helped define the materials and manufacturing process, which in turn had an enormous impact on the design.

4.5.1 CHRIS TUCKEY

Chris Tuckey is a bike frame builder who specialises in custom built steel lugged bikes.

THE OBJECTIVES OF THE INTERVIEW INCLUDE:

- Understand basic Frame building processes
- Gain an understanding of bike geometry and the main angles that effect riding characteristics.
- Establish Chris' opinion on the type of geometry best suited to a rental bike.
- Advice on components that would make a bike very easy to maintain.
- Establish Chris' opinion of the best suited materials in building a rental bike.

KEY OUTCOMES:

Chris builds very traditional style frames, using a steel and lug construction. The first decision made is the style of bike, as this is the most important factor that will influence the geometry. The frame angle ranges and decided on and then put down in full scale on paper. The design is sketched up in full scale from here, and when this is decided on, construction begins. Chris has a fully adjustable bike-building gig that allows very accurate size and angle adjustment. High-end steel tube sets from brands, such as Columbus, are used with lugs and then brazed together.

BIKE STYLE

As the intended users for the bikes will range from experienced riders to the very inexperienced Chris recommends a cruiser style bike. They are very easy to ride, comfortable in most applications and are very user friendly. Keep everything simple, no suspension, also styling the bike to be very basic.

FRAME GEOMETRY

Cruisers bike generally have very relaxed frame geometry and angles. Chris recommends a seat tube angle of 68/69 degrees. The frame can be made quite small and the seat height given a large amount of adjustment to allow for differing rider heights. In terms of crank length anything from 170mm – 175mm is commonly user on cruiser bikes. The strength of the frames will not be a big issue as it is with racing bikes.

MAINTENANCE

Chris recommended a number of different features that can make the bikes easy to maintain. Firstly the gears can be simplified for this type of application, standard front and rear Derailleur can be replaced with internal hub gears. Standard Derailleur systems can't be very problematic to adjust and require frequent maintenance by a trained mechanic, beginners also tend to damage them regularly as they try to change gears while stationary. Internal hub gears allow users to change to any gear without moving, they also require very little maintenance. Tyres are also an area to consider as the average user will neither have the skills or desire to replace a tyre. Very strong tyres are on the market and these can be made more durable with a slime tube that will temporarily fix a leak.

MATERIALS

Steel has the advantage of being very cheap, but can also be very heavy in lower grades. Steel will also rust if left out in the rain and can rust from the inside on the tubes out if water gets inside them. As the bikes a likely to encounter rain and the elements ensuring the on going strength of the bike would be difficult. Aluminium can be harder to work with and tends to give a much more ridged ride but will not corrode and as such be much more resilient to the elements.

DISCUSSION

Chris provided some great and valuable information regarding frame geometry and standard components that could be used. However, it became apparent throughout the interview that I would have to take a non-traditional approach when designing this bike. Following Chris' advice exactly would have led to a bike that looks like every other bike on the market.

4.5.2 GALLOWAY INTERNATIONAL

After interviewing Chris Tuckey it became apparent that an alternative material and process for manufacturing the bikes would lead to a more unique and distinct final product. A senior tutor of Massey University suggested rotational moulded plastic as a possible way to produce the bikes as per his experience with rotational moulding.

Galloway International Limited is one of Australasia's leading rotational moulding companies. They specialise in the development and manufacture of plastic products and have over 35 years experience in this field.

- Garth Galloway – CEO of Galloway International Limited.
- Keith Roberts – Operations Manager of Galloway International Limited.

A full-scale mock-up was taken to the interview and proved an extremely valuable tool used to show both Garth and Keith the design. It provided something tangible that was easy to analyse and make suggestions and areas that required attention.

REASON FOR INTERVIEW:

- Proof of concept – To get an indication if the concept is viable for plastic moulding.
- Get an indication of areas of the design that require further refinement due to materials and manufacturing limitations.
- Establish how the design would be manufactured and the tooling involved.
- Get an indication of cost involved in tooling and unit cost to mould each bike.

KEY OUTCOMES

- Proof of concept: The bike could be rotational moulded without to much difficulty.
- The plastic used would be very important to provided a great enough strength to weight ratio.
- The main body would be rotationally moulded using a 3 piece heavily jigged tool.
- Smaller parts would be more economically produced using injection moulding.
- Some parts such as handlebars and the front forks may require metal parts to be moulded in to ensure strength and the safety of the riders.
- Tooling estimated at costing $100-$200,000 with a unit cost of roughly $200-$300

4.6 MATERIALS AND PRODUCTION

After the literature reviewed in Section *2.4 Bike Design* and speaking to Chris Tuckey (bike frame builder), it became apparent that if the advice was to be followed the bikes would only look one specific way. The decision was made to steer away from the advice given and find an alternative production method that would allow greater freedom of design. Rotational moulded plastic was chosen as the production method after talking to Galloway International in *section 4.5.2.*

BENEFITS FOR MOULDED PLASTIC BIKES

- Rotationally moulding plastic gives very interesting shape restrictions. The tubes strength is gained through volume and hard edges at certain points.
- The extra volume to hide parts.
- Graffiti.
- Chipped down and recycled.
- Economising production costs without making them undesirable to ride.
- Graphics inlayed into the plastic for wear and tear.
- Cheap production run cost once the tooling is made.

4.7 FULL SCALE MOCK-UP

The construction of a full-scale mock-up allowed designs drawn on paper to be translated into three dimensions. Lines, edges and surfaces can be experimented with and defined. Polystyrene was used as the material of choice. This is because it can be cut, sanded and shaped with ease. A clay model however, would have been ideal and would have allowed for greater control and surface refinement. Then again, due to the size of the mock-up cost prevented me from using this method.

The full-scale mock-up proved an invaluable tool in discussing the design with my supervisor and potential manufacturers. Changes could be drawn on the mock-up and made very quickly.

The full-scale mock-up when refined and finished served as the base to produce a 3D CAD model.

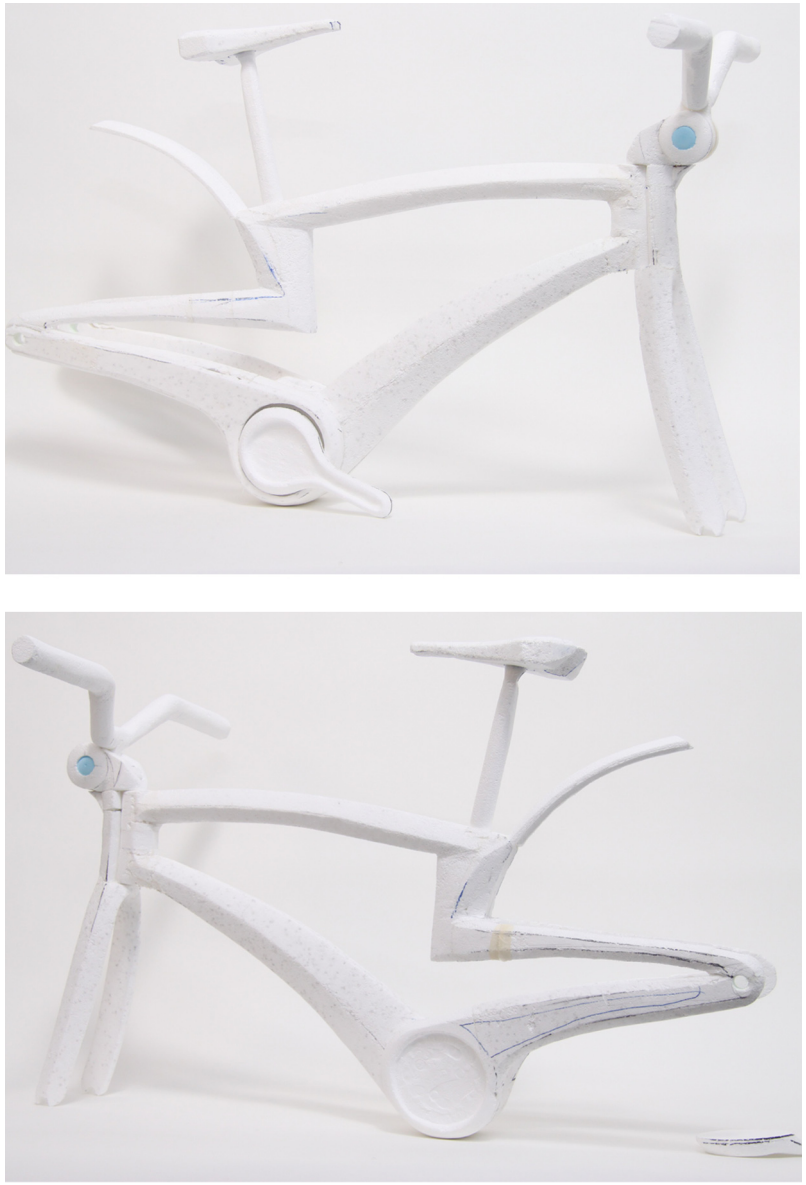

Fig 41: Full scale mock-up.

4.8 ERGONOMIC TESTING

Using the package drawing developed in *Section 4.2 Package Drawing* two different methods of ergonomic testing were used. Firstly, 2D cut outs were tested against a full size package drawing. Secondly, an ergonomic test rig was built and tested by a range of riders.

4.8.1 FULL SCALE 2D PACKAGE DRAWING TESTING

Full scale ergonomic cut outs of 99th percentile male and 1st percentile female sizing were used to test the geometry and dimensions of the concept bike on a full-scale package drawing. Anthropometric data sourced from Henry Dreyfuss': *The measure of Man and Woman.*

Fig 42: 99th percentile male package drawing test.

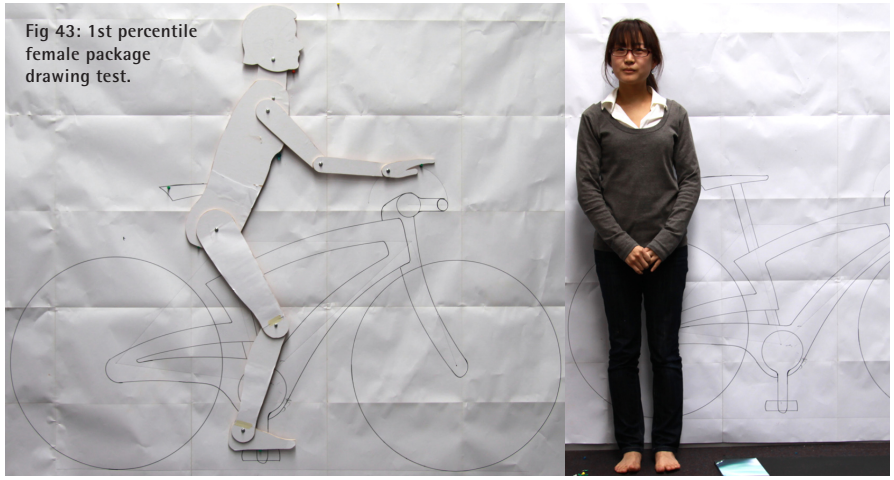

Fig 43: 1st percentile female package drawing test.

4.8.2 FULL SCALE ERGONOMIC/USABILITY TEST RIG

When the geometry had been proven in *Section 4.8.1 Full-scale 2D package drawing testing* a full-scale test rig was built. The test rig was constructed to have identical geometry and sizes defined by the package drawing. Also, the function was to be the same as the actual design, but it was not intended to look identical. The aim of building the test rig was to establish whether users of different sizes, ages and genders could adjust the bike to find a comfortable position. It was also important to assess whether they could operate the gears and brakes without being prompted.

The bike was given to a sample group of 20 riders. The participants were asked to take the bike for a ride. Observation was the chosen method of gathering information from the test because it allowed for an informal relaxed environment. As a result of this, participants appeared to do as they normally would without displaying symptoms of being under testing conditions.

Results indicated riders within the 99 percentile male and 1st percentile female range, were able to find comfortable positions on the given test rig. In addition, it was found that all the riders were able to operate the brakes and change gears.

Fig 44: Full scale ergonomic/ test rig adjusted for 99th percentile male rider.

Fig 45: Full scale ergonomic/ test rig adjusted for1st percentile female rider.

Fig 46: Full scale ergonomic/ test rig adjusted for 50th percentile male rider.

5.0 FINAL MODEL PROCESS

The decision was made early on in the design process that the most relatable outcome for this design research project would be a full-scale design model. The model would be a lookalike representation of the final design but would not function or be constructed from the same materials. Small-scale and full-scale mock-ups plus a full-scale test rig established the valuable information regarding ergonomics and usability. This prior research meant that there was little value to be gained from a functioning final model. The construction methods used to make the final model allowed for great freedom to change form and surface, this allowed the bike develop naturally in a very unconstrained way. The CAD work completed previously served as a solid base to work from but in no way constricted the final outcome.

Below is a breakdown of the major stages undertaken during the construction of the final model.

5.1 METAL UNDER CONSTRUCTION

- The ergonomic/usability test rig was torn down and used as under skeleton to ensure a straight and solid base to work from.

Fig 47: Final model process, metal under construction.

5.2 FOAM BODY CONSTRUCTION AND SHAPING

- Polyurethane foam was used to shape the main body: it allowed great control and freedom to sculpt the bike. As soon as the foam was securely attached to the frame the foam allowed for the bike to take form very rapidly, changes could also be made in real time while discussing them with my supervisor.

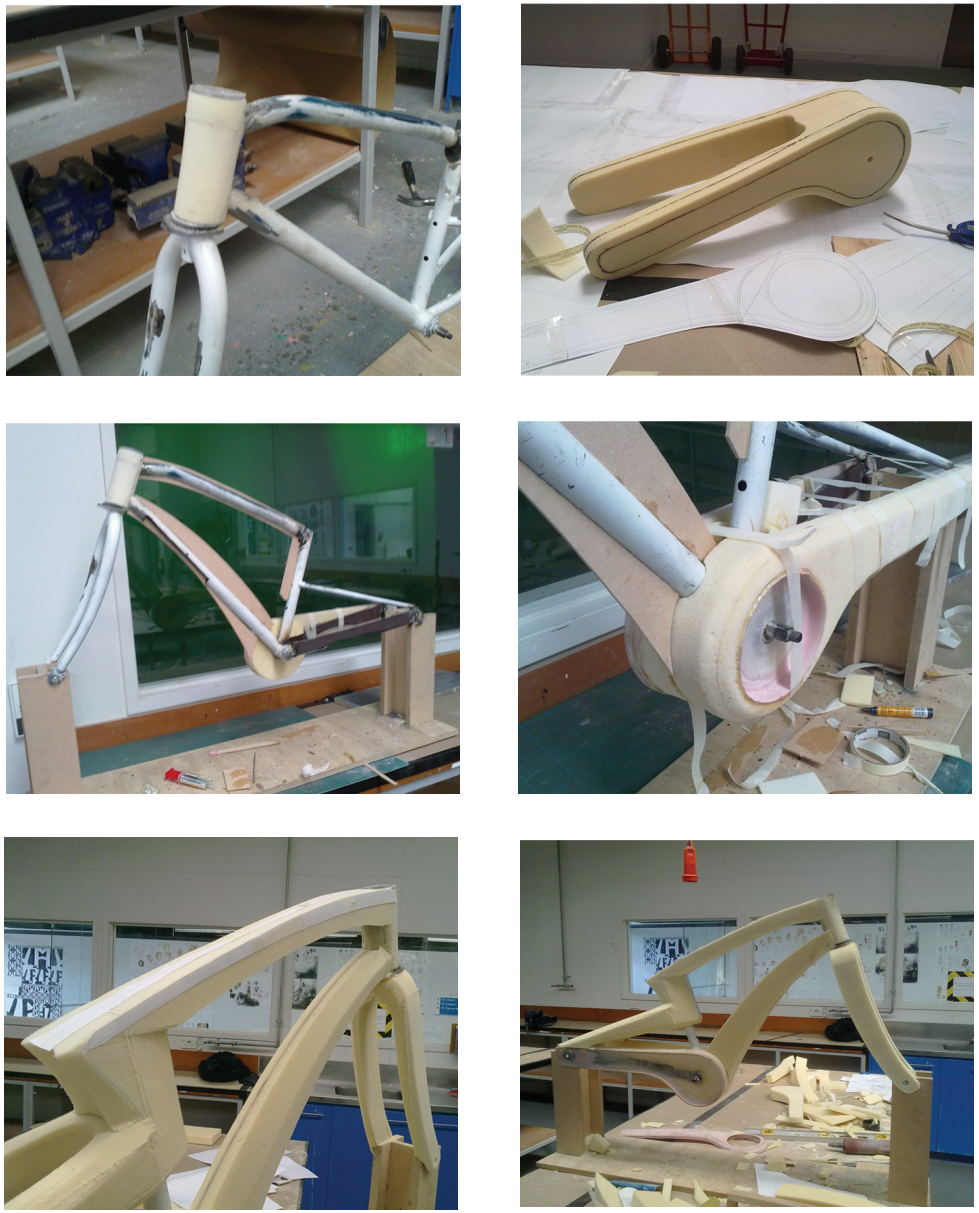

Fig 48: Final model process, foam body construction and shaping.

5.3 RESIN AND SKIM BOGGING

- When the bike had been shaped to its basic form, two coats of epoxy resin were applied to give the bike a strong layer to work from and add the final details. The decision was made not to use fibreglass cloth as it is much more time intensive to finish and the model did not require the strength it would add.
- The whole bike was given a coat of bog as to level the surfaces and not eat into the foam.

Fig 49: Final model process, resin and skim bogging.

5.4 DETAILS

- Smaller parts were constructed Cibatool modelling compound as it offered great finishing qualities.

Fig 50: Final model process, details.






Fig 51: Final model process, details.

5.5 WHEEL CONSTRUCTION

- Existing rims served as a base to work from. Strips of flexiply were laminateed together to give the rim thickness and a slight angle to align with the spokes.
- The hubs were turned out of solid hard work to the exact dimensions of Nexus internal hub gears.
- Spokes were made from close gain hard wood using a wheel jig to align them.
- The entire wheel was glued using epoxy glue.

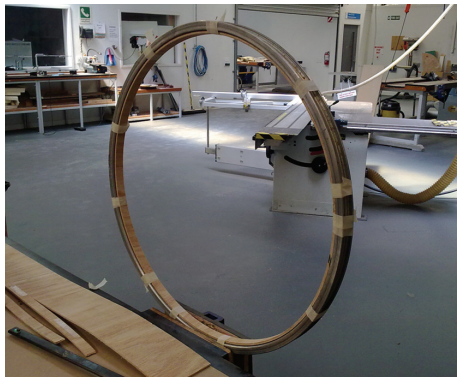
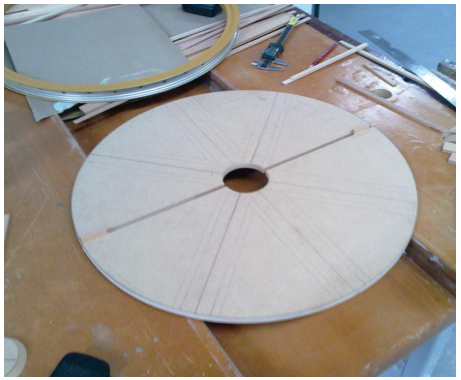
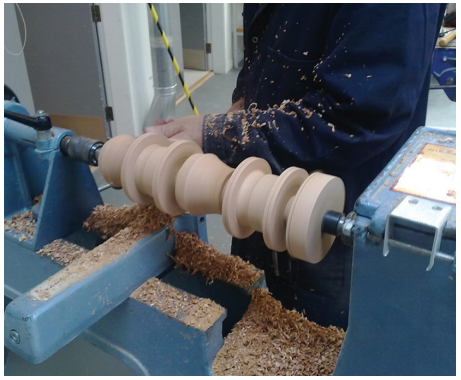


Fig 52: Final model process, wheel construction.

5.6 STAND CONSTRUCTION

- A wooden frame was constructed to give strength to the stand.
- Polyurethane foam was applied to the frame and shaped to the desired form.
- Two coats of epoxy resin were applied and the surfaces finshed using bog.

Fig 53: Final model process, stand construction.

5.7 FINISHING AND PAINT

- All parts were sanded and finished to a high level before primer.
- Two pack Durapox high build primer was used before paint.
- Resene donated supplies and painted the bike once finishing and primer had beenapplied.




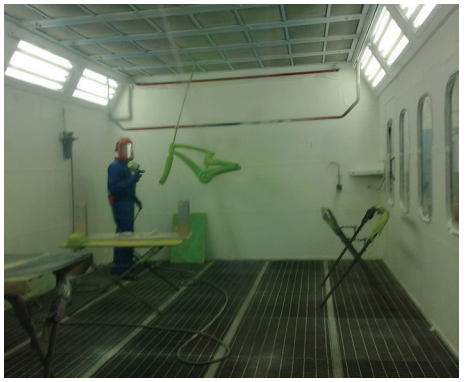

Fig 54: Final model process, finishing and paint.

6.0 FINAL DESIGN

Bikes and locking points for a self-service bike rental system to be placed along side the potential New Zealand cycleway. The bikes are fun simple products that everyone can rent with ease and enjoy the national cycleway and see the beauty the New Zealand landscape has to offer.

Fig 55: Ryde NZ final design.

Fig 56: Ryde NZ final design.

Fig 57: Designer Alistair Patterson with Ryde NZ final design.

6.1 FEATURES

There are internally routed gear/brake cables and a completely enclosed chain. These features make the bikes very hard to tamper with and give a clean aesthetic appearance. The chain can be tensioned quickly without removing the chain guard. A mechanic with specialist training and tools would be required for any technical work.

The helmet clips onto the seat using a clipping system similar to that used to fasten the helmet. This makes the function familiar and therefore, simple to use for riders. The helmet also serves to keep the seat dry in the wet weather.

Fig 58: Integrated helmet design.

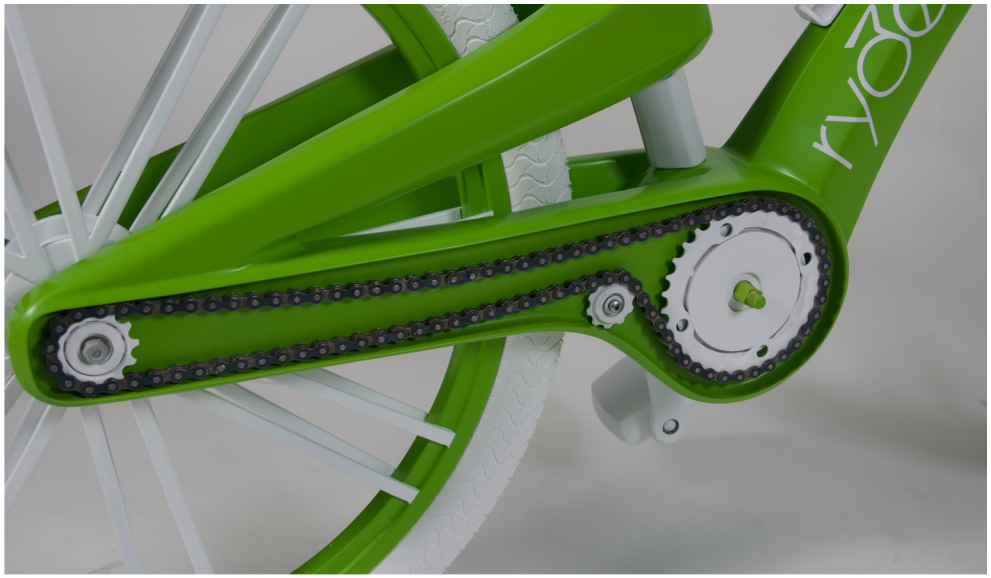

Fig 59: Internally integrated chain and gearing design.

Front and rear LED lights are integrated into the bikes fenders which provide extra visibility both from other bikes being used on the cycleway and changeable conditions. The lights automatically run on a small dynamo which means that the user does not have to learn about activating this function.

Fig 60: Integrated front LED light.

Fig 61: Integrated rear LED light.

Seat levers are integrated into the form of the bikes to give a pleasant aesthetic whilst still maintaining simplicity. However, they operate in the same way standard seat leavers work as tested in *Section 4.7.2 Full scale ergonomic/usability test rig.* The seat post is numbered to allow repeat users to remember their number for when they next use the bikes.

Fig 62: Integrated seat adjustment lever closed.

Fig 63: Integrated seat adjustment lever open.

Side pannier bags have been designed as an additional feature which enables the bikes to be rented and toured around the country. The bags have a hard back and plastic clips which push onto the rear seat. The chain stays in place, which holds them securely in place.

Fig 66: Pannier bag in use.

Fig 64: Snap on pannier bag clips.

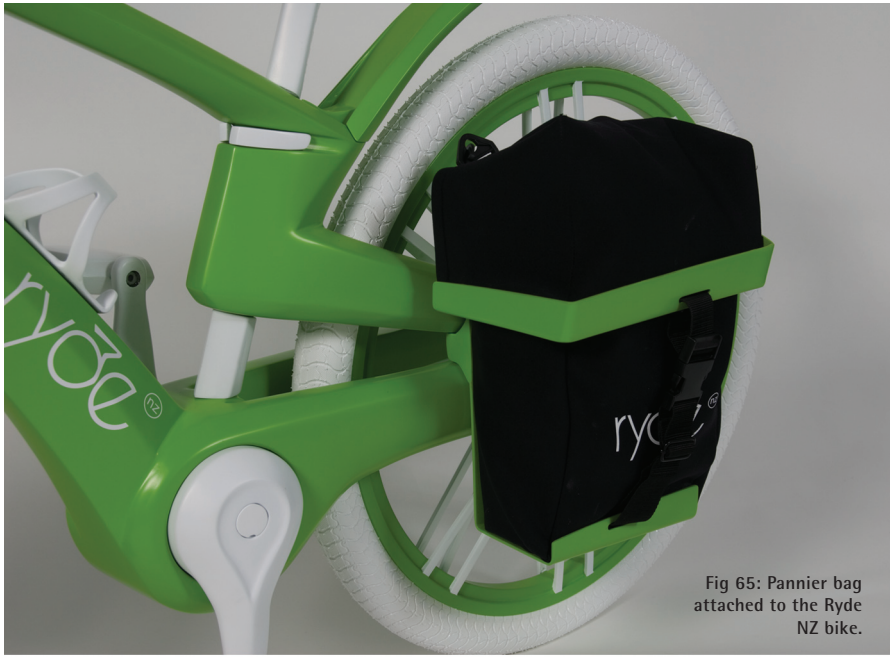

Fig 65: Pannier bag attached to the Ryde NZ bike.

6.2 CONTEXT

The bikes sit alongside the cycleway with their rears facing the path for ease of access. The bikes have individual stands that add a modular aspect to the system: more bikes can be added to popular areas of the cycleway and less where needed. It can be clearly seen in the photos the bikes are extremely visible against the green bush backdrop.

Fig 67: Multiple Ryde NZ bikes along side a track.

Fig 68: Ryde NZ bike in a potential environment.

6.3 USABILITY

The storyboard illustrates the steps used when renting a bike.

- The bikes can clearly be seen from afar.
- The rear of the helmets clipped to the seats of the bikes displays a sign saying: rent me: call or txt 7966
- When the number is called or txt the user identifies the number of the bike and it is remotely unlocked. The rental is charged to the users credit card or phone account.
- A light on the rental stands changes from red to green indicating the bike is free to be taken.
- The helmet attached to the seat of the bike is unclipped and worn by the rider.
- The seat can be adjusted to suit the height of the rider.
- The handlebars can be adjusted to suit the reach of the rider.
- The rider gets on and rides at their leisure.
- The bike can be returned to any of the rental points along the cycleway.
- The helmet is clipped to the seat allowing the bike to be returned. A small RFID chip in the helmet communicates with the bike, the bikes can not be returned without the helmet present.
- The stand recognises the number of the bike returned and stops charging the rider's account.
- The light on the stand changes in colour from green to red indicating that the bike is locked and secure.

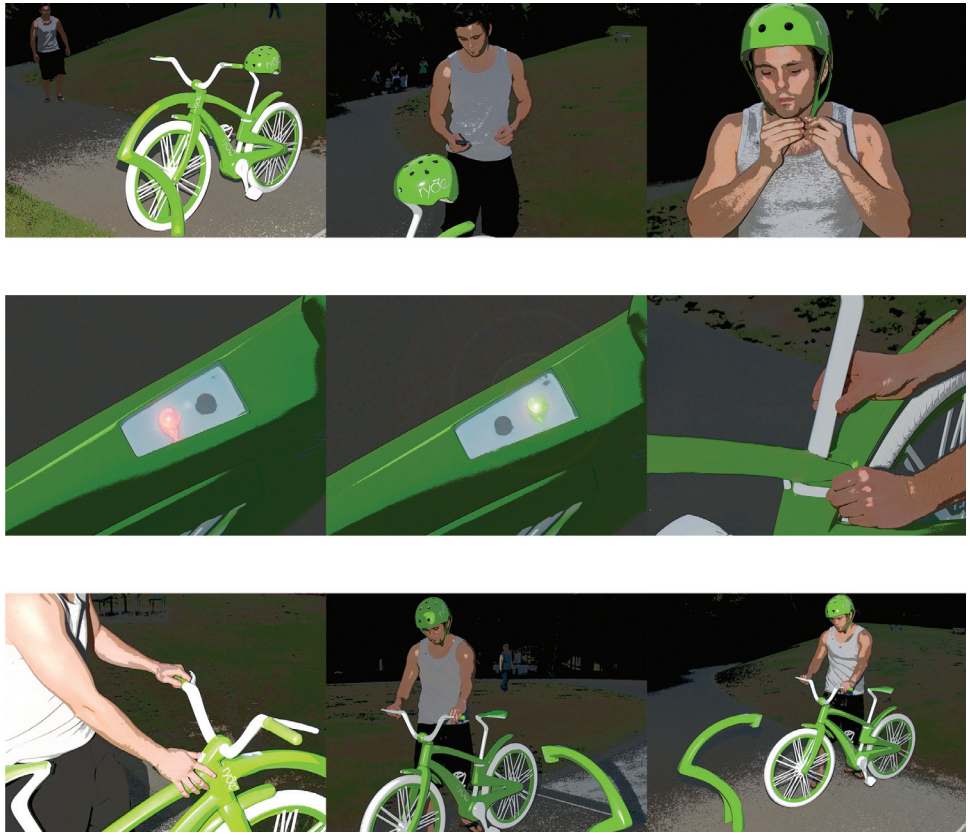

Fig 69: Ryde NZ
usability storyboard.

6.4 BRANDING

Branding was not a fundamental part of the research project. However, it was important to create a small amount indicative of the complete product package.

Branding for the bike was completed with the assistance of a visual communication design student Olivia Mills. A brief was created and given to Olivia as a starting point and regular meetings between Olivia and myself were used to discuss designs and further refine them.

- Ride NZ is the chosen name for the system.
- 'Rent, ride, lock, leave' is the slogan for the system.
- Photos were attached to the brief for inspiration.
- Simple, distinct, clean, crisp and words that can be used to describe the bikes and and as inspiration.
- The colours used in the branding have to stand out and be very distinct. However, because the system will be placed alongside a native and natural backdrop they must not detract or be offensive to the surrounding area.

BRANDING DISCUSSION

- Green and white were chosen as the colours for the system as they created a simple clean and crisp feel that aligned with the form language given to the bikes. The green chosen is extremely bright making the bikes very visible and distinct it is also not offensive to the natural surrounding scenery.
- The word ride has been modified to use the letter 'Y' in the place of 'I' as it creates a point of difference to the otherwise very plain name.
- The top of the 'D' in the title has been stylised to mimic the side profile of the unique seat design.
- The addition of NZ in a circle to the right of the name allows for potential modification of the logo to be used else where around the world.
- White is used in places of importance on the bike as it stands out extremely well against the green base. Logos, rental instructions, adjustment levers, and suspension are all white so the user is aware they are there.

Fig 70: Ryde NZ branding

6.5 USERS

The bikes have been designed to have a universal fit as the following photo illustrates. The bike is shown with a wide range of riders adjusted to fit their body type and size.

Fig 71: Ryde NZ users.

7.0 CONCLUSION

The aim of this design research project was to design bikes and locking points for a self-service bike rental system to be placed alongside the potential New Zealand cycleway.

Literature revealed bike rental systems have been around for over 40 years, in that time three generations of rental systems have existed. Early generations were very low tech and as a result were largely unsuccessful. Later generations saw far more success as technology enabled greater ease of rental and greater security against theft and vandalism. Case studies looked at several of the rental systems currently operating throughout the world and critically evaluated each. This identified features of each system and bike that could be integrated into the cycleway bikes and those that should not.

Three video documentaries were completed as a way of immersing myself in to cycling in New Zealand. These documentaries helped to identify points to design and features that would be required for a cycleway rental bike. Extensive ergonomic testing was completed including package drawing tests and a full-scale test rig using 1st percentile female and 99th percentile male anthropometric data. This ensured the final bike was inclusive of as wide a range of riders as to make it effective as a rental bike.

The final product is Ryde NZ, bikes and locking points for a self-service bike rental system to be placed along side the potential New Zealand cycleway. The bikes are fun, simple products that everyone can rent with ease and enjoy the national cycleway and see the beauty New Zealand has to offer. The bikes are styled and branded to be extremely visible and distinct against a natural cycleway setting. The bikes include features such as internal hub gears, simple seat and handlebar adjustment making them simple to use. All technical aspects of the bike such as the gearing cables and the chain are hidden away to give a clean simple aesthetic.

The bike has been briefly taken out to the public to gauge their reaction and obtain feedback, this all came back positive. The bike drew attention from people all around enquiring about what the bike was for and wanting to ride it. Before any further development were to take place further testing of this sort on a larger scale would need to be completed. In its present state, the bike design is ready for further development for manufacture. A new CAD model should be constructed using the final design model. This will allow strength analysis to be undertaken and further development to refine the integrity of the design before manufacture.

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