CRAFT, DETAIL & QUALITY

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2018

CRAFT, DETAIL
& QUALITY

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A 120-point thesis
submitted to the Victoria University of Wel-
lington in partial fulfilment of the require-
ments for the degree of Master of Architecture
(Professional)

Victoria University of Wellington
School of Architecture

2019

for Mum & Dad

ACKNOWLEDGEMENTS

I would like to thank...

Firstly my supervisor Hans for your constant support and knowledge to help shape my thesis into what it is today.

My family, friends & colleagues who have always taken an interest in my work and provided a fresh perspective.

And most importantly, to my parents, Katie & Matt, for your love, support and endless encouragement. Thank you for always believing in me, I could not have achieved this without you.

ABSTRACT

Over the past decade and even currently within New Zealand there have been quality issues within timber construction. My research proposes to address what these quality issues are both functionally, and aesthetically and how we can create a dialogue between craft, detail and quality. In residential architecture in New Zealand, the most common practice is timber stud framing or otherwise known as traditional platform framing. This construction type results in little variety throughout NZ as the vast majority is dominated by NZS:3604. This common platform framing can also create architecture that barely resembles the timber material.

This research creates a framework to what will be a possible solution in exposing the details of timber joints, which in turn may prevent quality issues along with creating a crafted timber design. As a starting point for this research, it seemed appropriate to draw on traditional Japanese, European and Pacific construction techniques. These cultures have mastered the art of craft, and we in New Zealand could learn from this and reflect in contemporary practices in NZ. This could in turn create a solution which highlights the quality issues in construction of New Zealand residential architecture.

Typically, in New Zealand platform framing construction, timber joint details are concealed. These concealed details are more prone to failure and so by exposing these, it can lead to improving

quality of construction. Quality is, however, an elusive concept and this will become clear through an analysis of interviews with numerous builders, project managers, architects and of course the everyday user. These interviews define what they believe is the most common area of defect, and where quality can be improved. This research will therefore look at what system can be designed between the connections of architectural elements to focus on exposed refined details and joints. As these connection details are explored the definition of “craft” will become more defined, where it currently begins as examples of exposed, visible and readable detail.

Taking place in a rural New Zealand environment in Raglan Waikato, the portfolio proposes a boutique hotel, with a scheme that demonstrates this newly proposed construction system as an alternative to platform framing. The role of the hotel design is merely a vehicle to apply and test the research. There are many implications that may be a factor in the conclusion of this research proposal, for example CLT timber accessibility and costs. However further outcomes will result in celebration and awareness of detailing which leads to improving quality of New Zealand timber architecture.

This research explores turning traditional methods of construction into contemporary architecture using the technologies and material practices of today.

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I.

INTRODUCTION

- 1.1 *Problem Statement*
- 1.2 *Practical Relevance*
- 1.3 *Aims & Objectives*
- 1.4 *Thesis Structure*

PROBLEM STATEMENT

In residential architecture within New Zealand, the most common construction type is a timber stud framing method or otherwise known as platform framing. This construction type results in little variety throughout New Zealand as the vast majority is dominated by NZS:3604. At the same time this research indicates quality issues throughout timber platform framing and architecture in NZ.

"Damage is usually hidden and may not be obvious during a visual examination." ("Weathertightness: Guide to the Diagnosis of Leaky Buildings," 2011, pg. 11). This could be an opportunity for exposing details and reducing defects in the process.

These quality issues are explored through interviews of practitioners involved in the building process. My research aims to create a dialogue; a connection between the two. The

common platform framing creates architecture barely resembling and in fact masquerading the natural characteristics of the timber. I would like to test my hypothesis and expose the details of timber joints, which in turn may prevent quality issues along with creating a crafted design. As a starting point for this research it seemed appropriate to draw on European, Japanese, and pacific construction techniques. I believe these cultures have mastered the art of craft and we in New Zealand could take learnings from this into contemporary practices and create a solution that hopes to bring attention to the quality issues in construction of New Zealand residential architecture.

However the point is not that we should mimic the style or features of historic architecture today, but that we should challenge the notion against contemporary technologies and material practices.

PRACTICAL RELEVANCE

New Zealand's common platform framing has succumbed to the norm of NZS 3604, and provides little variation across residential architecture. Not only do many houses barely resemble, or celebrate the timber material, but the construction type demonstrates low productivity with many chances for issues to arise. Quality is an important issue within New Zealand construction and one that is further explored in the literature by BRANZ, discussing the types of quality issues and their causes. It looks at functional and visual quality both of which I will acknowledge in the duration of this research.

Weather tightness within New Zealand has been a major issue over the past decade, otherwise known as the leaky homes crisis. New and relatively cheaply built homes became defectively inadequate and are some of the many causes in the leaky home syndrome. Some of the reasons can be linked back to the housing boom where many unskilled builders were enlisted. How can we overcome these unskilled trades, and poor quality in housing by making fool-proof designs that can minimise defects and essentially provide better visual, and functional quality homes in New Zealand.

AIMS & OBJECTIVES

This research aims to explore alternative methods of construction to the most common platform framing, relative to New Zealand. The research considers the contribution of a higher quality of timber architecture, drawing from international traditions through contemporary manufacturing. The research also aims to provide more knowledge and insight to these alternative timber construction methods and it looks at addressing both functional and aesthetic quality issues in New Zealand architecture, and how alternative crafted solutions may resolve these issues.

- This prompted a set of objectives:
- / To investigate detail in timber architecture drawing from international construction methods through contemporary manufacturing, then applying and contrasting them to the New Zealand platform framing.
 - / To investigate quality in New Zealand architecture both functional and aesthetic, whilst improving lack of quality by applying the previously investigated craft techniques.
 - / To build upon the initial detail experiments to explore the proposition of a hotel scheme and its quality and craft in relationship to the common platform framing.

THESIS STRUCTURE

This research is design led. Research driven design produces primarily a design outcome with a site and programme specific that is informed by research. The primary mode of research is an iterative process that evolves into a framework that then influences the design. The first part beginning with research is broken up into four main bodies of knowledge. My thought process sequentially orders each section. Beginning with what this thesis will be looking at in terms of the very broad term "craft", followed by what details are currently out there in the timber construction industry (in NZ and abroad), followed by research into quality. All three craft, detail and quality will aim to create a dialogue between each other thus creating essentially a framework that will influence the design. Part two is all about design. Broken up into three chapters the methodology will look at project studies and reviews, site and context, iterations developing into a preliminary and final design. All chapters influenced by this research framework initially discussed in part one. Part three will be concluding all research ideas and design decisions, whilst assessing the aims and objectives throughout the entire design-led research process.

PART ONE

RESEARCH METHODOLOGY

I

LITERATURE STUDY & REVIEW

- 1.1 *Introduction*
- 1.2 *Scope & limitation*
- 1.3 *Craft*
- 1.4 *Timber construction*
- 1.5 *Quality*
- 1.6 *Detail & construction*
- 1.7 *Conclusion*

The following literature studies will not only back up the problems I see within the timber construction industry, but also posit theoretical approaches to resolving these problems. The primary mode of research is an iterative process that evolves into a framework that then influences the design. This research encompasses the scales of detail and craft in joints, a hotel design and the wider New Zealand construction industry. The experiments are reflected on and discussed through comparing related works and literature, and issues faced in the industry. Interviews to members in the profession, and users of a space, who are involved in either the process or outcomes of a construction project have been conducted as a side aspect to inform the research. All these issues challenge the design outcome and the framework used to influence the design.

These reviews will provide context for you as a reader, and aim to make the research problems clearer, in giving examples of what steps others may have taken to resolve them. The order of reviews will be set out in order of objectives previously mentioned. Firstly, insight into why these selected methods of construction applied overseas have been successful in their craft and approach to construction in contrast to New Zealands common platform framing. Followed by the timber construction industry in New Zealand, and why I believe quality is a problem over the past decade and even still today. Other reviews will look into technologies and how these are changing the way of contemporary architecture .

<
Quote

Bird, W. (2010, January 17). Learning old ways to build for today. The Japan Times Online.

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Figure #1

Dovetail joints create character throughout the building, inside and out.

To explore the said aims and objectives through design-led research, consists of looking at three main bodies of knowledge: Engineered timber, quality and detail design and assembly. Feeding into each of these three bodies of knowledge are the traditional Japanese and European construction influences and cultures. The green pathway being the design processes, and the black being the research process, is a constant reflection and feeding into each other to produce a final outcome of a design brief as a way to showcase the research tests and findings.

This craft that I speak of during the research portfolio is a look at detail within architecture and its connections and joints, not a consideration of potters making mugs, or Moroccan leather grainers. envelope, but to consider the joints of architectural elements. The research will draw on interviews and quality literature that are essentially snapshots or side aspects that inform the design, however do not drive the design.

Although the research starts with broad initial architectural detail experiments, it is limited to a specific response of readability in architectural joints. The thesis will result in a newly proposed, crafted solution of residential architecture. It is however not aiming to develop an entire new construction set or a new acceptable solution set, nor advocating for a specific way of living/constructing. The research is not aiming to create a solution to weather-tightness or a product for the building Although cost and affordability is a large issue in this context, that form of analysis goes beyond the scope, expertise and time constraint of this thesis. I acknowledge that in the short period of this research portfolio it would be difficult to resolve all research topics. However, each topic is essential in addressing as it enables critical reflection as a whole in how craft could tackle quality issues. These additional topics could be of further research taken beyond this thesis.

1 . 3 C R A F T

| kra:ft |

Noun

- 1. Skill or ability, especially in handiwork
- 2. ~~skill in deception and trickery; guile; cunning~~
- 3. An occupation or trade requiring special skill

Verb

- 4. To make or fashion with skill, especially by hand

Collins English Dictionary

Craft is a very large research topic in itself and is difficult in trying to identify, recognise and understand. We assume and say that specifically craft in *architecture* is all about the connections a building or space creates (Forker, 2015, p.g. 1). The following book by Richard Sennett titled "The Craftsman" plays with the broad idea of craftsmanship, the perfectionism, and the desire to do well that he believes resides in all of us. "This craft is an exploration of skilled work, where the desire to do a job well done for its own sake still flourishes." (Sennett, 2008).

"The objective of craft in this architecture is to deepen the purpose of constructed environments through the type and quality of the connections. These connections can be either intrinsic or extrinsic to the place or its elements. Intrinsic connections might be literal, as in the way components are assembled; or symbolic, as when a contextual association is registered in the space." (Forker, 2015). This research looks at the intrinsic. The way horizontal and vertical components of construction are joined.

Why choose timber? Many exposed designs that carry detail in their architecture are also comprised of steel, concrete or a hybrid of materials. Firstly, New Zealand has plenty of it. It is a sustainable, renewable resource. Timber requires less energy to produce than many of the other said materials. It also has fewer detrimental global effects than steel or concrete. In many cases timber may not be appropriate for use, however with the increase in structural timber within New Zealand such as such as glue laminated timber, plywood, medium density fibre board, laminated veneer lumber, orientated strand board, densified veneer lumber this material should always at least be considered. However it has become apparent that Timber construction in New Zealand is somewhat dominated by the building code and regulations

of NZS 3604. That is not to say that the architects of New Zealand cannot produce well crafted, timber designs. With the right architect and client (and possibly high budgets), there are endless opportunities as seen through the likes of Herbst, Fearon Hay, and so many more. This research however refers to the majority of common NZ construction or otherwise known as platform framing.

By creating a solution that can be utilised by anyone, not only the top architects in the country, and that will overcome quality issues in construction, we will then begin to see our common residential environments reflect the timber materials, and celebrate the use of timber in our environments.

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Figure #2

The Camp, by Fearon Hay

“...The earliest known typology of quality is found in the writing’s of Vitruvius, who proposed that structures must have three aspects: utility, durability and beauty.”

Craft, Detail & Quality

Quality is an important concept for designers, builders and users of buildings. Over the past decade and recently within New Zealand there have been quality issues within timber construction. Some of these issues include weather tightness issues, or better known as the leaky home syndrome, along with material quality issues, workmanship and construction methods. The two overarching quality concepts I am concerned with in my research portfolio is aesthetic quality and functionality quality. Because of these quality issues, I believe the answer is to master the building envelope detailing, and draw from techniques such as log construction, Japanese post and beam, and CLT. In order to ascertain this, we must first develop a so called 'handbook' of all the typical details for each of

these construction types. Then from there we can develop these into new solutions, answering the research question and celebrating detail within architecture. The next chapter is primarily looking at quality and the article by BRANZ that sparked my initial interest in quality in housing. This led me to construct a set of interviews with numerous builders, project managers, architects and of course the everyday user. These interviews are not a driver of the design, but a side aspect, or snapshot, of the research that informs. The chapter then goes on to address the handbook of selected detail areas of the four construction types showing what is currently on the market and designed today, along with what is involved in the makeup of a building envelope.

<

Quote

(Construction Industry Council, 2017)

WHAT IS QUALITY IN BUILDINGS?

BRANZ

Ian Page & Greta Gordon

Building quality is not easily measured or defined. This report focuses on a programme of eliminating quality issues, whilst examining the various aspects of what defines "quality" in buildings, covering aesthetics, finishes and the functionality, and the most common issues that arise in New Zealand homes. These two concepts of aesthetic quality and functioning quality are the two concepts I desire to address in my research portfolio. Contributing to these quality concepts, as the report discusses, is the failure in workmanship, building error, design, construction methods and materials; which all become a component of quality failure in the NZ construction industry. It is said that when a "high-quality" building is produced, its essentially the result of workmanship with a 'focus on quality' and the quality of the materials. Standards have been developed to reduce quality issues in the individual elements, but not necessarily the connections between these elements, which is where the quality begins to fail. I seek to create a framework for these connections, or "joints" and design prefabricated details that essentially tackle these failures.

BRANZ undertook a New House Construction Quality Survey to observe the defects that occurred. The survey inspected 225 houses during construction and recorded the types of defects observed. The most common defect in houses appeared to be wall insulation fit, with the main cause being poor workmanship, and improper construction techniques/sequencing. The most common problem builders have when producing quality housing is lack of construction details. Followed closely behind is the requirement for special onsite skills. The issue of not being able to build as per drawings and inability to interpret drawings is also an obstacle. These findings indicate that poor workmanship plays a large part in the quality control of construction in New Zealand. In this ressearch, it assumes that with the use of modern technologies of today this will reduce the fault and risk of this poor workmanship. Prefabrication will enable faster production of timber craft whilst reducing defects on site.

Why is quality even a factor to consider in the construction process? The earliest known typology of measuring quality of buildings was found in the writings of Vitruvius. In the first century BC Vitruvius proposed that structures must have 3 aspects: utility, durability, and beauty. In other terms these aspects can be translated to functionality, building quality, and aesthetics. From this it becomes clear that for centuries a building needs a certain quality to be successful,

not only functional quality but also have an aesthetic quality in its looks and its feel. However it is somewhat difficult to define visual, and aethetic quality without being too subjective. Visual quality is all in the eye of the beholder. When preparing for this research paper, the term celebrated was used to define the main aims of the timber construction. This to can be seen as too subjective, as what one believes as celebrated might not be too someone else.

So how can visual aesthetic quality be defined and tested? By firstly including the everyday user in a survey with Architects, Builders, and Project managers with their views of quality, we will also define it as exposed. We will define it as readable, and expressed craft that may appeal to many users in a number of ways whether it be celebrated or not, they will all be able to read the quality in its expressed form.

When examining quality, it can often be a matter of "he said, she said". In this Branz report study I believe it quite successfully sums up the cause of the defects by not pin pointing onto one profession, but acknowledging everyone's part and role they take in the outcome of a successful construction project. The development and outcome of a building is a collaborative effort. How can we ensure every role that is played is successful in reducing defects and minimising risks? Whether it be simply better communication and acknowledging the collaboration, or will it be technology of today creating

Defects in the BRANZ New House Construction
Quality Survey

precision in building, and eliminating human error?

To further develop the research done in this article, a number of interviews were conducted to look into the concept of quality, by speaking personally with a number of builders, project managers, architects and of course the every day user. The purpose of these interviews was to gain second opinions at first hand on what they believe is important in terms of functional and aesthetic quality, where the most common defects lie in a number of construction projects in New Zealand, and what these might be a cause of. It also gave an insight to where they see room for improvement in this area and what could be done

to prevent it from occurring more often. Anticipating the results of this study was that each field would begin to blame each other. The builder would say it's the architect's drawings, the architect would say it's the builder, and the project manager might blame alternatives. The user however could possibly be the most important. The user is the one who experiences the finished product and whose value of quality is the most important of all. Does the client value quality enough to pay more for quality materials, time spent to prevent quality and so on? Once again, the eye is in the beholder and the idea of quality can be subjective.

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Figure #3

Author's own graph summarising table 5, appendix B: Defects in the BRANZ New House Construction Quality Survey

Interview Summaries

Project Manager

Architect

Builder

User

"There are quality issues with everything in building!". The project managers get to see the overview of an entire site and communicate with all parties involved in the construction process. It seemed appropriate to first begin with the project manager interviews as there is no particular bias, or "he said she said" involved.

The project manager iterates how much additional cost goes in to the re-doing of issues on site, that haven't been completed properly at first hand. It was suggested that the cause of this is the demand for builders resulting in poor workmanship or trades that don't care for the quality of the build.

Where do you believe quality in construction could be improved? "Better drawings/details from the architect would certainly help, however it is hard to understand every detail before it is actually built. Often the architect is required to come to site to figure out different details that the builder can't grasp. Prefabrication would certainly help. It's an environment that is easily controlled including less risk and more repetition to minimise mistakes."

"I have noticed extreme lack of quality by builder's." After interviewing an architect who is now in the process of becoming a project manager, he believes that a lot of the construction workers on site are not even professionally trained builder's. As an architect, this interviewee highly prioritises quality, as I'm sure many other architects would too. Only wanting what is best for the user, and quite often the public perception, we as architect's constantly strive for high visual and functional quality. So why is it that the urban environment is filled with architecture with very little variety throughout? Mostly because 3604 is what we *know*. We know that it works, and that it is safe, and that it is cost effective. However we are sacrificing the visual quality by not stepping outside of the comfort zone of 3604.

Better workmanship and communication on site is where this interviewee believes we can improve in the future and where we currently lack in our construction industry.

Multiple builder's were interviewed being asked what they believe the cause of quality issues in construction is. The most common outcome being the lack of construction details. This is interesting in the way that every other profession being interviewed had mentioned the extreme lack of skilled workmanship in construction. With a builder stating that the construction details are not accurate or detailed enough, is this subsequently the cost of the builder not being able to read the drawings? This could be the reason many architects wish to stay within 3604, to minimise error, for example if there were to be an unfamiliar detail drawing the builder could not understand. If the architect were to provide adequate drawings, and present 'fool-proof' diagrams could this be the solution in helping builders further understand the detailing of the design?

Other problems on site that the builder's have reported is the difficulty installing services, requiring special on-site skills, and not being able to build as per the drawings.

Functionality relates to how well a building meets the needs of its users. New house owners may be doubtful of how well a house proposal will suit their needs. A key consideration for the user or client, is the price to be paid for building costs. The higher the costs get and the price to be paid becomes may result in a focus on the client's needs of 'right now' rather than the lifespan of the building. However most clientele have a strong focus on quality, and the quality of workmanship no matter the cost. Whether the visual impact is less important, or the want is for more externally attractive, and user-friendly internally, the fact is that quality in buildings is the most important whether it is basic quality; absence of defects, enhanced quality; How a building meets the needs of its users, or higher quality; How a building impacts users.

"You pay for what you get." Quality may cost more initially however in the long run, quality succeeds in its lifespan and value. This interviewee believes premium products and prefabrication could help monitor quality in the future of construction.

"Damage is usually hidden and may not be obvious during a visual examination." (Weathertightness: Guide to the Diagnosis of Leaky Buildings, 2011). Here, it further demonstrates the reasoning in my research portfolio of creating and celebrating exposed details that will essentially reduce quality issues. When you are able to see and identify detailing, you are able to assess the damage, if any at all.

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Figure #4

Common areas of weathertightness risk
(*Weathertightness: Guide to the Diagnosis of Leaky Buildings. 2011*)

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Figure #5
Building envelope
component layers

1 Roof covering: weather protection to the underlying elements.	7 Thermal/acoustic insulation: Provides necessary thermal and somewhat acoustic performance throughout summer and winter.
2 Ventilation space: ventilates between roof covering and waterproofing layers; may be one or two ventilating spaces.	8 Vapour barrier/membrane: Moisture control and ensuring necessary airtightness.
3 Secondary waterproofing layer: Weather protection during construction, run off layer for water penetrated through roof covering.	9 Battens, space for services: supporting framework for the inner lining whilst providing space for pipes and cables.
4 External cladding: Architectural design element as well as weather protection.	10 Soffit or wall lining: terminates the construction on the inside of the wall or roof construction
5 Ventilation cavity: ventilates external cladding	
6 Protection Layer: protects thermal insulation layer and inner wall construction.	

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Figure #6

Functions and component layers

- 1 Weather Protection
- 2 Thermal Performance
- 3 Moisture Control
- 4 Airtightness
- 5 Sound Insulation
- 6 Fire Protection

- Primary function
- Secondary function
- Other components

The interaction of individual components of the construction - ground floor, suspended floors, roof, external walls, windows, etc. - must be assessed against each construction type - platform framing, CLT, post and beam, log construction - and considered in context over the entire building envelope. Here shows the selected junctions that will be assessed.

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Figure #7

Selected junctions between components to investigate

All detail drawings are authors own,
re-drawn from the stated references.

As a starting point in this research, by looking at and reviewing the details of construction methods currently out there in the practice, and then comparing to our traditional New Zealand platform framing, we are able to create a 'manual' of handbook of details. This then informs the research to then be able to create something different, and relevant to my design framework. In order to create a new design or set of exposed details, we must firstly record what has already been done and how they are working, to then build upon the literature and inform the design. The following chapter is the recorded literature of 4 construction types: Platform framing, CLT, log construction, and post & beam. To record and analyse every detail on these construction types would be an entire thesis in itself, and beyond the scope of this research. Therefore I have selected 4 detail areas to record, based on the research done of quality in New Zealand housing and where the problems mostly lie.

Platform Framing

Platform framing is a further development of timber stud construction. It is currently the most popular method of construction within New Zealand. The load bearing elements consist of storey-high pre-assembled frames of squared sections braced by flat cladding panels or diagonal boards. The floor by floor construction method allows the floor slab to serve as a platform on which to then assemble framework on top of, and based on the principle of stacking storeys one upon the other. The building system presents options for standardisation and prefabrication, and allows for use of standard building components. The advantage of this form of construction is its flexibility in terms of both design and architecture. Platform frame construction is straightforward and economic because it uses identical timber sections wherever possible, which thanks to their small size are easy and cheap to produce.

External Wall Representation

Thermal & Acoustic Properties

External Cladding	External Cladding	External Cladding	External Cladding
Ventilation cavity	Ventilation cavity	Ventilation cavity	Ventilation cavity
Thermal insulation	Protection for insulation	Wood fibreboard	Wood fibreboard
Load bearing structure	Thermal insulation	Thermal insulation	Thermal insulation
Plasterboard	Load bearing structure	Load bearing structure	Load bearing structure
	OSB	Plasterboard	OSB
	Thermal insulation		Thermal insulation
	Plasterboard		Plasterboard
	External wall with insulation between structural members and additional space for services provides better sound insulation & acoustics with a better U-value than A.	Only one more element than A, being the wood fibreboard creating added acoustic value to the wall, however potentially not by enough to justify the added cost.	Double insulation thickness than B with the added wood fibreboard, therefore greater acoustic performance however same thermal performance than B.

<

Figure #8

Axonometric representation of the connection: Component layers / functional layers of an exterior solid wood wall

Artists own diagram inspired by:
(Kaufmann, H., Krotsch, S., & Winter, S. 2017)

Footings

Slab foundation

Any timber construction can use this method and can be on wall or blanket of gravel. (This method shown below).

Strip foundation

Space under small enough that no animals will fit, however adequate cross ventilation to keep air flowing.

Individual footing

Suited for skeleton framing. Keep base as freely ventilated as possible and to allow precipitation water to run off the timber.

- 1 Battens, space for services, additional insulation.
- 2 Internal lining.
- 3 Vapour barrier, airtight membrane.
- 4 Insulation.
- 5 External cladding with ventilation cavity.
- 6 Protection to thermal insulation
- 7 Bottom plate
- 8 Floor covering
- 9 Cement screed or dry subfloor
- 10 Impact sound insulation
- 11 Waterproofing, bearing

Figure #9

Typical section external wall (non- loadbearing)
(Kolb, J. 2008)

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Figure #10

Incorporation of the ceiling in the outer wall in the event of a changed support situation

(Kaufmann, H., Krotsch, S., & Winter, S. 2017)

Figure #11

Panel construction with one layer of insulation
(Kolb, J. 2008, pg. 229)

Panel construction with two layers of insulation

Figure #12
Ridge details showing arrangement of airtight membrane
(Kolb, J. 2008)

Figure #13
Roof Ridge building envelope
(ArchitectureLab. 2014)

Soffit board attached to underside of ridge purlin, which means the airtight membrane can be laid exclusively during the fit-out.

Strip of airtight membrane laid over ridge purlin in advance during erection of roof structure.

- 1 Ridge profile
- 2 Turn up troughs
- 3 140x45 continuous member fixed to top of ridge beam
- 4 Roofing underlay
- 5 90x45 dummy rafter
- 6 Ridge beam
- 7 140x45 Rafters
- 8 Ceiling insulation
- 9 GIB standard plasterboard fixed to battens

Domestic - Pitched truss roof

Domestic

Domestic & Commercial

- 1 Metal cladding
- 2 Permeable underlay
- 3 Purlin
- 4 Truss
- 5 Air space
- 6 Insulation
- 7 Battens
- 8 Ceiling lining

- 1 Metal cladding
- 2 Permeable underlay
- 3 Purlin
- 4 Rafter
- 5 Insulation
- 6 Vapour barrier (if required)
- 7 Ceiling lining

- 1 Metal cladding
- 2 Permeable underlay
- 3 20mm air gap
- 4 Purlin
- 5 Insulation
- 6 Vapour barrier (if required)
- 7 Ceiling lining
- 8 Exposed rafter

Figure #14
Roof Ridge building envelope
(Kolb, J. 2008)

Additional insulation
Roof Ridge building envelope
(Kolb, J. 2008)

Prefabrication

Platform framing showing the degree of prefabrication and its connection points.

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Figure #15

Competency training depending on the degree of prefabrication of the elements.

(Kaufmann, H., Krotsch, S., & Winter, S. 2017)

CLT

CLT is a solid wall construction, and is made up of layers of solid wood boards glued together. The two common methods for the construction of CLT buildings is Platform construction, which I have discussed in the previous chapter, and Balloon construction. Typically platform framing is preferred in CLT construction for ease of installation and efficient assembly sequence (XLam, 2017, p.g 2). CLT is particularly strong and therefore structural because of the layers of boards running in opposing directions. Although what it makes up in strength, it loses in acoustic value so the building envelope makeup will require acoustic insulation in particular between inter-tenancy walls within the hotel design. The CLT solid wall construction category is gaining more and more attraction due to the high prefabrication it allows, in being able to assemble the wall panels efficiently, and quickly on site.

External Wall Representation

Thermal & Acoustic Properties

This configuration achieving an STC rating of 55dB, and being the most cost effective, and size effective of the alternative examples given. This option meets the minimum NZBC rating of 55dB, however does not exceed so doesn't guarantee maximum quality.

<

Figure #16

Axonometric representation of the connection: Component layers / functional layers of an exterior solid wood wall (Kaufmann, H., Krotsch, S., & Winter, S. 2017)

By adding additional insulation and by covering the CLT panel on both sides we increase the STC rating from 55dB to 58dB. If we added another layer of GIB standard plasterboard to side O we would increase the acoustic rating to 63dB.

By having equal thickness & greater thickness of the CLT panel we increase the STC rating to 62dB. Add 1 layer on standard plasterboard to both sides and the acoustic performance increases to 66dB.

This option is similar to A as it gives us the minimum STC rating that will comply with code of 55dB, however provides an option to have exposed CLT panels instead of covering one side with plasterboard. Adding GIB on to both sides will increase the performance to 60dB.

CLT to concrete foundation CLT to concrete foundation CLT to timber sub floor

^
Floor panel connections
(XLam CLT panel assembly guide)

Platform Construction - CLT wall Platform Construction - Frame wall Balloon Construction

^
Mid-Floor panel connections
(XLam CLT panel assembly guide)

- 1 Internal Lining
- 2 XLam CLT wall panel
- 3 Vapour permeable membrane
- 4 Phenolic Insulation board / Thermal insulation
- 5 Vapour permeable membrane
- 6 Cavity batten, fixed to CLT through insulation board
- 7 Exterior cladding
- 8 Cement screed or dry subfloor
- 9 XLam CLT floor panel
- 10 EPS sheet insulation
- 11 Cavity base closer

^
XLam & Pole sub-floor assembly
(XLam CLT Building Envelope guide)

- 1 Internal lining
- 2 XLam CLT wall panel
- 3 Vapour permeable membrane
- 4 Phenolic insulation board / thermal insulation
- 5 Vapour permeable membrane
- 6 Cavity batten, fixed to CLT through insulation board
- 7 Exterior cladding
- 8 Cavity base closer
- 9 Flashing to code requirements

^
XLam Mid floor / Platform framing / CLT wall
(XLam CLT Building Envelope guide)

Square edge panel at ridge

Shaped edge panel at ridge

Panel to panel ridge connection
(XLam CLT panel assembly guide)

XLam roof ridge
(XLam CLT Building Envelope guide)

- 1 Selected roofing over underlay, on galvanised mesh
- 2 Ventilating spacer batten over purlin
- 3 Purlins fixed to CLT with engineered wood screw
- 4 Purlin on spaced packers
- 5 XLam CLT roof panel
- 6 Internal lining
- 7 XLam CLT wall panel

CLT roof on CLT wall

CLT roof on framed wall
- Shaped panel edge

CLT roof on framed wall
- Shaped top plate

Roof panel to wall connection
(XLam CLT panel assembly guide)

XLam roof ridge
(XLam CLT Building Envelope guide)

- 1 Selected roofing over underlay, on galvanised mesh
- 2 Ventilating spacer batten over purlin
- 3 Purlins fixed to CLT with engineered wood screw
- 4 XLam CLT roof panel
- 5 Soffit lining
- 6 Perimeter soffit vent
- 7 Fascia board
- 8 CLT wall panel
- 9 Vapour permeable membrane
- 10 Phenolic insulation board
- 11 Vapour permeable membrane
- 12 Exterior cladding
- 13 Cavity batten, fixed to CLT through insulation board

Prefabrication
Platform framing showing the degree of prefabrication and its connection points.

>
Figure #17
Competency training depending on the degree of prefabrication of the elements.
(Kaufmann, H., Krotsch, S., & Winter, S. 2017)

Log Construction

Log construction has a long tradition particularly the 20th, throughout many new technologies and countries, in particular the European Timber a greater influence construction industry on early European considerably. As the timber architecture. timber became scarce Log construction as a building material, using solid timber those who did not own walls was established their own wood moved and developed in the to other methods of mountainous regions of construction and strikbau the alps, as well as in vastly moved out, while northern Europe with more affordable methods its wealth of straight- such as bolt-building trunked conifers. In construction became the 19th century, and increasingly popular.

Log construction or the term "knitted construction" (Strickbau) is where the beams cross at the ends, subsequently described as being knitted together. The walls were originally built with round trunks, slightly levelled off at the contact surfaces. As the quality of the tools were enhanced over time, the degree of craftsmanship was developed. Mortise and tenon improved jointing, and squared rather than round timber evened out the cross-section of the wall.

When erecting a log building, the primary consideration is the assemblage of the corners. The most simple way to think about this is how can the top log not roll off the one below? It must be suitably supported which leads us to the idea of cutting the lower log in a way that the top fits into nicely. This prompts the timbers to be scarf-jointed at the corners. The beams are generally offset to each other by half their height. This cogged link creates a bond between the two walls suitable in external forces and loads such as wind, snow or earthquake loads. Typical timber construction joints consists of mortise and tenon between each horizontal beam member; scarf and cogging joints at the overlapping corner joints; and tension proof dovetail joints for internal walls tying into the external ones.

A wall with only single log elements , which provided the cladding, enclosing and loadbearing functions is no longer sufficient with the modern standards of living in regards to thermal and acoustic properties. Log construction methods today therefore need additional insulation which can be fitted in multiple ways.

Log construction requires a special craftsman to assemble the pieces, however if these pieces were prefabricated and essentially a puzzle to be put together with the technologies of today, then less risk and quality issues will be present during construction. This assemblage of elements could also then be an element of DIY which us as kiwi's are known for. This could be an element that the whole town may play a part in assembling the log construction pieces, similar to the Mortuary by Gion, A Caminada. The features of this method of construction include careful selection of wood, artistic corner joints, rigid plan layout, high timber consumption and settling allowance (Kolb, 2008).

All drawings in this chapter are done by the author, adapted and inspired by the recorded references.

>

Figure #18

(Steiger, 2007)

Isometric scarfing diagrams of log construction

^
Straight Scarf

^
Internal Wall

^
Corner Scarf

^
Corner Scarf with cogging

^
Corner Scarf with
cogging profile beam

- A Round Logs
- B Round logs with bearing faces and joined with loose tongues
- C & D Squared sections with tongue and groove joints
- E Prefabricated sandwich elements
- F Thermally insulated log wall: Log wall remains visible internally
- G Thermally insulated log wall: Log wall remains visible externally

<

Figure #19
Development of Log Construction

Settlement of log walls

The concept of settlement of the log houses is derived from shrinkage and expansion. The property of the wood which reduces the timber in size when moisture is decreasing is called shrinkage. In the modern day there are attempts to stabilize this movement and stabilize the timber, including pre-drying the wood to the desired humidity content. The value of shrinkage often depends on the type of wood. In large timber architecture with 3 and above stories, this shrinkage and expansion would have to be taken into account with the concept of settlement (Polina, I, 2010).

For the purpose of this research and the hotel being smaller in scale with only 2 stories high, the issue would not have to be addressed in the design, however the concept is an important factor of the construction type that is worth addressing.

>

Figure #20
Settlement of Log Walls

1. Always consider settlement at the junction of log wall and rigid construction i.e windows or doors, stairs, posts etc.
2. It should be noted that the building will be taller after completion than the supposed height reflected in the drawings.
3. Settlement mainly occurs within the first two years.
4. Compacting and tightening the log frame will reduce the settlement.

Settlement of log wall per 1m:
around 50-70mm

External Wall Representation

Thermal & Acoustic Properties

Solid log wall, thickness 204mm

U-Value 0,53W/m²K
As mentioned previously, a wall with only single log elements which provided the cladding, enclosing and loadbearing functions is no longer sufficient with the modern standards of living in its thermal and acoustic properties. Therefore we require elements of a building envelope to create a livable environment.

<
Figure #21
Own drawing inspired by:
Axonometric representation of the connection: Component layers / functional layers of an exterior solid wood wall
(Atlas, Kaufmann, pg. 97)

Solid log wall
Timber Studs
Airtight Membrane
Insulation
Vapour permeable membrane
Space for services
60mm Larch board

U-Value 0,17W/m²K
This external wall is in a two-layer form of construction. In the case of external block wall, this stops the intrusion of humidity from outside to inside, if the formwork is properly ventilated. If the block wall were to be on the inside, the humidity would move through the insulation and meet there on the block wall. however with insulation on the inside we have moisture problems. having vapour permeable membrane will stop this

Solid log wall
Insulation
CLT wall panel

U-Value 0,17W/m2K
Although insulation can be installed on either side of the load-bearing log wall, by insulating the outside of the solid timber wall it increases the benefits of thermal mass. By leaving the interior of block wall exposed means the timber can absorb heat and release it back to the building. This option keeps the structural log wall safe from the elements, however eliminate the "log" look to the architecture.

Solid log wall
Thermal insulation
Solid log wall

A potentially feasible option offers an insulated double log wall. both aesthetically and in terms of cost efficiency. This option results in passive house level U-values with massive wooden walls at a regular wall thickness. This however results in no ventilation gap between insulation and external cladding which could cause insulation layer to dry extremly slow.

External wall to ground slab

External wall to suspended ground floor

^

Figure #22

(Log Construction Junction Details, 2018)

^

Figure #23

(Wartzeck, Herrmannm Krammer, Schultz, & Reichel, 2015, pg. 59)

- 1 Log construction, Loadbearing, 120mm
- 2 Thermal insulation on grid of battens as substructure
- 3 Vapour barrier
- 4 Thermal insularion between battens as installation plane, 40mm
- 5 Double layer of plasterboard, 25mm

Mid-floor - small building

Mid-floor - medium building

^

Figure #24

(Log Construction Junction Details, 2018)

^

Figure #25

(Wartzeck, Herrmannm Krammer, Schultz, & Reichel, 2015, pg. 59)

- 1 Log construction, Loadbearing, 120mm
- 2 Thermal insulation on grid of battens as substructure
- 3 Thermal insularion between battens as installation plane, 40mm
- 4 Double layer of plasterboard, 25mm
- 5 CLT Floor panel

Soffit board attached to underside of ridge purlin, which means the airtight membrane can be laid exclusively during the fit-out.

<
Figure #26
(Polina, I, 2010)

- 1 Ridge vent
- 2 Strapping
- 3 Metal roofing
- 4 Building paper
- 5 Roof joists
- 6 Mid-span Douglas fir log ridge beam
- 7 Insulation
- 8 Vapour barrier
- 9 Ceiling finish

^
Figure #27
(Log Ridge Beam, 2017)

^
Wall to roof junction
(Log Construction Junction Details, 2018)

^
Figure #28
(Wartzeck, Herrmannm Krammer, Schultz, & Reichel, 2015, pg. 59)

^
Figure #29
(Log Construction Junction Details, 2018)

Post & Beam

Post & beam walls, this provides construction, or skeleton construction, consists of timber columns and beams. This construction type is particularly compatible with large, open plan spaces with very little obstruction of interior spaces, and also makes for a very flexible layout. It also provides possibilities for large areas of facade glazing. Because of the low use of load-bearing internal walls, this provides future-proofing as the interior partition walls can easily be relocated or even removed. Post and beam construction allows for the roof to be built quickly, providing shelter for the rest of the build. Post and beam timbers are commonly exposed and therefore celebrated for their aesthetic form.

For centuries in Japan wood was the dominant construction material. Although the industrialisation spurred a shift away from wood, in more recent times and the 20th century many qualities of traditional Japanese architecture are carried forward into today's designs. In this section I will be looking back at traditional Japanese timber construction methods, and then later exploring these techniques with the modern technologies of today.

"Hardly any other architecture reveals so convincingly the inherent characteristics of wood, both structurally and aesthetically, as does that of the Japanese." (Engel, 1964, p. 43).

How is Japanese timber architecture separated or distinguished from other wooden architectures of the world? In fact it is not the timber itself but the mere craft in which its put together. How it has been used and decoratively exploited is what makes it become not just a structurally wooden house but the distinctive Japanese house.

During the Yayoi period (200 B.C.- A.D. 250) noted the somewhat first great revolution in Japanese architecture and joinery. This being the introduction of iron tools. The mortise and tenon was fashioned and Japanese architecture took a radical leap. It is simply impossible, and quite frankly unnecessary, to

name every constructional detail along with its variations throughout Japan. The vastly different histories and design & engineering requirements of varied structures resulted in, among other things, a seemingly endless proliferation of joints, with a combined total of several hundred distinctly different joints. With minor alterations dependant on climate, personal preferences or modifications through the more recently developed metal fasteners, they are basically the same across Japan. We are however referring to the more traditional construction methods and joinery which was completely void of nails or metal fasteners. The *shokunin*, or craftsmen, demonstrate expert control over the behaviour of wood.

Splicing joints, or *tsugite*, must be reinforced and the simplest way to achieve this is through nailing together with the use of iron or steel; however this method has only been developed recently, while before this, the majority of splicing joints employ tenons, dowels, pins or splines. In figure #30 is shown the scarf joint, the most basic joint for splicing and widely used for roof-truss

beams. "It's square-shouldered tenons not only increase the contact surface but make it more resistant to shifting and slippage." (Seike, 1977, p. 93).

Connecting joints, or *shiguchi*, are used in Japan to connect timbers at an angle, with the most widely used and most common kind being the mortise and tenon. The tenon is cut to fit the mortise hole exactly and usually has shoulders that seat when the joint fully enters the mortise hole. As with splicing joints, connecting joints may also include and be reinforced with dowels, pins, metal strap or adhesive; however unlike splice joints that are concealed and hidden, the connecting joint needs not only structural properties but appearance of the finished joint also. To avoid a weak joint, resulted from too large a mortise or too small a tenon, the rabbeted tenon was developed as shown in figure #31. This method of segmenting the tenon increases the area of contact as well as added efficiencies in load bearing. With the large cross section of post and beam, this increase in strength is essential to the joint.

^
Figure #30
Daimochi-tsugi,
oblique scarf joint with stub tenons

^
Figure #31
Kone-hozo (bottom), rabbeted mortise
and tenon

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Figure #32

Forms of frame construction

- 1 Columns and compound beams
- 2 Compound columns and beams
- 3 Columns and oversailing beams
- 4 Beams and continuous columns
- 5 Forked columns

The choice of post and beam construction depends on the architectural requirements and loads that need to be carried. It is therefore best to first establish a grid of the architecture first. In this paragraph we discuss the literature and precedents first, before applying to a concept design. This diagram shows the five most common forms of frame construction in timber.

External Wall Representation

Loadbearing structure and building envelope

- System with external insulation and loadbearing structure positioned on the inside.

This arrangement is recommended for structural reasons to ensure good protection from the weather. Strictly speaking this is the only option recommended from the point of view of a sustainable, reliable construction as there is no thermal bridges or penetrations to the loadbearing elements.
- System with insulation between the loadbearing members.

This loadbearing structure is integrated into the wall construction and has similar properties to platform framing. If there is cladding on both sides and is therefore integrated into the wall construction, regions with higher thermal conductivity ensue at the columns or beam penetrations.
- This system is with internal insulation and loadbearing structure positioned on the outside.

Not recommended owing to problems with penetration of the envelope and providing adequate protection for the timber.
- Hybrid system: Internal insulation for the walls (loadbearing structure positioned on the outside), external insulation for the roof (loadbearing structure positioned on the inside).

Similar to option C, this arrangement is also not recommended owing to problems with penetration of the envelope and providing adequate protection for timber.

Figure #33
(Kolb, Josef. 2008, pg. 108)

Figure #34
Own drawing inspired by:
Axonometric representation of the connection: Component layers / functional layers of an exterior solid wood wall
(Atlas, Kaufmann, pg. 97)

<
Figure #35
Timber loadbearing post to ground
section

<
Figure #36
(Hugues, T., Steiger, L., & Weber, J.
2012, pg. 91)

- 1 120 x 180 mm beam
- 2 120 x 120 mm post
- 3 2 /60 x 140 mm pairs of beams
- 4 Gutter
- 5 Larch flooring
- 6 wall construction:
Boarding
battens
Oriented-strand board
timber stud posts
27mm sandwich slab
tiles

<
Figure #37
Load transfer in frame construction
with continuous or forked columns;
forced transfer via longitudinal
timber or direct-contact joint,
but mostly in conjunction with
mechanical fasteners let into the
timber (the wall elements do not
carry vertical loads)
(Kolb, Josef. 2008, pg. 189)

- 1 Loadbearing structure
- 2 Inner lining
- 3 Thermal insulation
- 4 Protection for thermal insulation
- 5 Framework of battens, ventilation
cavity
- 6 External cladding
- 7 Floor covering
- 8 Cement screed or dry subfloor
- 9 Impact sound insulation
- 10 Structural sheathing
- 11 Secondary structure
- 12 Loadbearing structure

^
Figure #38
(Kolb, Josef. 2008, pg. 110)

Figure #39

Rafter roof connection details
(from top to bottom) Ridge, rafter
collar tie (collar tie roof), rafter feet

- A Rafter
- B Lap joint
- C Collar tie
- D Ridge board
- E Plate (rigid collar tie roof)
- F Tie beam
- G Plate
- H Furring

- 1 Ridge profile
- 2 Roof cover
- 3 Roofing underlay
- 4 Insulation
- 5 Membrane
- 6 Beam
- 7 Rafters

Figure #40

(Wartzeck, Herrmannm Krammer,
Schultz, & Reichel, 2015, pg. 119)

Principal elements of a gable roof

- A Rafter
- B Tie member
- C Ridge
- D Ridge board
- E Eaves purlin or plate
- F battens, counter-battens
- G Close-boarding
- H Thermal insulation
- I Covering layers
- J Eaves
- K Dormer window
- L Valley
- M Wind brace

- 1 Roof cover
- 2 Roofing underlay
- 3 Rafters
- 4 Membrane
- 5 Insulation
- 6 Loadbearing structure
- 7 Downpipe

Figure #41

(Wartzeck, Herrmannm Krammer,
Schultz, & Reichel, 2015, pg. 119)

Responding to the initial labour, and reduce risk in the research I knew I wanted to building envelope for functional 1) design with a certain craft, quality issues to occur. and celebration of the timber The second option will be a post material and 2) tackle the and beam construction type quality issues in construction joined with CLT panels where of residential architecture in the exposed joints of the post New Zealand. I have come intersecting the beam will aim up with the beginning's of a to address the visual quality and design framework, that will design with a certain craft whilst inform the design drawn from celebrating the timber material. the research topics discussed in Both of these methods will this chapter. The design will attempt to strip back the covered propose two options of timber GIB walls of platform framing, construction as an alternative and look at the intersection to platform framing. One being and exposure of vertical and log construction as the solid horizontal construction wall and ease of installation will elements . aim to tackle the lack of skilled

PART TWO

DESIGN METHODOLOGY

I.

DESIGN PROPOSITION & BRIEF

- 1.1 *Introduction*
- 1.2 *Project study / review*
- 1.3 *Drawings series*
- 1.4 *Model series*
- 1.5 *Conclusion*

In order to develop the framework that will further influence a concept design, we need to firstly look at case studies displaying the chosen construction methods. What solutions to the problem are currently existing and how can I create something that is different? What solution carries the same characteristics in the way these case studies have interrogated and therefore mastered the craft in timber architecture? In the following case studies I have selected one demonstration of each method of construction. I observed a post and beam system from traditional Japanese joinery, and a Log construction approach from traditional European methods. I believe these selected precedents best showcase craft and detail within exposed timber joints. I was then able to reflect on the way each method of construction effects the atmosphere and shapes the space created in the architecture. I then compared these against traditional platform framing in New Zealand, which then initiated the framework to influence my design through research.

Tamedia Headquarters

/ Shigeru Ban

^

Figure #42

The shear scale of the post and beam connection demonstrates the exposed nature of detail and joints. The oversized joint exaggerates the post and beam structural system, whilst making the timber material a celebration within the architecture. To further enforce and express this idea the building skin is entirely glazed.

<

Figure #43

Log construction, dovetail corner joint

Vacation Homes in Leis, Vals
/ **Peter Zumthor**

Zumthor has taken the old log construction technique, or Strickbau (Knitted construction), and developed this a contemporary form of architecture with new design principles. By using the requirements of the Log construction type, Zumthor has created large picture windows framing the landscape. The structural qualities of strickbau mean that comparatively short walls are stabilised by reinforcing corner joints

<
Figure #44
Log Construction home in
Leis, Vals by Peter Zumthor

Common NZ Home
/ Platform Framing

^

Figure #45
Typical Weatherboard cladding
covering any hint of the timber
material

^

Figure #46
Timber Framing in the
process of construction

In contrast to the precedents, we must also acknowledge the contrasting example to further emphasize the argument at hand. Presented on the opposite page are modest, common family homes in New Zealand. Family homes that show our lack of quality and timber celebration. Current construction culture is to hide timber detail and present architecture that barely resembles it's timber materiality, whilst also providing very little variety throughout.

<

Figure #47
Common Architecture in New
Zealand Urban environments

Figure #48

Floor Plan / Case Study

(Zumthor, P. 2010)

By looking at the floor plan of a log constructon case study, we are able to analyse its properties to begin a framework for the design. The details of the log construction type require the over-lapping or 'knitting' of the corner joints. Because of the requirement to lock the log walls into place, Zumthor has created a way to emphasise this detail by extending walls into pockets of space or extrusions. Zumthor's system of internal boxed spaces not only provides corner detailing, but also acts as support columns with the structural solid walls. This leads the research to now apply this beginning framework of log construction to the initial concept design, and analyse the floor plans development according to their construction type.

EXPERIMENTATION & TESTING

- A Initial concept iteration
- B From concept to *post & beam* typology
- C From concept to *Strickbau* typology

TYPOLOGICAL DEVELOPMENT

The structural qualities of Strickbau mean that comparatively short walls are stabilised by reinforcing corner joints. This gives the room cell a basic nature, with rigidity and symmetry.

The structural qualities of post & beam mean for a more flexible floor plan layout, greater floor area as well as wider open spaces are developed. Post & beam technically does not require any loadbearing or bracing walls - bracing could also be done by ties or other form of metal bracing, however this with the CLT in mind, this became the conclusion of the floor plan.

>

Figure #49

Floor Plan Diagrams

No scale.

Author's own image.

Development planning sketches of the post & beam grid layout and structural walls drawn from the log construction plan are presented on the opposite page. Without sacrificing view points and sun exposure, the grid and structural walls form two separate box cells with what could be seismic separation in the case of external earthquake loads. In consideration of this a regular plan layout similar to the log construction is generated. Alternatively post and beam offers a greater variation of irregularity in plan.

>
Figure #50
Floor Plan Sketches.
No scale.
Author's own image.

DESIGN METHODOLOGY

1.4

MODEL SERIES

Craft, Detail & Quality

^

Figure #51

Spatial model of hotel room built to understand void forms of log construction and how it affects the internal atmosphere.

Original size 1:20

Author's own image

<

Figure #52

The process of the construction for a log wall was tested by building a scaled model of each log piece, and engineered as would occur in reality on site. For the purpose of the experiment each log piece was created through laser cutting technology (as opposed to the use of CNC technologies which would occur in actuality), and labelled as a component of each wall. The floor members were firstly placed in the centre, with every wall being positioned on its designated side. Proceeding this a log from each wall was overlapped on top of each other, and locked into place. This process gave insight into how the structure could be built, and that by making as many logs and walls identical, will ensure speeding up the construction process and create less risk in the CNC phase.

Original size 1:50

Author's own image

<

Figure #53

To test the process of the CNC modelling technology, a smaller scale model of the corner joint for log construction was created. A 3D form of each piece was modelled, and programmed into the CNC router for testing. At first it was discovered that the drill bit for modelling had a small radius of 6mm. This required any corner that was cut to be less than 90 degrees with a curved radius of 3mm. This required me to re-build the 3D model with each cutout being curved at the corners, and prompted a larger cutout for the vertical posts to be slot into. More assumptions had to be made in relation to a larger scale, as the smaller radius would not have the same consequence, however the process was helpful in understanding the CNC machine and the vertical and horizontal direction it moves.

Original size 1:5

Author's own image

In conclusion of the design methodology chapter, the space and structural qualities of the two construction methods have been briefly explored and developed, with the main driver being the characteristics and framework shown on the opposite page. In the development process the two variations slowly begin to develop their own qualities and veer away from the initial single concept drawing and blank canvas as a floor plan. Derived from the research, a floor plan for each variation is produced and presented in the next chapter, with an opportunity for the design of new details with exposed craft that can be tested against platform framing.

Craft, Detail & Quality

II.

PRELIMINARY DESIGN

2.1	<i>Introduction</i>
2.2	<i>Site</i>
2.3	<i>Programme</i>
2.4	<i>Hotel</i>
2.5	<i>Conclusion</i>

2.1 ROLE OF DESIGN

The role of this design is essentially a platform for which to apply the research. The design, as well as the site, acts as a vehicle; a way to demonstrate and iterate the researched principles by testing the theories against a design.

The design brief consists of a small two-storeyed boutique hotel. The proposal of a hotel design was chosen as a response to the site, and the town analysis of Raglan. Due to the increase in population over the duration of summer there is a shortage of accommodation for travellers, which corresponded the demand for a hotel design. The hotel exposes the user to what

essentially will be a crafted, high quality design. This design will create a viewing platform for the future of what the customary architecture could evolve into, and provide a community that begins to defy the everyday NZS:3604 designed residential architecture. The brief in the concept phase consists of four dispersed two-storeyed units in response to the use of timber and the integration within its surroundings. With approximately 900m² of building footprint, this chapter explores the processes of design iterations through research, before applying the crafted principles noted earlier in the book.

PRELIMINARY DESIGN

2.2

SITE

RANGITAHU

RAGLAN

>

Figure #54

Rangitahi Peninsula, Raglan,
Waikato

Craft, Detail & Quality

Firstly, to introduce the site. Raglan is a small town on the West Coast of New Zealand, about an hour south of Auckland. A small town of around 4000 people in population of which increases by 400% during the summertime. Raglan is somewhat under developed however is a beach town that remains true to their roots. The Rangitahi Peninsula is an up and coming development that sits a mere 5 minutes out of the town centre with over 300 different sections on offer. The chosen site for the design is a selected section on the edge of the subdivision, close to the water and overlooking the western harbour.

Along with this site, comes a set of design guidelines that derive from the council of the Rangitahi Peninsula. The guideline purpose is to ensure that a consistent, high quality approach is taken to the design and construction of houses and landscaping at Rangitahi. The builders and residents will have confidence that the neighbouring properties will be of equal or similar quality, elevating the value of the entire peninsula. The design panel assess each proposal before submitting consent, to create a coherent and sustainable subdivision that envisions everything the town of Raglan is all about.

1. The Round Tent

^
Figure #55

Self-catered accommodation
Camping/glamping eco retreat in raglan.
Positives include:
A getaway amongst nature
A rural outlook over farm and river
Incredibly private

Negatives:
Only accommodates up to 3 guests at a time
A far distance from the CBD
Short life span

2. Solscape

^
Figure #56

Sustainable living, in Raglan
Many different options of accommodation from teepee, to eco bach.
Positives include:
Self-contained options with private facilities as well as shared facilities

Negatives:
Long distance from the CBD
Would need a car to drive into town
Camping doesn't appeal to everyone
Weather dependant

>

Figure #57

Site Overview & Amenities

Image adapted by author

>

Figure #58

Site Plan & Analysis

1:2000

Author's own image

The Rangitahi Peninsula project aims to create an extension of the existing Raglan community, with an objective to "showcase high quality houses, streets and public spaces" (Rangitahi Peninsula, 2017). Rangitahi is committed to encouraging sustainability through high quality design. The guidelines will control this quality, along with the use of a design panel process. The design guidelines seemed an appropriate place to begin in order to create the starting framework for an initial design. Important factors taken into consideration are set out following:

- / Maximum rolling plain height limit of 7.5 meters
- / Minimum setback of houses to the front boundary to be 3 meters
- / Quality materials will be used
- / Roof forms designed to emphasize the vertical dimensions
- / Minimum outdoor area of 80m2

The chosen programme is somewhat paired back, so that the *craft* can become the main focus of the research. The initial concept consists of dispersed two storeyed units with the use of timber and integration into the landscape. The programme in the concept design includes the main hotel buildings, reception building, shared communal spaces, isolated sauna and gym room, and a pathway that connects between the amenities whilst creating a journey through the landscape. The site layout became difficult in trying to achieve maximum daylight whilst sheltering from winds off the coast and accessibility throughout the programme. Factors taken into account when planning the programme and layout onto site was access from the road, view points from the peninsula and privacy to the hotel rooms. In the initial phase

of planning, it came to my attention that part of the chosen site, on the left hand side is in fact an archaeological Pā site. After further investigation into the archaeological reports the discovery of cockle, pipi and other elements that resembled the habitation of Maori was uncovered (Gumbley & Gainsford, 2017). Consequently in the plans of the proposed subdivision nothing may be built on this site, and will remain in it's existing state to preserve the heritage that lies within. Though I do not wish to discourage this factor in the planning of the hotel, this was an unforeseen element that came in to play after choosing the site, and is not a main driver in the development of this research. The site will remain as a green space of the hotel and left untouched to preserve the heritage that lies within.

N

SCALE 1:500

AREA BOUNDARY 1720m²

FOOTPRINT 501m²

SITE

The purpose of the driveway and entrance in the initial concept was to focus on the accessibility and the natural curve of the car's pathway. The car would enter from the road, park or drop off outside the reception building and continue to drive through the site, underneath the footpath and back out the entrance road. Although this was the best route for the car, it caused privacy issues for the hotel rooms and blocks the pedestrian access over the landscape. The main purpose was to attempt to keep the landscape in it's original state as much as possible and to avoid creating a focus around the vehicle.

<

Figure #59

Site Plan - Concept

1:500

Author's own image

Figure #60

Sauna Floor Plan

The Sauna building was an initial concept to embrace the idea of the surrounding landscape, and add another feature into the programme. As an escape for the residents of the hotel the building was to be completely timber and positioned amongst the existing Manuka trees. Although it was a nice element to the programme it did not benefit or emphasise the research therefore was a distraction and not a necessity.

Author's own image.

Figure #61

Reception Floor Plan.

Upon entry you are first greeted by the reception building, which acts as a large void directed out to views of the Raglan harbour. The main driver of the L-shaped design was to give privacy to the units, whilst still being open to the landscape. Surrounding the structure is a deck that begins to blur the definition of inside and outside space hinting towards Japanese design.

Author's own image.

Development of Hotel Rooms

The drawing shown on the opposite page is the beginning concept sketch from which the iterations evolved. The main driver of the sketch being the blurred boundaries between outdoor and indoor, stemming from the Japanese design influence. Drawing from the main factor of the landscape the sketch attempts to give every hotel room their own outdoor space and pockets of viewpoints, however the sketch lacks privacy and while the 360° facade is successful in achieving sunlight and viewpoints, it is not ideal in access and privacy for each room.

>

Figure #62
Hand Drawn Floor Plan
No Scale
Author's own image

Evolving from the sketch on the previous page, the floor plan shown above developed and advanced into two side-by-side units with incorporated access relative to the site throughout. Stair access was transferred to the centre space creating a moment of interaction for patrons of the hotel. This is an initial universal plan with no particular construction type or set of rules driving the design.

The preliminary developments of both construction typologies

were then evolved from the first floor plan, simultaneously driven by the framework that was drawn from the research (as shown on the page opposite). Issues that arose from the concept was access and privacy. Although view points from each face of the building is desired, it has a cost in regards to the privacy from hotel guests walking around to and from their rooms. The circulation was subsequently reassessed with a grid layout for the post and beam design, and structural wall layout for the log design.

^

Figure #63

Concept Floor Plan

Original size 1:200

Author's own image.

ITERATIONS

<
Initial Concept
Post & beam

<
Developing towards
Log Construction

<
Applying corner rigidity
Log Construction

^

Applying columns &
open space grid
Post & beam

^

Figure #64
Site Overview

CRAFT APPLICATION TO DESIGN

LOG

CLT

POST & BEAM

The next step towards creating a design in response to craft, detail and quality is to apply the discussed construction techniques to what was originally a blank canvas of a hotel design, and to then test the theories by contrasting these to the common platform framing of New Zealand. Along with the high quality, fast construction and environmentally sustainable aspects of CLT, the timber provides a high strength to weight ratio, allowing long spans up to 7 meters

in which greatly simplify building structure (XLam, 2017). CLT panels are applied to the floors of the hotel design in combination with the two different options being log construction as one, and post & beam as the other. Additional features across the site include a Japanese influenced verandah framing the pathways over the landscape, and the reception building to take on features of post & beam construction techniques as an entrance to the retreat.

<

Figure #65

Exploded Isometric Representation.

No scale.

Author's own image.

From the first and second review, the feedback that was received was to essentially define what it was this research was trying to achieve. Was it trying to become an acceptable solution? No. The basics of the design were apparent however it was not clear where the craft occurred. The relationship between the research and the design needed to be further integrated, and a step towards a crafted solution needed to be explored in more depth. The outcome of this research-led design is still to create alternative possible solutions that could eventually improve both visual quality and functional quality. It seemed appropriate going into the final design phase to further assess what this meant in the concept

of quality, and how it can be further applied to the New Zealand environment to differ from those of the Japanese and European case studies. What I found from the first few stages was the distraction of the boutique, retreat hotel and the surrounding landscape that the proposed design was to be set in. The focus was differed from what I was truly trying to achieve; looking into the craft and detail of the construction techniques, with the site and hotel merely design vehicles for this research to be tested. Moving forward into the next stage the focus was to emphasise the details, and to draw attention to the qualities of timber construction and its material properties.

III.

FINAL DESIGN

- 3.1 *Introduction*
- 3.2 *Part One: Hotel*
- 3.3 *Part Two: Craft & Detail*
- 3.4 *Conclusion*

The following outcomes are a progression and development from the initial design experiments shown in the previous chapters. The research continues to build on the initial design, exploring how a rich detail and craft in architecture can provide an alternative to the common built environment, whilst challenging quality both functionally and aesthetically. This chapter, in part one will look at the final design of the hotel itself, followed by the craft and detail principles of the design. The main factors taken from the initial concept design was to consider how can this method of construction be different to any of the precedents and examples in the European and Japanese cultures? Responding to this it deemed most important to adapt the scheme in relation to the New Zealand environment and our construction industry.

This meant referring back to the initial study of quality in the New Zealand building and construction industry, and to provide a design for the so called 'lack of skilled trades'. There is a need for consideration of our environment against the precedents, resulting in a simpler building envelope, as opposed to those built in an alpine climate for example.

The arrangement of the units on the site of the peninsula were particularly focused on the integration with the waters edge, and creating pockets of private and public space for each hotel room. The splayed nature of the units was used to maximise this notion, and to emphasise the symmetry of the construction techniques in the semi-circle of the plan. These drawings are a tool to define the programme of the design with the hotel units, entrance and carpark, reception building, and the connecting boardwalk down to the waters edge.

>

Figure #66

Site 3D Isometric, no scale

How can the detail and craft be incorporated into the plan itself? The use of the effortlessly played units along a perfectly curved pathway, all drawing back to one point was a tool used to implement this craft. One might say visual quality can be drawn from the pleasantness of visual symmetry. Going back to Vitruvius's thoughts on architectural beauty is that an architect's designs must refer to the unquestionable perfection of the body's symmetry and proportions. He believed that the body's proportions could be used as a model of natural proportional perfection (The British Library Board, n.d.).

>
Figure #67
 Rangitahi Site Plan
 Scale 1:500
 Author's own image.

The design was influenced by the Japanese nature of indoor and outdoor spaces being blurred, achieved by the surrounding deck and opening shutters. Having a loosely defined indoor space insinuates the importance of landscape within the design.

Scale 1:200

I was mindful in the planning and design of the programme of the hotel scheme to not distract from what the research is focused on. A minimal approach is taken to the design of the programme so that the direction could then be concentrated on the craft being applied to the design. The use of the post and beam pergola along the wharf begins to initiate craft movements drawing on the Japanese construction influence.

<
Figure #69
Visual representation
Water's edge wharf & boardwalk
No scale

!!The pressures of globalisation have resulted in architecture becoming more general and increasingly universal" (Caruso, 2010). In the book, 'Gardens of Experience,' Adam Caruso points towards the commercialised language of architecture, and in particular glass and steel skyscrapers across cities (Caruso, 2010). This concept can be also said of the residential homes across New Zealand's urban environment, with the increasingly universal trends of architecture being overlooked. Architecturally the problem could be seen within the language and details of architecture, where I will begin to provide an alternative. Although it may still conform to regularity and could eventuate into another common overlooked architectural characteristic, it is a beginning point in alternatives relative to the skill of our profession here in New Zealand. Part two: Craft & Detail looks at applying the researched construction types, adapted for our environment, onto the blank canvas of the hotel proposal and in turn providing a higher visual quality of architecture. It is hard to test these solutions, and to find an outcome of the improvement of quality both visually and functionally. Contrasting renders of the old, and newly proposed are shown in this chapter. These help to get a sense of whether you, as a viewer believe the visual quality is an improvement. Included is a construction 'IKEA' manual of provided guidelines for the builders of New Zealand, and the exposed details in the construction. I believe this solution can be an improvement to the functionality issues in our industry.

“...part of the reason people are taking another look at traditional houses is that they feel more like they’re made of wood, and people love that,”

To the right is a ground floor plan showing the development of space driven by the principles of the post and beam construction technique. As a combination of CLT with post and beam, Spaces are greater and more open in plan with larger area's of exterior glazing. With a squarer floor plan than what you will see in the log typology, the plan demonstrates the craft in the exposed split columns with less exterior walls.

>
Figure #70
 Post & Beam Construction /
 Ground Floor Plan
 Original scale 1:50
 Author's own image.

BUILDING
FLOOR AREA

238m²

101	26m ²
102	23m ²
103	30m ²
104	26m ²
105	25m ²
106	25m ²
107	55m ²

ROOMS #08
 TOTAL ROOMS #30

The section highlights details and junctions of architectural elements with the perspective giving a sense of spacial and visual qualities. The ground floor overcame the issue of not having the luxury of a pitched roof by the exposed beams supporting floor loads. Detail 'A' represents the junction between split columns, beams and rafters, having an inset for the beam to be positioned along with a pin joint to support the beam. Detail 'B' represents the section between inside and outside, and how the water-tightness might occur by having a gap before the decking begins, and appropriate shelter above the outdoor area.

>
Figure #71
 Perspective Section
 No scale
 Author's own image

This research is a constant, and ongoing reflection on the New Zealand construction industry

Figure #72
Post & Beam wall makeup adapted to the New Zealand environment
Author's own image

Figure #73
Post & Beam interior visual representation
Author's own image

1.

External Facade
Precedent

^

Figure #74

Isometric Detail Drawing.

Youth Village

Cieux, Haute Vienne, F; 1985

Architect: Roland Schweitzer, Paris

(Herzog, T., Natterer, J., & Volz, M, 2003, pg. 337)

1.

Sliding Door Jamb
Design

^

Figure #75

Isometric Detail Drawing.

Adapted detail with CLT wall

& exposed beams.

Author's own image.

1.

Platform Framing
Before

^

Figure #76

Interior Visual Representation

The blank canvas that is the outcome of the common platform framing construction. Barely no resemblance of the timber material. Author's own image.

1.

Post & Beam
After

^

Figure #77

Interior Visual Representation

The newly proposed solution of a post & beam construction method with exposed timber materials & joints. A display of aesthetic quality in architecture begins to show through in the contrasting images. Author's own image.

2.

Platform Framing
Before

^

Figure #78

Interior Visual Representation

The blank canvas that is the outcome of the common platform framing construction.

Author's own image.

2.

Post & Beam
After

^

Figure #79

Interior Visual Representation

The newly proposed solution of post & beam, with exposed timber materials & detailed joints of the structural members.

Author's own image.

2.

Platform Framing
Before

^
Figure #80
Exterior Visual Representation
Common platform framing methods of weatherboarding, hiding any element of the timber material.
Author's own image.

2.

Post & Beam
After

^
Figure #81
Exterior Visual Representation
The newly proposed solution of post & beam, with exposed timber materials & detailed joints of the structural members. A display of aesthetic quality and blurring between indoor and outdoor.
Author's own image.

“The presence, scent and touch of wood can have remarkably positive effects....”

To the right is a ground floor plan showing the development of space driven by the principles of the log construction technique. Spaces are smaller and more 'box like', with created pockets of viewpoints. With a more elongated floor plan than what you will see in the post and beam typology, the plan demonstrates the craft in the junction between walls and corner joints. Shrinkage and expansion in the beams, caused by moisture content in the timber over the seasons results in movement within the walls. This design would not see much movement as only two stories high. To allow the wall beams to settle but still perform a loadbearing function, they are flexibly "laced" to dovetail sections fixed by a rigid system of vertical posts.

>

Figure #82

Log Construction / Ground Floor Plan

Original scale 1:50

Author's own image.

The section on the opposite page once again proves an appropriate method to get a sense of the spacial qualities in the hotel rooms. A challenge that arose in planning of the spaces was the ground floor rooms not having the luxury of the exposed pitched roof detailing. Therefore the exposed detail was instead implemented in the corners. Section 'A' explores the log profile and weather-tightness. By having appropriate grooves and seals this prevents water entering and allows us to expose the log wall. Section 'B' looks at the weather-tightness of the exterior sliding glass doors. With shelter above and the roof eaves this eliminates mass amounts of water, however the little water that may occur can drain through a gap on the exterior of the sliding door to the soil underneath the elevated structure.

>
Figure #83
Perspective Section.
No scale.
Author's own image.

To the right shows the proposed wall make-up of the log construction type, with its component layer alongside the function layer. If we were to compare this solution to one of the previous precedents of a wall makeup discussed in part one - chapter 1.7, this development has been adjusted to the New Zealand environment by eliminating additional vapour barriers and thermal layers. The following pages will demonstrate the difference in a precedent example, and the newly proposed solution in 3D detail drawings to get a sense of the exposed nature in the final design.

>

Figure #84
Log Construction wall makeup
Author's own image

1.

External Corner
Before

^
Figure #85
Isometric Detail Drawing.
Existing wall makeup & external
corner detail for Log construction.
Author's own image.

1.

External Corner
After

^
Figure #86
Isometric Detail Drawing.
Newly proposed, exposed external
corner detail.
Author's own image.

2.

Inter-tenancy Wall
Before

^

Figure #87

Isometric Detail Drawing.

Existing wall makeup & inter-tenancy
wall junction detail for Log construction.

Author's own image.

2.

Inter-tenancy wall
After

^

Figure #88

Isometric Detail Drawing.

Newly proposed, exposed & overlapped
inter-tenancy wall junction.

Author's own image.

3.

Window Jamb
Before

^

Figure #89

Isometric Detail Drawing.

Existing wall makeup & window jamb
junction for Log construction.

In this detail the end of the log wall is
covered by another timber member

Author's own image.

3.

Sliding Door Jamb
After

^

Figure #90

Isometric Detail Drawing.

Newly proposed wall jamb & external
corner, leaving the end of the log wall
joints exposed, and setting the window
profile flush with the end of the wall.

Author's own image.

1.

Platform Framing
Before

^

Figure #91

Interior Visual Representation

The blank canvas that is the outcome of the common platform framing construction.

Author's own image.

1.

Log Construction
After

^

Figure #92

Interior Visual Representation

The newly proposed solution of log construction, with exposed timber materials & corner joints.

Author's own image.

1.

Platform Framing
Before

^

Figure #93

Interior Visual Representation

The blank canvas that is the outcome of the common platform framing construction.

Author's own image.

1.

Log Construction
After

^

Figure #94

Interior Visual Representation

The newly proposed solution of log construction, Providing pockets of external space creating private outdoor areas, & exposed log joints

Author's own image.

1.

Platform Framing
Before

^

Figure #95

Exterior Visual Representation

Common platform framing methods of weatherboarding, hiding any element of the timber material.

Author's own image.

1.

Log Construction
After

^

Figure #96

Exterior Visual Representation

The newly proposed solution of log construction, with exposed log profiles and timber materials.

Author's own image.

In response to the quality interviews discussed in Part One: Chapter 1.6, the most common theme throughout each profession that was interviewed was the lack of skilled trades within New Zealand. Having endless demand for construction workers has led to a somewhat shortage of quality build, and more towards quantity building. To cater for this lack of well-trained builder's, essentially an IKEA inspired construction manual has been designed. This fool-proof manual system aims to improve communication and readability of drawings between the architect and the builder's. The use of this manual, in combination with the CNC technologies of today will aim for high precision and higher quality of the overall build.

Figure #97
Proposed Log Construction Manual.
Author's own image.

STRICKBAU

A delivery of Goods

You will need:

- / Delivery truck w/ 40' shipping container
- / Forklift
- / Reserve space near foundation area with timber supports as base for logs
- / Ensure timber supports are minimum 400mm off the ground
- / Provide enough materials to cover and protect the logs

Take into account the order in which you will unpack the packaged logs. Ensure the timber materials are not exposed to the elements to eliminate shrinkage and distortion from the moisture content.

D Tightening and Securing Log Frame

A log wall can be stiffened with a single or double log strut on one or both sides of the wall.

- Slide the connecting timber tenoned strut into the designated mortise of the logs.
- Struts can be attached as soon as log courses have reached top of wall.
- Strut is dovetailed in to the log to allow movement vertically from moisture, and restricts tensile stress acting on the structure.
- Strut is dovetailed in to the log to allow movement vertically from moisture, and restricts tensile stress acting on the structure.

Leave settlement gap at head of strut. Ensure no gaps between butt jointed logs behind strut.

B Settling Logs

- Provide during construction covers to protect logs and timber supports on each side of foundation
- Lay the interior walls on the inner side of ground timber on their supports (off the to foun) in order from lowest log, closest to foun
- Check fation
- Compare each timber log and its markings in ison with the wall schedules

E Bracing Cable Wall

- Nail a to their wedge ends of logs supply log below with nails
- Hammered for that purpose the inner vertically so that into wall penetrates 50mm
- Each edge ancho cable log must be braced by at least two log rods.

Ensure that the gable is adequately braced during construction

Leave settlement gap above each bracing rod

G Settling Log Frame

- Place joining strip flush with internal log ends and set back at external cross lapped end.
- Bed next log course by striking downwards on it with care.
- Seal any drying splits appearing in log ends exposed to the outside elements with filling or sealant.
- Use staples to fix into joining strip into place and staple downwards

H Duration of Construction Periods

C Joining Logs

- Bed first, bottom log in place on foundations - refer to details. Fix log in place to each butt joint.
- After the log frame is complete, apply the first coat of stain or protection to the entire log wall
- Always check alignment of foundation walls and make sure that diagonal dimensions from corner to corner are equal

Make sure that logs are tightly butted and cracks have not appeared

F Settlement Gaps

- Always consider settlement at the junction of log wall and rigid construction i.e windows or doors, stairs, posts etc.
- It should be noted that the building will be taller after completion than the supposed height reflected in the drawings.
- Settlement mainly occurs within the first two years.
- Compacting and tightening the log frame will reduce the settlement.

Settlement of log wall per 1m: around 50-70mm

It was suggested in the final review in December, that I reconsider the definition of visual quality. As I had discussed the very subjective term to be defined as 'readable' detail, perhaps this was slightly too ambiguous. How might I rephrase the term visual quality, as there are many 'readable' details that are not of high quality. However the research is not a matter of redefining the term visual quality or beauty, but to apply it to a design framework whilst comparing to the existing built environment to produce a better (not perfect) outcome.

<

Figure #98

Presenting at final review

PART THREE

RESULTS & FINDINGS

I.

CONCLUSION

- 1.1 *Conclusion*
- 1.2 *Looking Forward*

CONCLUSION

This thesis presents an example of producing a potential alternative to the common platform framing construction in New Zealand. From working through the two main drivers of craft and detail, it explores how exposing the timber material and its architectural connections could possibly lead to an improved visual and aesthetic quality for the urban environment.

This research began with an analysis of both the literary and visual context which provided a discussion around quality in architecture. The research evolved into a framework from which the relationship between craft, detail and quality could be addressed. A series of detail studies built up a knowledge base from which the proposed solution could build upon. Drawing series and model series were composed to explore both the spatial 3D and 2D environments. In part two, chapter two, the experiments build upon this

language to explore the proposition of a hotel scheme in Raglan, Waikato. In the final chapter, applying the researched techniques and 'craft' to an architecture amongst the New Zealand environment is explored. A number of findings emerged through the design-led research process. The most significant of these findings hinged around the relationship between the quality of architecture and exposed details, highlighting the importance of craftsmanship in timber construction. The refinement of quality in architecture allowed for a response to the objective, and the subjective. However, the lack of differentiation in the beginning was evident, and perhaps could have been addressed separately earlier in the research. The approach to this research invites residential architecture to challenge the common platform framing, and with the technologies of today perhaps the signs of higher quality and a more sophisticated urban environment.

LOOKING FORWARD

The design outcomes in this research uncovered a range of opportunities in the development of timber construction within New Zealand. Although this is not a single solution to New Zealand's quality issues, it offers variation in how we can provide alternatives that celebrate craft and detail, whilst considering the future of residential architecture. The attention to detail and aesthetic importance in today's construction is becoming more evident. We as a discipline are constantly analysing the influence of atmosphere and observing our surroundings. There is an emphasis on creating a crafted urban environment celebrating attention to detail, and embracing natural materials within New Zealand.

To take this research forward into practice, as I believe it will inevitably continue, each system could be scrutinised in how far it is willing to be pushed. To continue to use CNC modelling, and the robot

arm along with prefabrication is a large step forward for the future of our construction. To continue to understand and challenge the technologies will be required of the millennials to engage the older generation of architects. The future of robotic fabrication is one that is interesting in its potential and although it has been explored through detail scale, what happens at house scale? or for the production of a log house designed in this research?

This research is limited to exposing timber connections and details whilst drawing from cultures construction techniques abroad. With the use of the modern technologies of today, will aim to produce a higher quality of architecture and construction.

II

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