A MINDFUL COLLABORATION:

A TIMBER DESIGN-BUILD

EXPLANATORY DOCUMENT
A Research Project submitted in partial fulfillment of
the requirements for the
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To my family, you were my cheerleaders from the beginning; allowing me to be whatever I wanted in life and supported my every decision and follow my heart, even when it took me further away from home than you would have liked.

To my friends who stood by me after countless cancelled dinners and events; your patience when I turned up with my laptop to dinner. Your kindness and support got me through. The nights you gave up for me to help will never be forgotten.

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It was 3 years ago that I was faced with a choice during architecture school; either keep going along the path of sitting behind a computer, pretending to know what I was producing or get stuck into the workshop to tackle a design build elective.

Early on I noticed that many students would avoid the workshop (myself included) but it was now or never that I tackled my weakest point in architecture school, hands-on 1:1 making within a workshop environment, utilising ALL that the workshop had to offer.

Fast-forward eighteen months and I was an ambassador for empowering women in fabrication. For me, the role was about encouraging more architecture students to be hands-on so that they too could create beautiful designs. Additionally, in the right environment, these students could learn about the science behind construction, which helped extend their knowledge, further arming them for entering the workforce. All designers can learn from being hands-on which can mend the perception that designers “don’t know what they are doing“ in terms of building - a piece of slander that’s often used around a construction site.

I am now onto my seventh design-build project where I have learnt enough skills around team work, process, communication skills, software and CAD/CAM to tackle a final design project as the lead designer. This is putting all my knowledge to the test as a student for the last time.
Abstract

Architects and designers should create atmosphere and invoke a connection from the built environment to the inhabitant. For the vision of a designer or client to be complete, a whole team of individuals is required to be involved throughout the process. Hundreds of years ago an architect nee master craftsman was employed to design, build and construct a building. The master craftsman title was trusted, only earned over years of training as an apprentice, learning the tested techniques and processes to deliver the final product to the client. In this day in age, architects are reduced to merely a form-giver or design-shaper; the skills required to produce architecture have been dissected into so many specialist roles that a disconnect has appeared in the design delivery process. The architect is no longer hands-on during the construction phase and is left with a compromised design that commonly lacks in individual expression. Technology these days has forged new skills and through additional tools, enabled designers to obtain the complex forms capable by the advanced software and CAD/CAM systems available. The flexibility within the traditional design delivery processes allow for hybrid design build methods to be employed by designers to realise their complex concepts through making. The aim is to give the designer back some hands-on experience by adapting the design process with the support of trained industry professionals to create bespoke architecture.
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1.0 Introduction
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This introduction is divided into three sections. The first of which being a project outline to introduce what the document will be discussing. The second is the scope and limitations to clearly define the various projects and their individual parameters given by clients. The third section is the document structure, which will clarify the further chapters within the document.

1.1 Project Outline

The research document consists of multiple design build experimentation products and one final design build project. The experimentation pieces are led by students for industry professional clients, and the final project is led by a M.arch (prof) student for the design portion in collaboration with a team of industry experts.

Initially the students will learn about the file-to-factory process which is where the designer turns the 3D model into 2D components that are then programmed and cut by a CNC (Computer Numeric Control) machine. The students will adapt the methods within the process to produce bespoke design outputs, constructed of timber. The methods will employ the use of digital fabrication tools and software but are not limited to them while following the file-to-factory process. The projects are for different clients which have their own brief and are not related to one another, but the learnings and outcomes from the first project are reflected on and developed further to produce a more complex design for the following project. This will subsequently test the resilience of the students and their ability to adapt and change the file-to-factory process within a team to produce a product within set time frames and budget constraints.

The relationship between industry and institutes is key to the development of a students understanding and application of ideas in terms of building methods and processes outside of institutes. The current disconnect lies between a designers product and its build-ability. Bridging gaps in the design process is, from a designers perspective, the importance and value of the design-build studios. It provides the hands-on experience that has been lost, while overseen in a safe learning environment set up by institutions which will help resolve the current disconnect.

The approach to design will be utilising digital software and machines such as laser cutters and CNC routers to refine designs and work through problem areas in details to reduce waste and time when it comes to fabricating. The more attention to detail at the refined design stage, the more efficient and effective the process becomes to fabricate. Rapid prototyping will be used in all experimentation and final design
build projects. For the designer, the file-to-factory process reconnects the 3D computer concept to the construction and assembly stage, whereas a traditional design delivery method would see the process end after the concept stage.

Note: Six year 2 students from the Bachelor of Architectural school will be participating in the first built project as a negotiated elective. The final build project will consist of a single MArch(prof) student as the sole designer, but during the construction phase over Autumn there will be students helping.

1.2 Scope & Limitations

The project will focus on developing multiple design build projects each with different associated scales, briefs and clients. They are broken down into two sections, 1: experimentation (three small projects) and 2: the final design build project.

1.2.1 Projects

The first is the Carter Holt Harvey interactive exhibition stand - This project will be a temporary, indoor, dynamic design that can adapted to the multiple sites it will be used at over one year of service. It must comply with all health and safety requirements at each event site. The second is the Carter Holt Harvey LVL (Laminated Veneer Lumber) product - a small interactive desk model made of LVL in order to encourage brand and product awareness. This is to test the designers’ knowledge of the material reaction to manual and digital machinery. The third is a more complex component exploration intended to show how connecting components create certain geometries which can be self-supportive. From here designers are able to further adapt each component to suit desired look.

The final design project: CUE Haven pavilion is a static outdoor timber pavilion that will require New Zealand legislation and will need to comply with the various parties such as engineers, architects, Auckland council and sponsors’ products.

1.2.2 Scope

All projects will require each participant to work within the team to achieve the projects within their respective deadline. When required, materials will be locally sourced but predominantly determined by clients and sponsors. At each crossroad where a design decision is to be made, the opinions of all
team members will have validity and a conscious decision will be made and agreed on by all parties. The designer has to let go and adapt with the path of “conversation decision making”.

Research into an appropriate fabrication technology should factor in both the designer’s digital and manual skills for this document. Each design will be based around a digital form created from design drivers outlined in the briefs. Utilising design fabrication tools such as laser cutters and CNC routers to produce the designs via rapid prototyping will ensure the design works both structurally and aesthetically. This exploration will be through a design build scheme including students that participated in an elective which was part of the Carter holt Harvey exhibition stand.

1.2.3 Limitations
The limitations within each brief are detailed within a scope of works and responsibilities outlined in the appendix for each project. The documents were formed on a weekly basis from summarised meeting minutes where each member was clearly tasked with the appropriate jobs and deadlines to which they were to complete to keep on schedule.

Limitations are also imposed from each of the sites. The CHH stand is a dynamic structure that requires setting up and packing away within hours of a conference or trade show. As such, its size limitations are clearly set out before the concept phase has been started. Meanwhile, the CUE haven pavilion is a static design that is positioned in an extreme weather environment, with steep gradient, and has limited accessibility for heavy machinery. This imposes limitations to the design, material selection, structure and build-ability.

Another layer of limitations imposed upon the design is the sponsors’ materials as these are non-negotiable and are partially preselected. A lot of standardised fixings and details are required due to council and ease of build-ability from the contractor’s perspective as the time frame is short for the site work.

Lack of experience and knowledge within the creation of custom design build projects poses constraints on the process from moving past the iterative prototyping phase. Students who are first exposed to the process and methods can become overwhelmed and what could have been a quick problem-solving moment can turn into a drawn-out trial and error process.
Although trial and error does encourage hands on learning, the ominous time frame and budget can sometimes not permit, so planning is key to allow for hands on learning within the allowed time frame.

1.3 Document structure

The structure of this document contains a further five chapters. 2.0 reviews the background and literature relevant towards the research. 3.0 will discuss the methodology as well as the research question with the aims and objectives to follow. 4.0 is the introduction to material experimentation covered off with 3 separate projects that increase in complexity through the document. 5.0 is the final design project that incorporates all content, skills to produce a customer design-build product at CUE Haven. Chapter 6 will conclude the findings and reflect on the discoveries within this document.
2.0 Background & Literature
2.0 BACKGROUND & LITERATURE REVIEW

The purpose of this chapter is to give background information about how the architect’s role has changed as technology has advanced. The chapter will be split up into five parts. As the role evolves, this chapter also investigates the relationships architects have with other members involved with creating architecture, and how it has affected them over time. It will also discuss the disconnect designers face within the industry. The fifth and final part of the chapter will go into detail with precedent studies chosen.

2.0 BACKGROUND

Technology has always changed architecture, in this day and age, design is becoming more adaptive rather than responsive to its environment; it’s becoming more interactive for both designers and clients to experience concepts through virtual reality and active 3D modelling. By linking computational design to computational manufacturing, it has begun redefining the practise of architecture by giving the full process and mastery of construction back to the designer. From the perspective of the architect, the strong link between technology and architecture has morphed and changed their role throughout history but in turn has given greater opportunity for the industry and the consumer. With the imaginative mind of the architect combined with the readily available technology, new revenue streams are created and are redefining the roles and relationships within the industry. Now there is the opportunity to create more streamline communication and design input from all parties.

2.1 THE EVOLVING ROLE OF THE ARCHITECT

Technology and architecture are two very closely linked fields. The advancement of technology has sent a ripple effect within the architecture industry causing change to the designers’ workflow and skill set as they take up new technologies to assist or solve architectural problems. The three industrial revolutions rapid evolutions in technology have transformed the way people live, which in turn changed the architecture needed to keep up with the changing world.

The role of the architect has become more disconnected as the field has become more segregated into specialist sections of the process in design and construction. The term Architect comes from the Greek word “architekton” meaning chief carpenters were not always thought of as a

profession but just as a person who could design and build structures that wouldn’t fall down. With the introduction of reinforced steel buildings, architects were no longer the captain of the helm, as it became a collaborative affair between engineers and architects. As materials became more regulated in terms of quality, the engineers were able to allow for higher more elaborate designs to be produced, which resulted in more specialised engineers and construction workers on site. Increasingly, the role of the architect seemed to be reduced to that of a shaper, a form-giver, a designer – with very limited responsibility regarding the outcome of the entire endeavour. The master builder of past times, the generalist-architect who had the competence and capacity to integrally design, construct and build an edifice, is nowadays threatened by extinction. Architects ride the wave of technology, grasping at the cutting edge to aid their designs and help with decision making. Presenting design’s to third parties can be a challenging task. Architects may find it difficult to describe spaces to their clients, therefore more firms are incorporating virtual reality into their workflows and project presentations. Visual representation on paper is one thing but the majority of people struggle to grasp what is being discussed, so having an aid such as a scale model or walk through VR (virtual reality) video, erases a lot of assumptions and lowers miscommunication. The importance of the architect constantly reinventing the role is that as the world advances, architects have to come up with the appropriate response for the clients, as lives change so too does architect’s response to the client’s brief. In the current culture of affluence and abundance, materialism and obsessive consumption, architecture has become a threatened art form as universalization in standardised process and fabrication has threatened nationalism and cultural thematization.

The four main factors that changed the architect’s products, process and skill set were between the 1600-1800s

1) The introduction of new materials from the “new world”
2) Growth of the markets
3) Introduction of new products
4) Development of new technologies.

The driving force behind these four main factors of change was the industrial revolutions. The first revolution was at the start of 1760 this was the emergence of mechanization, a process that replaced agriculture with industry as the foundations of the economic structure of society. The use of coal along with the invention of the steam engine created a new type of

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energy that allowed the development of railroads to accelerate the trade of material goods over further distances than before. The iron and metal shaping skills grew so quickly that cities began taking a new form upon the horizon.10

Readily available materials and large-scale mass production sparked innovative designers to build and design differently; they were breaking out from the traditional design guidelines that had been set out for many centuries. Progressive thinkers like Joseph Paxton who was the master mind behind Crystal Palace, was a design that showcased a new thinking towards the use of the latest materials at the Great Exhibition in 1851.11 Crystal Palace was a modular prefabricated design built up additively from a large number of few elements. The key behind the success of the build came down to the organisation of production and assembly by engineer Charles Fox.12 The design was easy to assemble and disassemble in a short space of time, unlike the usual static designs being produced, Crystal Palace was a revolutionary self-supporting design which led the way for more prefabrication. This type of assembly and material choice divided the field due to the new aesthetic the combination produced but despite the doubt from other architects, Joseph Paxton continued his work by developing his methods and application.

The second revolution came at the end of the 19th century. New sources of energy such as electricity, gas and oil were introduced, and the development of the combustion engine was further refined and thus saw the start of Ford-ism in the car manufacturing industry at the turn of the century.13 The steel industry surged as the demand grew and, due to the development in building science, allowed engineers to achieve greater spans and heights. Methods of communication were also revolutionized with the invention of the telegraph and the telephone. All these inventions were made possible by centralizing research and capital structured around an economic and industrial model based on new large factories and the organisational models of production as envisioned by Taylor and Ford.14 Architecture had evolved with the advancements in materials but the application of traditional materials combined with CADCAM fabrication were adapted to work alongside the newly produced materials.15 Although vested interests saw the market flood with steel, iron, and eventually reinforced concrete, it subsequently saw the decline of structural timber advancements.

The third industrial revolution was in the second half of the 20th

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century with the emergence of a new type of energy whose potential surpassed its predecessors: nuclear energy. This revolution saw the rise of electronics and biotechnology for industry. High-level automation was introduced in production factories due to two major inventions: programmable logic controllers (automatons) and robotics. Architecture utilised these new factories in terms of standardised components for fast, reliable applications. This revolution was a wakeup call to the damage caused to the environment by previous forms of production. The entire industrial infrastructure relied heavily on fossil fuels which are finite, and attitudes towards the inevitable resulted in the introduction of green energy - which can harness wind, water and solar. Architecture was directly able to assist the rise in green energy by incorporating solar power into many buildings that create their own energy in order to share with one another in an “energy internet” where the internet and renewable technologies are merging to create a powerful new infrastructure.

The third industrial revolution is paving the way for more collaborative relationships between industries as the overlap and processes can be adapted to aid one another. Rifkin believes the third revolution has laid down five main pillars, that can only function in relation to the others these pillars are as follows; 1. Shifting renewable energy; 2. Transforming the building into micro-power plants to collect renewable energies on site; 3. Deploying storage technologies for the intermittent energies; 4. Using internet technology to transform the local energy grid into an energy-sharing intergrid that acts like the internet; 5. Transitioning the transport fleet into electric.

However, the old energy industries continue to be a powerful force, primarily because of their deep pockets, continuously influencing the shape of economy and industry. The speed at which technology is advancing has lowered the price and accessibility to greener energies – allowing them to be adapted for existing architecture. Now that people are growing more aware of the effect their lifestyles have on the environment, more are turning to architecture to provide sustainable solutions.

Technology has aided designers with answers to labour, energy solutions and time saving devices, but has resulted in diminishing interpersonal skills and solid relationship building skills. Life is now centred around the internet and the platforms it has established around the world, which enables faster more direct forms of communication and self-expression.

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20. Rifkin, The Third Industrial Revolution. p217
Architects are faced with ethical and moral dilemmas in all aspects; to what degree are the architecture, planning and construction industries responsible for statistics such as waste, homelessness, crime and quality of life.  

The relationship between technology, architecture and economy calls for a radical change within the approach to the built environment. Life will always evolve, and it’s the designers responsibility to regather methods to deliver the correct solution in architecture that meets long term ethical ideals.

2.2 Effects on Economy & Relationships

The collection of revolutions created jobs and provided better living standards for the inhabitants of the developing cities. Factories which house machines and production lines for manufacturing have a high production output, increased profit and reduced labour, as a result a large number of building materials are now mass produced, such as nails, screws and fittings at a lower cost, while steel was adapted to create frames and reinforcement for larger scale buildings and structures, resulting in new building typologies. Architecture has, in response to the changes in peoples lives, reflected the changes in typology and programme. For example, the main street of a town in 1910 included a butcher, post office, baker, darning, medical store and general store. By comparison now it’s drastically different with one or two of these previously listed elements remaining. Our wants have exceeded our needs in terms of consumerism and material vanity. The main street shops need to adapt to the ever-changing demand or face being knocked down and completely rebuilt, resulting in a loss of traditional character.

Advances in transportation has allowed for varying materials from other areas to be shipped in, resulting in a disruption to traditional monopolies. Certain materials relate to certain areas or styles so when specific fabrics or material-dependent styles have now come in competition with imported materials it changes the fabric to which the area was originally identified for. The ability to now ship and transport premade items allows construction to be faster, cheaper and larger.

Labour costs are minimised and the labour itself is less invasive than previous methods. This also results in the partial loss of the area’s identity - expressed through materialism within the architecture.

The combination of good transport methods and factory production of housing components is dated back as early as 1842, the government house was originally prefabricated in London and shipped to Auckland New Zealand. The realisation of prenail timber frames, trusses and components greatly reduced time on site, meaning exposure to bad weather delays also reduced. The development of prefabricated modular/panellised homes are on the rise in New Zealand. It minimises labour on-site to just assembly and fixing of the modules. The time cannot be compared to previous processes as the estimated time before the owners can move in is three weeks after installation of the modules. The more technology available to the industry, combined with skill and materials, allows for faster turnaround, higher profits and satisfied clients.

While various prefabricated techniques have been adopted in New Zealand, it has previously caused a disconnect in the process between designers and construction. Architects are no longer as hands-on as they once were. Architects are reliant on good relationship building with their clients, but due to the disconnection at the construction phase relationships between contractors and architects have deteriorated. Face to face communication is commonly substituted to an email or text message to reduce time, but more often than not these forms of communication can be interpreted incorrectly, resulting in more time needed to resolve the initial issue. In architecture it is crucial to build and form lasting relationships with your peers and counterparts to ensure smooth practise and execution between each member involved with projects from start to finish. The foundation of social design comes back to communication and relationships; being able to be open and honest when pitching ideas or confronting issues. Being conscious and mindful of each other’s role played in the process can hone in to the client’s or industry’s wants better than the individual.

2.3 INTRODUCTION TO ARCHITECTURE & SOFTWARE

The representation of architecture has also undergone huge changes from the original two dimensional drawings on screeds of paper to a three dimensional space. Getting to the digital realm has taken hundreds of years, but one of the first to use perspective law in communication architectural drawings was Leon Battista Alberti, 1435. Alberti created his laws from authority and credibility through geometric order and principals. Beyond widespread use of perspective in art, perspective had also become a science where the rules were related to the optics. The quest for realism through virtual representation is the idea of the perspective window, which is highly used in today’s offices. Commonly known as renders, these images show a snapshot of what could be realised. Creating an environment that employs the perspective principles while adding materiality and human factor for clients or industry partners gains a better understanding of the proposed design. One of the best examples of the window perspective is Raphael’s School of Athens. Although centuries old, it displays the first use of one-point perspective and uses techniques such as foreshortening. Understanding perspective and depth to communicate a design to clients through images, provides a realistic view of what is proposed, or type of environment created by certain design decisions.

The creation of an architectural space is enriched by the electronic revolution in architecture. The way in which we now convey designs has transformed to the point where images now can be mistaken for photographs; the skills of the designer are that finely tuned that it has now become a benchmark for job applications. Drafting and realisation tools are now fully integrated within design software. Computer Aided Design (CAD) has transformed the architecture office from drawing boards, set rulers and pencils to a mistakenly common looking office with only computers; a once recognisable office has undergone a transformation. As technology in the office changes, so too does our mental capability. Resilience is tested due to the constant up-skilling or retraining on the job, and failure to keep up can easily result in a down turn for the company.

Before the rise of the computer generation, the architect would complete the design, construction and build portion as mentioned earlier; fulfilling the role of master builder. However many factors such as the scale of projects, economic and social impacts, complexity and functional demands which must adhere to the building regulations have seen the architect

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reduced to merely a shaper or form giver.\textsuperscript{31} Clinging to the design factor as the main importance of the building has seen a huge disconnect between design and construction. Rapid advancements in automated machinery has allowed designers to undergo quick concept iterations to master more complex designs. The danger of liability lawsuits are more common, which is creating a slight standstill in moving forward; using these methods in a way that can create innovative designs.

Computers to an extent allow the designer to test ideas, but can fall short when trying to best communicate new ideas or new ways of thinking, to the engineer or contractor. More common than not, a design on paper could be innovative and forward-thinking but a lack of software knowledge or no built precedent can present barriers for it to be accepted and built. As a result, this design would likely be reduced to a standardised concept. Many designers are compromised by the lack of skill, exposure and understanding to what the software can do for them. Designers have no shortage of imagination, but lack the follow-through of realising and producing the imaginative and innovative idea. These short-falls lead to a design that design becomes a product dictated by the computer.\textsuperscript{32}

The architecture field does celebrate success over social media, which itself can sell desired lifestyles whilst distorting the truth. This can cause both good and bad perceptions. In a positive light, it promotes the cutting-edge design of what the field can produce, but out of context it could paint the picture of an attainable/affordable design that in reality its purely conceptual. The crafts of architectural rendering and photography have morphed together to create a convincing digital construction.

“Our eyes are trained to believe that a photograph is a true representation of an existing condition. Thus in the digital age the graphic representation of architecture has moved beyond an exercise in persuasion; it has become an exercise in deception.”\textsuperscript{33}

-Belmont Freeman

New house and land packages commonly advertised in New Zealand as the “family home” are just like the catalogue homes in the 50’s; minimal originality for a large price tag. When clients pitch ideas they have seen advertised on social media or magazines it quickly increases the cost and becomes unattainable, leading to a disappointed client. Minimal identity

and originality are sacrificed for the lure of a new home and the “life style” that is portrayed with the brochures. To achieve new on-trend designs it would require a lot of willingness and patience from all parties to iron out all the complex details. Factors that can affect a cutting edge design can be:

- Research which can increase timelines
- Builders not having the immediate knowledge to implement complex design details into standard procedures and processes
- Price tag that is commonly prohibitive, meaning that designs never move beyond the planning table

The integration of originality is mainly achievable with a high price tag and unfortunately, many clients choose the lack of individuality to save money. Most driven designers will show a willingness to grasp what’s new and make the “new” become the “norm” by continuously up-skilling, however there is a faction unwilling to accept where the industry is going.

Digital software can produce near photo realistic images to sell ideas to customers and gain public approval. \(^{34}\)Adaptable lenses, lighting, angles and dressing can quickly make the undesirable, appealing and angled to the target market. Tainted by this, architects and designers can quickly find that the breakdown in credibility and trust between members in the industry can take its toll and affect future project outcomes.

The relationships between designer, engineer and contractor had become disconnected over the years, but technology and software advancements are allowing the reconstruction of these relationships. The introduction of cloud sharing communication allows the process to be more streamlined between the designer and engineer, resulting in easier issue refinements to be carried out in a fast and efficient manner. The relationship between the contractor and designer should be an open and honest one. Poor communication can lead to a disruption in the progress of the build and increase cost. Usually the architect is the main point of contact for the clients, but over the years clients have become savvy and employ a draftsman to draw up their desired plans then go straight to the contractor, resulting in the loss of “design build process” for the architect. \(^{35}\) A lot of the time it comes down to cost for the clients, with the building industry currently flooded with inferior quality materials and fixings. These are being selected due to the price, resulting in a build quality that is compromised and a final result that could look and act completely out of character from the intended healthy, quality built home intended.

For an architect to be hands-on during the whole process, they

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usually take a project manager role to oversee that the construction is to
the brief, and the clients are getting good quality in return. Forming good
relationships with all members of the team is essential to a smooth build.
Designers are given the opportunity to bring someone’s dream into reality,
but its really a collaboration of members. Software allows users to make
changes and designs with the clients in real time, allowing the relationship
to grow between designer and client and really hone in on the clients wants.

2.4 Custom vs Standardised

Bespoke architecture is a custom one-off design for a particular user or client.
Although a lot of the details, materials and construction techniques are
majoritivley standardised, the term bespoke has morphed from completely
original to a made-to-measure approach. Bespoke architecture has a longer
production time than a standardised method of construction as it requires
more specialised professionals, but the final outcome is expressive of the
clients themselves or used as a creative output for the designer.
The cost vs time vs quality equation (figure 1) is a tool used when discussing
the design with clients. A higher quality build will incur a higher cost, while
a client with a longer timeline can allow for a more detailed design. Every
client should be able to request some form of originality or customised
design to suit their lifestyle but in an architectural sense, each building
is unique to their location, the time they were designed and built, who
they were designed and built by and the circumstances that surround their
occupation and use.
Bespoke has a close relationship to craft, ornamentation and
materiality, that usually have techniques and methods which lean towards
hand craft and can be closely linked to cultural expression through design.
New Zealand has fallen into standardised designs disguised with cosmetic
facades. At the rate New Zealand is advancing and growing, a cities fabric
is changing and widening the sprawl, the architecture is changing but at a
cost to the liveability. Although standardisation has its merits with lower
cost and quality-controlled products, it comes at a cost to the language with
which we are creating in the fabric; a loss of culture or identity as we form
into the style of universalization.
The array of tools architects and designers here in New Zealand is larger
than expected, and allow for more complex, non-standard and adaptive
designs to emerge. Modular design is a method that allows for more

37. Sheil, p9
complex designs that have independent parts with a standardised interface. This design method can have parts that adapt as the user wants, upgraded or repaired. Modular design allows for a more “do it yourself” approach as the components create a modular volumetric form that are easily fixed to one another. The availability of these sorts of designs in the New Zealand market are limited due to strict legislation, but more open source designs are emerging. One example of this is Wikihouse, which is specialises in open source housing designs that are based upon modular principles. Their statement of being “one size doesn’t fit all” allows for every design to be instantly customised to the user, site and code while keeping control of the cost. Being an open source design model, it allows for local fabrication of components, utilising local materials. The Wikihouse model does require components to be cut on a CNC, but with the increasing number of these machines around New Zealand this doesn’t pose a problem; only the local council consent and approval to go ahead would create a barrier to the building stage.

The following diagrams are what can be used to establish certain outcomes. This diagram is used to help clients understand the implications of their requests. eg: if they request a certain quality and dictate a certain time frame this could incur higher fees. It will be employed at the final design between clients and the designer to gain the clients understanding of if they request a certain level of originality it may come with a longer time frame to build or a higher cost.

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2.5 Precedent Studies

The Precedent studies were carefully narrowed down to provide good foundations that could help answer design questions when they came up. By providing a good reference point, it reduces the chances of going too far from the design ideas. During design-build projects it is very easy to move off track if the influences are so rich when researching component based structures, timber based designs and natural based forms. All of this, combined with the ability of prefabrication CAD/CAM technology, leaves the design options endless. Having good precedents definitely keeps the design on track and within the client's brief.

The first precedent study looked into finding a design that promoted a good 360 degree view, natural looking curves that were irregular = fluid aesthetic, and the design would have to overcome the use of linear timber to create said curves. Within all of that; the idea of being able to create an indoor installation that requires no alternative screws or glue for fastening it together was why a small part of another design was added.

The second precedent was a result of analysing a natural form that was not produced by any CAD/CAM based technology, and not directly seen as architecture but could greatly influence by design analysis. The third is one of the most important designs, as it holds such a strong precedent within the final design that it becomes a point of reference when making design decisions. By being able to recreate such an elegant complex form, it offers a much better understanding about how to improve on it in order to fit the final design brief and become more efficient and effective at the fabrication phase. Again it is a design-build prototype but because of the successful analysis through model-making it was able to provide far more information than expected.

The fourth precedent was a collective look at a rich cultural influence here in New Zealand. It must be relateable for the site and embody the heritage of the area. Due to the build-ability, it must also pay respect to the culture, but still be an abstract approach that can allow a designer to produce the product using modern construction techniques. Overall, each design needed to be produced from start to finish following the hybrid design process (discussed in method) and will create an example that designers can in-fact regain their hands-on approach to design by creating a model and producing it themselves, diminishing the previously mentioned disconnect.
The sequential wall was the use of linear timber pieces stacked in a sequence that produced natural curves. This wall was built in Zurich by Silvan Oesterle, who utilised a 6-axis CNC to construct the wall. Due to the required skill level and access to machinery, such as a 6-axis CNC, the design was analysed so that the building methods would be adapted to fit the file-to-factory process, utilising tools available in the Unitec workshop. The below images are analyses of the curves and stacking method to re-create the design using Rhino software. Stacking to achieve the curve worked best at a 10 degree increment of change per timber element. Once established, the design could be tweaked to create the natural curves to the desired look. Another benefit to this design was that no matter where the user stood, it looked aesthetically balanced the whole way around.
While the sequential wall used no other joining methods than stacking timber elements onto one another, the interactive wall required by the client, Carter Holt Harvey, needed to meet certain health and safety regulations while at an exhibition. A secondary precedent was necessary, extracting a possible joint that could be reproduced to fit within the design that required no additional screws or glue, but met the safety requirements. Designer Kengo Kuma reproduced the jointing method from a simple child’s toy and turned it into architecture that did not require screws or glue. Something so simple could be re-engineered to suit the clients need. If the Chidori joint could be embedded into the design, it would but if not, then the method of re-engineering a traditional idea would be utilised for digital fabrication. The Prostho Museum is the product of the chidori joint repeated over and over again, showcasing the structure as the architecture. The design is experienced around the museum’s entire exterior, while also continued throughout the interior.

Figure 7: Prostho Museum

Figure 6: Chidori Joint
When looking for inspiration from a source that architecture revolves around – people – we find that analysis from the curves of a woman’s body can be projected into the design as a whole.

Analysis of multiple silhouettes gives endless forms that can be overlayed to create a desired natural form. Usually architecture is formed around creating a space for people to inhabit that is rich in atmosphere, but by using the human body as a model and extracting forms from a mapping style of analysis, we can create narratives and back stories to enrich a design.

This precedent provides an abstract approach to an architectural problem, informing it with a meaningful backstory. The images on the following page show a very fast process of taking the main silhouette and adapting to a component that could be produced with a CNC.
Drawing out abstract forms provides a freeing feeling in comparison to being on the computer for so long. Computers as mentioned earlier can restrict designers and dictate forms, especially when dealing with curved forms that need to be produced with linear timber pieces. Adaptive thinking along with fabrication knowledge can provide a solution to meet the desired outcome instead of reducing the design to common forms.
The dragon skin is a component-based design where replicating the component automatically creates a form. Usually there is minimal variation in components to reduce complexity, but the dragon skin has custom components as seen in figure 14. Each component is cut identically, but then undergoes a specific steam-bent form to retain the overall cave like form.

Each piece has been modelled with digital software, fabricated with a mixture of digital and analogue methods. This precedent is the most important, as it grounds the final design project and makes a point of reference for whenever the project strays off target. The textured aesthetic and repeated component are the main design drivers but the process of individually fabricating components will need to be adapted due to the workshop tools available. The dragon skin is an example of a complex prototype fabricated by designers from start to finish.
The dragon skin project was identified due to its prefabrication and assembly similarities. The aesthetics were established as a point of interest due to the use of materials being presented in an uncharacteristic manner. The idea of being able to create a three dimensional textured look to evoke the touch and feel senses were key, but learnings from the analysis brought to light the complex and interesting geometries that were deemed out of scope for the project due to the technologies used. The hand made reproduced model (figure 13) was to understand further the implications to the complexities and how moving forward they could be simplified to be within the scope and skill level of the designer.
The different methods of weaving to create different patterns has a detailed texture that can be reproduced in architecture at an increased scale. The reproduction of culture is an area that should be handled with sensitivity – in this instance, working closely with local Iwi to avoid disrespect or cultural inaccuracies.

The Unitec Wharenui (meetinghouse) is rich with traditional methods, style and aesthetic. At every inch it boasts a form of inspiration. The composition and form of the Wharenui is the main design driver as requested by the clients.
The loss in national identity through architecture is causing the western world to become more and more alike due to the readily available materials shipped around the world. With the resurgence of timber in New Zealand there is a potential to credit the history and culture of New Zealand through architecture, using the technology at hand by subtly and respectfully bringing in precedents like the Kowhaiwhai patterns that have a strong and powerful meaning. As architecture demands a designer to have reasons behind their design decisions, using both material and aesthetics that is already in New Zealand can make a designer's decision easier, as long as they are respectful in the approach taken.

Kowhaiwhai meanings:
Mangopare from Aotearoa - strength and power
Koiri from the Tai Rawhiti - to flourish
3.0 Design Method
3.0 Design Method

Introduction

This Chapter is split up into four sections, the first is the research question, the second is the aims and objectives for the design build, while the third section will discuss the method in how the design build will be approached. It will also discuss the types of processes and how they can be adapted to suit more complex design builds. The third section will also discuss the importance of prototyping, which is a part of the design build process. In the fourth section will be a time line showing the major milestones throughout the duration of this document.

3.1 Research Question

“How can architects collectively approach the design and construction processes to produce bespoke architectural products successfully”

3.2 Aims & Objectives

The objective is to create 1:1 scale design-build projects that promote the integration of digitally fabricated methods within a team environment. Showcasing full process-thinking from concept through to construction incorporating all members input. Industry professionals and suppliers will be working in conjunction with students for both projects, but most design decisions will be driven by clients. Both projects will utilise timber as the main material under exploration due to its malleability. A lot of investigation into the current methods used in construction will be analysed through a series of iterative prototypes that can be successfully re-engineered and used for digitally fabricated products.

AIMS:
• To create a working design process between industry and a digitally fabricated design process run by the designer
• Create a bespoke design that compliments both traditional construction techniques and digital fabrication methods.

OBJECTIVES:
• Devise a design that meets client’s expectations as well as incorporating other team members input.
• Working within industry standards to ensure completion of the design-build projects.
• Analysing the current processes and the roles within them to establish a new hybrid process that incorporates all parties from start to finish.
3.3 Method

The method will be discussing three ways of producing architectural products: Traditional, Design-build and file-to-factory. The method will be explaining the traditional process of design delivery, as this offers an understanding of how the industry professionals taking part in the CUE Haven project are accustomed to certain procedures. Although it will not be used to produce designs. This is necessary as the designer will be following a hybrid form of the file-to-factory process that is actually embedded within the design-build process. For this document, the aim is to analyse and adapt the process in order for the designer to also fabricate and construct a large portion of the project under the supervision of contractor who will be running the site works.

Structured timetables have been devised with achievable milestones to ensure each stage of the design process is met. As the final CUE Haven project is focusing on a collaborative approach with multiple industry professionals, the engineer and contractor will be far more involved at a much earlier stage in the process - so good communication around scope of works, roles and responsibilities will be monitored to ensure the design meets those milestones. (please see appendix 3-6)

The method will also include a section discussing the importance of prototyping has for when new designers who are unfamiliar with design build projects utilising CAD/CAM technology, and how prototyping fits within the methods chosen to produce the architectural product.

3.3.1 Design Delivery Process Comparison

The engineer and contractor working on CUE Haven are both used to following the traditional design-delivery process method in figure 20. The benefits to using the design-build model mean a closer working relationship between designer and contractor as they both work as one entity. As previously stated, a design-build process would see the architect responsible for overseeing the project, while a traditional process would put that responsibility with the contractor.42

In the instance of the CUE Haven model, a hybrid process will be implemented, using a blend of design-build and file-to-factory processes. As such, the responsibility will be a collaboration between architect and contractor; with each having a large contributing role from the early concept stages of design.

While either process would offer a single point of contact for the client – making meetings and decision-making easier for the whole team, this hybrid process will mean that changes can be addressed by the entire team, reducing miscommunication.43

42. Andrew Thomas, Design-Build, Architecture in Practice (Chichester, West Sussex ; Hoboken, NJ: Wiley-Academy, 2006), p9
43. Thomas, Design-Build, p36
Figure 20: Process comparison
3.3.2 File to Factory Process

Architects and designers utilising fabrication tools and software for their own design-build projects are entering an area of uncertainty, as the majority of architects have lost the ability to fully understand construction techniques. Meanwhile, the movement of architects back to the role of overseeing construction is sure to ruffle some feathers. While architects have the software, skill, and tools to fabricate their designs, these are assets to which very few contractors have access.

As such, when presented with plans that have prefabricated design portions and elements, it can disrupt the flow of the build. The working relationship between both roles can also be disrupted, as each brings a conflicting philosophy and process to the project. Architects and designers are following a file-to-factory process where the design and fabrication merge together. This is achieved by making allowances for one another and directly transferring the data from 3D modelling software to digital tools such as a CNC (Computer numeric control). Once the design has been modelled, there is an opportunity to select portions of the design that are important to clarify. These details would then be prototyped to ensure the design would work before committing time and materials to a potentially unsuccessful final product. Prototyping follows the same file-to-factory process, just at a smaller scale or selected portion. The basic process is as follows:

1. 3D modelling broken down into 2D components
2. 2D components assembled for the material size
3. Programming the files for the CNC
4. Setting up the CNC with the material and correct drill bit
5. Entering the programmed file and starting the cut.
6. Constructing and fixing the design together.

Step 1: Break down the design into 2D files that fit within the measurements of the CNC bed size and the selected material. This step can become complex and will test the resilience of the design. Experience with using the file-to-factory process allows the user to design knowing the intent is to be broken down and cut in 2D. As such, strategies around jointing methods, fixings and structural integrity can speed up the process, as the design usually has to be re-developed to allow for the limitations of CNC or material size. Limitations include: CNC being only a 3-axis so it only moves in the direction of X,Y,Z. Anything over 2.4m long won’t fit on the bed of

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the CNC. To reduce wastage with the material, layout and organisation of the components are crucial.

Step 2: The organisation of components can actually reduce the total time of construction and assembly, as you create an assembly line of tasks and spread it amongst the team. One person can program the files, another can load and start the cuts, while another person can remove components and start constructing the design. If components on the cut file are parts from different areas of the design, then the construction cannot begin until all necessary pieces have been cut. As such, organising files in a manner that allows for simultaneous cutting and construction will result in pique efficiency.

Step 3: Setting up the CNC correctly is crucial to reducing wasted material. If the CNC is set up incorrectly, cuts can come through unclean and require sanding or chiselling. Worse yet, if not configured correctly, cuts could come out wrong, wasting entire sheets of material.

Step 4: This step is as simple as loading the file, simulating the file to check the cut is correct, then starting the cut. The machine should be supervised at all time when in operation. Step 4 can be time consuming or quick depending on the organisation and thoroughness of steps 2 and 3, respectively.

Step 5: Removing the components now cut, these should be removed easily with the use of a mallet and chisel. The accuracy of step 3 will ensure a clean cut, although if aspects have been overlooked then this will require manual labour to sand back the imperfections, adding more work and pressure to the time frame.

Step 6: Assembly and fixing the components together to create modules that, when combined, will create the overall design. This step can go one of two ways; pieces slot and fix together with accurate tolerances that require minimal adjustments, or full recuts will have to be produced because steps 1-3 were overlooked and rushed. Inaccuracies can also occur if the 1:1 detail prototyping earlier in the programme was overlooked and not thoroughly worked out.

New Zealand’s current fabrication technology ranges in a selection of CNC routers, laser cutters, and 3D printers. These tools are utilised for both designers and industry manufacturers. The country has seen a large uptake in timber construction, with the Ministry for Primary Industries
partnering with Red Stag Investments, promising to invest 5 million dollars over a 4 year period (2018-2022) to boost New Zealand’s engineered timber construction. This will result in a boost of large scale CNC routers housed in factories around New Zealand. Designers are now challenged by these tools and the role they play when compared to the traditional design process. Digital tools are now providing so many options to the industry that a designer’s choice that it comes down to the aesthetics. CAD/CAM technologies free architecture from repetitive forms that were derived from the standard manufacturing process and products. Architecture is aesthetically and socially constrained, although CAD/CAM allows freedom, it can create implications from the design which will be discussed in both projects 1 and 2.

The hybrid file-to-factory approach employs both digital and analogue construction techniques. Due to some of the CNC’s limitations, manual forms of cutting can prove faster and more efficient than digital means. Below is a diagram showing the process of delivery:

Figure 21: File to Factory Process

3.3.3 Prototyping

This section has been reproduced from a paper presented in the fifty second Architectural Sciences Association conference, 28-3 of December 2018, produced with the author, and her supervisors Yusef Patel and Peter McPherson.

“Prototyping with digital technology can allow complex digital forms to be easily produced in a digital environment, however to realise them in the physical world may seem overwhelming when the incorrect approach informs production. If you can test the design before committing it to the contractual process, you can afford to be more ambitious - although you must be confident, since there is rarely enough time for major changes to be implemented. There is still room for conventional construction methods, even though they cannot produce the same levels of accuracy as a digitally-produced product. However, when an appropriate work flow is applied, the blending of analogue and digital fabrication processes is not as complicated as many are led to believe.

Modelling conceptual ideas in a 3D digital space provides an environment for information to be readily available to designers and fabricators. A great benefit of architectural software is the ability to create successive design iterations efficiently. Embedded data can be utilised to generate scaled prototyping, visualisations and quantity-surveying information. The obvious advantages of working within a digital environment over an analogue process is the way information can be manipulated, transferred and replicated with ease. For example, if an architect needed to change a hand-drawn design, it would entail a laborious process of redrawing. Again, if a physical conceptual model was required to be made by hand for spatial validation, the designer would have to physically measure, draw, hand cut, check and assemble it, rather than simply extracting data from a virtual model and printing it via laser cutter or 3D printer.

The iterative prototyping process included in the file-to-factory process allows for more creative outcomes to be refined at the 1:10 scale model size allowing the designer to iron out incomplete or unsatisfactory structures before committing time to programming and cutting material. Additional time spent in the iterative prototyping process has been reproduced from a paper presented in the fifty second Architectural Sciences Association conference, 28-3 of December 2018, produced with the author, her supervisors Yusef Patel and Peter McPherson.

phase allows for quicker decision making and shorter time frames. The process also allows for more engagement, which fosters collaboration between students and industry, while working together can achieve a product that meets each party’s needs.

“With advances in digital fabrication, many believe tolerance can be reduced to zero. Pinpoint precision may be attainable for particular production circumstances, but thought must be spared for material physics and environmental conditions when constructing architecture. Tolerance needs to be integrated into the design process to realise a successful project. This requires 3D virtual models to be vetted through prototyping to ensure they are constantly updated with relevant construction tolerances and to make sure imperfections are ironed out.

If the gap between physical and digital continues to increase, it will require the architect or designer to increase collaborations to acquire the skill, imagination and expertise of the craftspersons. It is likely that prototyping equipment and CNC produced mock-ups will become a regular exercise to produce important details, as architects become more accustomed to working with CAD/CAM or file-to-factory workflows. This process is forcing architects, engineers and builders to “throw away the rule book”, and rethink how they approach the workflow and presentation of data and the sharing of ideas.

3.4 Timeline

- **DEC 2017**: Carter Holt Harvey Installation start
- **JAN 2018**: Carter Holt Harvey prototype
- **FEB**: Carter Holt Harvey Start of fabrication
- **MAR**: Carter Holt Harvey Installation Finished @CoLab 2018
- **APR**: Meeting the clients of CUE Haven
- **MAY**: CUE Haven concept development
  - **IVL Experimentation Concepts**
  - **IVL project fabricated = 650 items**
  - **Component Concepts**
CUE Haven concept development

Component Development

CUE Haven Design Hand over to the Engineer.

Component Prototyping V1

CUE Haven decision to start full redesign

Component Prototyping V2

CUE Haven Concepts V2
CUE Haven Design Development V2

CUE Haven Refined Design V2

CUE Haven Design Finalised and handed over to engineer
4.0 MATERIAL EXPERIMENTATION: Industry Based Clients
This section will explore the opportunities timber provides for design build projects that employ a collaborative approach to design in conjunction with CAD/CAM technologies through digital design, simulation and fabrication from a vantage point of automation.

4.1 Material: Timber

Wood has always played a vital role in architecture as it is easily shapeable yet long lasting, it’s easily sourced in New Zealand, and a renewable and sustainable material. It holds cultural importance for both Pacific Island and Maori cultures.

New Zealanders have always had a love and connection to the outdoors, so it’s only natural that the country’s houses would reflect this devotion with the aesthetic finish of a natural material like timber. However the change from analogue to digital processes within wood architecture led to a loss in knowledge that wasn’t transferable and had to be re-engineered into new processes and workflows. This had a knock-on effect with the decline of timber production advancements. The surge of radiata pine forests were the solution for many farming communities, as they could make use of the unfarmable pastures, leading to long-term investments which promised carbon credits and large pay-outs for minimal labour. This then thrust the timber industry back into full swing all around New Zealand, resulting in many forms of engineered wood products.

Engineered wood products (EWP) include but are not limited to: LVL Laminated Veneer Lumber and PLYwood.

The EWP mentioned above both allow for easier foundation work and preparation, rapid construction, smaller work crews, faster erection and improved thermal mass and insulation.

A large resurgence in structural timber has flooded the New Zealand market, proven to be much more sustainable than its counterparts, it has had a large uptake here in New Zealand and is well received for structure and aesthetics all round. As architecture has evolved, so has the perception of what it should and shouldn’t look like, opinion is voiced freely, and expectations have become higher.

New Zealand has a wide variety of technology at hand, already working within the industry to produce homes or materials. Engineered timber and wood products are a hot topic in the market and highly desirable.

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due to the sustainable nature. Prefabricated techniques with timber, steel and concrete have picked up in New Zealand as the growth continues. Engineered timber is seen as more favourable due to its more forgiving and honest properties with a rich heritage for many cultures. The industry has also seen a large resurgence of timber based structural elements due to the aesthetic application of timber as an expression.

New Zealand promotes a clean green image, which is why the resurgence in timber design is encouraged here as it’s a sustainable, environmentally friendly material. With the abundance of digital tools, innovative thinkers and reasonably priced materials. New Zealand has started to form a style within architecture that is forming a national identity. The Venice biennale in 2014 prompted the industry to reflect on New Zealand’s national identity and ask the hard questions of: what’s special about our architecture? Are we different? Does our architecture have its own identity? David Mitchell explained it in his thesis

“The Pacific has a great architectural tradition, although hardly anyone honours it. That might be because it is not like European architecture, which is solid and massive and looks permanent. Pacific buildings are timber structures of posts and beams and infill panels and big roofs. It’s a lightweight architecture that’s comparatively transient.”

Although early settlers are responsible for a lot of New Zealand’s suburban context, it is directly relatable to most Kiwis growing up as “the house on a quarter acre dream.” It appears New Zealand’s national identity is a fusion or crossover style of architecture and that the county needs more architects like John Scott. The fusion would have an aesthetic that is sympathetic to timber construction with timber detailing and aesthetic ornamentation that responds to both digital and traditional methods of construction.

4.2 **Carter Holt Harvey Stand**

To begin, learning how timber responds to digital fabrication technology is best done with a hands on approach, so CNC experimentation will be explored. The industry client, Carter Holt Harvey (CHH) is a promoter of teaching and education so whilst they had an end product, this was a joint effort to learn how to operate a CNC machine in conjunction with the hand-making process. To follow the CHH stand completion was a scaled up application to understand how modular prefabrication design principle can be applied to the hybrid design process system, and is respectively the final design which incorporates the various skills and knowledge learned.

The Carter Holt Harvey team were looking to put together a unique exhibition stand for the upcoming year’s worth of trade shows. After building a relationship between institution and industry, the opportunity was formed and presented as a summer school paper for second year Bachelor of Architecture students led by a master’s student and overseen by a lecturer. The brief was worked up in the Spring, before the paper was started in early December. Both Unitec and Carter Holt Harvey representatives discussed the project and worked out the best way to achieve the exhibition stand within the predefined deadline. CoLab 2018 was the first event the stand was booked for, so the paper was structured around finishing the design by March 7, 2018.

4.2.1 **Brief:**

Once the brief was formed it was easier to produce manageable stepping stones for the students, as they had never been exposed to this type of programming, methods or fabrication. Please refer to appendix 1 and 2 for the negotiated brief, learning outcomes and aims. The fast-paced class was targeted at exploring timber-based jointing methods that each student formulated from more traditional methods, modelled digitally and reproduced to fit with their individual narratives. Once a base understanding of the file-to-factory process was established at a small scale of 1:5, the students moved on to creating the stand following the same process outlined below at full scale.
Figure 22: Students presenting scale models to a lecturer
Figure 23-24: Scale models of furniture and joints

Figure 25: Students presenting developed design to the clients
4.2.2 Software & Prototyping

This section has been reproduced from a paper presented in the fifty second Architectural Sciences Association conference, 28-3 of December 2018, produced with the author, and her supervisors Yusef Patel and Peter Mcpherson.

“Prototyping has an important part to play in the success of a design. For this design it came in two phases at suitable scales as outlined in the “file-to-factory” diagram on page 34. The first phase was about creating cardboard concept models at 1:5 and 1:10 scale with laser cutters, while the second, was about full-scale prototyping in the workshop. Within the first phase, digital technology became a useful tool for the students to rapidly prototype ideas, allowing them to engage with lecturers, guest industry designers, technicians and the clients to critique and interrogate the design. In total, the six students produced between five to ten iterative concepts each. The strongest design elements that were present were noted, combined, and developed further as a collective for one singular design.

“In the second phase of the process the students were introduced to the CNC and began producing full scale mockup prototypes with various types of plywood. Students quickly realised the importance of design-to-material behaviour. This required the student to predict and account for factors such as tolerance and finish in order to avoid extra time amending components to fit within an assemblage. The timeline allowed for full scale prototyping so the students could redesign their concepts and fabrication approach so they would better cope with the realities presented to them. This process is best seen through the fabrication of the Plinth (Figure 3) that was produced at full scale. The design was based on laminating layers of plywood to create a form that resembled a tree trunk. Although it hollowed out, weight issues were quickly raised upon completion.

Industry feedback: Critiques with industry professionals were held at the end of each week to ensure momentum during the summer break was constant. Students were encouraged to present the most successful scaled concept models and mock-ups, and became a valuable medium for both parties to create critical and valuable discourse. Although there were constant updates provided to CHH via email for critical feedback, there were three major presentations the students gave to the client. Again, scaled models and mockups became a key tool for presentation, as it allowed the students and CHH representatives to constructively work through issues such as scale, materiality and visual weight. It also served to be an avenue to explain the implications of why some designs were more successful than other concepts requested by the client. Outside the teaching realm the students were receiving feedback that boosted moral and drive. Input and support provided throughout the design process from industry created excitement for both parties and as a result, strengthened relationships that fostered innovation and creativity.”

Figure 26: Students presenting developed design to the clients

Figure 27: Prototype 1 of the plinth

Figure 28: Prototype 2 of a wall module
4.2.3 Design Development

The team had come to a point where they were no longer progressing; even when roles were rearranged, the team was going in circles. As the supervising Master’s student, the decision was made that instead of coaching the design along, I would take a more hands-on approach with the design in order to develop it further with the team.

Precedent studies were used that best reflected the language, aesthetic and structure already established by the team. Working with timber is perceived as a linear/square regulated material. Like Frank Lloyd Wright’s perspective, respecting the materials properties and only asking of it what is possible. Form and function thus become one, in design and execution if the nature of the materials and method and purpose are all in unison. The design was to showcase a fluid, more natural form. Each element needed to complement the next, as the design components were very disconnected.

The following images are snapshots of the design being worked through with more direct input from the master’s student using precedent studies elements.

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This is the design that the students could not develop further. The comments from meetings were:

- Keep the plinths
- Add more storage
- Too heavy
- Unbalanced aesthetic

This form was derived from the outline of a woman’s body, the aim was to use natural curves and mimic them into the design. This design was too complex and would require a lot of material and multiple forms of fixings, also the issue of weight was a factor in this design as we knew from the prototype that the 19mm ply becomes very heavy, very fast.
4.2.5 Second Iteration

The design had to be modular to allow easy assembly, disassembly, travel and reduced weight. To do this, methods were translated from the Sequential wall precedent. The design employed a horizontal division of form, but as the plinths were already stacked horizontal, the vertical division worked better to reduce the material consumption. Upon remodelling the sequential wall, it was discovered that multiple sine waves alternating over one another were responsible for the design’s form. Replicating these sine waves using Rhino software and the lofting tool and this was the result. (see following figures page 53-54) A much easier form to control and adapt until it worked in harmony with the plinths.

Figure 31: Design influenced by the abstract woman's body
Plinths - No change

Sine Waves

Sine Waves - Lofted together like the sequential wall precedent

Multiple sine waves lofted to create the wall

Trying to divide into modular components - following sequential wall methods.

Figure 32: Development process of design
Dividing Vertically

Creating linear components suitable for cutting out of timber sheets

Trying to subtract from the design to allow for storage and shelves

Additive method to allow shelves and draws

Smaller scale version added for larger exhibitions so more product can be displayed
4.2.6 Approved Design

This was the proposed design that got final approval and go ahead to start cutting and assembling. Due to the size of the CNC, material sheet sizes and the proposed design, they didn’t align with one another. The ply sheet fit onto the CNC bed fine, but the length and bespoke vertical components would take up 3x the amount of material due to the odd shapes once laid on the ply sheet, there was too much wasted material so the decision was made to use lap joints and have two components glued together to make one of the vertical components. Although file management, cutting and assembly design was increased, the amount of wasted material was decreased 40%
Unseen implications in design-builds, in general, are always popping up, meaning that file management has a large role to play in the process. While these are seen by many as mundane and repetitive problems that arise, they usually stem back to the file management and programming for the cuts. For example one reoccurring issue through the project was the understanding and implementing of tolerance within the design. Without adding tolerance, the assembly would require sanding and chiseling to get it to fit properly. Before programming the file, the addition of 1-2mm into each joint would result in an easier assembly.

The time taken to make the first plinth was too long, so it had to be reduced. Meanwhile, the number of components was over three hundred per plinth, with two plinths needing to be made. It was decided to increase the ply from 7mm to 12mm sheets, with the same method applied. Each component was split in two so it maximised material when laid on the sheets. Dowels were inserted into the design at certain points to make sure that the layers aligned and didn’t create any discrepancies in the form. Labeling was key to ensure each piece was glued into the right place during assembly.

Design-build projects teach students how to program cut files for the CNC on rhinoCAM; this allows users to check the file and simulate a cut before running the machine.
4.2.8 Fabrication

Once the issue of tolerance was resolved and each joint had its appropriate tolerance added, the assembly of the modules and construction of the full design was simple. Small changes were made, like the permanent horizontal members for the shelves (refer to figure 33) which were fixed permanently to reduce set up time at the exhibitions, while also helping the rigidity of the design for transportation.

Figure 35: Plinth Module
Figure 36: Wall Module
Figure 37: CNC ply sheet with cuts
This is the final set of modules that made up the design, as the deadline came up fast and rectifying the tolerance issues lead to a lot of sanding. As such, so the smaller leaning wall as pictured in previous images was not completed and would not of fitted into the van. The design was successful in the simplicity of construction, as the first assembly at CoLab 2018 in Auckland took 30 min from unload to full setup, and by the final set up it could be done by only Carter Holt Harvey staff in under 10 minutes with two people. The design also allowed for different site sizes that would vary from 6m2 to 12m2.

Figure 38: First installation at CoLab 2018

Figure 39: Second Installation at Design Experience.
Due to the amount of times the structure was assembled as well as transported up and down the country, the design began to degrade and the joints began to fail. The lap joints began to snap as they needed to be larger with more overlap, mainly in the large corner module. It required to have two new components cut and replaced. One of the combs that locked the shelves had gone missing, while a lot of foot and head joints had come loose, so the decision was made to put screws into both the feet and head joints. These were out of site, and were necessary due to the design needing to be assembled at four more events, including another one in Wellington. For these reasons, we sacrificed the design rule from the brief that states there would be no other fixings.

The design stood the test of time and fit the brief, although packing into the van wasn’t ideal, as it was like a game of tetris each time. This was a minor setback however, it was well received every time it was built, resulting in people interacting with both the product and the design, which set it apart from the rest of the installations at each event.

4.2.9 Refinements & Reflections
Hybrid Design Process

Clients → Design Team → Fabrication → Final Outcome →

Developed
Brief → Concept

Development → Prototyping

Remodelling ← Refining

File to Factory Process
Any decisions needing attention was discussed between the 2 parties only. Consensus is effective and efficient.
Carter Holt Harvey was wanting to promote its product laminated veneer lumber (LVL) within the New Zealand market. LVL can be engineered to specific strengths and lengths from their plant in the North Island of the country, so this was to be an experimentation focused on how far the material could be pushed in regards to tooling without compromising design.

The Brief was an abstract item that can be shipped via post to members within the industry that could be kept on their desk as a reminder. (Please refer to appendix 3 for full brief issued by CHH.)

Approach to brief:

- How does the LVL handle analogue tools
- How does it respond to digital tools = CNC and laser cutters
- Can LVL showcase CNC abilities
- Total time to produce

Note: This Brief was a collaborative team effort with Annaliese Mirus, Torben Laubscher and Kelvin Prasad assisting in the cutting of 600 units.
4.3.1 Manual Concepts

The process to produce these table top models was a test of skill to see if manual techniques could produce an item fit for mass production and would reduce time over digitally designed and fabricated models.

Figure 41: Manual Cut concepts
4.3.2 Digital Concepts

Sketch → Model → Client Selection → Final Product

600 units

Fabrication on CNC

Figure 42: Digital Concepts designed on Rhino
4.3.3 Mass Production

The relationship formed between the selected material and the CNC is only learnt over hours of cutting and running the CNC yourself. The user builds up an understanding of how certain types of timber will react to the speed, drill bit and programming style of each individual cut. Only after making mistakes and learning from them does the user of the CNC gain the ability to pre-empt the final product’s quality and finish.

After working with ply on the CNC for the last few years, each member of the team has built up a skill for manipulating the machine in order to produce more efficient and effective ways of cutting large-scale design-build projects. However, when drastically changing the cutting material, it is crucial to do many prototypes before committing to a final design. Even though technology is praised for its accuracies and designing to within 0.01mm, the materials are never perfectly square or level, and dependent on the grade of material, it can have imperfections like knots and burls. Hands-on knowledge is invaluable to a design-build student, as it enables quick design decisions as to what will and won't be feasible, which speeds up the process. The relationship between timber and machine of any kind is the endless possibilities within design and structural innovation. It's no longer a flat linear material, with digital computation and imaginative thinking, it has become a solution to many new urban, suburban and commercial issues.
4.4 Component Based Systems

As the material experimentation investigations move forward so too does the complexity. Each different project is utilising the file-to-factory process in conjunction with the traditional delivery process. Meanwhile, each designer is pushing their skills further and further to see how far they can go to create architectural products that can be realised from 3D computer models to viable built creations. More exposure to being hands-on with tools and construction is forming a foundation that can be further developed for the next project. The component based systems require good software modelling skills in conjunction with construction detail and material property understanding to realise build-able prototypes.

4.4.1 Component Based Models

These quick iterative models were to investigate the relationship geometries have with form when used as a component. The aim was to investigate what types of forms were created and how to adapt each form further if possible.
Figure 46-54: Component Concepts
4.4.2 Development

The selected design to develop further was chosen due to the make-ability of the components with the selected material - timber. The component was based off a developed form of the dragon skin pavilion from Zurich. The dragon skin has various unique components while the overall the design forms a complex process of fabrication and assembly. The idea behind this experimentation is to form a repetitive component that is replicated over and over forming an easy fabrication and assembly process.

Figure 55: chosen concept
Figure 56: Concept Breakdown
The idea of a component is that by repeating said pieces they will create their own form. The beauty of this design is that it allows both fluid and linear forms with manipulation to either the joint or component. The self supporting structure should be the primary structure with no other aids. The strongest structural form is a curve, but depending on what the final outcome is, the form is resilient to change and development.
In total, there should be only 2 types of components fabricated for the skin. They will be made out of standardised timber material. They will be required to be glued together with either epoxy or waterproof glue.

The idea is to increase the size of the components/modules and reduce the spacing of the portals. This will enable module to be attached the portal on the horizontal plane. Hopefully this will simplify engineering problems.
4.4.3 Prototype V1

The first prototype was tested using only manual workshop tools and a sketch - measure - cut, method of approach. The design was very unbalanced, and if any force was to be applied it would rock the component out of the joint as there was no screw or glue holding it in place; only gravity.

Workshop:
1x drop saw
9X Bandsaw
1x glue
4x clamps = 7min for 1 set
(excluding time for glue to cure)
The choice to move the joint closer to the central point of mass reduced the movement in the joint and made the design a lot more stable as there was minimal movement in the joint and when a downwards force applied to the model it didn’t move or pop out of the joint. With the prototyping and building to 1:1 scale the design still required, a lot of steel fixings were used to secure the weight of each component. More large scale testing would need to be done, because if the tolerance was out in some places it would become multiplied as it is replicated. The material for the prototypes were gifted from CHH. The properties of this LVL were structural in length, so when the notches were cut, the stability of the timber greatly decreased, becoming crumbly and weak. This would not be the timber of choice; treated pine would be the material of selection due to the design being exposed to the weather and not an indoor feature.
5.0 Final Design Project
Introduction

This chapter is broken up into nine sections, the first acting as the project description, which outlines the clients and brief. The second section is discusses the site, the third is design concepts, fourth is design development, fifth is refined design, sixth is the analysis of the design, seventh is the second iteration development, eighth is refining iteration 2 and ninth is reflections and analysis.

5.1 Project Outline

CUE Haven is a property located at 2704 Kaipara Coast Highway, Kaipara. It is owned and managed by the CUE Haven Community Trust. CUE Haven is the vision of Aucklanders Thomas & Mahrukh Stazyk, who bought the property in 2003 with the intention of building a retreat where individuals would come together to share ideas and learn from each other. However, concerned about the effect of grazing and the water quality of the working dairy farm; as well as the lack of public native bush reserves in fast growing Auckland, they decided to restore the farm into a native nature reserve for the community to use and enjoy into perpetuity. The property was gifted to the CUE Haven Community Trust on 1 July 2017. CUE Haven members and community volunteers have been restoring the land by planting hundreds of native trees and shrubs, as well as integrating 4km of walking tracks and access roads. A viewing platform and pavilion was to be the crowning jewel at the top of the property, elevated 80m above the road on the hillside which looks over Kaipara Harbour.

Clients: Tom and Mahrukh were the main point of contact and made the design decisions and would also be handling the sponsors

5.1.1 Brief

The clients are looking to finish their labour of love by adding a pavilion to their property.

The purpose of the property is to cultivate and share knowledge by providing a sanctuary where community groups can educate, unwind, team build or run specialised programmes. For example the Duke of Edinburgh students have used the property to complete certain parts of their programme but the property is lacking an open space use that connects to the land or provides an easy learning environment. What the clients really wanted in short was the pavilion:

1. To provide shelter from sun and rain
2. A space that is open enough to hold workshops
3. Connection to the pre-existing paths
4. Connection to the Pa site
5. Makes use of all the views

Please refer to appendix 3 and onwards for full brief from clients and meeting notes.
5.2 Site

CUE Haven is nestled into the Hills overlooking Kaipara Harbour, north of Auckland. The property was originally a dairy farm but with Auckland sprawl only increasing, the owners of the property saw an opportunity to create a special place for the community to take a break from the fast paced city life and enjoy the outdoors with 4km of open walking tracks surrounded by native bird and trees. The property has only recently finished planting so years of maturing is needed before full resolution is achieved. The pavilion is to be the crowning jewel of the property to be able to climb to the top of the ridge line and take in the view from the top.

Figure 69: CUE Haven boundary
5.2.1 Site Analysis

Figure 71: Site in green

Figure 72: Surveying Report
Figure 73: Analysis

Sun

Wind - High

Pa Site

Water

Access

Significant Foliage
5.3 Initial Design - Jeremy Parlane

Initial design was by Jeremy Parlane and due to geotechnical concerns it was agreed that the design should change to accommodate the engineers requests. Please refer to appendix 5 for full conversation notes. This was a good starting point to understand how unforgiving the site is. The Geotech consultants advised that the proposed design would be unstable and the engineer proposed that the platform should not be any larger than 2m off the ground.
Figure 74-78: Jeremy Parlanes designs
5.4 Site Investigation - Relationship between platform & ground level

The initial design (as modelled here) shows that the drop off is over 5m from the deck to the ground. Due to the ground conditions, site work was not attainable at these measurements. Being so high off the ground would also incur a huge price increase as alot of handrails and stairs would be needed, increasing labour and material consumption.

The Investigation leant towards a terraced idea to remove the need for hand rails, as the platforms would need no more that 2 steps and only 500mm off the ground. It also had a much better connection to the ground and potential for creative landscape ideas by incorporating plants instead of towering over them.

Figure 79: Site Investigation
Figure 80: Terraced site analysis
This exercise was to identify the amount of space needed when two or more strangers are sharing a space before it becomes uncomfortably close to one another, as well as the relationship the platform size has to the ground. The platform should encourage multiple people up to view the harbour. The ideal size was 6000x9000mm before the drop increased over 2m.
Figure 82: 3 Main view ports

Figure 83: View to the Pa site

Figure 84: View to the Kaipara Harbour

Figure 85: View to North
5.4.1 FINDINGS

It was discussed in the meeting with the supporting architect and engineer that the site should be investigated to see if it's possible to create platforms that don't require handrails. The current standards are that there must be no more than 2 stairs to avoid handrails. This investigation showed that the platforms could only be 1.5m deep to terrace down the steep site. It was agreed that the design would need more so we would be including handrails.

5.4.2 SITE PLANNING

Using the analysis and investigation, a series of abstract planning was underway. The site planning excluded a pavilion but would make a rough 6x9m area dedicated to the pavilion. The main design drivers were as follows:

- No more than 2m off the ground
- Incorporating trees and bushes into the architecture
- Using the contours for form

15 out of 60 proposed concept site plans were presented to the clients and the design drivers (from brief, in appendix 3) were considered in each design. A component model was selected to further research, the engineer has said that due to time constraints that the component model will require a primary structure to be able to withstand the loads from the environment.

The designs chosen were due to the fact that they maximised the site to platform ratio, not allowing anymore than 2m above the ground, they would allow for conventional decking design and the labour would be lower.

For the meeting with clients the proposed site plans included three platforms measured at:

- A: 6x9m
- B: 6x7m and 3x14m (double)
- C: 6x9m

The reason for these sizes were because they were the optimal size that was big enough to allow multiple people to use them without invading anyone’s personal space. Each platform also was positioned for a particular view; A was to be in line with the Pa site, B was to look back at the Taranaki range and C was to look out over the Kaipara Harbour.
Figure 86: Site planning
5.4.3 **Developed Site Plan**

![Developed Site Plan Diagram](image)

*Figure 87: New site plan*
Figure 88: Section through platform B

Section AA
Through Boardwalk & Platform B
5.4.4 **Pavilion Concepts**

Marae Form from precedents is non-negotiable from clients point of view. This is because they want a strong connection and Maori presence due to the Pa site at the top of the property.
Figure 91: First concept
Three Platforms centred around the three main view points are Taranaki Range, Pa Site and Kaipara Harbour.

Each position on site is directed to the main focal points. Due to Taranaki being on the other side of the site it was advised to try the double platform over one another to form the visual connection.
Working with the engineer to formulate a primary structure in the selected form. The materials are predominantly timber as this is the sponsored product. Reinforcing steel to meet council requirements for extreme weather conditions imposed on the site. There was discussion in regards to an adaptable pavilion that could adjust the height of the roof for the desired event. This would require investigation into timber and steel sleeves that are bolted into height. This was quickly ruled out by the engineer due to bracing issues and facade fixing complications as it would have to be some type of material that would end up weathering quickly and would require high maintenance = higher long term costs.

Figure 93: Structure investigation
The Site plan originally included 3 platforms but due to the lack of space between each platform (1.5m) the choice to move platform B across the pre-existing walkway was made. When proposed to the engineer it was established that the Geotec report was not done on that area so the engineer would rather we just remove the whole platform all together.

Since the form is predetermined, the primary structure partially agreed on (fixed not moveable portal frames) so the integration of the component system was agreed to be explored. The first render explores the mixture of canvas and timber components fixed to the portal frames.

The pattern of the components is similar to the flax weaving pattern. The skin is also like the dragon skin, likened to a Tuatara skin.
5.4.5 COMPONENT INTEGRATION - TUATARA SKIN

Figure 95: Canvas and timber combination
Main Steel sleeves to help hold the timber in place.

The main pole running down the middle was removed due to the clients request (blocking view) it was also discussed that the local Iwi would like to get involved and carve five poles in traditional methods. The local Iwi would like to donate them as they expressed an interest in holding workshops for the community and educational evenings during the Matariki.

Figure 96: Steel and timber
The canvas was removed due to the high maintenance and cost. The clients also pulled the pavilion back by 2m revealing uncovered deck space. At this point no balustrade had been decided on. The decision rested on how much view could potentially be taken away by the balustrade whist viewing from the back of the deck.
The Clients thought it would be beneficial to see what the design would look like in 5 years with some grown vegetation. The discussion is around whether to cover the front of the deck or wait for the foliage to grow in.

Note: landscaping plan will be devised by one of the CUE Haven board members.
5.4.6 Tui Balustrade

During a site visit it was apparent that the wildlife was happy and present on the CUE Haven property. One self-designated spokesperson for the wildlife was a rather loud TuiBird. Native to New Zealand the Tui bird is a symbol to the locals. Since there is minimal connection to the plants being incorporated into the design, the idea of turning sound into architecture was the challenge. The Tui bird has been studied and instead of musical notes the tuis song is recorded in frequency. This was the result of turning the sound frequency into a pattern through the break points on the balustrade.

Figure 101-102: Tui bird frequency

Figure 103: Balustrade
The decision to use battens also helped tie the precedent of the Marae back into the design again. By using the battens in that particular application drew a striking resemblance to the Pa fencing Maori would traditionally do.

Far right image is the engineers comments in regards to using timber battens is the spacing and lower horizontal piece of timber to deter children from being able to climb up.

**CUE Haven Dimensions**

*Note: Timber balustrade has been removed for easier viewing in these images.*

- **Platform A - Has the Pavilion (dotted area)**
  - 9000mm
  - 6000mm
  - 4000mm

- **B**
  - 6000mm
  - 9000mm

5x Timber & Steel portal frames

- 3500mm
- 2700mm
- 2000mm
- 1x
- 2x
- 2x

*Figure 106: Drawings that went to Dulux New Zealand*
At the final stages of handover the engineer was still not convinced of the design and its structural stability due to no precedents the team can use for calculations. Please refer to appendix 7 for conversations.

At this point there was two options; first go onto full prototyping for the next year to prove the design, or otherwise redesign the pavilion façades. The latter was chosen, to redesign the pavilion using the same brief,

5.5 Engineers Notes & Drawings

Engineer Pak Tang is employed by BECA and plays a vital role in the project. The engineer is required to attend all milestone meetings and the input has helped shape the design. In the early stages, compromise between the designer and engineer was crucial due to the complex nature of the component based design. The drawings supplied by the engineer are supplied in the appendix 5-6. The design has been established from the engineer’s perspective as unresolved and would need further testing to ensure the design is safe to the inhabitants and would withstand the harsh environment. The testing would take a further 18 months to become fully resolved via taking multiple tests, so it was decided to simplify the design and remove the risks that were brought to light.

At the final stages of handover the engineer was still not convinced of the design and its structural stability due to no precedents the team can use for calculations. Please refer to appendix 7 for conversations.

At this point there was two options; first go onto full prototyping for the next year to prove the design, or otherwise redesign the pavilion façades. The latter was chosen, to redesign the pavilion using the same brief, precedents and design drivers. The new design had to be simplified, lighter and directly fix facade.
5.6.1 Concepts

The Realisation of having to let go of the Tuatara skin design was bitter sweet. During a design-build project, if the design is not fit for purpose, it could hurt people or eventually just crumble and all the hard work would be for nothing. So looking forward and respecting the engineer’s decision for a redesign, the team rallied together to pull suitable concepts back together. Being a group decision, the design can be pulled in various ways due to opinions. However, the group was always kept grounded by reminding them of the scope and limitations as well as the aim of the design. This can realign the team’s thinking and bring people back onto the same page.

The first design was influenced by the weaving of the harekeke baskets which translates into the herring bone weave: easy to fix to the portals, works with the timber sizes from the sponsor, alot lighter and able to be built in modular pieces to make it easier for site work.

Figure 108: Concept 1

Herring Bone
The second concept was trying to channel the 3D nature of the Tuatara skin, and was just a flat fix like the herring bone. So the adaptation of the “shelf” coming out can be cut on various angles creating another layer of interest to the aesthetic along the exterior walls.

To create that extra layer of interest, the shelf components would have to be cut in multiple ways and would have to be placed in programmed spots, a lot like the dragon skin pavilion precedent study. This would add on a lot more time for the file-to-factory process, as each piece would become custom and not standardised. As the design need to be on site before Winter this was not an option. Modularisation was the key to increase hours in a controlled environment within the workshop unaffected by weather so that once on site, installation would be quick, moderately easy and could be planned around the weather. This design would not allow for this as it would need to be individually fixed on site to the portal frames.

Figure 109: Concept 2
The Third concept was based off 2 influences:
1. Flax weaving
2. Tuatara Skin in “plan” view

With the timber elements being linear, trying to create an interesting aesthetic can be done easily using a CNC and adopting the subtractive method of fabrication like the idea on concept 2, but again it presents the same problems as concept 2 which the team are wanting to avoid. Like the Sequential wall precedent, they used the additive method by cutting standardised pieces and to gain the “custom” look they adapted the assembly process to achieve the parametric bespoke design. So by having two types of timber, cut on the same angle, directly fixed onto the portals overlaid by an additive layer that can be produced in modular panels that gives the custom look ticks the brief in full.
5.6.2 Developed Concept

First attempt at applying the design to the pre-existing form. The dimensions of the platform and pavilion have stayed the same as the Tuatara skin, 6000x9000x4000mm. Trying to stay cohesive in design the balustrade was changed. As the design does not have to be weather tight, the roof has fenestrations to allow a shaded sun exposure.

Figure II: Developed Concept
The presentation meeting to the clients meant that the design undertook minor changes (please see appendix 8 for meeting notes).

Original “tui balustrade” was to be put back on and only the top section as the decision to allow the plants to grow in under the platform instead of adding another layer of timber battens.

Colour scheme was to be a similar pallet to the tuatara skin which follows the general Marae colour scheme.

Figure 114: Developed Concept on site
This diagram shows the make up from the engineer outlining his concerns which needed to be amended.

1. Width of the batten spacing
2. Addition of primary structure on the balustrade
3. Removal of the side balustrade to look like the tui design.
4. 1 timber batten to be capped at the top and cut at the bottom to create the tui pattern.

Quick noted drawings between designer and engineer were sent immediately to ensure problems were not repeated.
5.6.3 Refined Design

All amendments were made from the last discussion and it was settled upon that after the drawings were complete that they were to be handed over to the engineer for sign off.
5.6.4 Reflections

Working within a team that decides which way the design is driven can rapidly transform the concept and design drivers set out in the beginning. Looking back on the design as a whole, the only changes as the designer would be to reform the connection of architecture and nature which was originally set out in the initial brief, but as the design evolved so did the brief resulting in a lot of design drivers being left out.

Communication is one of the biggest aspects within this design build project moving through challenging aspects of the process. As discussed earlier, communication between team members can result in an email or text which can be understood in many ways, taken out of context and when stress is applied to the situation, it can increase tension between team members.

Every time the design came to a halt in process, the best way was a face-to-face discussion with the team, ensuring everyone had their say, everyone was on the same page and no one was left out or in the dark as to why a decision was made. When decision making was reduced to an email chain, a lot of things were missed, misinterpreted or caused tension. This resulted in the design being held up for long periods of time due to unresolved matters.

Being in a group collaboration also demands that you be able to speak up or voice concerns. When a team is made up of many personalities, some people can be overlooked or chose not to speak up at critical milestones. This caused the biggest upset in the design process which delayed the build for seven months because of a full redesign. It was discussed, in the very early stages of design concepts that the Tuatara skin would only be developed further if the engineer deemed the design to be fit. It was readdressed by the designer at every design meeting to gain the engineer’s approval before moving forward and refining the design. At every step the design was also taking on the opinions or feedback of a seasoned builder who aided the meetings with the engineer. Unfortunately in reality after the initial handover the engineer was unable to sign off the design due to engineering issues. So the design-build that was supposed to be opened in the summer was now put on hold and the pressure applied back on the designer to come up with a new concept. The designer had to weigh up time vs originality = standardised > custom. The clients were going to have to settle for a simplified design. Below is a diagram outlining the process the design went through and who was the pivotal point for each phase it passed through.
Currently sitting at this point
6.0 Conclusion
6.0 CONCLUSION

The research presented in this document sought to investigate the methods of design delivery in order to produce bespoke architectural outcomes as a team approach. The first part was looking into the current role, skills and technology available for today’s designer and how that fits within the design delivery process. Once that was established research examined how the developments of technology have affected the role of the designer and the strain it has caused on relationships between the team members; specifically towards contractors and engineers. Technology has created a disconnect within the design process for architects, removing them for being so hands-on due to the need for specialised roles that segregate the skills to the point that architects are merely form givers and design shapers. Yet due to the rise of design-build projects within the industry, it has opened the door to removing the constraints that architects face. Although technology over centuries has created the gap, it can now start reforming relationships by extracting some methods within the design-build process in conjunction with utilising CAD/CAM systems readily available in the New Zealand industry. This can help realise more bespoke designs that would usually never make it further than a render due to the complexity. Through utilising laser cutters, CNC’s, architects can communicate these designs to the contractor or engineer in a way that they can work more closely together, working out and resolving issues to realise the buildability of new concepts.

With the final design in this document it was established that although the designer had previous knowledge about bespoke construction methods, the relationship between the designer and engineer was richer because the designer and contractor had more communication at the development phase, which enabled the designer to engage with relevant comments within meetings. Knowledge and experience was key; if the designer had engaged earlier with the contractor then the Tuatara design would have either been resolved faster or established earlier that it was to complex to be resolved within the client’s time frame. In hindsight the Tuatara skin was ambitious for the site and pushed the scope of the engineer, but did show the current issue that without the construction knowledge from the designer’s perspective, a complex concept will only ever stay as a concept.

Communication is one of the key points that all the research within this document kept coming back to, establishing a relationship within a design team can make the total design journey more effective and efficient.
overall. But similar to the final Tuatara design journey, by allowing more input from all team members can distort the original idea. This was what happened to the CUE Haven project. Grounding clients and reminding them what the brief was and sticking to the main design drivers could have been more firmly enforced. The COST vs TIME vs ORIGINALITY/QUALITY triangles (figure I) was not enforced enough during the process. The end result was to have a bespoke architectural product, but due to the time being pushed out to ensure an original quality design, a larger cost was incurred due to the designer’s entry level construction knowledge at this level of design.

The realisation from this research is that while designers may have technologies at their fingertips that can help resolve any number of design issues and enable better communication, it is all wasted without experience and exposure. It takes many years of being exposed to the design-build process. This exposure can come easily within a learning institution, however when in an industry environment it becomes easier to outsource to a specialist that can so easily result in the industry falling back into the cycle that sees the designer sticking to form giving while the specialist contractors try to embody the designer’s vision as best as they can with minimal compromise. Yet a lack of understanding makes compromise inevitable. So the industry is relying on the institutes and future generations to uptake the rapidly advancing technology.

The aims set out in the beginning were mostly achieved, other than that fact the digital technology had to take a step down when working on a permanent design-build. In contrast, when working with industry-based clients, there was a willingness to push their materials to its limits at any cost. The control given to the design team by Carter Holt Harvey allowed for further experimentation and an increase in designer satisfaction. As the designer progressed, more competency and confidence was seen. The design understanding and ability to work out design flaws was becoming faster and more concise.

Although designing in a large collective team of specialist roles, technology neither helps nor hinders a design; it all falls back to the communication and respect given to each team members to all work to their abilities and achieve the common goal. Willingness and resilience from each member will get the concept off the page and into production. Like Henry Ford said: “coming together is a beginning, staying together is process, and working together is success” 68


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Figure 89: Unitec meeting house
   Reproduced from: https://www.unitec.ac.nz/maori/who-we-are/te-noho-kotahitanga-marae

Figure 90: Form variations of a meeting house

Figure 91: First concept

Figure 92: Platform layout with pavilion

Figure 93: Structure breakdown

Figure 94: Revised site plan

Figure 95: Component integration

Figure 96: Steel and timber structure

Figure 97: Timber and canvas iteration

Figure 98: Full timber skin iteration

Figure 99: View to the harbour

Figure 100: Grown in foliage

Figure 101: Tui frequency

Figure 102: Tui bird
   Reproduced from Pak Tang, Beca Engineering

Figure 103: Decking with balustrade

Figure 104: Traditional Pa fencing

Figure 105: Image from engineer

Figure 106: Reproduced from Pak Tang, Beca Engineering
   Images presented to Dulux New Zealand

Figure 107: 1:100 models

Figure 108: Concept 1

Figure 109: Concept 2

Figure 110: Maori weave

Figure 111: Tuatara skin v1 in plan

Figure 112: Concept 3

Figure 113: Developed Concept

Figure 114: Developed concept on site

Figure 115: Engineers images

Figure 116: Site plan

Figure 117: Plan

Figure 118: Section AA

Figure 119: Section BB

Figure 120: Perspective 1

Figure 120: Perspective 2
Appendix I. - Brief & Learning Objectives for CHH

SPECIAL TOPIC
CHH and PrefabNZ exhibit

Course Co-ordinator: Yusef Patel
Teaching Assistant: Gemma Campbell

Course Number: Level: Credits: 15
Main programme: Bachelor of Architecture Studies
Pre-requisites: nil
Learning time:

<table>
<thead>
<tr>
<th>Directed (Supervised) Hours</th>
<th>Self-Directed (Unsupervised) Hours</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

Course aim:
To explore in depth, the theoretical and practical outcomes with the production of an innovative plywood structure through digital means.

Learning Outcomes:

By the end of the course the student will be able to:

1. Research, select and analyse key literature to inform innovation within the field of architectural construction.
2. Evaluate and recommend appropriate materials and fabrication techniques.
3. Critically analyse, reflect and understand the relationship between literature, prototyping and innovation to produce tangible research.
4. To generate innovative solutions to complex and sometimes unpredictable problems.

Assessment:

<table>
<thead>
<tr>
<th>Weighting</th>
<th>Nature of assessment</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>60%</td>
<td>Group Assignment to complete 1:1 Responsive Exhibit</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>20%</td>
<td>Group Report</td>
<td>1,2,3,4</td>
</tr>
</tbody>
</table>

Brief:
The students will need to create a product that can allow for interaction by visiting observers both physical and visually. The students will have to work with the clients and supplement their needs and wants. The group will have to understand the implications of their design that it has to be able to be packed up and down multiple times and fit into a van and transported and rebuilt requiring minimal help.

The products we will be showcasing are the new interior ply products from Carter Holt Harvey. We will also have help from Prefab NZ so we will also be working closely with them.

Outputs/Timeline:

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Date</th>
<th>Students Tasks</th>
<th>Yusef &amp; Gemma’s Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intro to software – each student to model an outdoor chair</td>
<td>Intro to illustrator and the laser cutter Explain tasks and overall expectations and final out comes. Assist with getting started on rhino, illustrator and laser cutters. Assign reading.</td>
</tr>
<tr>
<td>1</td>
<td>4/12/17</td>
<td>Reading literature and documenting the importance of that reading.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11/12/17</td>
<td>Concept designs presented and analysed in a group. Model a precedence and discuss its relevance to the class with short presentation</td>
<td>Shape and guide concepts, run safety class in workshop with the cnc. Assign readings for following week. Material and contingency.</td>
</tr>
</tbody>
</table>
3 18/12/17
Refine design and present to CHH
Discuss the literature in class and review precedence showing the implications to the design and the making process that would go behind it and how that will relate to our design.
Model and prepare presentation for CHH.

4 8/01/18
Prototyping – understanding the joints, loads and construction.
Learning the importance of cost and material use by learning how to prepare cut files on rhino.
Jersey Devil reading and producing a diagram of the build process and why these steps are important.
Refine design and come up with Joints, etc

5 15/01/18
Prototyping and dry runs documented and further improvements noted.
Review on what we have done so far and revisit the important ideas covered off previously.
Delegate tasks for final presentation
Delegate tasks and oversee any implications and rectify

6 22/01/18
Final cutting and fitting of the design
Plan and prepare final presentation.
Make sure it’s finished correctly to high standard. Reports and readings completed.

Topics:
- Prototyping and fabrication studies
- CAD/CAM technologies
- Analogue production methods
- Research Methods
- Analysis and documentation
- Literature Review

Learning and teaching approaches:
- Studio workshop
- Writing groups
- Field trips
- Group and individual work
- Studio sessions with practising architects, material suppliers, engineers, etc.

Learning resources required:
Handouts given and/or directions to Short Term Loans in the library.
Safety Gear – Ear Muffs (Level 5), steel cap shoes, safety glasses and gloves.

Learning resources required:
Handouts given and/or directions to Short Term Loans in the library.

Learning resources recommended:
As indicated from time to time.
CAMPAIGN PLANNING 2018

ARCHITECTS

2. Direct Mail

Promotional Marketing Campaign

Unitech Brief

The balancing act of sustainable beauty.

Goal:
Create a campaign concept around which content marketing can be drip fed to architects and specifiers, encouraging them to delve deeper into the LVL brand, learn more about the offering and reach out to sales for support when specifying Futurebuild LVL.
Showcase the sustainable nature of Futurebuild LVL and acknowledge the design aesthetics and balancing act that is an architect's role between their vision, the client's vision, their code of ethics and the technical requirements of a build.

Concepts:
The balancing act of sustainable beauty.
Network, Support, Connectedness.
Each piece in the puzzle.

Tone: Inspirational and emotive, poetic higher level.

Messaging:
Each 'Piece of the Puzzle' is delivered with a piece of the lvl story, from Product to Design Services, Sustainability to technical, each piece is as crucial as the next to creating the final build.

REQUIREMENTS
LVL Sculpture Concept: To be delivered in two parts.
Part one, is the core/body of the sculpture, high visual impact, strong, stable, complete - to a point.
Part two, is the cherry on top, the extra touch, the final piece/s that completes the puzzle and makes everything else come into balance.
Watch as with the final piece the sculpture/object comes into balance and how the slightest, gentlest change effects the balance of those pieces around it.
LVL Sculpture Packaging Concept: Practical considerations, cost, weight, user experience etc.
# Appendix 3 - CUE Haven Brief

**CUE HAVEN**

- Digitally Fabricated Pavilion

**Brief:**
Location: 2704 Kaipara Coast Highway, Glorit
To design a permanent pavilion in conjunction with walkways.

**Client design requirements:**
- Nearby Pah site
- History of the land
- People and community
- Low maintenance
- Long lasting
- Timber from local mill
- One with the land
- Incorporate trees and bush
- Whare style
- Incorporate boards to educate visitors
- Include something to buy and you get a plaque (fundraiser)
- Include plaque of people who helped
- Platform and railing included
- Pavilion possible = 4x5m
- Must protect from prevailing winds
- Provide shelter from rain
- Transport via flat deck truck
- Seating

**Client Expectations:** To focus on the pavilion and its design – assist with the hand rails and decking, include seating. I will keep a record of the budget of the pavilion to the best of my abilities. Work alongside Pak in regards to engineering design and regularly keep in touch with Tom and Mahrukh with updates. By the 1\textsuperscript{st} of June present concepts and renders.

**Deadlines:** 1\textsuperscript{st} July – final design with renders and scale laser cut model for unveiling.

**Context:**
- CUE Haven is a project to restore a 59 acre former dairy farm to create a sustainable forest ecosystem by restoring connectivity between the forest remnants and rehabilitating wetlands. Benefits include enhancing biodiversity and wildlife values, and providing headwater protection of the stream tributary that discharges into the Kaipara harbour.

- The placement of the pavilion is located near a par site at the top of the sanctuary.

**Geotech parameters:**
The platforms or decking can’t have more than a 2m drop to the ground level.

**My expectations**

**Design parameters:**
- The need to respect context and the contour/ground conditions. Therefore 2m pile and terracing is required.
- The dimensions that work in conjunction with the contours are roughly 4m deep and 5m wide giving a total platform of 20m²
- Timber – treated – standard sizes
- Modular design
  - To fit with the CNC
  - Modules to be carried on the back of a ute
  - Able to be lifted by 2 people
  - Adaptable tolerances for site conditions

**Precedents:**
- Tezuka Architects
- Kengo Kuma
- Component Pavillions
Appendix 4 Scope of works

Agreed Scope of Works

**Unitec Responsibilities (Gemma, Peter, Semisi and Yusef)**

1. Design concept of deck
2. Design and fabrication of pavilion and hand rail
3. Shop drawings for Fabrication @ Unitec only
4. Fabrication @ Unitec facilities only
5. Material quotes for production @ Unitec only
6. Volunteer labour @ Unitec only
7. Budget for labour and facilities use
8. Organise tools to supplement the local contractor if there is a need
9. Assisting with the lodging of consent

**Que Haven Responsibilities (Tom, Mahrukh, Jane and Anne)**

1. Sponsorship
2. Appoint project manager
3. Organise Volunteer labour for onsite
4. The building consent submission with be done by Tom and Mahrukh, but will require input from all the designers.

**Beca Responsibilities (Pak)**

1. Assisting the Lodging of consent
2. Design and engineering of the Deck
3. General Project management
4. Organise material deliveries, quotes, etc.
5. Budget for labour
6. Engineer and help develop the design of pavilion
7. Producer Statement 1 for Geotech and Structures. Producer Statement 4 for Geotech. The Producer statement for the structural design will cover the deck and pavilion, including handrails. - There is no need to produce any construction producer statements (3) as the council will come and inspect the building works and sign off for compliance. There may still require a PS3 for ground works but I believe a PS4 is sufficient from Beca.

**Local Contractor Responsibilities (To be Determined)**

1. Supervise volunteers and students on site
2. Provide tools for volunteers to work with onsite
3. Organise transport of prefab elements from Unitec to QUE Haven – I think the ‘construction’ including logistics will have to be provided by the contractor. We should put this on his responsibility list so whoever is involved is aware of their expectations.
4. Piling of timber poles and fabrication on deck

Appendix 5 - Meeting Minutes after site visit

**Cue Haven 27.4.18**

Cultivating, understanding and enlightenment

Site visit

Working with the land – reducing the height of the decking = reduces the contractors work and the depth of the piles that need to be within the ground.

Modular decking – reduces contractors work and makes on site install easier if the weather conditions aren’t favourable.

The potential of having people appreciate the stars at night and maybe sleeping out

Reducing hand rails

Tiered platforms

Multiple areas for public to be in

Allowed for picnics

Multiple joint points for the tracks to interrelate

Not restricted to current tracks

Wind shelters around picnic spots

** look at boundary stream as an example of canopy = open space ratio .. think and analyse in regards to cue haven.
Hi Team,

Geotech Investigation Update

Our Geotech team completed the site investigations. A couple of them were able to meet Tom and Mahrukh up at Cue Haven yesterday (Tuesday) and complete some tests which will give us further confirmation of what the ground is like up there.

I have attached the initial Geotech report for some leisurely reading, and while the site investigations made some way into verifying what the desktop investigation found, I do want to highlight a couple of points and summarise where we stand. (I will try to convey my understanding of what the geotech have explained to me the best I can!!!)

The report outlines that the surrounding area shows extensive areas of shallow instability (such as slips, landslip). These issues are most commonly associated with water induced erosion and soil creep, SK-01 of Appendix B has a great graphical representation of the number of land movements. This is also consistent with, I believe, Mahrukh and Tom’s experience after heavy rain fall events. The most stable parts of the slopes appear to be at the ridgelines where water does not tend to accumulate, and fortunately for us, our timber platform is meant to be right at the top, at a ridgeline! We also don’t expect bearing capacity of the soil will be any problems, so just stability.

However, the Geotech team will still need to analyse the data gathered from the site investigation to properly quantify the likelihood of any stability issues at the location of the platform. The Hand Augers they did on site will allow them to assess the soil properties and build a cross-sectional profile of the ground. With these parameters, they can do some analysis on what the safety factor is for the stability of the site. They will aim for a number and will factor into whether the site is suitable for the proposed works.

If the analysis doesn’t come up with a favourable safety factor, there are ways to mitigate the risk of stability issues, such as ground improvement or installing sub-soil drainage, but of course there are costs associated to these mitigations. The extent, if required would be a consequence of what the detailed Geotech analysis shows.

There is also room for engineering judgement to accept a lowered safety factor, and this is where building our platform at lowered heights will help (risks associated to consequence), if we need to come to this stage.

What this means moving forward?

As discussed with Tom and Mahrukh, the timeline for finishing the geotech analysis will be around 3 weeks. The logs are currently being analysed but Matthew can only be available at a later date to complete the analysis. The architect team should keep working on the concepts based on ~2m high platforms in the meantime. Although the stability issue is not fully signed off, it does look like we are moving towards the lowered and stepped platforms for various other reasons as well. Gemma, give me a call and you can update me on how you are coming along, and we can see if we are on the same page J.

Tom & Mahrukh, we have conveyed some pretty positive comments to you recently regarding the geotech findings, and although this hasn’t changed, I do want to convey there are still those additional steps before we can fully quantify the risks/safety factors and thus what we can do at this site and documents such as producer statements can be signed off. I believe there is a small chance that the analysis will give us anything to stress about, and there are then steps to mitigate those risks, but nonetheless, the risk of having an unstable site is still there – and what that ultimately means is hard to say right at this moment in time... We will know more soon!

Let me know if you have any questions or what some further clarifications of what I have written, appreciate there is a bit there.

Thanks,
Pak Tang
Structural Engineer
Beca
Phone +64 9 300 9000 Fax +64 9 300 9300
Mobile +64 27 836 6572

Appendix 6 - Email from engineer outlining height restrictions.

Appendix 7 - Email from engineer outlining Issues with Skin design which prompted a simplifies second iteration.

Hi All,

I’ve just had a meeting back here at Beca regarding the design of the platform – generally went well and I’ll be able to progress with our design processes. We haven’t quite nailed down how we are going to deal with the cladding/skin. We did have some ideas we jotted down but we are going to plan another meeting with our technical director (person signing off the Producer Statements) in terms of what the ultimate solution/design proof will be.

Unfortunately not the update I wanted to give in regards to certainty around the skin – but there were ideas that gave us a bit of confidence we can make it work.

In the meantime, I will progress the design of the other aspects of the platform along with discussing the solution of the cladding. Just wanted to give an update to the team on the back of our previous round of emails.

Thanks,
NOTES:
1. FOR GENERAL NOTES REFER DRG No SE-002 & SE-003.
2. REFER DRG No SE-005 FOR NOTES.

1. ISOMETRIC ON SIDE CLADDING - ROOF CLADDING SIMILAR
   1:5 (A1), 1:10 (A3)

2. FRONT ELEVATION
   1:5 (A1), 1:10 (A3)

3. SIDE ELEVATION
   1:5 (A1), 1:10 (A3)

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P. Tang 14.11.18
P. Noble 14.11.18

---

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   1:5 (A1), 1:10 (A3)

2. FRONT ELEVATION
   1:5 (A1), 1:10 (A3)

3. SIDE ELEVATION
   1:5 (A1), 1:10 (A3)

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P. Tang 14.11.18
P. Noble 14.11.18

---

1. FOR GENERAL NOTES REFER DRG No SE-002 & SE-003.
2. REFER DRG No SE-005 FOR NOTES.
Dulux Meeting update
Yusef Patel <ypatel@unitec.ac.nz>
Tue, Apr 9, 10:38 AM
to Thomas, me, Pak

Hi Tom and Mahrukh,

We had a very productive meeting with Dulux today. Dulux specification manager Simon Blincoe was present at the meeting. We worked through different options. His advice was the following:

Use paint over stain as it would give a 7 year protection. Stain only gives 2 years protection for Cue Haven’s environment.
Leave the H3.2 timber decking bare. You may wish to apply stain to help reduce slip resistance. If visitor are to wear walking or tramping shoes, there is no real need for it. You can use a revive product to help protect the decking timber. This will need to be re-applied every spring/early November to be affective. The product will allow the product to look fresh and clean after winter season.

Questions for Pinepack/Cue Haven to answer:
Is the timber going to be supplied as;
Rough sawn timber
Dressed timber

Unitec/Gemma and Cue Haven to answer:
Timeline
Quantity of material

Dulux to provide the following:
A specification checklist for Que haven and Unitec’s order
Rollers and brushers
Volunteers/teaching if needed

Regards,

Yusef Patel
Lecturer | School of Architecture
Email ypatel@unitec.ac.nz  Mob +64 21 208 3022

Hi All,
Gemma and I are waiting for any updates in respect to the engineering confirmation re the Cue-haven project. We have programmed for material delivery and building activities to start this week. We need Pak to confirm engineering aspect of the project. This will allow us to do quantities surveying, adjust model, and create a prefabricated building programme.

The tasks we have outstanding to complete is to talk to Dulux re sponsorship. This requires Tom and Mahrukh to confirm colour scheme, so Gemma and I can order stain and other related equipment.

Once we know above, we can provide a detailed timeline to which Tom and Mahrukh can organise site works and volunteers.

Kind Regards,

Yusef Patel
Lecturer | School of Architecture
Email ypatel@unitec.ac.nz  Mob +64 21 208 3022

From: Pak Tang <Pak.Tang@beca.com>
Tue, Apr 2, 12:38 PM
to Info@cuehaven.com, Yusef, Thomas, me, Peter

Hi Yusef,
In regards to the engineering works – this is under progress but we are allocating a lot more time than we imagined in regards to updating the construction drawings. We had initially thought the 3D revit file was able to be converted directly into design and construction drawings but realised that was not the case. We currently have a senior draftsmen helping full time on this project setting out the drawings for us with the Revit model as a guide, and although this has taken a lot of time which we had never allocated for, he is nearing completion.

Upon completion, this will provide us with detailed dimensions and set out points of the whole timber platform, and will also allow me to finalise some of the detailing and design calculations.

I am working towards getting the package complete this week and I am currently on this project full-time – however the additional time we have needed to spend on the drawings have delayed us.
Feel free to give me a call and we can discuss further.

Thanks, Pak Tang

Yusef Patel <ypatel@unitec.ac.nz>
Tue, Apr 2, 5:37 PM
to Pak, Thomas, me, Peter, Info@cuehaven.com

Hi Pak,

thank you for the update and your hard work. We will wait patiently till your end is complete.

Regards,

Yusef Patel

Lecturer | School of Architecture
Email ypatel@unitec.ac.nz  Mob +64 21 208 3022

Hi Pak-

Thanks for the update. This does create some real timing issues with winter approaching.

Would you please let us know a date when we can expect to get something to take to the Council and we can start preparing a revised timetable for the construction.

Thanks very much.

cheers,

Tom & Mahrukh

Hi Tom, Mahrukh and Yusef,

We have progressed with the design drawings and have now redone the set out and configuration of the deck + portal frames. As a result, there are some detailing that I am in the progress of designing - one of the main items is how the portal frame structure gets connected to the supporting deck and the finer connection details between the hearing bone cladding and portal frames itself. I am working finalising the details but due to the upcoming Easter and Anzac stat days it unfortunately looks like we are tracking for a post-Easter delivery.

I do apologies for the failure to deliver on programme, I had originally underestimated the scope of the required works and my time estimate was purely based on our experiences dealing with much simpler pedestrian timber boardwalks. The addition of the timber portal frame and architectural elements have resulted in the additional complexities which we are working through.

In light of the above comments, we are still working our best towards finishing the design and I have the wider beca team helping me achieve so as they are also aware we have fallen behind.

I will work towards providing an updated model for Yusef and his team as soon as possible as well.

Please don’t hesitate to further contact me and discuss. I understand this puts a huge spanner in the overall programme with other aspects of delivery.

Thanks,

Pak Tang

Hi Pak -

Hope all is well and you had a productive week. Would you please give us an update on the status of the design drawings.

We’d like to know when can we expect the drawings to be finalised so Yusef can finalise the materials list for us to give to Pinepac. And also when can we have a package to submit to Auckland Council for the building permit.

Thanks for all your help. Talk soon.

cheers,

Tom & Mahrukh
Hi Pak - 
Just wanted to let you know that we have all the CUE Haven trustees and the Rodney Local Board members and Cr Sayers coming to CUE Haven on Monday, Apr 29th afternoon. When the meeting had been scheduled two months ago we were expecting to show them the viewing platform under construction. As it stands we currently do not even know a confirmed date when Beca will provide us a package to get the Council permit.

Please let us know where things are at with the viewing platform design. When can Yusef and Gemma can get the final drawings so they can work on the materials list and we have a package to take to Council for the permits and we can start scheduling the work.

Please discuss this matter urgently with your team and let us know latest by noon on Monday so we know what to tell our trustees and the Local Board members & Cr Sayers.

Thanks.
cheers,
Tom & Mahrukh

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Structural Engineer

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I am working towards getting the package complete this week and I am currently on this project full-time – however the additional time we have needed to spend on the drawings have delayed us.

Feel free to give me a call and we can discuss further.

Thanks,
Pak Tang
Structural Engineer
Hi Yusef and Gemma,
As you may be aware – there has been a bit of communication between Tom, Mahrugh and I regarding our plan moving forward.
Based on our discussions and understanding of Gemma’s and Unitec’s availability, along with the builder’s availability we are working on delivering the building consent package on Thursday June 6th, to meet this date, we now have an engineer working full-time under our supervision and have been progressing well. We are not staggering the design and delivery of the piles.

The building consent package will have updated construction drawings, and if it’s any help, we should also be able to provide a full materials list as well (as we need this for our own calculations).

Let us know if you have any questions, or anything else that could help moving forward. As always, happy to discuss over the phone.

Thanks,
Pak Tang
A MINDFUL COLLABORATION:
A Timber Design-build
Declaration

Name of candidate: Gemma Campbell


is submitted in partial fulfillment for the requirements for the Unitec degree of Masters of Architecture (professional).

Principal Supervisor: Yusef Patel

Associate Supervisor(s): Jeanette Budget

CANDIDATE’S DECLARATION

I confirm that:

• This Thesis/Dissertation/Research Project represents my own work;
• The contribution of supervisors and others to this work was consistent with the Unitec Regulations and Policies.
• Research for this work has been conducted in accordance with the Unitec Research Ethics Committee Policy and Procedures, and has fulfilled any requirements set for this project by the Unitec Research Ethics Committee.

Research Ethics Committee Approval Number: n/a

Candidate Signature: ........................................ Date: 23/5/19

Student number: 1436795

..........................................................
Full name of author: Gemma Campbell

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