THE role of architects

IN POST-DISASTER RECONSTRUCTION

[BY JESSICA HULME]

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ABSTRACT

In post-disaster reconstruction in underdeveloped countries, architects all too often create design solutions with little appreciation of the environment in which their solutions are expected to work. The disaster context for reconstruction is complex and irregular. Issues vary from lack of available resources; difficulty in transporting resources, inflation of costs for construction materials, corruption in the allocation of aid money and resources, language barriers, and the complexity of architects needing to meet the local socio-economic and cultural norms of each particular community. These are but a few of the complexities that need to be addressed when working in post-disaster reconstruction.

This paper draws on grounded theory field research and analysis of reconstruction efforts in Samoa after the tsunami in 2009 and category 2 Tropical Cyclone Evan (TC Evan) in 2012,; and category 5 Tropical Cyclone Winston (TC Winston) that devastated Fiji in 2016. This paper measures this research and analysis against literature and research and analysis of other post-disaster reconstruction case studies to come up with design iterations that are viable for the post-disaster context of Nanokonoko village, Viti Levu, Fiji.

This thesis investigates the ways that the architectural process of design can be used so that post-disaster communities have access to adequate, self-sustainable, and affordable housing. It does so by identifying the gaps and potential barriers that are created along the rebuilding work flow, then analyses and recommends an improved process for post-disaster reconstruction in underdeveloped countries for the architect and architecture to follow. By adopting the recommended process of reconstruction, the living situation of communities will significantly improve immediately following the disaster and in the long-term.

This thesis also explores the many other value adding roles that the architectural framework can benefit reconstruction through. By ensuring designs are culturally and socio-economically viable to the rural village of Nanokonoko and engages with the affected community in the early stages of recovery.

Figure 1.00
School on Tanna,Vanuatu, post Tropical Cyclone Pam 2015
[image courtesy: Regan Potangaroa]

EPIGRAPH

In general, the word "design" is defined and based on how an object or concept balances three attributes: aesthetics, function, and cost. The "best" designs are usually equated with the highest costs, so that the designers' names attain an aura of privilege and distinction – and thereby bestow commenstruate prestige on the user. [...] we are surrounded by images of things designed for a culture of indulging in, and seeking fulfillment of, desires rather than genuine needs.

There is, however, another definition of design as intentional problem-solving, [...] to help alleviate the suffering of those lacking even the basic necessities. These designers recognize that by actively understanding the available resources, tools, desires, and immediate needs of their potential users – how they live and work – they can design simple, functional, and potentially open-source objects and systems that will enable the users to become empowered, self-supporting entrepreneurs in their own right.

– Barbara Bloemink, Design for the Other 90%

PREFACE

Ko Horouta me Māhuhu-ki-te-Rangi ōku waka,
Ko Awatere me Waipoua ōku awa,
Ko Whetumaturau me Pahinui ōku maunga,
Ko Ngāti Porou me Ngāti Whatua ōku iwi,
Ko Tuwhakairiora te tangata,
Ko Te-Whānau-ā-Hinerupe me Te Roroa ōku hāpu,
Ko Manumamu, rātou ko Rangitauwawaru, Pipi ō Ngāti Ira nō Horouta, Tohe, Tiopira, Pīpīwharauroa, Tuohu, Māui-Tikitiki-ā-Taranga, Toi Kairākau, Rauru nui ō Toi, Paikea Ariki Moana, Huturangi, Porourangi, Tāne Mahuta ōku tīpuna,
He whakapapa Hāmoa anō hoki au,
Ko Va'asili'ifiki ō Lalomalava tōku wharenui, mē tūpuna a Hāmoa,
Ko Brooking rātou ko Nathan, ko Asaua, ko Hulme ōku whānau,
Ko William rāua ko Michelle ōku mātua,
Tihei Mauri Ora!

I come from a long line of Mana Tīpuna (ancestors) who stand for mana motuhake (self-determination), tino rangatiratanga (absolute sovereignty), mana wāhine (Māori woman in authority; respect and dignity of Māori women), mātauranga Māori (Māori knowledge), mātauranga wāhine (Māori women's' knowledge), and tikanga (culture, custom, protocol) that supports whakawhānaungatanga (relationships), Te Ao Māori (Māori worldview), Te Ao Hāmoa (Samoan worldview), the wairua (spiritual), and waiora (well-being and health) of our people, our land, our waters, our resources, and our wildlife through my Māori and Samoan ancestral lines.

Before my architectural education, post-disaster reconstruction and humanitarian projects had always struck a chord in me. I saw architects as people with a practical skillset to transform the spaces that affect the experience of their inhabitants. I saw architecture as a tool that could improve a person's well-being by improving their living conditions, an aspect that can affect the quality of life, especially for those living in poverty.

The people of the South Pacific to whom I belong are known as Tagata Pasifika (people of the Pacific), or Te Tangata o te Moana-nui-ā-Kiwa (people of the ocean). European explorers who visited our territories some 200 to 250 years ago considered our land, from their world view, as Terra nullius or 'empty land' that was unaltered by man and therefore uninhabited; despite our presence, our cultures and our norms.

The downstream effects of our colonisation has meant that mātauranga Māori and matauranga Pasifika (Pacific knowledge) are on the brink of extinction across the board. Vernacular architecture and its methods of construction are but one of those aspects of lost mātauranga (knowledge). The environment and native ecosystems of the Pacific have also been colonised, through the introduction of foreign flora and fauna; as well as the over-harvesting of native flora and fauna. Many plants once used for traditional vernacular building are now endangered or already extinct.

With disasters occurring on a more regular basis and their severity increasing; with the widespread loss of knowledge and expertise of how to build vernacular housing; and the availability of traditional building resources facing extinction; many of our tagata pasifika are left vulnerable to future disasters during the reconstruction phase.

Figure 1.01
Cement and reconstruction materials shipment, Tanna Port, Vanuatu. Post TC Pam 2015

DEDICATION

To the many gracious people who I met while visiting your damaged lands in Christchurch, Vanuatu, Samoa, and Fiji.

Ngā mihi nui ki ā koutou mā.

Also, to my family.
Especially my nieces and nephew:
Talynn, Alyssa, and Ezra.
Thank you for your love and support.
You guys are the best.

ACKNOWLEDGEMENTS

Ā Io Matua, ka nui te mihi ki a koe,
Ihu Karaiti, Wairua Tapu, ko te waiora, te toka, te pūkenga, tēnā koutou.
Papatuānuku rāua ko tō hoa rangatira a Ranginui, tēnā kōrua.
Ki nga Maunga, ngā Awa, ngā ngāhere, ngā whānaunga, ngā mea tātou katoa, tēnā tātou katoa.
Kia kōrua Willie rāua ko tō hoa rangatira Michelle Hulme, he kōrua tōku mātua, ā aroha me āwhina mē au, tēnā kōrua.
Kia ngā kaumātua, ko Lofty Brooking, Phoebe Nathan, Ian Hulme, Fonima Asaua, tēnā koutou.
Kia ngā whānau, Ben, Kristy, Alesha, Aaryn, Tom, Talynn, Ezra, Alyssa, tēnā koutou mā.
Kia kōrua ki tōku kaiako, Regan rāua ko to wāhine Florence Pōtangaroa, tēnā kōrua.
Nā reira kia ngā hoa, I roto I ngā mahi parekura, mē ngā patunga o ngā parekura, tēnā koutou mā.

From Vanuatu: Launkarae village, Efate. Jerry and Annie Esrom and their family. Bob Mulligan. The villages and schools on Efate and Tanna island. The IFRC Shelter Cluster.

Samoa: fa'afetai tele lava Aunty Silaulelei and Aunty Lydian and the Kaleopa fanau for having me stay with you all. Aunty Va'asili'ifiti Moelagi Jackson, Lagipoiva Cherelle Jackson, Paul Anderson and fanau for your hospitality. Fa'avae Gagamoe. Uncle Kolone Vaai for all of your help in setting up meetings and interviews, and to your family for your hospitality. Aunty Namulau'ulu Tautala Mauala and the Red Cross Samoa team for showing me the different villages affected by disasters on Upolu, and for having me at your home.

Uncle Sonny Natanielu for looking after me and for all of your hospitality. Lai-Yandall-Alama and Jian Vun and the Planning and Urban Management Agency. Leiataua Isikuki Punivalu from the Engineering & Management Consultants. Su'a Pou Onesemo and Anne Godinet-Milbank at the Ministry of Works, Transport and Infrastructure (MWTI). Su'a Julia Wallwork and ADRA Samoa. Elsa Fruean. Athol and Kramer Ausenco Samoa architects. Van Wright and his quantity surveying expertise. The families and villages who kindly let me into their homes and assisted with my research in Upolu. And to all of my friends and fanau in Samoa who have showed hospitality like no other, fa'afetai tele lava.

Fiji: Michael Ah Koy and your generous help with contacts. Jamila Homayun and Habitat for Humanity NZ for your help with contacts. Chris and Susan Howe and the IFRC Shelter Cluster. FNU University and the Directors, Professors, lecturers and students of the Architecture and Engineering faculties. Warren Yee and the Fiji Institute of Engineers. Masi Latianara and Habitat for Humanity Fiji. Adish Naidu and the Fiji Association of Architects. The Red Cross volunteers that I met in Rakiraki, Viti Levu. Nanokonoko village and the communities on Viti Levu that kindly assisted with myresearch. Suzie and her family at the Colonial Lodge for your hospitality. And all others that I met on my research journeys, thank you.

Lastly, dad again, for your help, and for getting me contacts through fanau and friends overseas. The VUW SOA Research Sub-Committee and Faculty Research Committee for the opportunity to research abroad. Jared Hubbard, Anthony Mak, Elise Ranck, Jack Leason, Christina Leef, and Lionel Taito for helping with the earthbags, Ben and Victoria Webber and Papa Lofty Brooking for your love and help.

This thesis could not be completed without all of you.
Aku mihi nui ki a koutou ma
(many thanks to you all).
Nā reira, tēnā koutou, tēnā koutou, tēnā koutou katoa.

AUTHOR'S NOTE

(De)colonizing reconstruction can potentially engender the capacity to translate and represent a different praxis of post-disaster reconstruction, liberating it.

Such an urgent move is 'from an [...] impulsive imagination to a [...] collaborative ethical imagination'. If this critical separation can be achieved then space will be opened for more culturally sensitive approaches to the production of post-disaster space, where architects and designers are needed to translate and not become lost in translations.

— Camillo Boano and Marisol García, 'Lost in translation? The challenges of an equitable post-disaster reconstruction process: Lessons from Chile in 'Beyond Shelter After Disaster: Practise, Process and Possibilities'

Firstly, one must keep in mind that every culture and place have mechanisms already in place that are sustainable for their own people, the environment, ecosystem, and culture. They have built over centuries if not millennia from traditional knowledge that helps them live, adapt and thrive.

'Solutions' has become a problematic term in the design realm. The term 'solutions' disregards the complexities and irregularities of society, where there are cultural and historic systems embedded with roots in segregation and exclusion. It also disregards the changing nature of society: demographically, as well as a society's access to education, health, food, employment, and security, which can change over time. Therefore there is no one simple thing to solve for (Miller, 2017).

There is no one right 'answer' or 'solution' to post-disaster reconstruction. However, there are possible design 'approaches' for those who choose to use them. The approaches found take into consideration the many issues and complexities of the disaster context, as well as local issues such as resources, tools and transport. The design output of this thesis considers the practicality and affordability of construction, while also considering the desire of homeowners to have a home that aesthetically pleases them and which they can take pride in.

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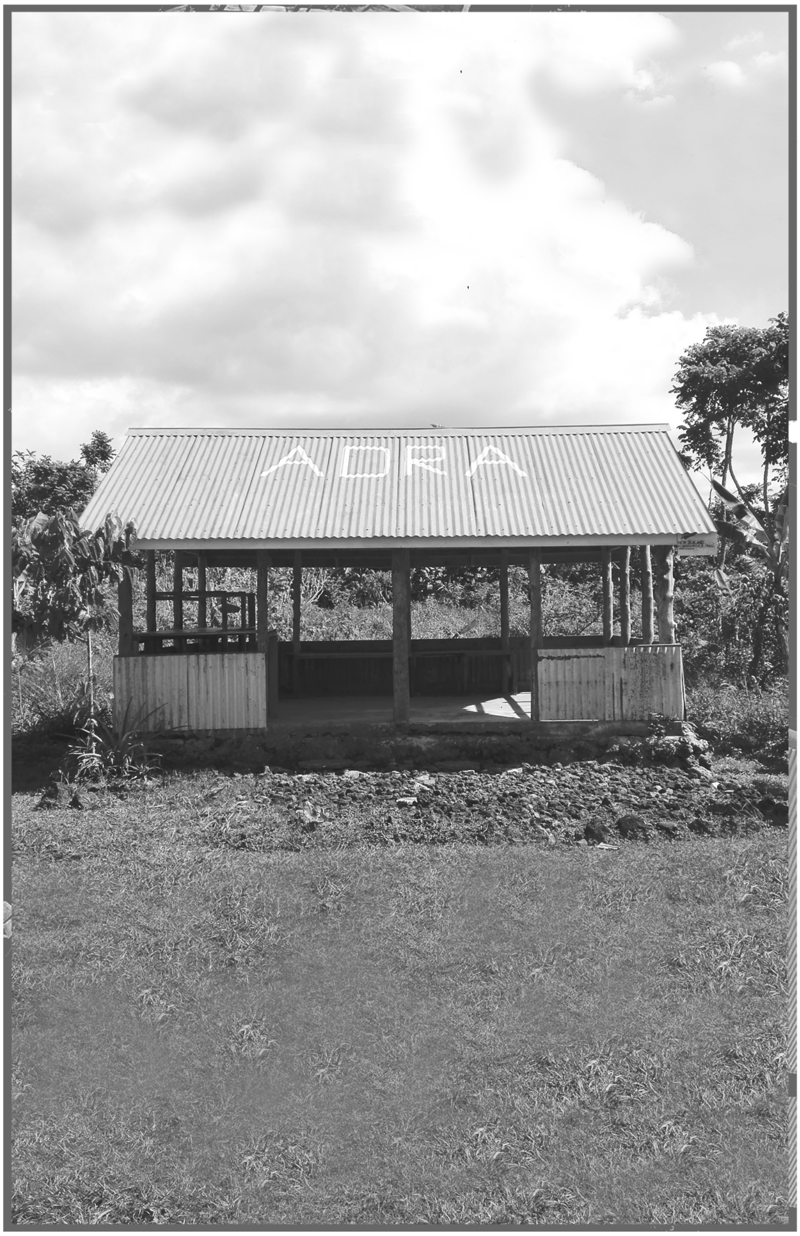


Figure 1.02
ADRA Bus Stop in Samoa
Post TC Evan 2012, Post
Tsunami 2009

The Role of Architects
in Post-Disaster
Reconstruction

By

Jessica Hulme

Supervised by
Regan Potangaroa

CHAPTER ONE

1.0 Methodology
1.1 Introduction
1.2 Literature Review

Figure 1.04
School on Tanna Island, Vanuatu.
Post TC Pam 2015

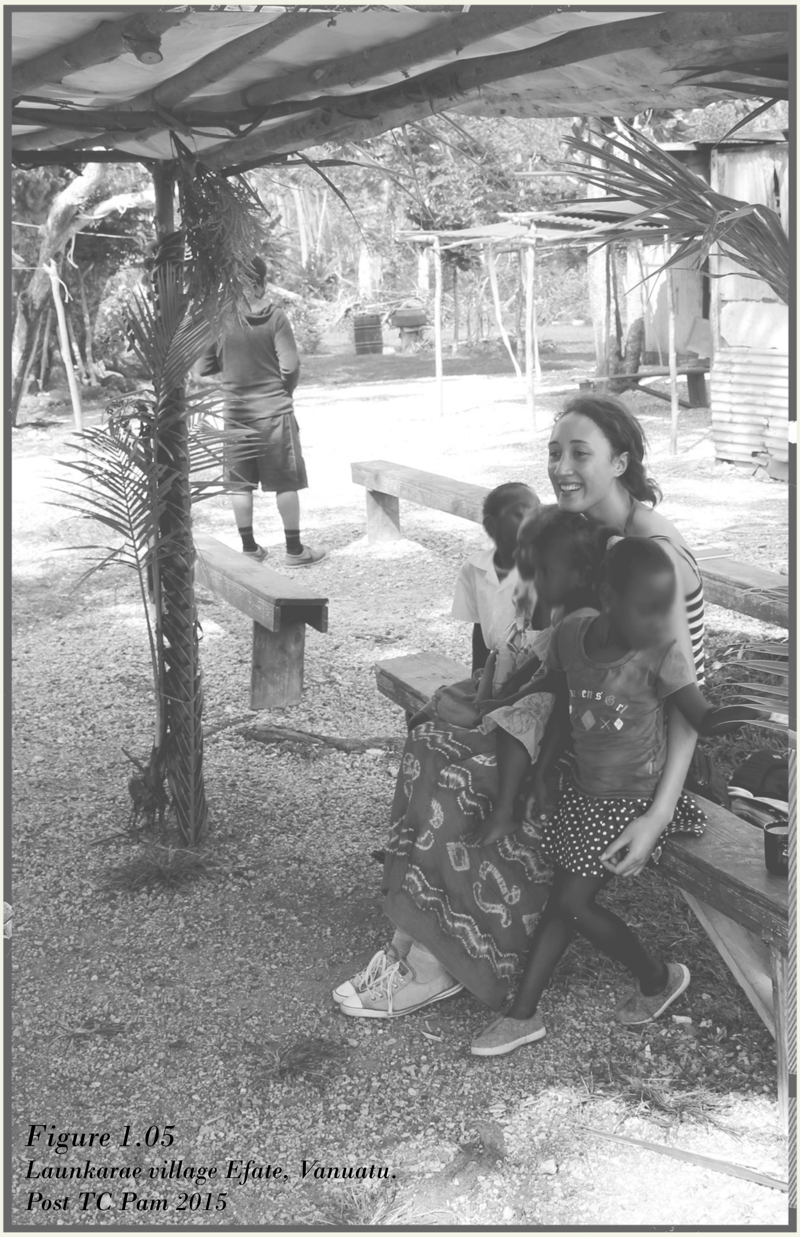


Figure 1.05
Launkarae village Efate, Vanuatu.
Post TC Pam 2015

1.0 METHODOLOGY DIAGRAM

How can we (architects) provide architectural solutions in post-disaster reconstruction, that take into consideration the many complexities and irregularities of the post-disaster context?

So that we can be of help, and provide appropriate solutions, rather than provide temporary solutions that are detrimental to the community long-term?

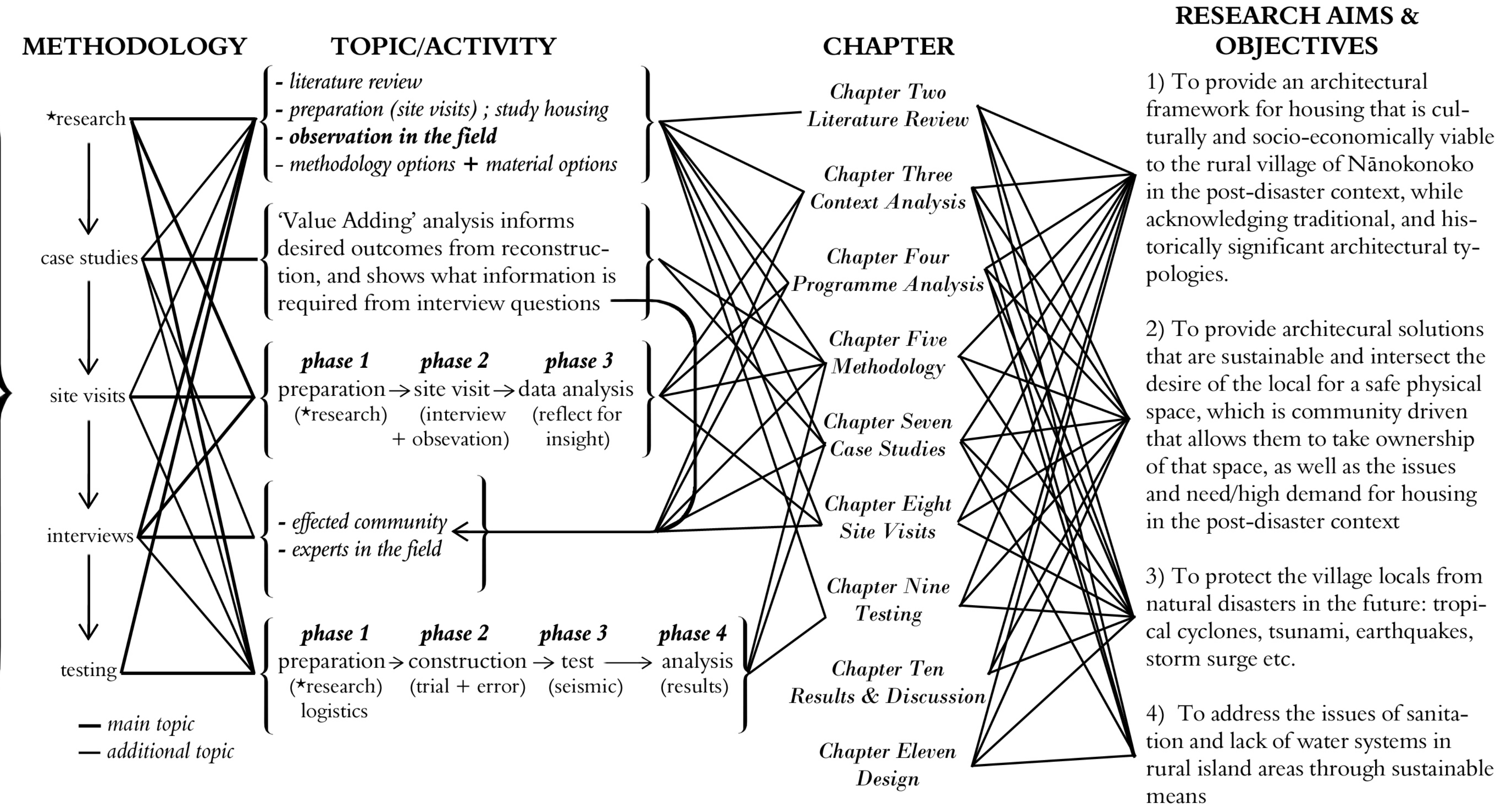


Figure 1.06
Methodology Diagram

1.1 INTRODUCTION

There is a perception that is prevalent in the field: that architects and the technical sector limit their involvement during post-disaster reconstruction to house design, the restoration of infrastructure, and the provision of technical assistance through technical manuals for emergency, transitional and permanent reconstruction projects (refer to Figure 1) (Davis, 2013; Lee, 2013a). Consequently, post-disaster housing is considered as merely supplying a physical product, in the form of a shelter, dwelling or repairs (Ian, Thompson, & Krimgold, 2015), with some critics arguing that architects are the last responders to a disaster.

Many believe that reconstruction should instead establish and maintain a goal larger than the provision of the house itself (Gardner, 2016a). It should encompass and be considered as the 'process' of sheltering, housing, educating, and building the capacity of the affected community (Gardner, 2016a; Ian et al., 2015; Lee, 2013b).

But the house provided is not merely a shelter or structure. It is the 'foundation for livelihoods, a location where building skills are taught, a place to recover damaged identities, an opportunity for psychosocial recovery for a family as they re-group and a structure that is environmentally friendly. Most of all, every shelter has to become a home not just a house.' (Ian et al., 2015, p. 163).

This is in line with Bakarat (S, 2003) and Mo Hamza (Davis, 2013) who raised their concerns that the line between the provision of a physical shelter and the provision of a home is often blurred.

There are also the complexities and irregularities of the disaster context. Transport of resources becomes an issue with road blockages, as well as accessibility to remote areas like smaller islands. Resource availability is an issue, with construction materials in high demand, as well as the inflated costs of materials with distributors exploiting need.

When assessing architectural approaches in the post-disaster context, it is important to factor in the unique needs of each society. Every society has its own socio-economic and cultural systems in place which must be respected. Societies must be given the opportunity for self-determination, a principle that should be interwoven into all architectural approaches.

These are some of the considerations that make post-disaster reconstruction a complex field for architects to get involved in. Thus if architects hope to engage in this field they must ask themselves:

How can we (architects) provide architectural approaches in post-disaster reconstruction, that take into consideration the many complexities and irregularities of the post-disaster context?
So that we can be of help, and provide appropriate approaches, rather than providing temporary approaches that are detrimental to the community long-term?

Figure 1.07
Opposite page: Shelter Project Planning (SPP): HfH FJ Workflow Chart (Kerlesz, 2016)

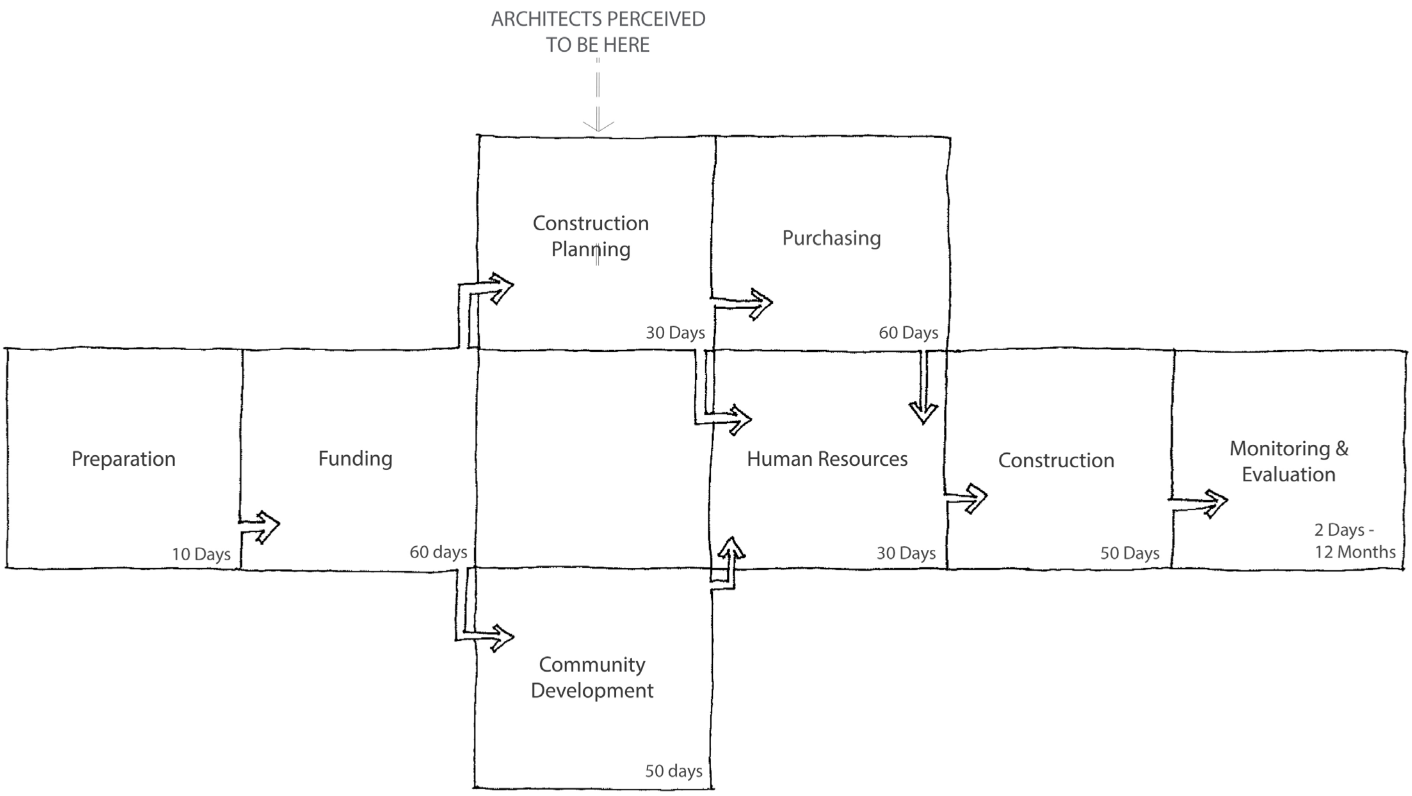

ARCHITECTS PERCEIVED
TO BE HERE
Construction
Planning
30 Days
Purchasing
60 Days
Preparation
10 Days
Funding
60 days
Human Resources
30 Days
Construction
50 Days
Monitoring &
Evaluation
2 Days -
12 Months
Community
Development
50 days

Figure 1.08
Above: Resilience, Process, Reconstruction Diagram

If the role of architects in post-disaster reconstruction is to be the 'process' of housing the affected (Davis, 2013, p. 10), then resilience should be regarded as the process of reconstruction. The process considers complexities of resilience such as: livelihood security, the increase of building skills, the recovery of damaged identities. Resilience should provide the opportunity for psychosocial recovery for families as they re-group in a structure that is both environmentally and socially friendly and is not just a 'shelter' or 'house', but a home.

On the 20th and 21st of February 2016 a disaster struck Fiji; the most severe cyclone to have hit the Republic in recorded history, and amongst the the most severe to ever hit the South Pacific. According to the Fiji government, category 5 Tropical Cyclone Winston (TC Winston) adversely affected 350,000 people (roughly 40% of the total population). With wind speeds of 233 km per hour and gusts of 306 km per hour (Food and Agriculture Organization of the United Nations, 2016) (Esler & Cluster, 2016). TC Winston caused a total of 44 fatalities, due to storm surges and waves, flying debris, and sustained injuries. It caused an estimated USD 1.42 billion worth of damage across all Central, Northern, Eastern, and Western divisions (Asian Development Bank, 2016).

With this background, I conducted some of my research on the Fiji island of Viti Levu in July 2016. One of the villages that I visited was Nanokonoko, situated in the Western Division of Ra. Nanokonoko village is the proposed site location for this thesis and is used to explore architectural iterations for post-disaster reconstruction, and to study the role architects and architecture should play in post-disaster reconstruction. The design iterations for Nanokonoko village will be a useful addition to the academic research bank and reconstruction field as examples of what can be done in the wake of other natural disasters of similar geographic location.

My design iterations began with research of suitable reconstruction materials. Scale models were made out of an appropriate reconstruction material, and tested for their method of construction and seismic strength through trial and error. Approach design utilises the results of material testing, where the method of construction is eventually realised.

The design iterations presented are examples of what can be built in post-disaster reconstruction, arranged in easy-to-build instructions for architects to use as the process of reconstruction. This can be used to facilitate the partnership between local homeowners, architects and builders who are engaged in the design and construction process.

Figure 1.09
Below: Tropical Cyclone Winston
Severely Affected Areas
(image courtesy: OCHA)

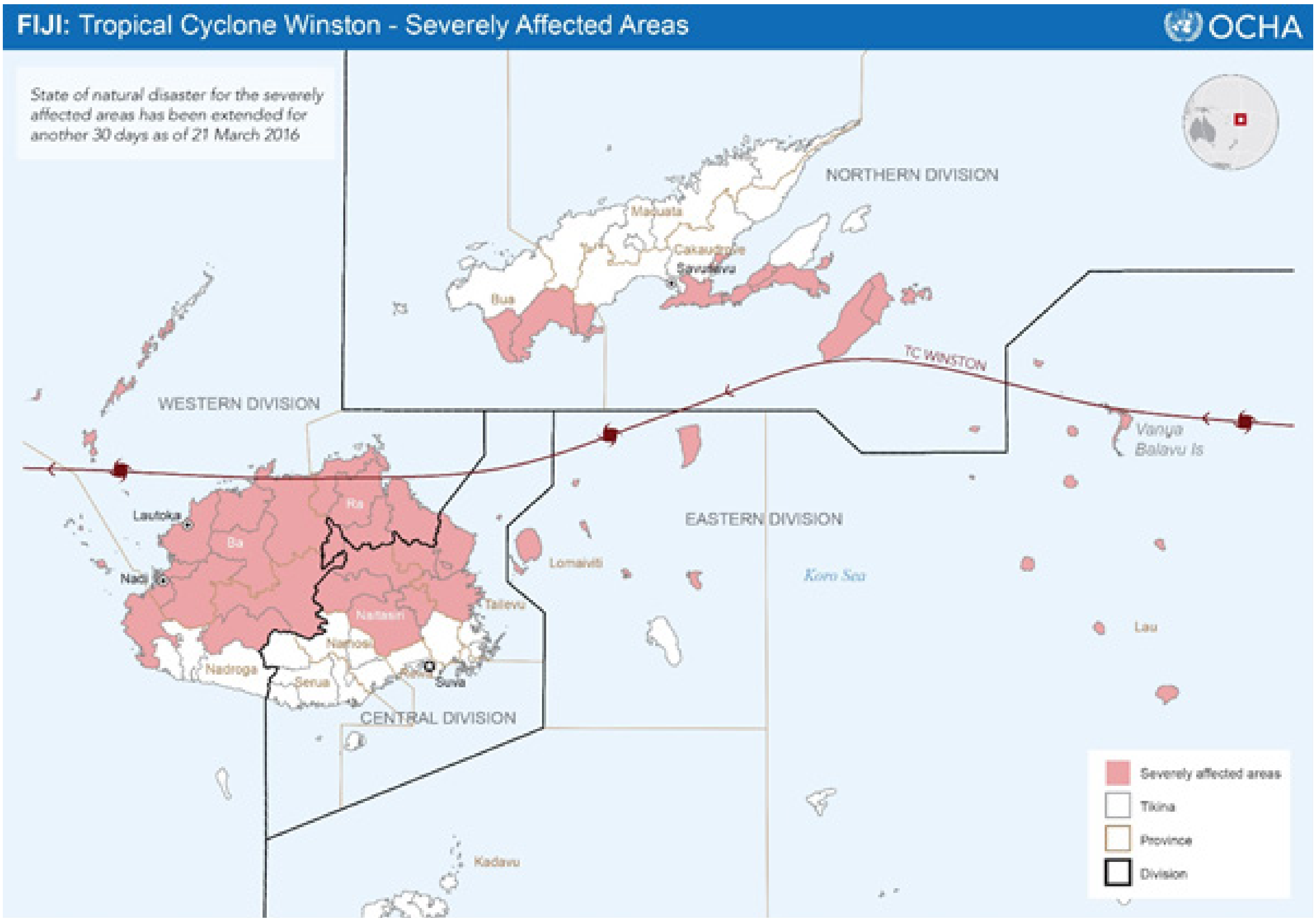


Figure 1.10
Village housing in Tanna, Vanuatu. Post TC Pam 2015

1.2 LITERATURE REVIEW

The seamless process of sheltering and housing in reconstruction as outlined in Shelter after Disaster (2nd Ed.) begins at the initial stages of relief of damaged buildings and belongings (2015).

In the Shelter Project Planning Workflow Chart (refer to Figure 1.11) by Habitat for Humanity Fiji (HfH Fiji), the initial preparation stage includes the repackaging of products to suit donor needs; initial community and stakeholder analyses and needs assessments, keeping in mind the assessment of individual and collective capacities, and extends to the construction, monitoring and evaluation stages incorporating the lessons learnt (Jesus, 2015; Kerlesz, 2016). The Reconstruction Planning Workflow Chart below shows the involvement of the architect from the beginning to the end of the reconstruction process.

The process should also allow for the support of individual and collective capacities to navigate and negotiate for construction materials and building services, livelihood security, identity and psychosocial recovery, and environmental resources that sustain the wellbeing of the occupants. (Ian et al., 2015)G.jpg

<u>Complexities in the 'Process'</u>

Lee suggested that there is no pre-defined ethical process for architects in reconstruction(2013a). This is due to the dynamic and irregular complexities of the socio-economic, political, environmental, institutional and geographical environments of the post-disaster context (Alberti, 1452/1988; Wachter, 2006). Also with the increasing frequency and intensity of disasters (Freudenburg, 2009) reconstruction requires a "series of difficult decisions and choices rather than easy solutions"(Lee, 2013a, p. 487).

The disaster research field came about due to the need for the development of response strategies and mitigation rather than their reinvention for each new disaster (Haas, 1977) (Rodriguez, 2007; S, 2003; Stallings, 2003). As Mo Hamza (Davis, 2013) points out, there is a 'gap' in the field that requires the development rather than reinvention of the role of architecture and architects in reconstruction as well as the development of the process which

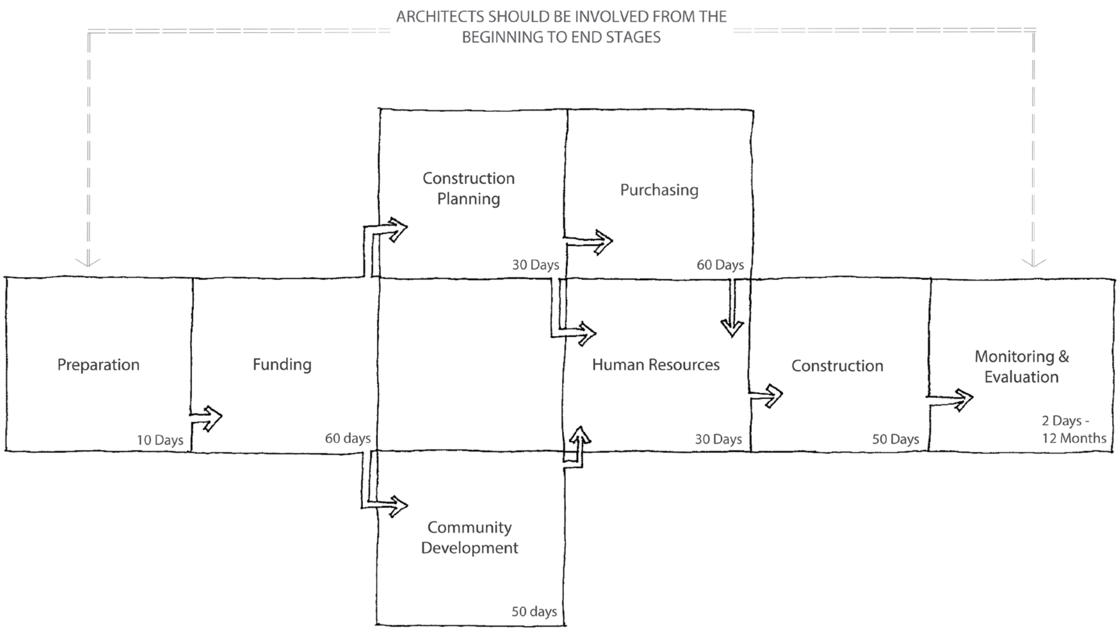


Figure 1.11
HfH FJ Workflow Chart: The Role of Architecture and architects as a 'Process' from initial to end stages (Kerlesz, 2016)

considers a series of difficult decisions due to the complexities involved.
The ‘gap’ could also be that there are no agencies solely devoted to housing reconstruction, and very few that claim to specialize here (S Bakarat, 2003).

Many stakeholders, in a ‘haste’ to act in recovery, provide housing solutions that leave the occupants dissatisfied (refer to figure 3) (Barenstein & Leemann, 2012). Tran (2016) suggests this is caused by their limited involvement in assessing the actual state of the affected community and supplying appropriate reconstruction housing designs. Bakarat (S, 2003) is certain this is due to underestimating the problems posed, poor coordination between agencies and having poor reconstruction planning, as was seen in the case study of Post-Tsunami housing in Samoa (refer to Figure 4). For example, the design was socially and culturally insensitive with toilet facilities located in close proximity to living spaces. Perhaps their involvement in reconstruction should be alongside the first responders to disaster and the affected communities (Lee, 2013a), rather than coming in as the last responders, "because the groundwork for last responders cannot wait until after the decision makers and key stakeholders of disaster have left the room" ("Beautiful Diversion: Response to Nussbaum’s ‘Are Designers The Enemy Of Design?’ by 50 Members of the Global Design Community," 2007, p. 487).

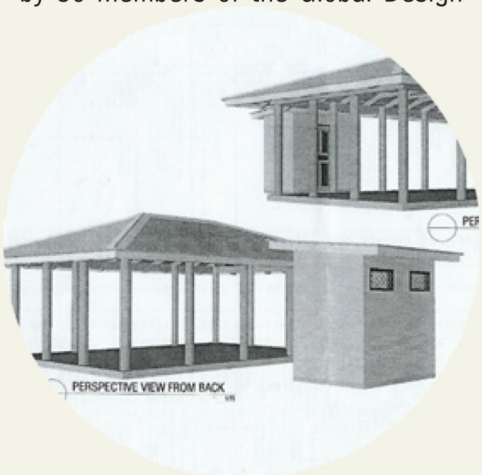


Figure 1.12
Post-Tsunami 2009 Samoa - Reconstruction Design of a Fale with a toilet facing its interior

The tasks architects are involved with in post-disaster reconstruction have been examined by the Max Lock Centre (2013a), and summarised by Tran (2009) into nine different phases of reconstruction; however there is no pre-defined ethical process (Tran, 2016), and no guiding framework for architects to explain what the role of architecture and architects is in post-disaster reconstruction, as it has varied over the years due to the inevitable, irregular and complex gaps within the disaster context (Davidson, 2007; Lee, 2013a).

The architect’s assistance in reconstruction is questioned by Zetter and Boano (2010, p. 210) as they defined the action of place making as ‘not just the domain of the powerful or of design professionals’; as the relationship between decision makers (including professionals) is usually established by the knowledge and the categories defined by those in power (Zetter & Boano, 2010) (Foucault, 1971) (Hobart, 1993; Turner, 2009 1976). Rather it is the architect’s job to observe and listen (Tauber, 2015), and to include and actively engage all of the local population (Davis, 2013), otherwise they can get it wrong on location, culture, materials or quality (Aristide, 2015).

Thus, Boano and Garcia (2013, p. 295) discuss a "possibly innovative way of looking at experts as translators,aiming to include the voices of those excluded by dominant forms of knowledge production". Lizzaralde et al. (2011) also suggests that they should interpret the ways of living of affected residents and the housing typologies of disaster-affected areas, to analyse those ways and translate them into technical, organizational and design solutions capable of promoting long-term development.

On the contrary, the role of architecture and the architect is also defined as the backbone to reconstruction because of their technical assistance and provision of safe resilient housing (Lizarralde, 2010) (E. Charlesworth, 2014) (2011; Design like you give a Damn: Architectural responses to humanitarian crisis, 2006). Saunders highlights that it is to not only provide technical assistance, but it is to support the local socio-economic and political environments, and a vast range of approaches (Coulombel, 2011). Their role is seen as adding 'critical value to long-term recovery' (Davis, 2013; Harris, 2011).

Aquilino (2009) summarized three major roles for architects, one being 'capacity building', the second being 'representation', and the third 'vision'. To build capacity was to improve local construction practises by creating disaster-resilient housing, and by implementing resource and needs assessments (Aquilino, 2011). Davis (2011) stressed that professionals should keep in mind the capacity of the disaster-affected community and the danger of potential dependency. Saunders' said that the point at which assistance decreases, the processes of how a community functioned before the disaster strives to return to normality. However, some reconstruction interventions typically disregard or impede such processes through external supply or product-driven activities. He suggested that their role should "fully capitalise on existing housing processes." (Davis, 2013).

As mentioned earlier, architects are considered as the last responders to disasters by society ("Beautiful Diversion: Response to Nussbaum's "Are Designers The Enemy Of Design?" by 50 Members of the Global Design Community," 2007; 2015). In contrast Lizzaralde et al. indicated the need for architects in the beginning of reconstruction to fully understand and capture local capacity and needs into spatial and technical solutions(Lee, 2013a). 'Representation' according to Aquilino (2010) involved collaboration and consultation with the community and households for appropriate, responsive and safe shelters specific to the local context.

Charlesworth (2011, p. 16) saw that architects were seldom involved in critical political decisions determining the reconstruction process. Thus she suggested that architects use their design expertise to take a professional stand against human rights violations. Bakarat (Esther Charlesworth, 2006) said that when there is a lack of experience in terms of assessment, projects turn out inappropriate and impractical, and beneficiaries neither want nor need what was provided. Bakarat states that this is when reconstruction becomes unsustainable, and at its best, the house is remodelled by the beneficiary, or at its worst, is simply rejected and abandoned.

Da Silva (2003) identified the gap of engaging appropriate technical expertise for work in the reconstruction field. It was common for international engineering and architectural consultants to be employed who had only recently graduated, and did not have the practical experience nor knowledge required for the post-disaster context and seismic design.

'Vision' according to Aquilino (2010) looks at likely scenarios of the future vulnerability of communities based on "in-depth understandings of their long-term needs and capacities" (Aquilino, 2011, p. 57). This is almost a proactive approach to resiliency, and Norton (2016) believes that preparedness is the key. He promotes action to know and address risks so that the hazard does not become a disaster. Shaw (2004) suggests that recovery or reconstruction is a development opportunity for local communities. He states that if recovery planning aims to minimise future risk and enable post-disaster recovery using an integrated disaster risk reduction approach, recovery becomes an integral part of risk reduction. Recovery moves away from rehabilitation and brings to the forefront its interconnection between risk reduction and sustainable development.

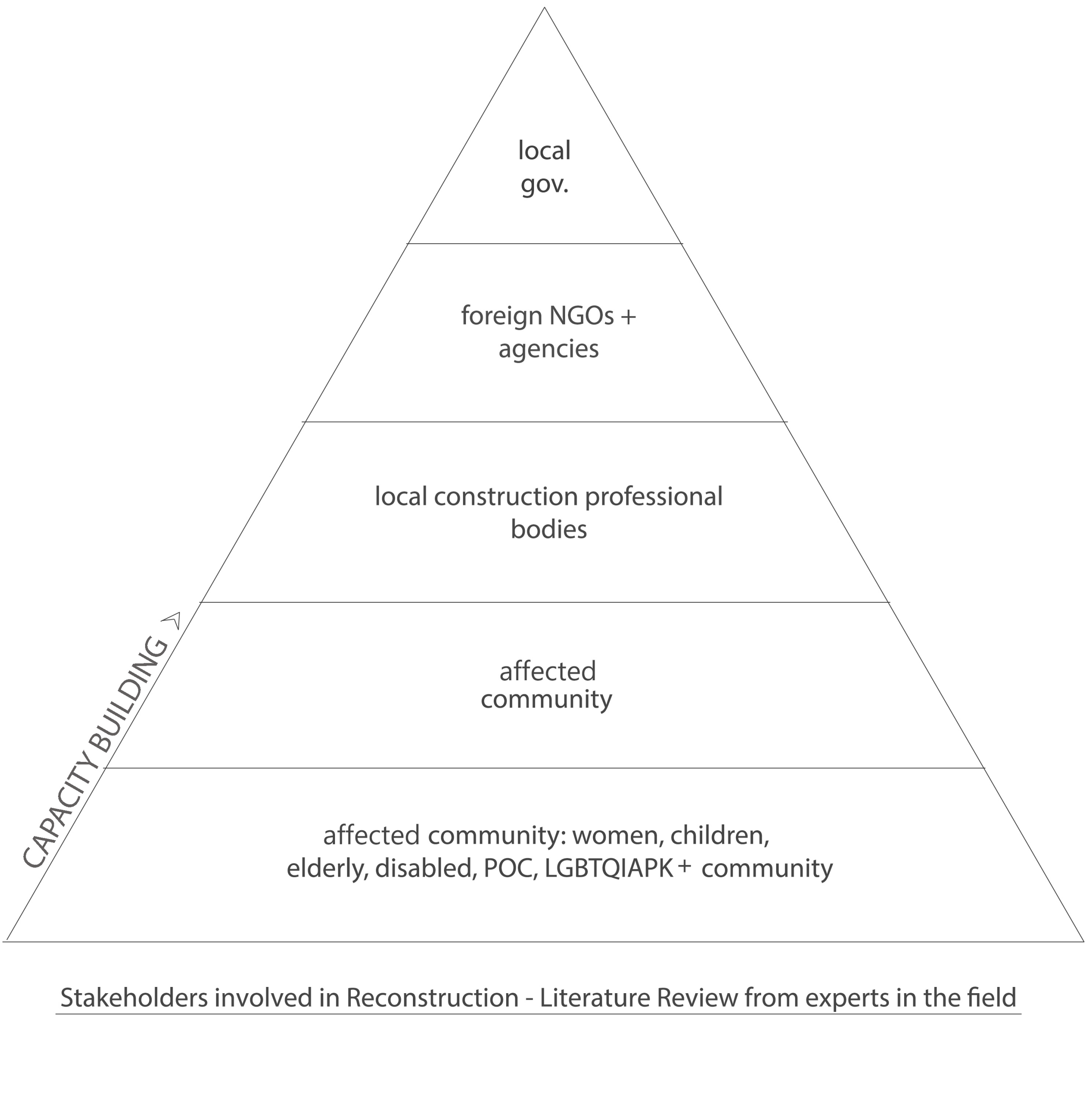


Figure 1.13
Top-down approach as opposed to the Bottom-up approach in Recosntruction

CHAPTER TWO

2.0 CONTEXT ANALYSIS

Geography and effects of TC Winston

The archipelago of Fiji is made up of 332 islands and 522 smaller islets, with 110 inhabited islands located in Melanesia, the South Pacific Ocean (Sivakumaran, George, Naker, & Nadanachandran, 2015)(World Bank, 2016). 32,000 houses across all four divisions of Fiji (North, Central, East, and West) were damaged or destroyed by Tropical Cyclone (TC) Winston.

Climate

Fiji has two distinct wet and dry seasons in a year. River flooding occurs almost every wet season, and occasionally in the dry season during La Niña events (Current and future climate of the Fiji Islands, 2011). Floods are usually linked to extreme weather events, like TCs which bring heavy rainfalls, and tropical rainstorms. More floods are caused by tropical rainstorms, whereas larger floods are caused by TCs in humid tropics (Gupta, 1988) (Kostaschuk, Terry, & Raj, 2001). Droughts are associated with El Niño events.

The typical TC period in Fiji runs from November to April, and occasionally from October to May during El Niño seasons (Fiji Meteorological Service; Pacific Climate Change Science Program, 2011). TCs are also known as 'hurricanes' and 'typhoons', and are formed by warm sea surface temperatures and little vertical wind shear aloft in the South Pacific Ocean (© WMO, 2014 Edition)

The annual average temperature is 20°C to 27°C, with little change in temperature from season to season. Differences depend largely on the temperature of the surrounding ocean (Fiji Meteorological Service; Pacific Climate Change Science Program, 2011). The average night temperature of coastal areas is a low of 18°C and during the day a high of 32°C. Inland average night temperatures reach as low as 15°C.

Population

Viti Levu is the largest island of the Republic of Fiji, and is home to 600,000 people.
Nanokonoko village is rural and is situated in the Western Division of the Ra Province of Viti Levu, home to an estimated 160 people.

Information regarding how the method of construction, processes followed, costs, and the possibilities and limitations of the applied post-disaster reconstruction process was gained through interviews, research and exploration of post-disaster and humanitarian housing (from case studies), and the analysis of HFHFJ housing that currently exists in Fiji. There are two HFHFJ (Habitat for Humanity Fiji) homes in Nanokonoko Village (labelled on Figure 5: Nanokonoko Village Site Plan).

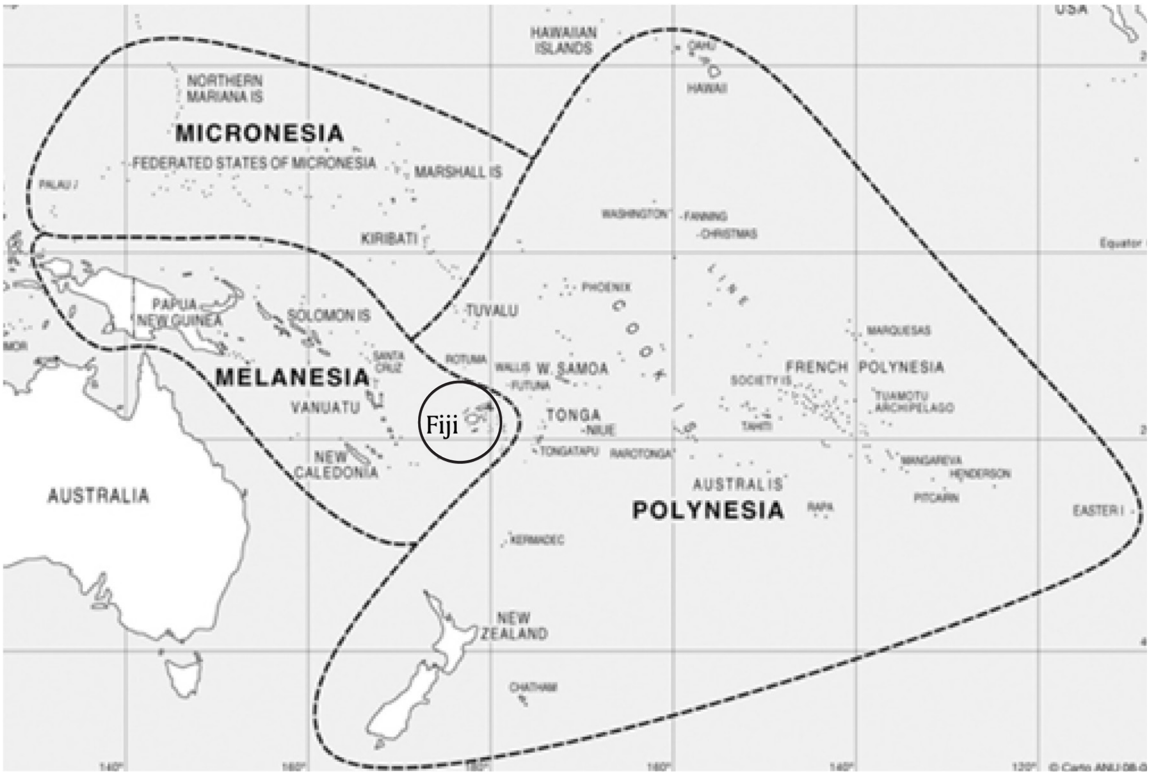


Figure 2.01
Polynesia, Micronesia, and Melanesia of the South Pacific (image courtesy: Australian National University)

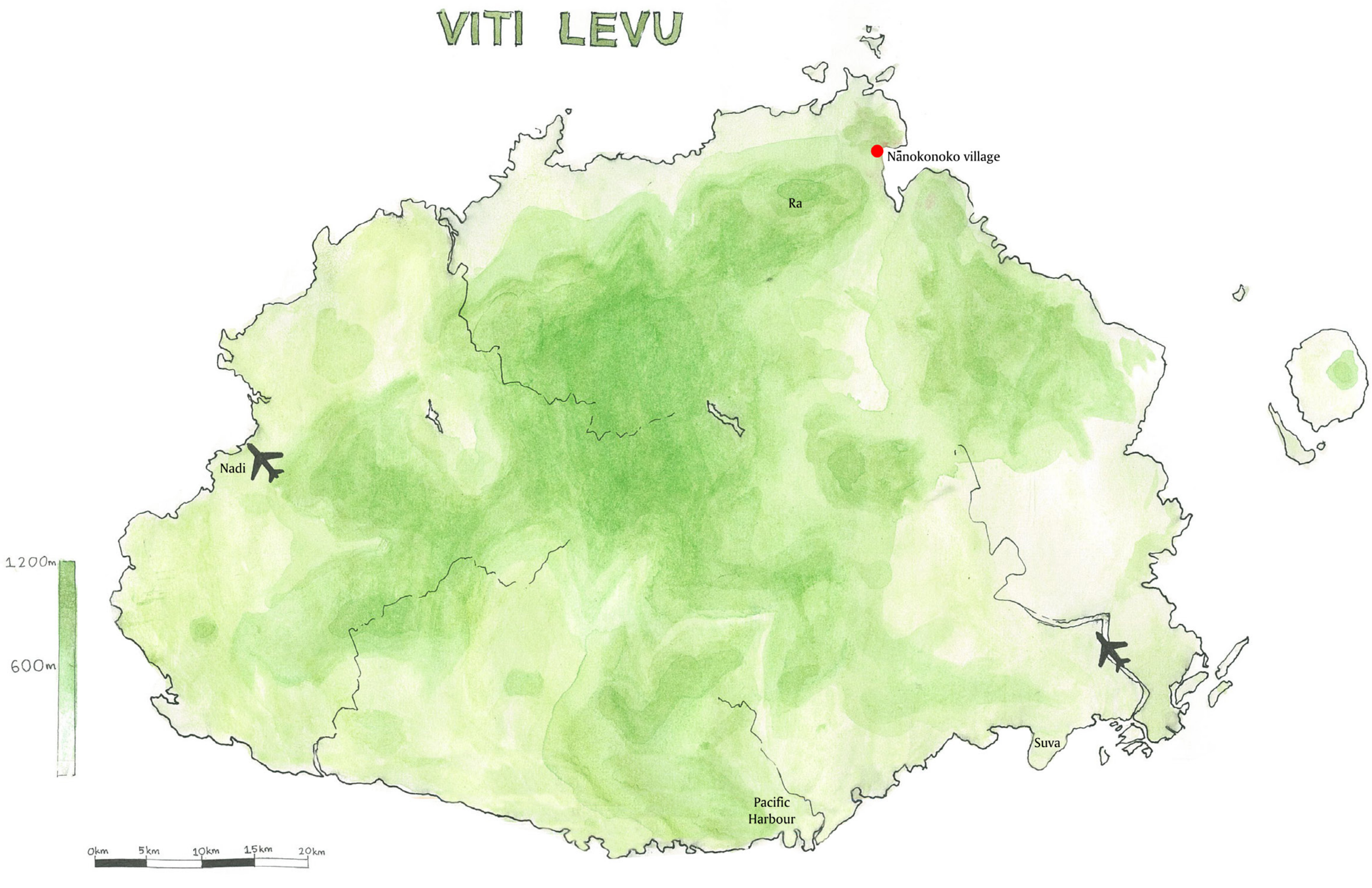


Figure 2.02
Nānokonoko village, Rā District, Viti Levu Island, Fiji.

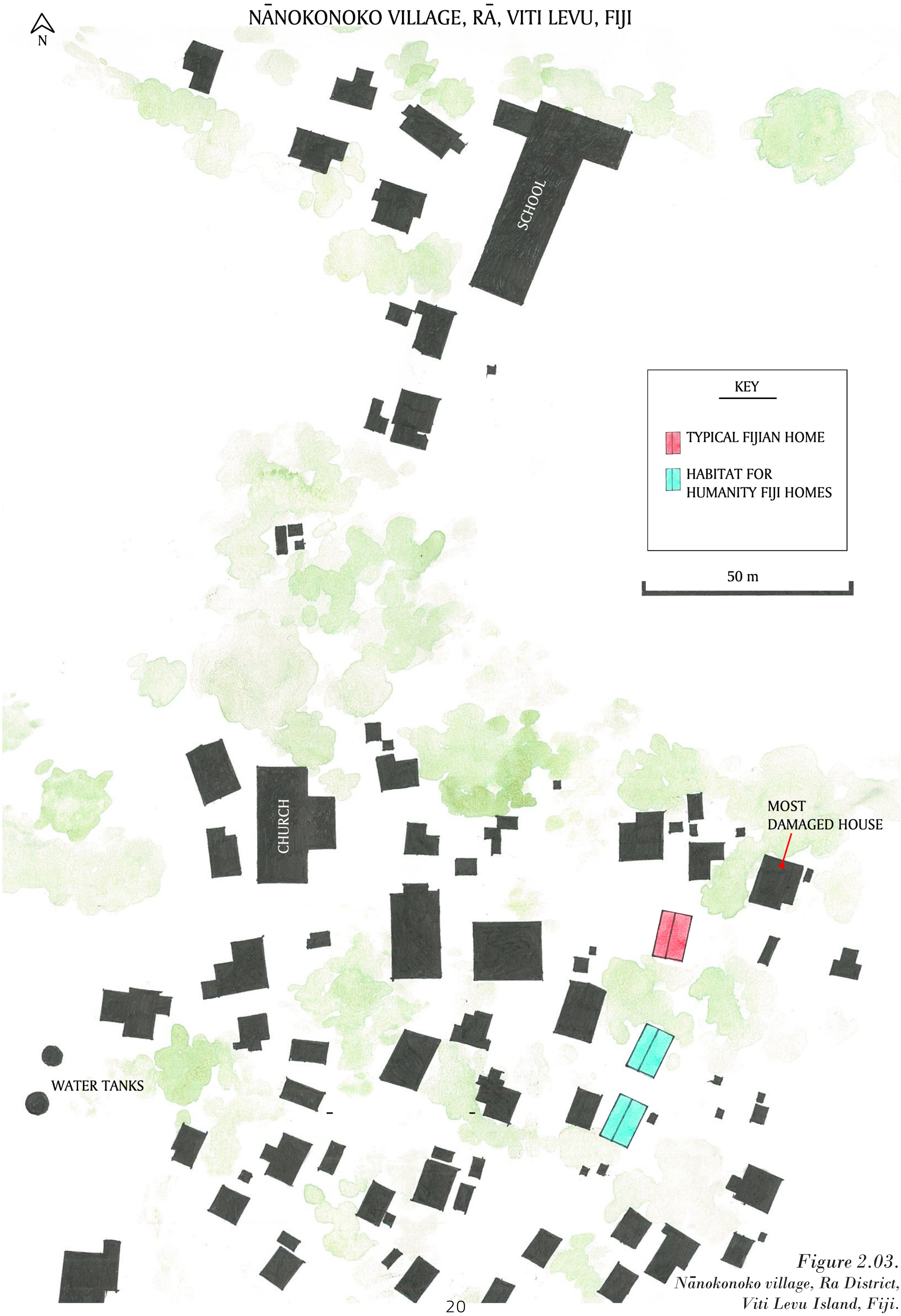
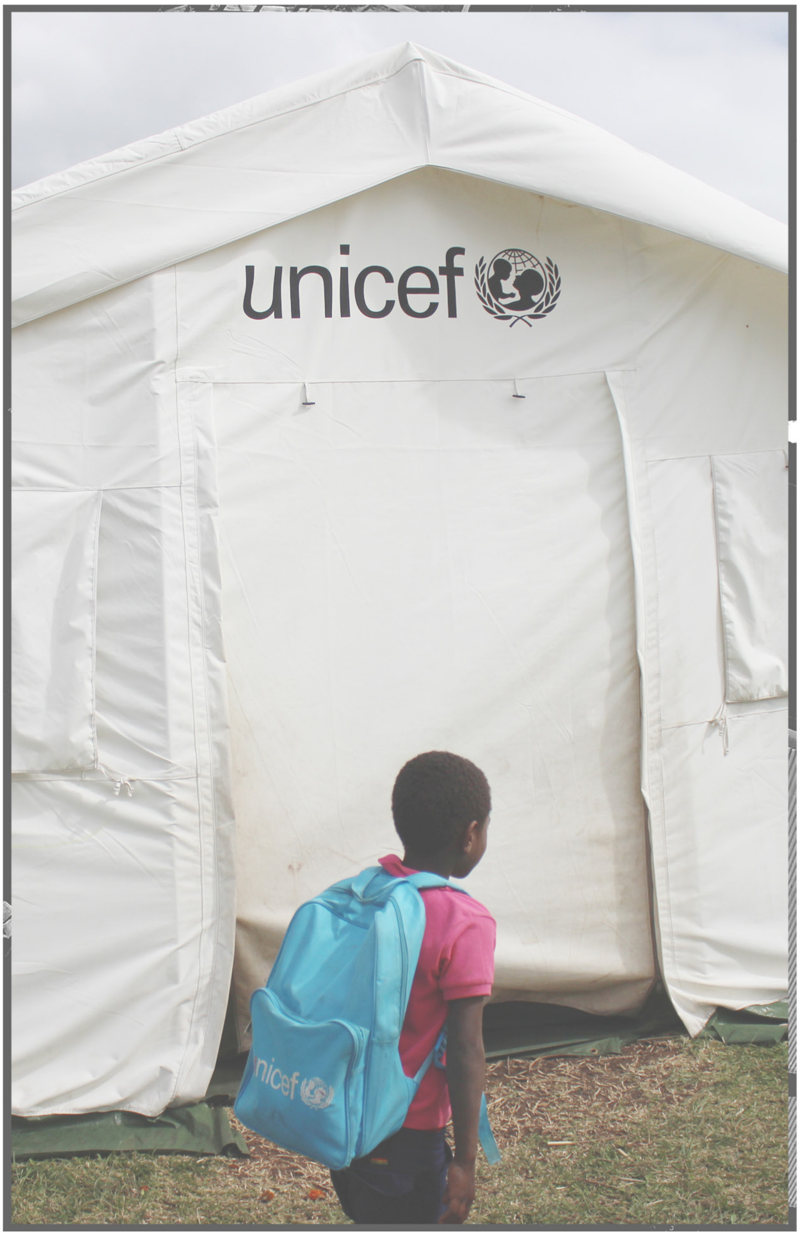


Figure 2.03.
Nānokonoko village, Ra District, Viti Levu Island, Fiji.


unicef
unicef

2.1 PROGRAMME ANALYSIS

A 'catalogue' of HFHFJ housing was analysed for costs, materiality, sourcing of materials, construction process used, volunteer process used, project management, accommodation for volunteers, transport for people and tools/resources/prefab pieces, the prefabrication process, local builder training and/or expertise hiring an experienced workforce and the logistics involved for the role of the architect.

The most common structure to be built by HFHFJ according to the organisation's Director is the Transitional Shelter, with an average cost of around $7,628. This structure and the Full Transitional Shelter with an average cost of $12,032 are the most common to be donated and built. The Director stated that the standard designs were used because donors would want to see visible results (maximum output) from what little money they could donate, given that 'shelter' is the most immediate need of the people. However this is not the case, as the Director put it, water and sanitation are needed just as equally. The houses that include water and sanitation (kitchen, bathroom, toilet) cost more, the cheapest costing $23,778 on average (Full Transitional Shelter with Toilet, Shower, and Kitchen). A hurdle that needs to be bridged in humanitarian architecture is the tension between what is needed by the homeowner, versus what is wanted (or seen as needed) by the donor.

In the case of Nanokonoko village, the watercolour sketch (Figure 2.05) is one of the two HFHFJ home's in the village. As seen in the sketch, it has been expanded by having a kitchen built onto its exterior. Although the floorplan is not presented here, the house design is the 'Open House with Porch & Bath'. It costs $36,069 to build in Nanokonoko village, Ra, Western Division, Viti Levu. In the Central Division it costs $32,790, and the Northern Division $39,348. It takes 20 days to build.

The only fault with the 'transitional' home design is its inability to be 'extended' for growing families. All walls on the house design are structural so any future modifications cannot be performed economically. Given that the walls cannot be taken down, any extensions were in effect an 'outer shell' to the original, central house.

Figure 2.04
Opposite Page: UNICEF tent and donated school bags for school on Tanna Island, Vanuatu, 2015.

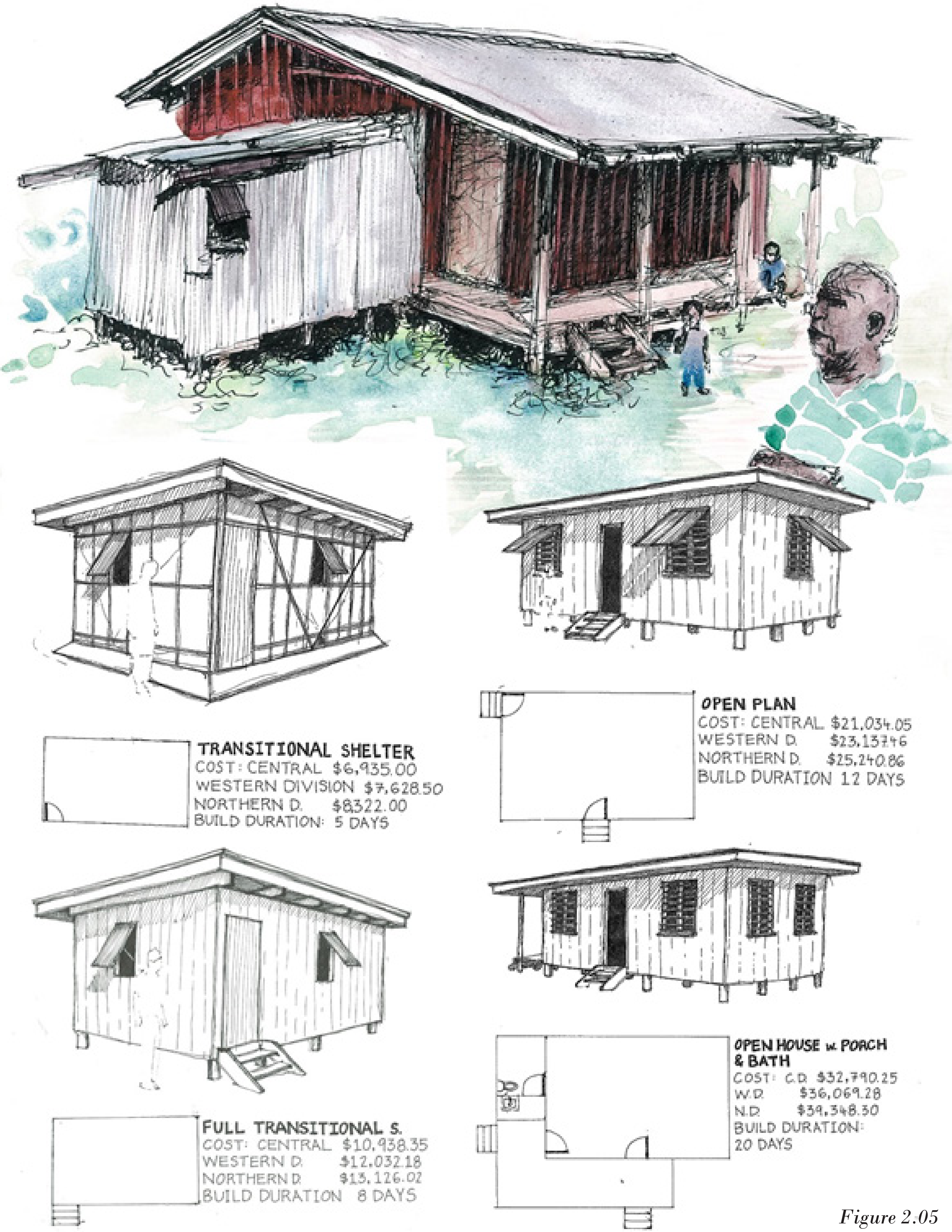


Figure 2.05
HFHFJ House Catalogue
Top image: HFHFJ house sketch in Nānokonoko Village, Fiji

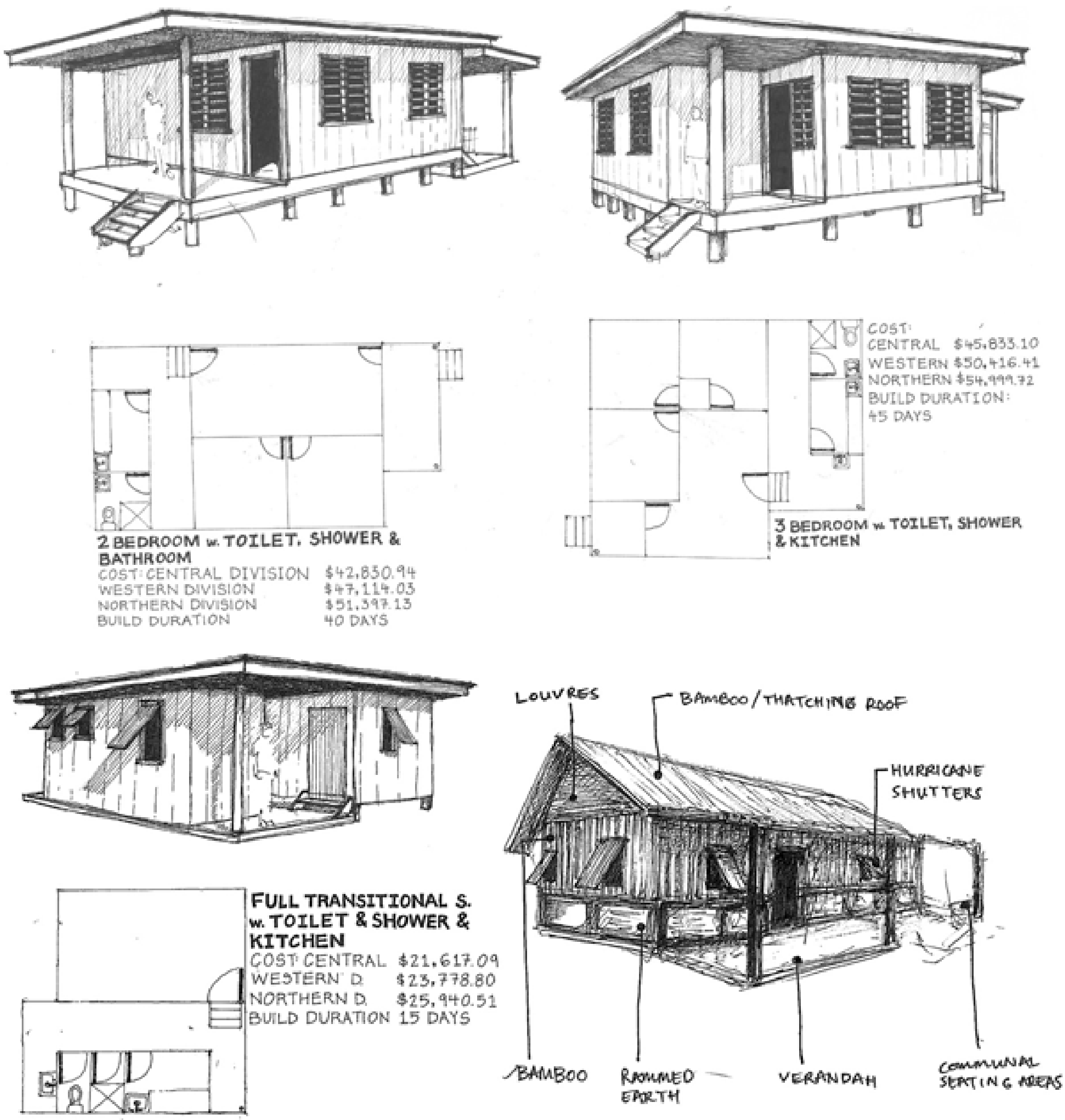


Figure 2.06
HFHFJ House Catalogue
Bottom right image:
House Material Brainstorm

Figure 2.07
Typical House in Fiji
[Sketch of home in Nānokonoko Village]

This typical Fijian home was observed and sketched in Nanokonoko Village. It was made of timber frames, corrugated iron exterior, had a front garden area, back porch, and hallway separating amenities from living spaces. The Living area was about 30m2, both bedrooms 7.5m2 each, the outdoor porch also 7.5m2 (lost the roof in the cyclone), and the indoor kitchen, toilet and wash areas were together about 20m2. The total floor area about 72.5m2.

This house belonged to a family of four from three generations who lived there permanently. Family members from surrounding houses stay at each other's homes regularly. The outdoor circulation spaces (corridor, front porch, and back porch) worked well. The indoor circulation space of the living area was slightly more awkward, with couches located around circulation spaces. The couches were often too far from each other for people to hold a conversation. From the sketch in Figure 2.07, part of the two HFHFJ homes can be seen behind the typical Fijian home.

Analysis of the socioeconomic and cultural patterns of the village was conducted to achieve design iterations. The study analysed house designs, master plans, through sketches and interviews.

Referring back to the HFHFJ Workflow Chart (Figure 1.11), the process of reconstruction shows that the Preparation stage that contains analyses for socio-economic and culturally appropriate design data collection precedes the concept design phase (in construction planning).

Adequate housing according to international law is a basic human right, and entails security, habitability, affordability, safety, and is to be culturally appropriate (Office of the United Nations High Commissioner for Human Rights, 2009).

Figure 2.08
Damage of school on Tanna Island, Vanuatu 2015. UNICEF tents as classrooms were a common sight. [image courtesy: Regan Potangaroa]

2.2 CASE STUDIES

The 'Value Adding' framework developed by Kestle was used for case study analyses. This framework has been extensively used in the humanitarian field as it uncovers the value generation within the design management process and hence the role of architects in terms of value adding. It has four key areas of the framework which reflect the many stakeholders participating in the value adding process — 'value generation', 'knowledge integration', 'process integration' and 'timely decision making'. Each stakeholder, client and case study emphasized where their project added the most value in one or more of the four areas, reflecting the differing values of the different participants (Shaw, 2014). Perhaps more importantly it can also point out the gaps between the theory and the reality.

From the literature written on each case study, one mark was given each time value was put on one of the four categories. For example, if the case study captured and integrated specialist knowledge (1 mark), and local knowledge (1 mark), the project would have a total of 2 marks for

Figure 2.09
Sri Lanka after the 2004 tsunami [source: CNN)

Figure 2.10
Shigeru Ban's Kirinda Housing post 2004 tsunami. [source: AKDN]

'Knowledge Integration'.

30 post-disaster reconstruction case studies were studied and analysed through the 'Value Adding' framework to see what the contributing agencies perceived as adding the most value.
The information gathered was then used to record what factors of the reconstruction process were deemed to add the most value, and was used to evaluate against what was seen in the field to find similar or dissimilar gaps, including how the agencies decided to address these gaps (if at all) in order to maximise value added and minimise complexities. The data was used to design the questionnaires for experts in the field (the questionnaires can be found in the Appendix).

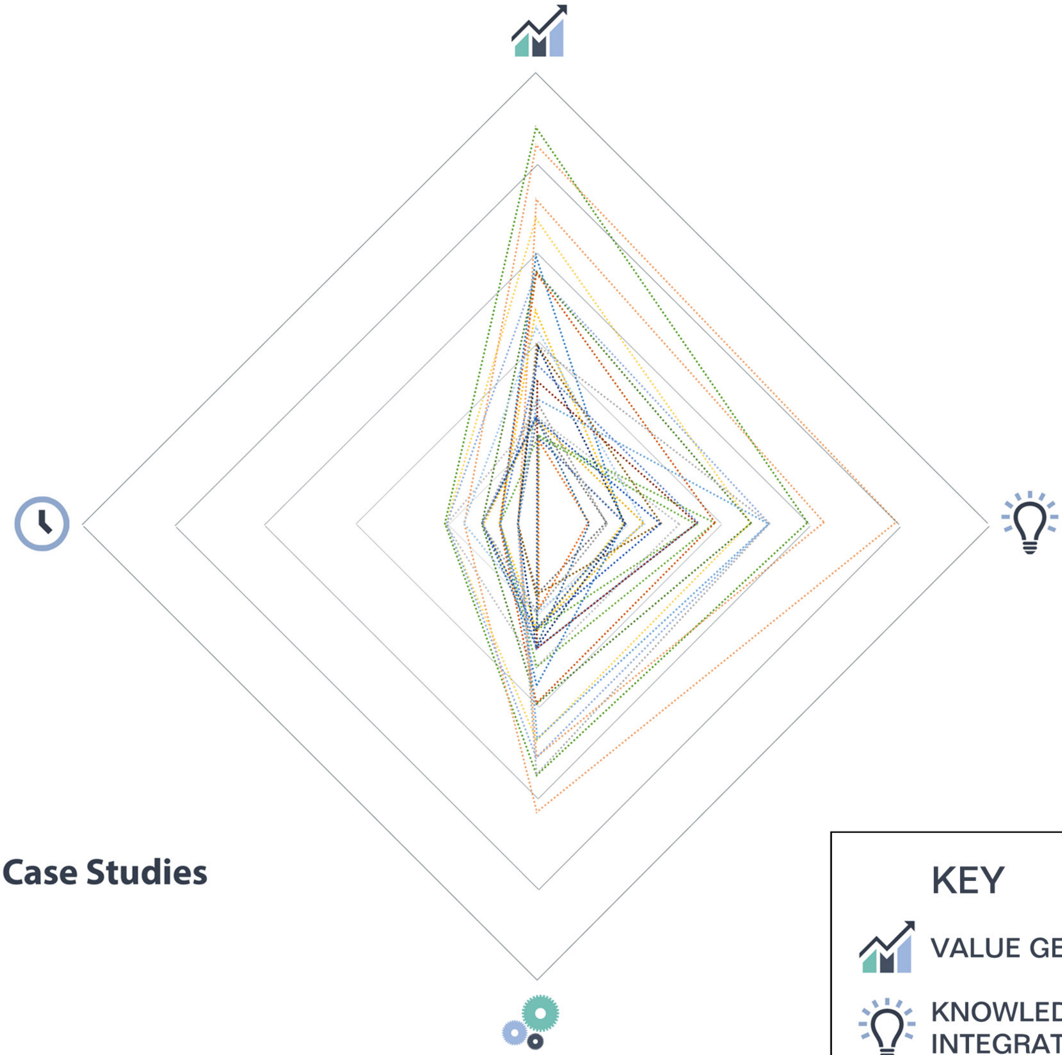
To ensure the reliability and validity of the data collected, the data from the case studies used in the Value Adding framework was obtained from 10 various book and journal sources, and were kept varied by the contributing agencies, authors, disaster type, date of reconstruction, and location of the disaster. Refer back to Case Studies for more information on how the case studies were analysed.

The case studies were used to record what factors of the reconstruction process deemed to have added the most value; and to compare and contrast against what was seen in the field in terms of the similarity or difference in gaps, and lastly to study how agencies decided to address these gaps.

Table 1. 30 Case Studies used in 'Value Adding' Framework

COUNTRY	PROJECT TYPE	DISASTER	YEAR
India	New House Reconstruction	Cyclone	2000-2
India	Reconstruction & Rehabilitation	Earthquake	2001-4
Indonesia	Semi-Permanent Housing	Floods	2002
Sri Lanka	Community Resettlement	Tsunami	2004
Sri Lanka	Community Resettlement	Tsunami	2004
Angola	Resettlement Construction	Post-Conflict	2004-5
New Orleans	Reconstruction & Rehabilitation	Hurricane	2005
Mississippi	Reconstruction & Rehabilitation	Hurricane	2005
Vietnam	Reconstruction & Repair	Typhoon	2006
Indonesia	Reconstruction	Earthquake	2006-8
Pakistan	Transitional and Permanent Housing		2006-8
Banda Aceh	Reconstruction & Rehabilitation	Tsunami	2006-8
Vietnam	Reconstruction & Rehabilitation	Typhoon	2006-9
Jakarta	House Repair	Floods	2007
India	Community-Based Disaster Preparedness		2007-8
Bangladesh	Rehabilitation & Transitional	Cyclone	2007-9
China	Permanent Housing	Earthquake	2008-10
Nepal	Reconstruction	Monsoon Flooding	2008-10
Nepal	Reconstruction	Monsoon Flooding	2008-10
Myanmar	Rehabilitation & Transitional	Cyclone	2008-11
Kingslake	Temporary and Permanent Village	Bushfire	2009
Vietnam	Housing Repairs	Typhoon	2009
Marysville	Temporary and Permanent Village	Bushfire	2009
Bangladesh	Owner-Driven Reconstruction	Cyclone	2009
Samoa	Resettlement Reconstruction	Tsunami	2009-10
Sumatra	Reconstruction & Rehabilitation		2009-11
India	Reconstruction & Restoration	Floods	2009-12
Haiti	Community-Development Program	Earthquake	2010
Haiti	Community-Development Program	Earthquake	2010

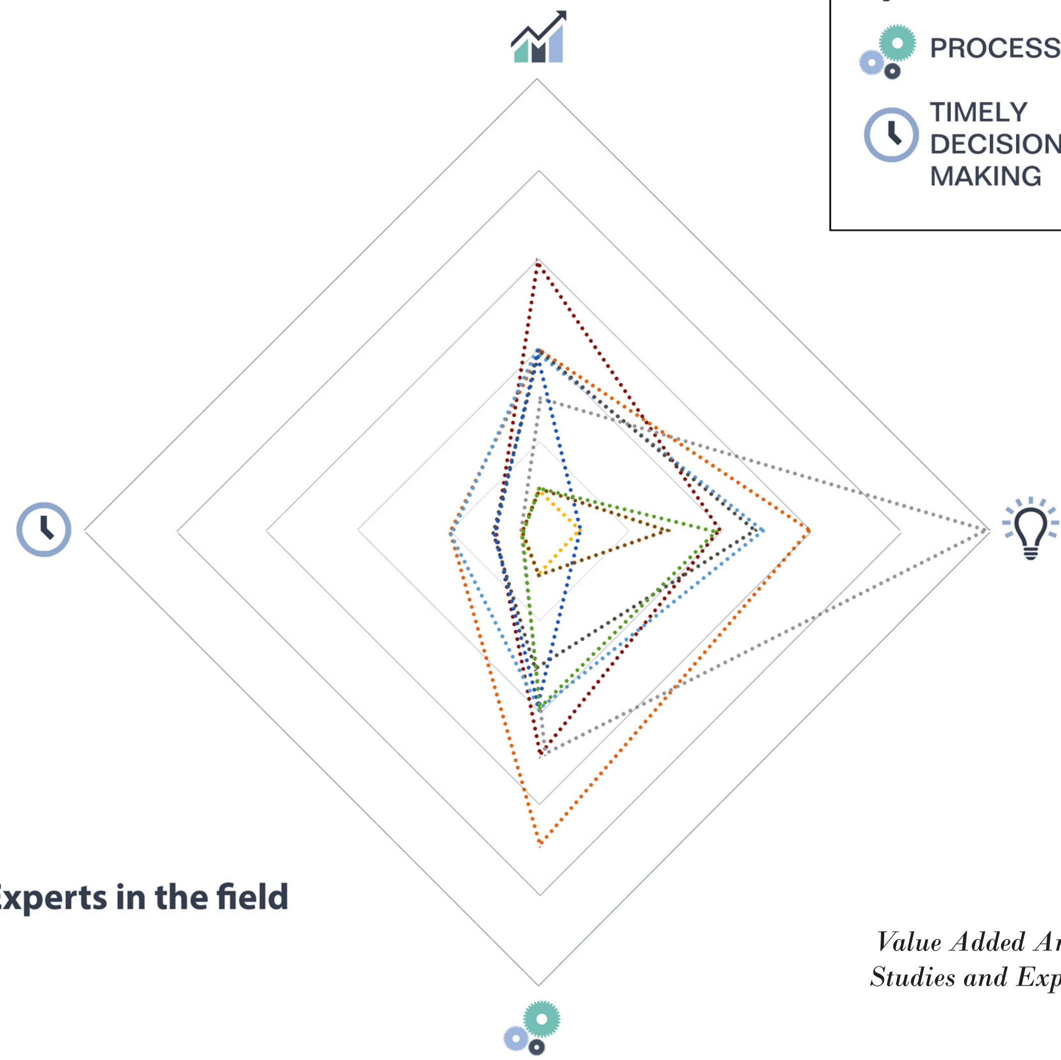
VALUE ADDED COMPARISON



30 Case Studies

KEY

- VALUE GENERATION
- KNOWLEDGE INTEGRATION
- PROCESS INTEGRATION
- TIMELY DECISION MAKING



9 Experts in the field

Figure 2.11
Value Added Analysis of Case Studies and Experts in the field

2.21 RESULTS & DISCUSSION

The results from the 'Value Added' (VA) analysis of the 'Case Studies' and 'Experts in the Field - Literature Review' revealed there was less value placed on the 'Timely Decision Making' (TDM) component in comparison to the other three values.

On average, out of the 30 Case Studies only 7.6% noted that there was value added through 'Timely Decision Making'. For 'Experts in the Field' an average of 9% said that TDM added value to their reconstruction projects. The experts' opinions of TDM are close to the results of the case studies, revealing an underlying knowledge that strict budget timeframes and project deadlines is inevitably complex and hard to plan for. This could be due to the uncertainties and irregularities of the post-disaster context. Further study on how this area can be improved, and the analysis of case studies that emphasize budget and timeframes can have valuable lessons to learn from.

These results were reflected in observations of the field in that complexities and gaps such as villages that were less accessible due to distance to main roads, road damage etc., received less attention from agencies. The TDM component was lengthened as the agencies deemed fit. The villages were reached and that was what mattered, not the time in which they what mattered, not the time in which they were reached.WEFWF.jpg

An average of 32.4% of the Case Studies placed value on the 'Process Integration' (PI), whilst 36% of the Experts in the Field placed value on PI.

The case studies that had the highest amount of 'Value Generation' (VG) emphasized the importance of community initiatives, whether that be a community building or community participation during reconstruction. From the planning and analysis stage at the beginning, through to the design phase and construction phase, community participation was looked at as adding value. It also included the financial literacy of some projects, looking at the long-term sustainability of communities being rebuilt. Gardner (2010) emphasized the importance of a community building with community participation in the process, as he believed it fostered their healing process and acceptance of architectural approaches. It also created a sense of ownership for the beneficiary community. HFHNZ included in their Samoa housing projects financial literacy courses for beneficiary families, and reported the improvement in poverty alleviation for the low socioeconomic families, placing value in this area also. There was a higher average of value placed on the VG of Case Studies at 39% as opposed to 30% for Experts in the Field.

'Knowledge Integration' (KI) highlighted the need for collaboration and the sharing of knowledge between experts as well as the local workforce. The aim being to build the local capacity. The case studies that effectively accentuated this component stressed the importance of including a variety of local and international 'experts' from contributing agencies, the local government, nominated community leaders, as well as leaders of minority groups. This was the case for post-cyclone housing in Samoa by the UNDP and Samoa government, utilizing effec tive planning between the different stakeholders. The Case Studies had an average of 35% value placed on the KI, whilst the Experts in the Field placed 42.8% value on KI.

The data collected suggests that the role of architects in post-disaster reconstruction must include more than just the design. The role entails effective community participation, the possible inclusion of community facilities to aid the process of psychosocial recovery and create a sense of ownership for their newly built community.

The role also comprises early planning and analysis from the outset, acting as one of the first responders, or least having a presence amongst the first responders, to bridge the gap between relief and reconstruction. This is to get a better gauge on the state of the community, and to ensure validity of the cultural and social components of architectural responses. The role includes financial literacy, budgeting, effective communication and collaboration between agencies and stakeholders, and should also look at the long-term sustainability of communities. It is a process of reconstruction, and the architect should be actively involved throughout this process.

Figure 2.12. Above: HFHFJ House in Nanokonoko village, Fiji, 2016.

Figure 2.13. Construction materials shipment, Tanna, Vanuatu.

2.3 SITE VISITS

Architectural and construction experts in both Samoa and Fiji were interviewed for their opinion on what the role of architects is in post-disaster reconstruction, and what they deemed as being 'gaps' that needed addressing in the reconstruction process.

Table 2. Interviews in Samoa

DATE	ORGANISATION / POSITION	LOCATION
30/05/2016	ACEO at Planning and Urban Management Agency	Apia, Samoa
30/05/2016	Urban Design Officer - Samoa Planning and Urban Management Agency (PUMA)	Apia, Samoa
30/05/2016	Managing Director at Engineering & Management Consultants Samoa	Apia, Samoa
30/05/2016	CEO of Ministry of Works, Transport and Infrastructure (MWTI)	Apia, Samoa
30/05/2016	Architect + Asset Managemnt Building Division ACEO of the Ministry of Works	Apia, Samoa
31/05/2016	NZ Registered Architect, Director of Kramer Auresco Architects Samoa	Apia, Samoa
31/05/2016	Pacific and Carribean Disaster Risk Management Consultant	Apia, Samoa
31/05/2016	PQS Quantity Surveyor	Apia, Samoa
31/05/2016	CEO Director at ADRA Samoa (local partner with Habitat for Humanity NZ (HFHNZ))	Apia, Samoa
31/05/2016	President and Campaign Manager at Red Cross Samoa (SRC)	Apia, Samoa
3/06/2016	President of SRC and various Upolu Island villages	Upolu, Samoa
3/06/2016	Stephen Gardner, Architect employed by HFHNZ on Housing in Samoa, and The Peace Project housing in the Philipinnes	Apia, Samoa

Table 3. Interviews in Fiji

DATE	ORGANISATION / POSITION	LOCATION
06/06/2016	President of Fiji Association of Architects	Suva, Fiji
06/06/2016	Shelter Cluster Coordinator for Fiji TC Winston International Federation of the Red Cross Red Crescent Societies	Suva, Fiji
06/06/2016	Principal of Fiji Institute of Engineers	Suva, Fiji
07/06/2016	Architect, and National Director of Habitat for Humanity Fiji (HFHFJ)	Suva, Fiji
07/06/2016	Architectural Lecturer at Fiji National University (FNU)	Suva, Fiji
07/06/2016	Civil Engineering and Construction Professor at Fiji National University (FNU)	Suva, Fiji

Table 4. Field Observations and Meetings in Fiji

DATE	ORGANISATION / POSITION	LOCATION
7/06/2016	Shelter Cluster meeting	Suva, Fiji
12/06/2016	Volunteers of Red Cross Fiji	Rakiraki, Fiji
13/06/2016	Affected community leaders	Nākonoko, Fiji
15/06/2016	Fiji National University Presentation of findings to FNU, IFRC, FAA, HFHFJ, FIE, Government representatives and other construction shelter related fields	FNU, Suva, Fiji

Field research was conducted in the form of visiting affected villages Post TC Winston gaining insight from the different community representatives who attended community meetings, interviewing construction expertise from different agencies on the ground, as well as attending various shelter related meetings and presentations.

The information gathered highlighted what role architecture and architects should play in post-disaster reconstruction, the gaps in the reconstruction system, and how experts plan to address these gaps.

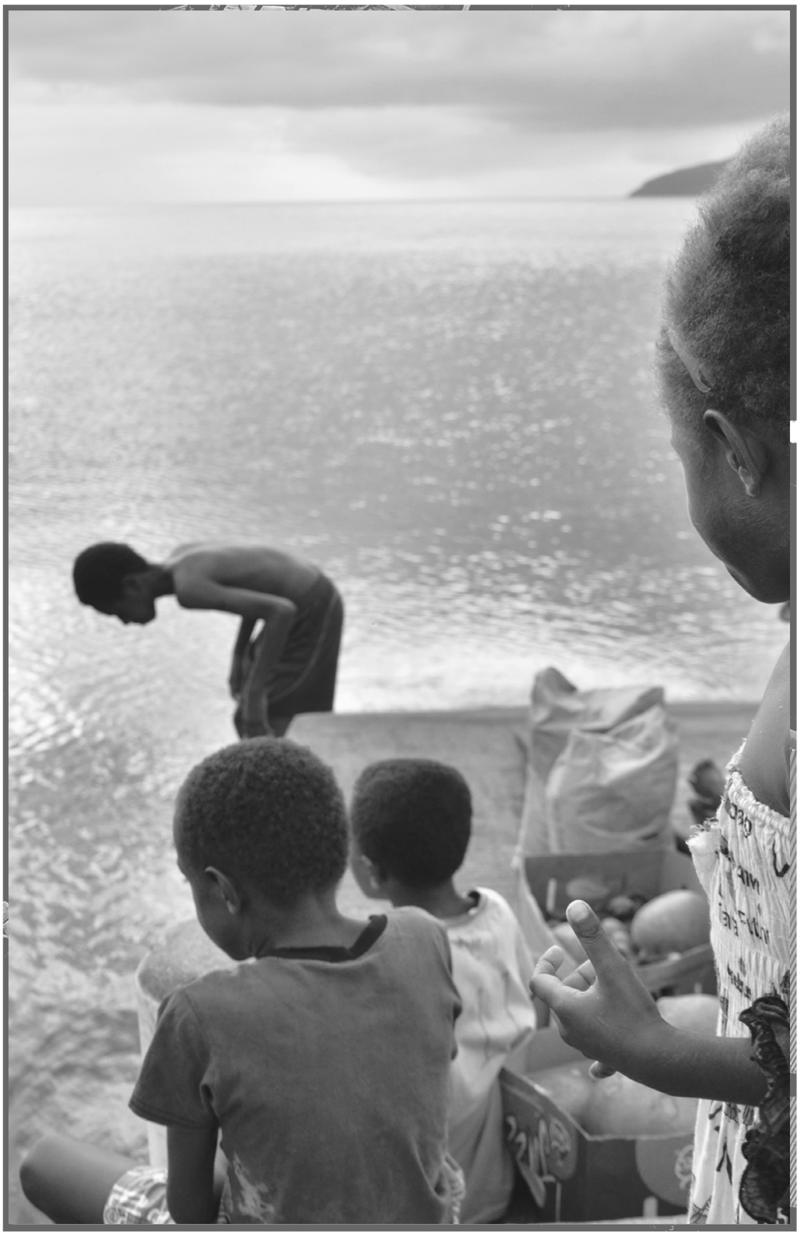


Figure 2.14
Island life. Efate, Vanuatu, 2015.

2.31 RESULTS & DISCUSSION

In this section of the report, the results of five expert interviews are presented. The results identify many gaps in the reconstruction process and, in some cases, how the experts believe the gaps can be addressed. Additional interviews could not be recorded in the report due to space restrictions, but are available on request. However a mix of interviews taken in Samoa and Fiji are included for variety.

Observations from field and community meetings follow the interviews, and lastly the case studies and how they correlate.

2.32 Interviews

1. Role/Position

Architect (2011)

Disaster

Post-tsunami 2009, Typhoon

View of Role of Architect/Architecture

- maintain appropriate vision of goal larger than the shelter provided
- technical details, water and sanitation, quantity surveying, project managing, surveys and evaluations, community consultation, and quality control through construction supervision
- Designed a community centre to help foster small business ventures and provide for community events

Gaps

- Providing livelihood program
- Transportation and storage of goods

Addressing Gaps

- Material goods shipped from United States – provided higher stability to project
- Infrastructure is just as important and necessary as shelter

Figure 2.15
Community Building-participation [image courtesy: Stephen Gardner]

2. Role/Position

Architect and Asset Manager of Samoa (2016b)

Disaster

Tsunami, Cyclone

View of Role of Architect/Architecture

- opportunity for development
- technical details, quantity surveying, project management, assessments, evaluations, and community consultation

Gaps

- quality control of materials
- materials unaffordable for locals
- fees charged by architect, qualified builder, engineer, and building consent unattainable by locals
- locals would use cheap scrap materials, not building to standard

Addressing Gaps

- Affordability (UNDP built 64 of these homes on south coast of Upolu)
- Target the most vulnerable individuals first

Figure 2.16
UNDP house in Upolu, Samoa [www.ws.undp.org]

3. Role/Position
Architect and National Director of Habitat for Humanity Fiji (HFHFJ)

Disaster
Cyclone

View of Role of Architect/Architecture
- Provide adequate housing and basic construction training
- Alleviating cycle of poverty starts with shelter – the most basic need
- Build to SPHERE standards
- Integrate skill level and technology related to cost and sustainability of ownership
- Repackage goods for donor needs; needs assessment reports, site inspections, budgeting, log frames, funding reports at beginning, logistics, human resource planning, quantity surveys, family selection processing, home partner training, organizations of staff, purchasing of materials, construction, assessment reports, and follow up reports (Surveyor, 2016) (refer to Figure 1 and 3 for the Workflow Chart)

Gaps
- Coordination between agencies: miscommunication prolongs aid work to affected communities
- materials unaffordable for locals
- Almost all HFHFJ housing materials are imported, as it is cheaper than buying locally
- Leap in costs from $400 housing kit to $7000 permanent home – so donors spend least amount as needed
- Inflation of material costs by suppliers
- There is not a traditional and alternative or conventional material hybrid design
- How to increase people's incomes to afford materials and housing
- Build local capacity and skill-set
- Socialization and acceptance of hybrid housing being desirable

Addressing Gaps
- Research hybrid housing

4. Role/Position
Architect and Director of the Fiji Association of Architects (FAA)

Disaster
Cyclone

View of Role of Architect/Architecture
- No role for architects in immediate disaster, but possibly intermediate or long-term recovery stage.
- More of an engineer's role in post-disaster reconstruction
- Architects should create spaces that are comfortable, their role is of the social and psychological

Gaps
- SPHERE requirements are too small, basic, and expensive
- Government financial assistance of FJD 1500 for repairs, and FJD 7000 for total reconstruction was insufficient
- Suppliers too expensive
- Corruption in using government assistance by locals
- Overseas or foreign persons are in management roles more often than local professionals – it should be the other way around

Addressing the Gaps
- He suggested a documentary for awareness and construction skills training for locals

5. Role/Position
Engineer and President of The Fiji Institute of Engineers (FIE)

Disaster
Cyclone
View of Role of Architect/ Architecture
- Not architect's role, but rather the engineer's.
- Architects should volunteer and not expect pay

Gaps
- Fees charged by architects (affordability)
- Volunteer work is based on set contractual periods, varying from six, to twelve or more months (FIE, 2016)
- Architects work in private sector rather than public

2.33 Observation and Attendance of Meetings

Disaster
Samoa Tsunami 2009, Cyclone Evan 2012, Cyclone Winston 2016

Observation
From the field there also appeared to be gaps that arose from observation and through the attendance of meetings.
- Core Shelter expansion is unrealistic (due to its design, and probability of extra income for homeowners to do so)
- 'Fale' design has no walls, so it does not protect homeowner from oncoming disasters, but the structure is resistant
- Knowledge gap of different professional sectoral roles in reconstruction
- Land tenure, especially informal settlements in Fiji were an issue
- Water infrastructure in relocated villages were insufficient, making families move back to vulnerable areas for water
- Core shelters at times were not designed to the local climate (miscommunication between stakeholders (architect, project manager, builders, homeowners, partnering agencies)
- More accessible villages received more aid than more remote villages
- Corruption through uneven distribution of aid and goods between villages by village leader(s)
- Labour shortage for reconstruction, miscommunication between available help and agencies in charge of recruiting help

Figure 2.17
Outdoor kitchen, Vanuatu, 2015.

2.4 TESTING

2.41 Material Construction and Seismic Testing

Design iterations began through the research of suitable reconstruction materials. Scale models were made out of appropriate reconstruction material, and were tested for method of construction and seismic strength through trial and error. Designs were completed, including the method of construction, after reconstruction material testing was completed.

Low-cost and low-tech architectural materials were researched in this section. Natural architecture (made from earth), can be both low-tech and low-cost, therefore more accessible (and are mostly seen) in developing countries and rural areas in Fiji (Blondet & Villa Garcia M., 2011). With the benefit of reducing fossil fuel energy consumption and CO2 emissions, natural architecture has low embodied energy in all stages of harvesting, processing, construction, and demolition (Shaikh, 2014) (Buchanan, 2006).

About 30% of the world's population live in natural earth-made homes (Houben & Guillaud, 1994). Approximately half of these homes are in developing countries, where 80% of these homes are in rural areas (Blondet & Villa Garcia M., 2011).

Earth materials were researched and presented in a tabular format. Through discussion they were compared to see which material were researched further and used for the design output.

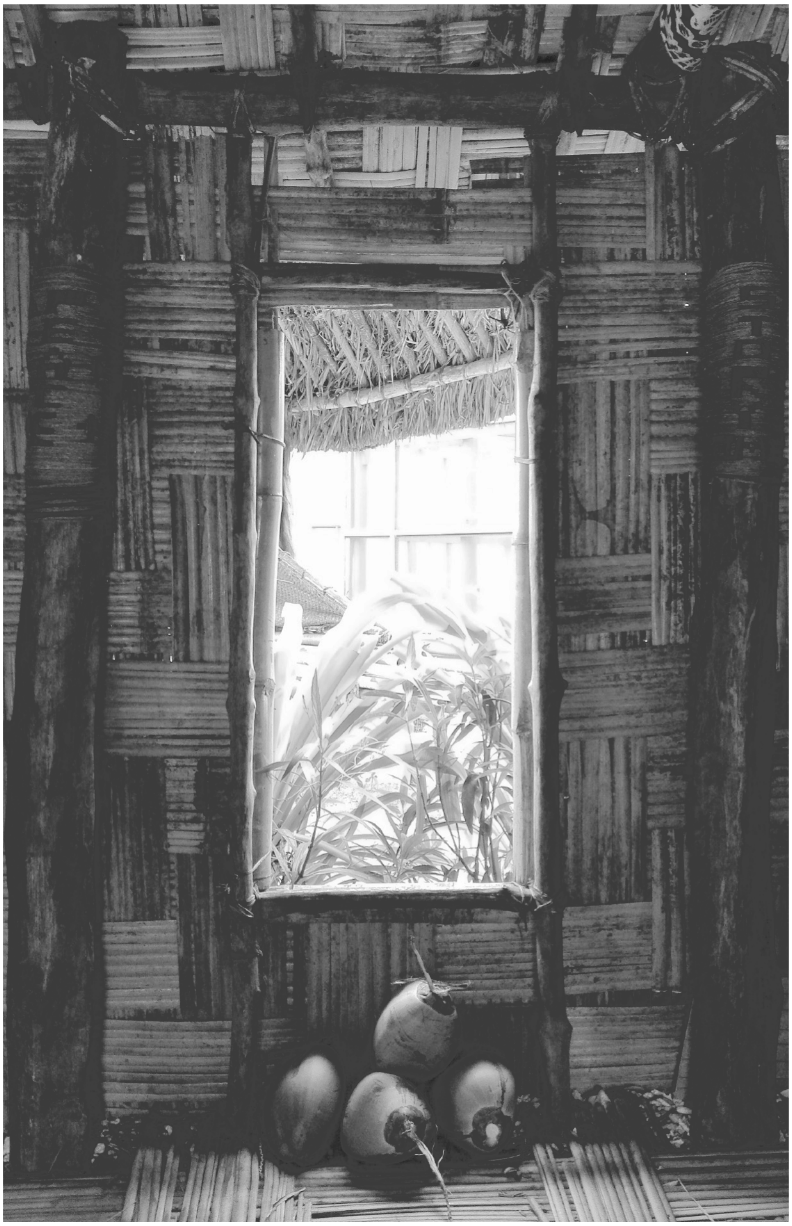


Figure 2.18
Vernacular Bure (House)

1. Material

Earthbag (commonly referred to as earthbags)

Figure 2.19
Earthbag House Construction (Hart, 2004)

Technology

The embodied energy of polypropylene bags used for earthbag construction is about 4800 Btu/bag, and it takes 1200 bags to build a 130 m2 (1400 sq ft) house (Grinnell, 2015). Thus it is about 382 Btu/m2 (4,114 Btu/sq ft) to build a home out of earthbags. Therefore for a typical Fijian home of 75 m2 (Figure 2.07), the total embodied energy would be about 28,650 Btu (excluding roof construction etc what is etc.? expand?.). The average embodied energy for a timber frame wall with timber wall cladding house of 195 m2 is 5,638 MJ + 25,137 MJ (excluding interior lining) (BRANZ, 2017).

Therefore the calculation for a 75m2 home would be as follows: If it is therefore a 75 m2 home,

195 / 2.6	=75 m2
5,638 / 2.6	=2168.46153 MJ
25,137 / 2.6	=9668.07692 MJ
2168 + 9668	=11836.07692 MJ
1 MJ	= 947.817 Btu
11836 x 947.817	= Btu
	=11,218,435 Btu

According to the above calculation, the Btu would then equate to 28,650 Btu for wall construction out of earthbags, and a timber frame with timber wall cladding is 11,218,434.921 Btu. As this shows, earthbag walls are a more sustainable option compared to the average timber construction home.

Equipment and Ingredients

- Sand or earth, soil, stones, crushed materials from surrounding environment
- Bags (polypropylene)
- Something heavy to flatten each layer of bags, such as a small wooden post.
- Barbed wire
- Top and bottom plate timber
- Earthbag/sandbag construction is low-tech (no prior construction knowledge required, and little to no tools or technology)

Method of Construction

- Fill bags to 85% full with earth
- Stitch ends closed or fold bag end over
- Butt each bag tight against the previous bag
- Tamp (pack or ram) bags flat after each layer is complete

2. Material

Adobe (mudbrick in Spanish)

Technology

- Open timber frame (for brick), typically 25 cm by 36 cm (frames can be any size or shape)
- Puddled adobe (puddled clay, piled earth)
- 50-60% sand and 35-40% clay, not less than 1/2 sand, and never more than 1/3 silt
- Straw can be added for extra strength

•Bamboo poles to be used for reinforcement

Method of Construction
•Mixture molded into frame
•Slow dry in shade (to prevent cracking). After drying for a few hours, turn bricks on edge to dry completely
•The maximum height of adobe walls are two storeys.

Figure 2.20
Adobe Brick Drying (Funsomehow, 2015)

Figure 2.21
Adobe Brick Construction (Adobe Building Systems)

3. Material
Rammed Earth Walls

Equipment and Ingredients
•Bamboo (optional for reinforcing structure)
•Soil: Clay or sand
•Binder:cement or asphalt cutback
•Water (10% to mix soil and binder together)
•Boxing/formwork (to compact wall into)

Method of Construction
•Spread mixture evenly across bottom of boxing to about 200 mm depth
•Use tampers to compact material down to about 50% of its original volume
•Repeat with 200 mm depth more mixture on top; and compact with tamper until the boxing/wall is complete

Conclusion
The earthbag construction was used, as no formwork is required, nor time for drying of materials. Also there are no strict requirements of what material needs to be put into the sacks, as any crushed material (that is available on site post-disaster) can be used. Bamboo is not as accessible as 'any' material on site.

A sufficient amount of polypropylene bags for an earthbag house can be transported to site in a box by truck or by plane in a post-disaster situation. Ideally, a village size of required polypropylene bags should arrive in one container (or less) post-disaster.

2.42 Logistics Planning

From the dimensions, estimate drawings were made – as well as calculations of the amount of material needed.

When filling earthbags, it was estimated that 4 cubic metres of sand, and 400 bags were required for the construction of the largest wall – the 'C' shape. About 4 straps were also needed.

Earthbag Construction and Testing

For construction and logistics of transport and workshop space, the wall needed to be scaled down for testing. A scale of 0.7 was used, as a maximum of 1,600 mm width was advised by OHS in the workshop.

'C' Wall

Scale 0.7

- 1.6128 cubic metres of sand OR
- 2,324 kg of sand
- 2.324 tonnes of sand

400mm width walls now 210mm
2400mm length walls now 1680mm long
2400mm high walls now 1680mm high

'L' Wall

Scale 0.7

- 0.8064 cubic metres of sand OR
- 1162.826 kg of sand
- 1.16 tonnes of sand

800mm length walls now 560mm
400mm width walls now 210mm
2400mm high walls now 1680mm high

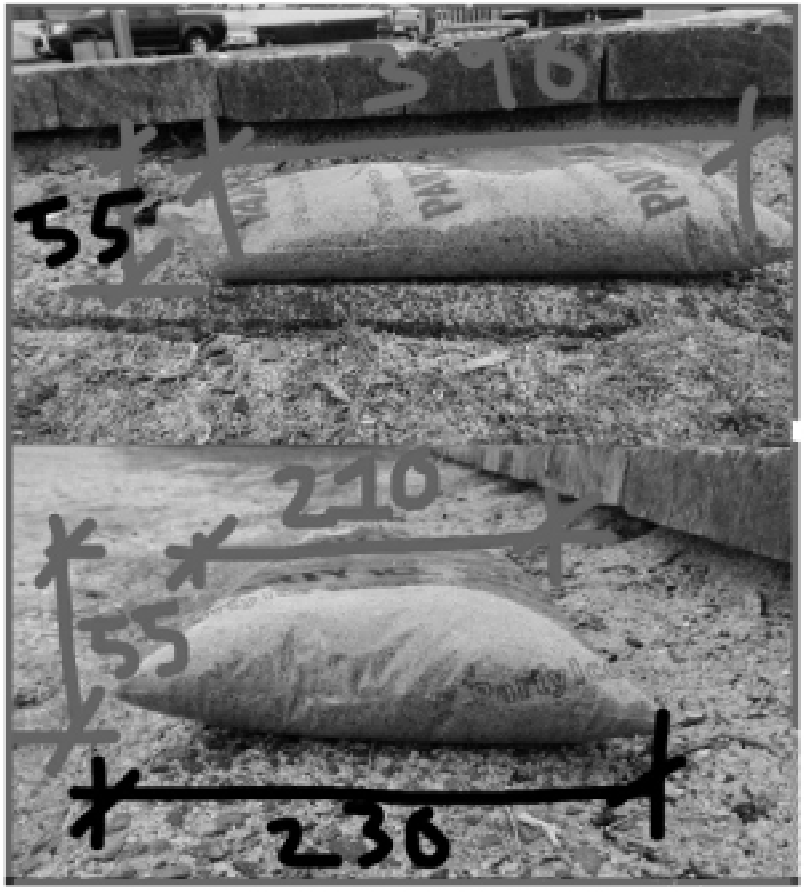


Figure 2.22
Earthbag filling and dimensions

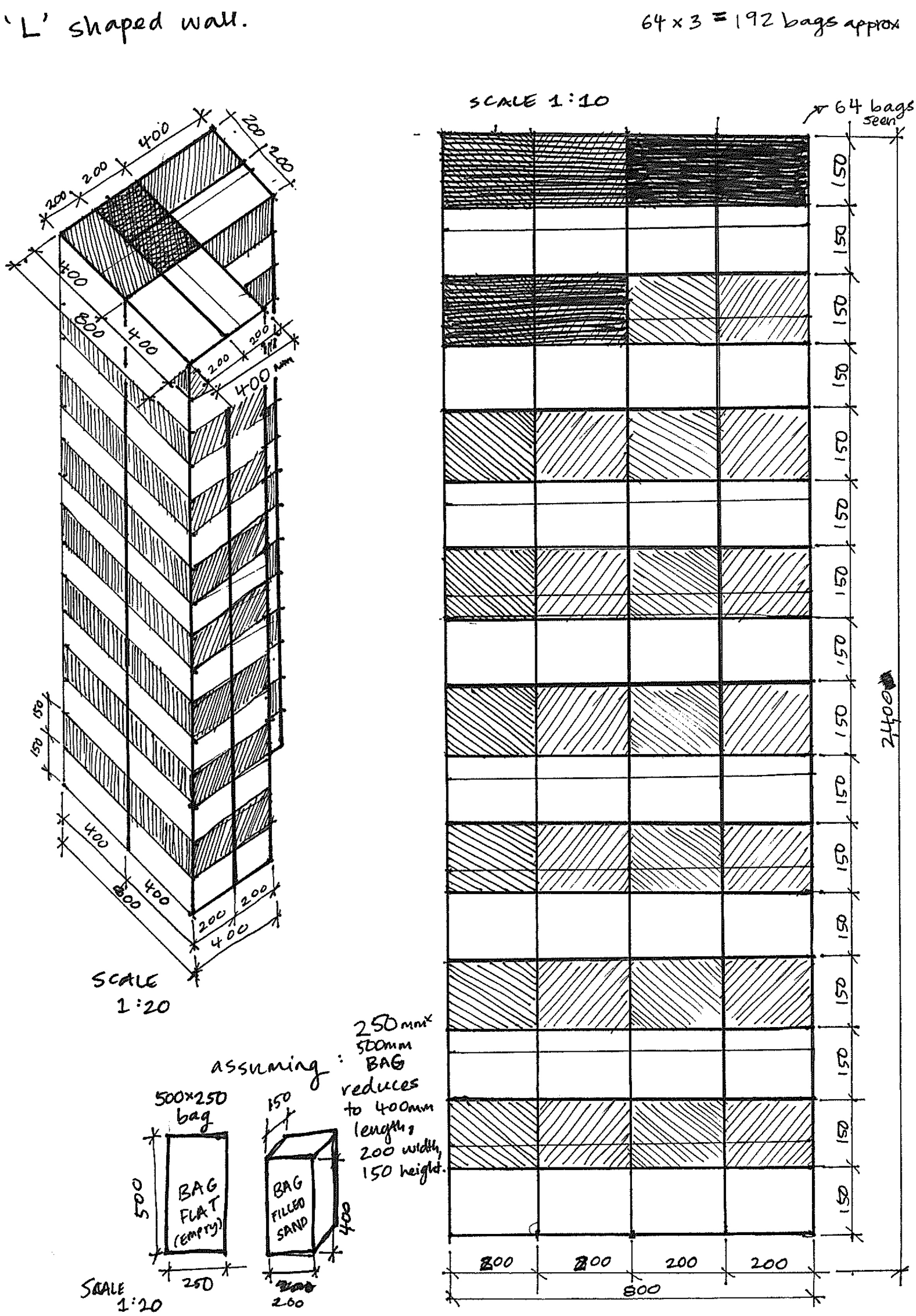
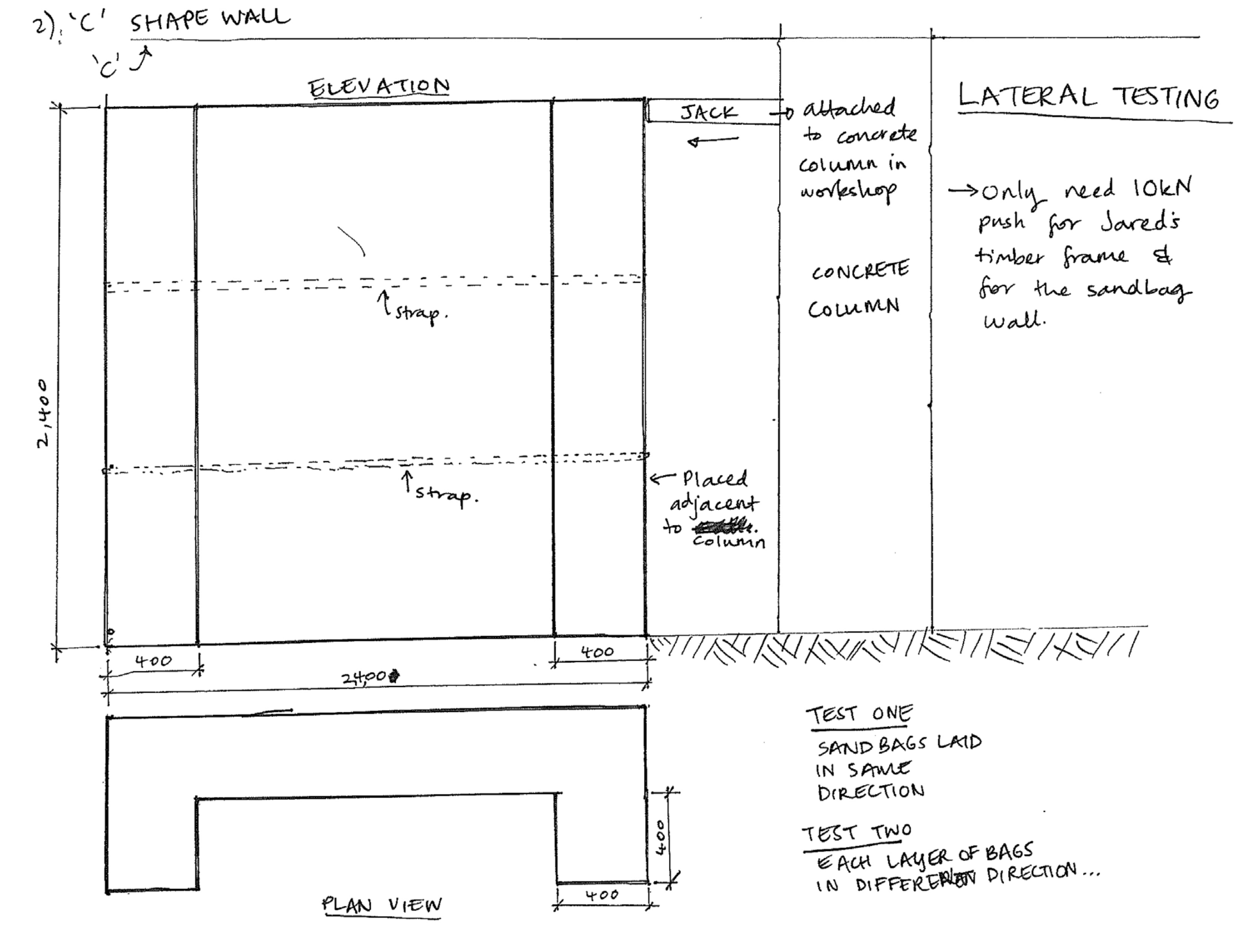
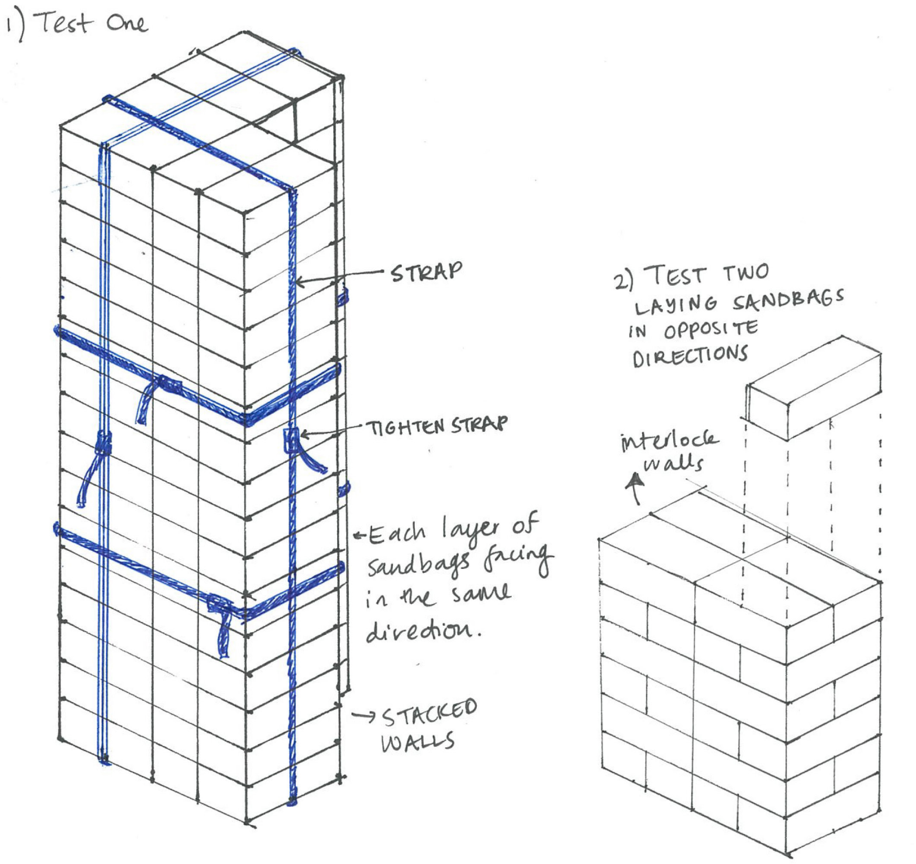


Figure 2.23
Earthbag Dimensions 'L' Shaped Wall





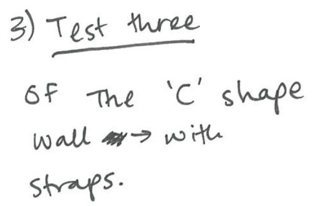


Figure 2.24
Above: Earthbag Dimensions 'C' Shaped Wall

Figure 2.25
Below: Earthbag Dimensions 'L' Shaped Wall

From the earthbag book:

4.4.1 Limitations

c) In areas where the NZS 4203 seismic zone factor is greater than 0.6 the ground floor plan area shall not exceed:

(i) 600 m2 for single-storey earth buildings

(ii) 200 m2 for two-storey earth buildings

(iii) 300 m2 for two-storey buildings where the upper storey is constructed of timber and the walls of the lower storey are of earth

d) The total height of the earth wall, including any gable end, from the lowest concrete foundation top surface adjoining shall not exceed 6.5 m

4.6.1

Earth walls shall be a minimum of 250 mm thick except for cinva brick walls which may be 130 mm thick.

C4.6.1

Walls less than 280 mm may require additional insulation to meet thermal insulation requirements of the New Zealand Building Code clauses E3 and H1.

4.6.2

Maximum slenderness ratio, Sr, shall be as follows:

Earthquake zone factor:	$Z \leq 0.6$	$Z > 0.6$
(a) Unreinforced load bearing wall	10	6
(c) Unreinforced columns	4	3
(e) Unreinforced non-loadbearing wall	12	8

Unreinforced walls higher than 3.3 m and unreinforced columns higher than 2.4 m shall have their dimensions assessed by special study.

4.6.3

Adequate lateral restraint shall be provided at wall tops by a diaphragm, bond beam, or other similar device. Lateral restraints shall be constructed from timber, steel, reinforced concrete or reinforced masonry or a combination of these. They shall be designed to resist loads and actions imposed on them.

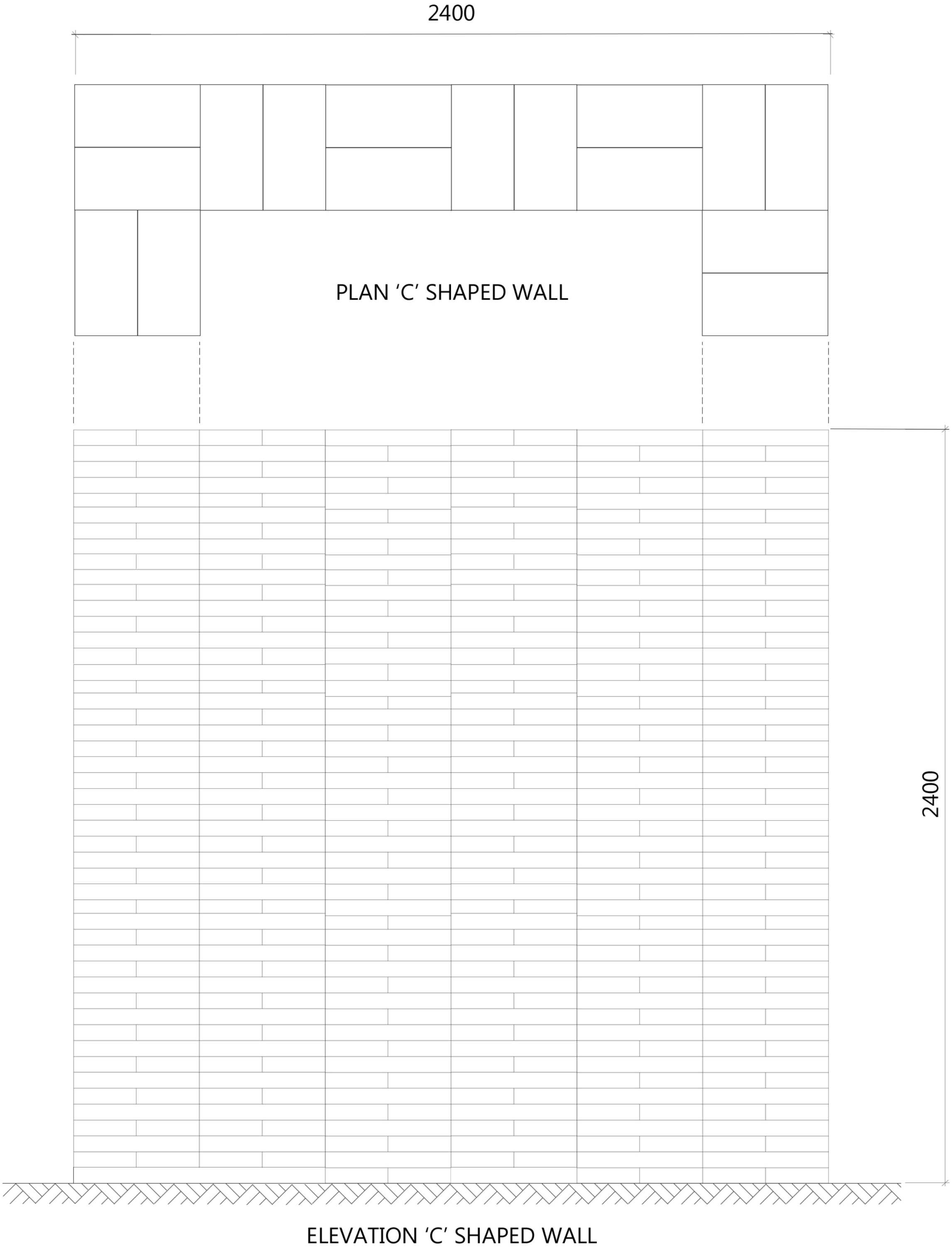
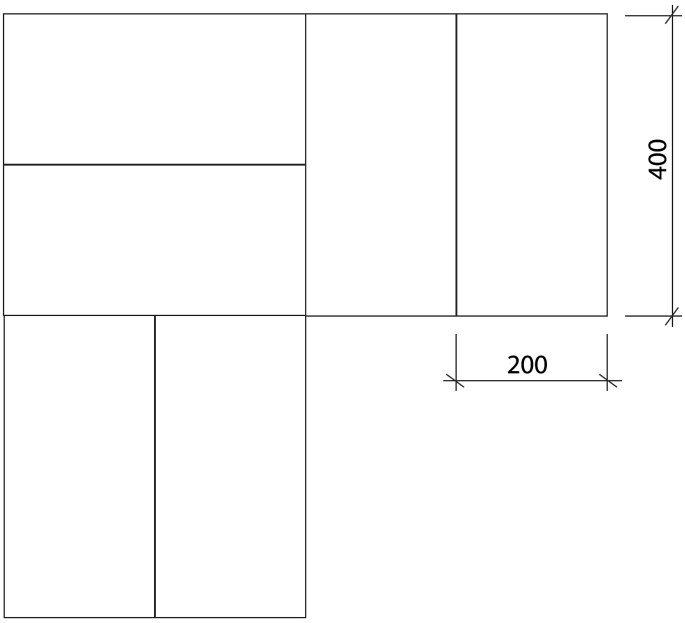
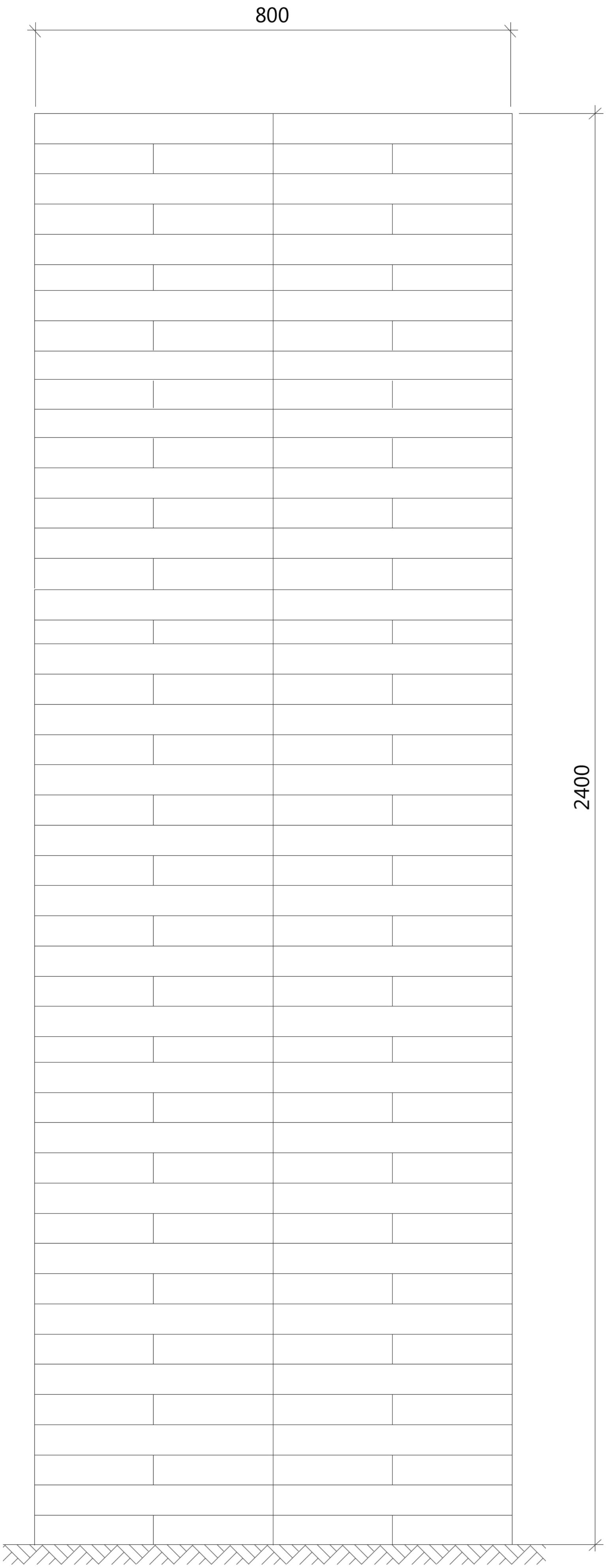


Figure 2.26
Elevation and Plan Drawing of 'C' Shaped Wall



PLAN 'L' SHAPED WALL



ELEVATION 'C' SHAPED WALL

Figure 2.27
Elevation and Plan Drawing of 'L' Shaped Wall

Figure 2.28
ADRA Bus stop, Uplow, Samoa, 2016.

2.43 Construction of Earthbag Wall

1.2 tonnes of sand was delivered to the design campus workshop.Low density 70 mu strength 250 x 500 plastic bags were used for the earthbags. To seal the top of the bags, their openings were folded over twice and closed with a strip of duct tape across the top. Air was squashed out of the filled bags so that the earthbags would not open.

When the bags encountered rainfall during trolley transportation, they became slippery, which resulted in the bags not being able to be stacked on top of one another as they would slip. It was then evident that their friction properties were not as effective as polypropylene bags with woven surfaces, This is an important observation as the added movement from a seismic shock would further the devastation.

As a result spray glue was used for the first 30 plastic bags, and sand was sprinkled over the glue to add extra grip (creating a sandpaper type surface).

The spray glue ran out quickly, proving to be an expensive 'friction adding' alternative to the friction which would occur with the polypropylene bags. Subsequently, I opted for the 'no nail' construction glue gun (roughly $6 per 25 bags). The glue was spread evenly over the surface of each bag, and sand was then sprinkled over the top of the glue. Each bag took about 10 minutes to dry each side, thus about 20 minutes to complete each bag.

Stacking the Earthbag Wall

A top plate and bottom is used to tie the wall down to the foundation. To do this, a small ridge underneath the bottom ridge, was chiseled out for the strap to fit through (figure 29). A buffer timber was placed at the end of the 'C' shaped earthbag wall, to reduce the slip of the wall due to low friction of the workshop's concrete surface. A jack was drilled to the column and was placed at the full height of the wall – so that it could push against the top plate to imitate the movement of an earthquake.

Test One

The full height of the wall is 2,400 mm, however the earthbags would fall after reaching a height of 1,200mm.

Test Two

The second test involved half-filling earthbags; then twisting the corners, interlocking them with each other. Although this construction method did add strength to the wall, the construction still reached the approximate height of 1,200 mm before collapsing.

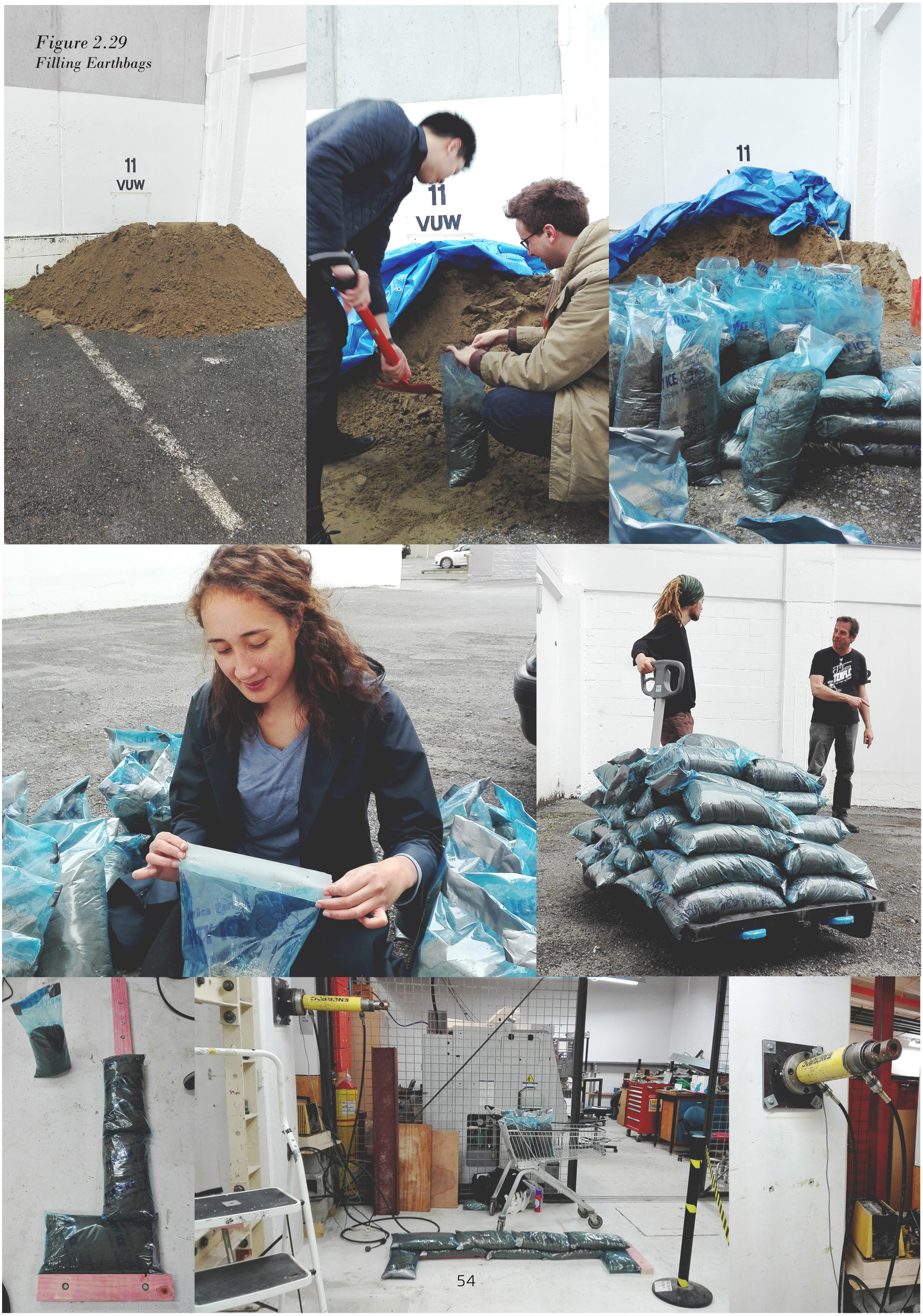


Figure 2.29
Filling Earthbags

Test Three

It was then realised that there was an absence of tamping, which was possibly contributing to thewall collapsing. Consequently, for the third test, tamping was employed to flatten each layer of earthbags. However, the wall would reach a height of approximately 1,400 mm before continuing to concave and collapse.

Test Four

For the fourth experiment, each layer was tampered, as well as the supporting wall construction, which sits behind the main construction. A third buttress was added in the centre of the main wall for extra strengthening, and the strap put in place over the top plate.

The top plate had two small blocks drilled to its underside at even intervals, so that it could slot onto the top of the earthbag wall. This was so that the top plate would not slip off the top of the earthbag wall, but would pull the wall with it.To ensure this would happen, a strap was tied over the top of the top plate, inserted into the hole in the bottom plate and pulled tight.

Use extra tamping when filling bags for corners or next to openings. Some earthbag builders have problems with drooping (slumping) earthbags at corners and next to window and door openings. Bags in the center of walls are butted against other bags and supported by them. Unsupported bag ends near openings or corners tend to slump.

Pre-tamp every bag, but tamp extra on corner bags and end bags. Densely compacted bags will not slump, but stay level and form a firm edge at the opening, as shown in the lower drawing. Wall corners remain level if carefully pre-tamped.

Figure 2.30
Opposite page: Testing Earthbags

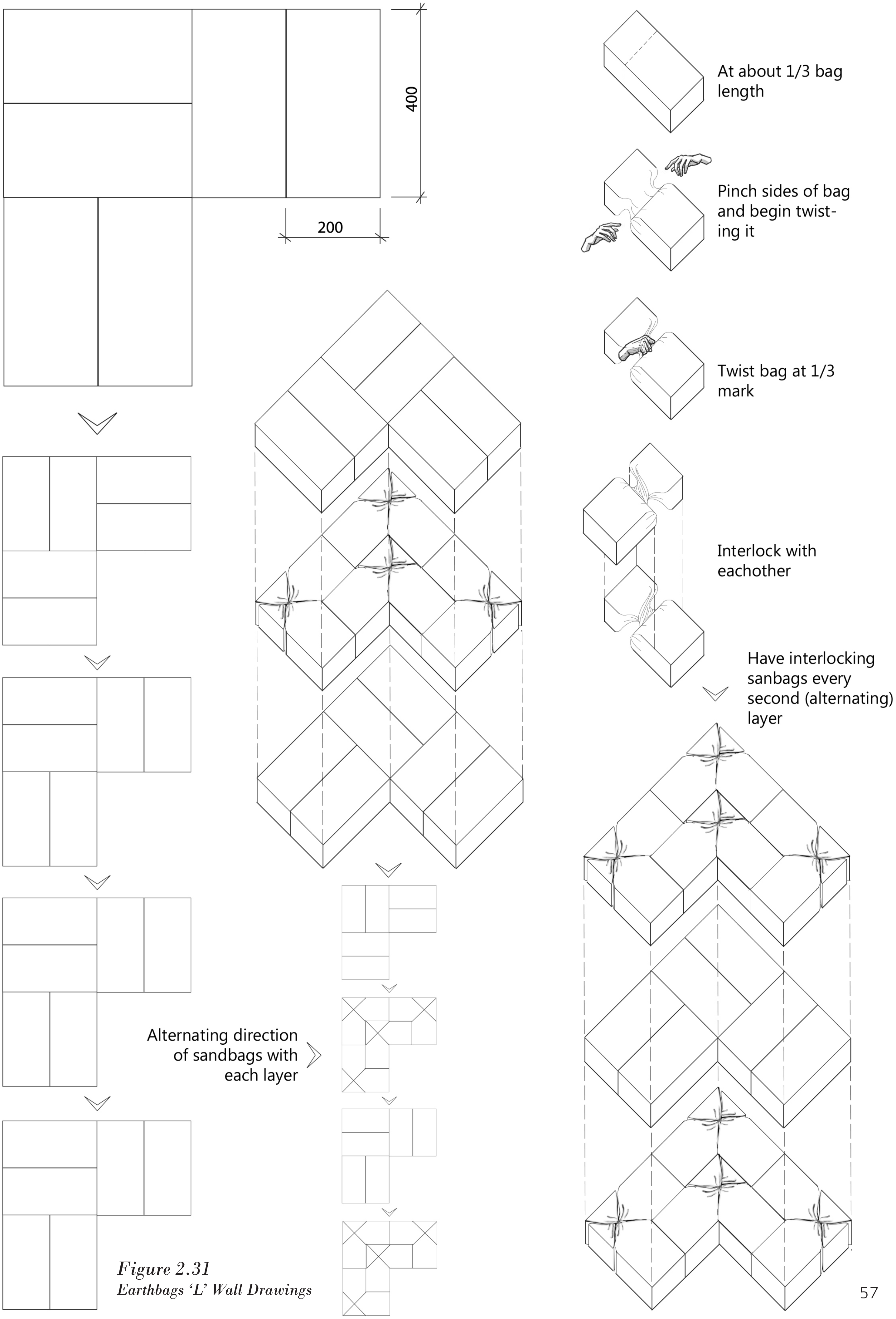


Figure 2.31
Earthbags 'L' Wall Drawings

'C' EARTHBAG WALL SEISMIC TESTING

LOAD (kg)	ΔWALL (mm)	ΔBAY (mm)
0	0.000	0
51	1.000	3.1
99	1.659	6.6
115	1.746	27.6
110	1.784	40.85
105	1.808	53.09
86	1.825	63.09

Table 5
Earthbags 'C' Wall Results

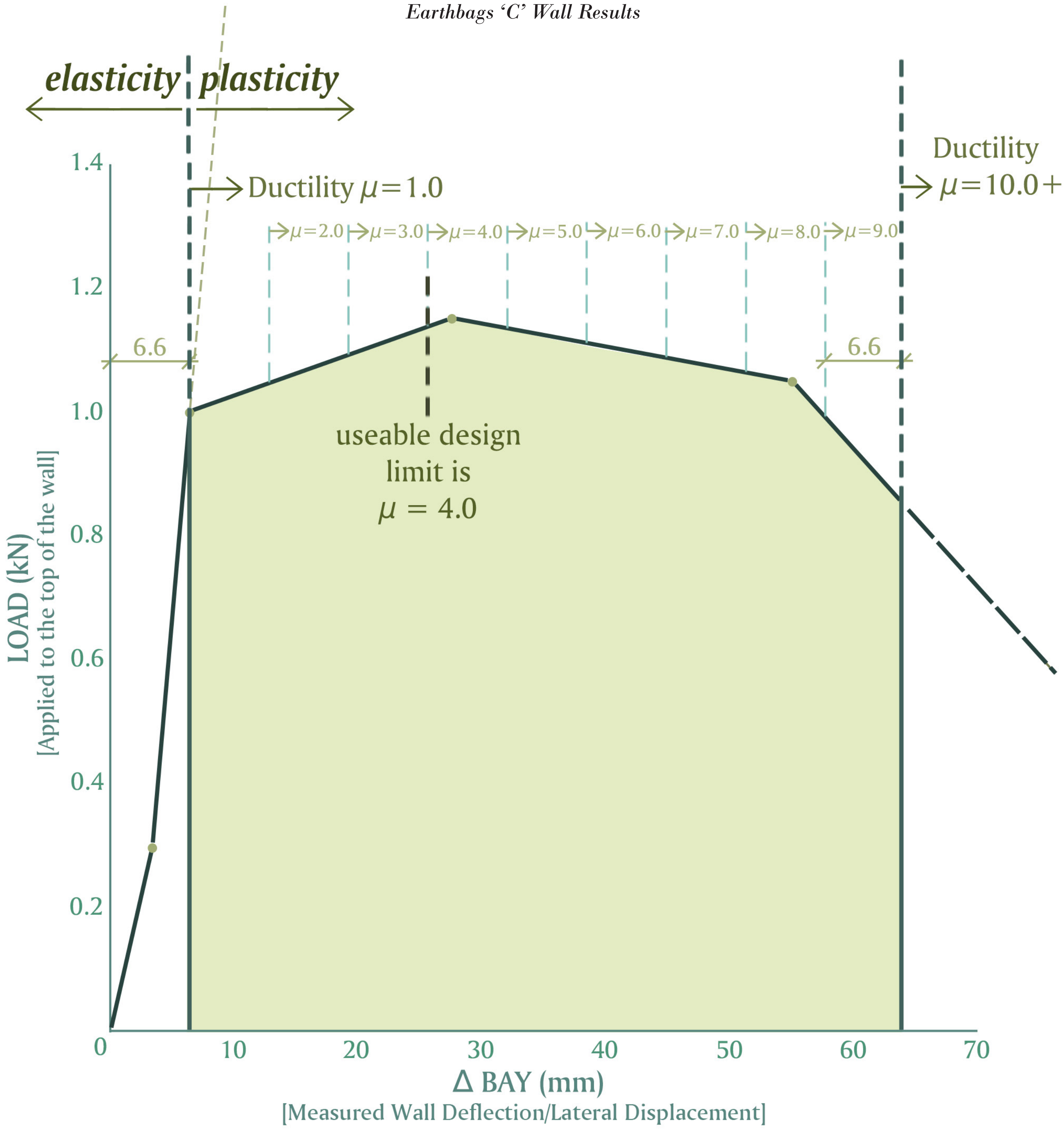


Figure 2.32
Earthbags 'C' Wall Results

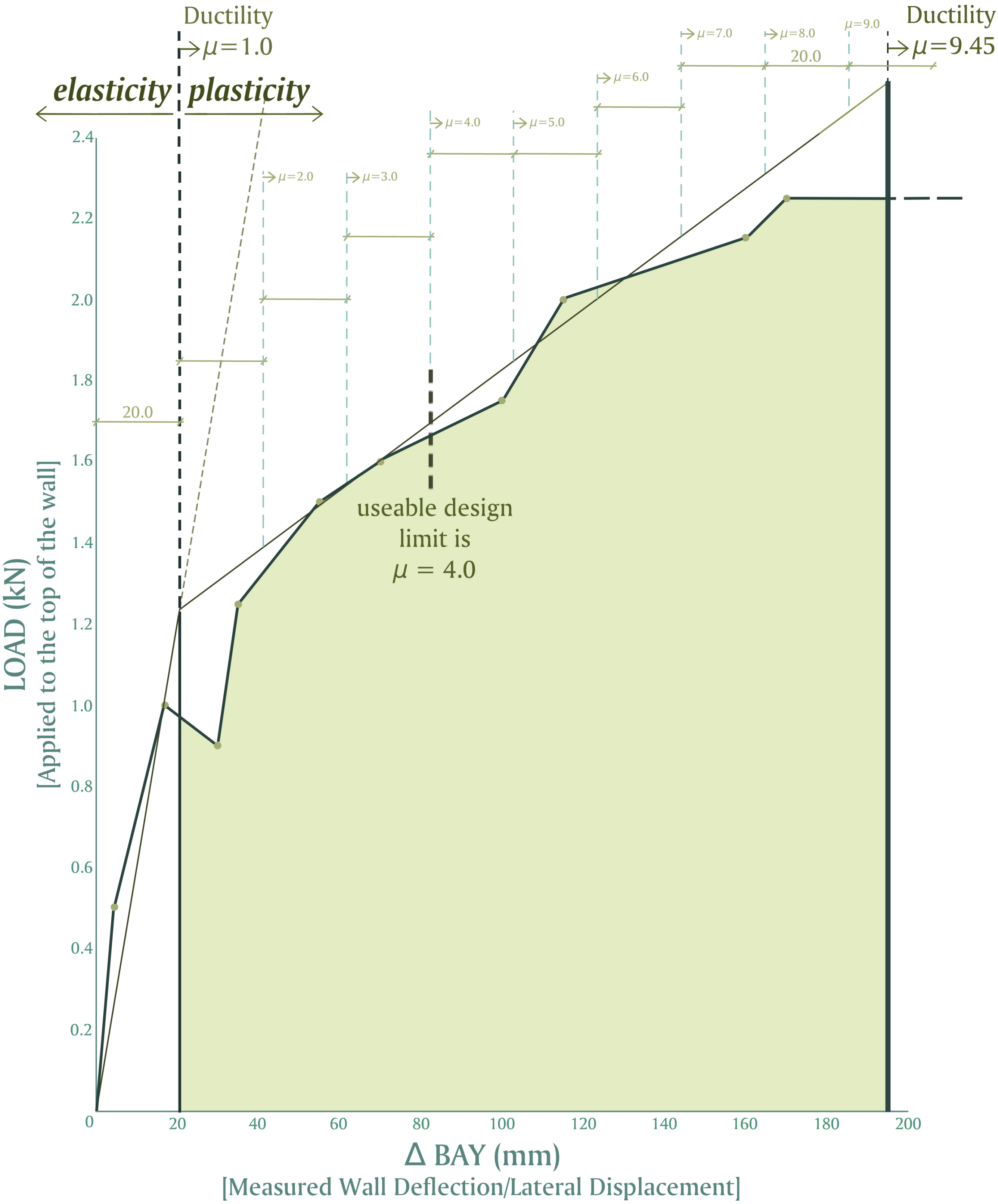


Figure 2.33
Earthbags 'L' Wall Results

‘L’ EARTHBAG WALL SEISMIC TESTING

LOAD (kg)	△WALL (mm)	△BAY (mm)
0	0	0
40	1.282	0
50	1.287	4.91
70	1.293	11.88
100	1.304	17.01
90	1.320	31.00
125	1.329	34.85
150	1.357	56.31
160	1.377	72.79
176	1.416	102.76
200	1.433	117.68
218/219	drops back	drops back
215	1.479	161.75
225	1.501	172.82
226	1.536	197.17

Table 6
Earthbags ‘L’ Wall Results

2.44 Results & Discussion

From the testing, the earthbag construction of the 'C' and 'L' shaped walls performed extremely well. The overall ductility of the 'C' shaped wall was 10+. The 'L' shaped wall had a ductility level of 9.45+.

Usually seismic design is $\mu = 4.0$ for timber frames, or for braced frames with yielding occurring in both tension and compression (NZ Wood, 2007) (Timber Industry Federation, 2007) (NZS1170-5 (S1), 2004). That makes both the 'C' wall and 'L' wall more than twice as ductile as timber framing systems.

A high ductility means that a lower level of seismic design is required.

2.45 Conclusion

1. Both the 'C' shaped wall and the 'L' shaped wall performed seismically well to excellent.

2. Both would make excellent structural elements for house construction in seismic areas.

3. Both would make excellent structural elements for cyclonic load capacities.

4. Both their weights could be used for counteracting uplift.

5. It would appear at this stage that the 'C' shaped wall could be used for spatial division.

6. The 'L' could be used for partial connection (columns that can create space for adaptability in design).

CHAPTER THREE

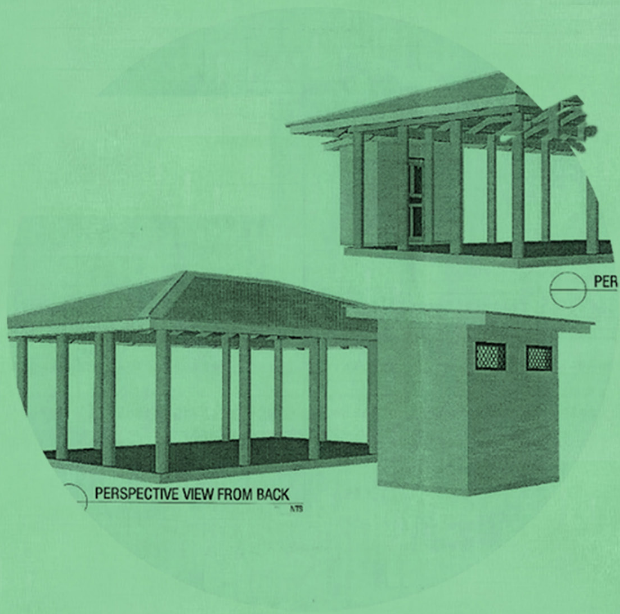
Figure 3.00
Roof structure held down by concrete blocks. Downpipe made of gutter off-cut.

3.0 DESIGN

3.1 Preliminary Design

Figure 3.01
Nanokonoko Village,
Viti Levu, Fiji

Figure 3.02
Viti Levu island, and
Nanokonoko viallge



Post-Tsunami 2009 Samoa
Reconstruction Design of a Fale with a toilet facing its interior

Figure 3.03
Post-Tsunami Housing and Toilet facilities. Socially and culturally inappropriate

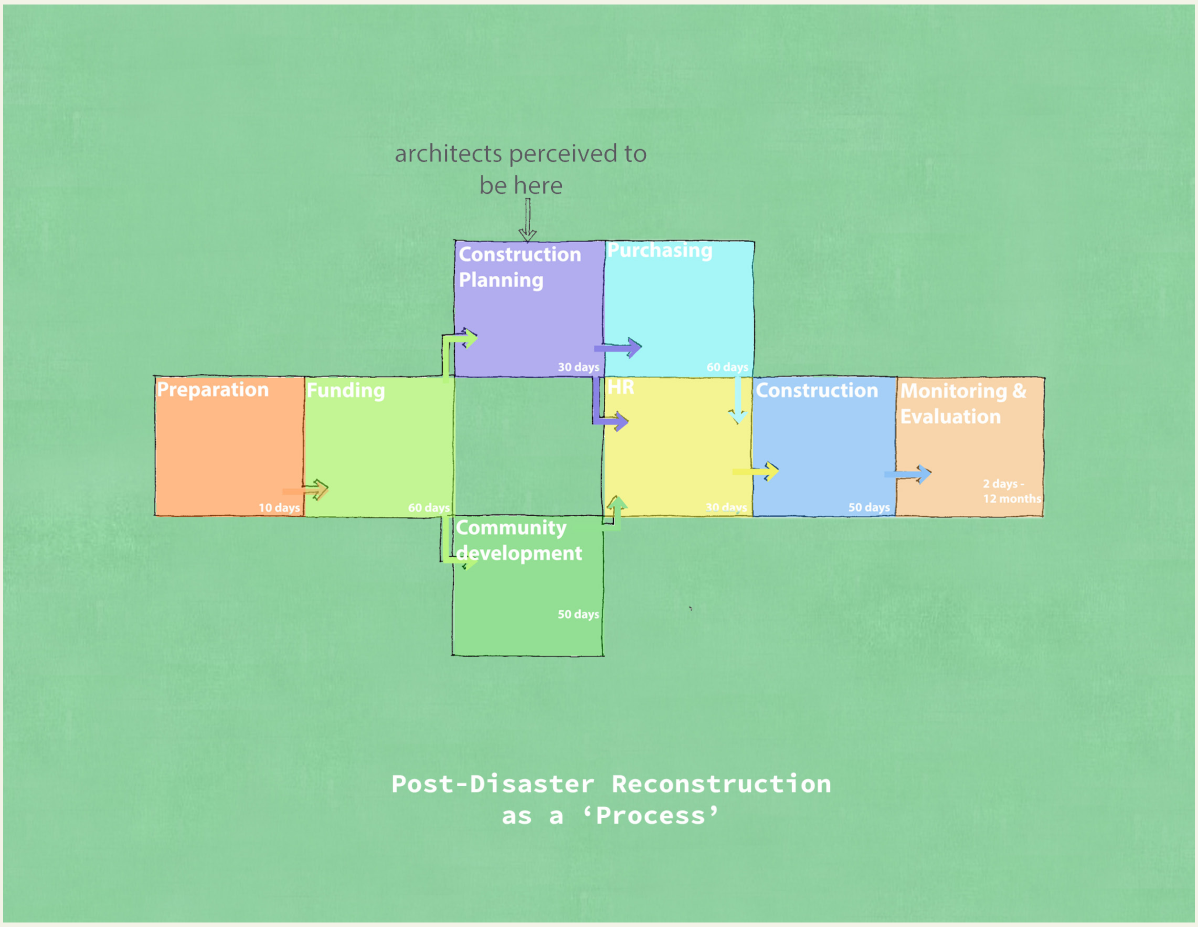


Figure 3.04
HFHFJ Reconstruction Workflow. Where arcihtects are perceived to work.

Figure 3.05
Kestle Model explaining the four value adding measurements for reconstruction

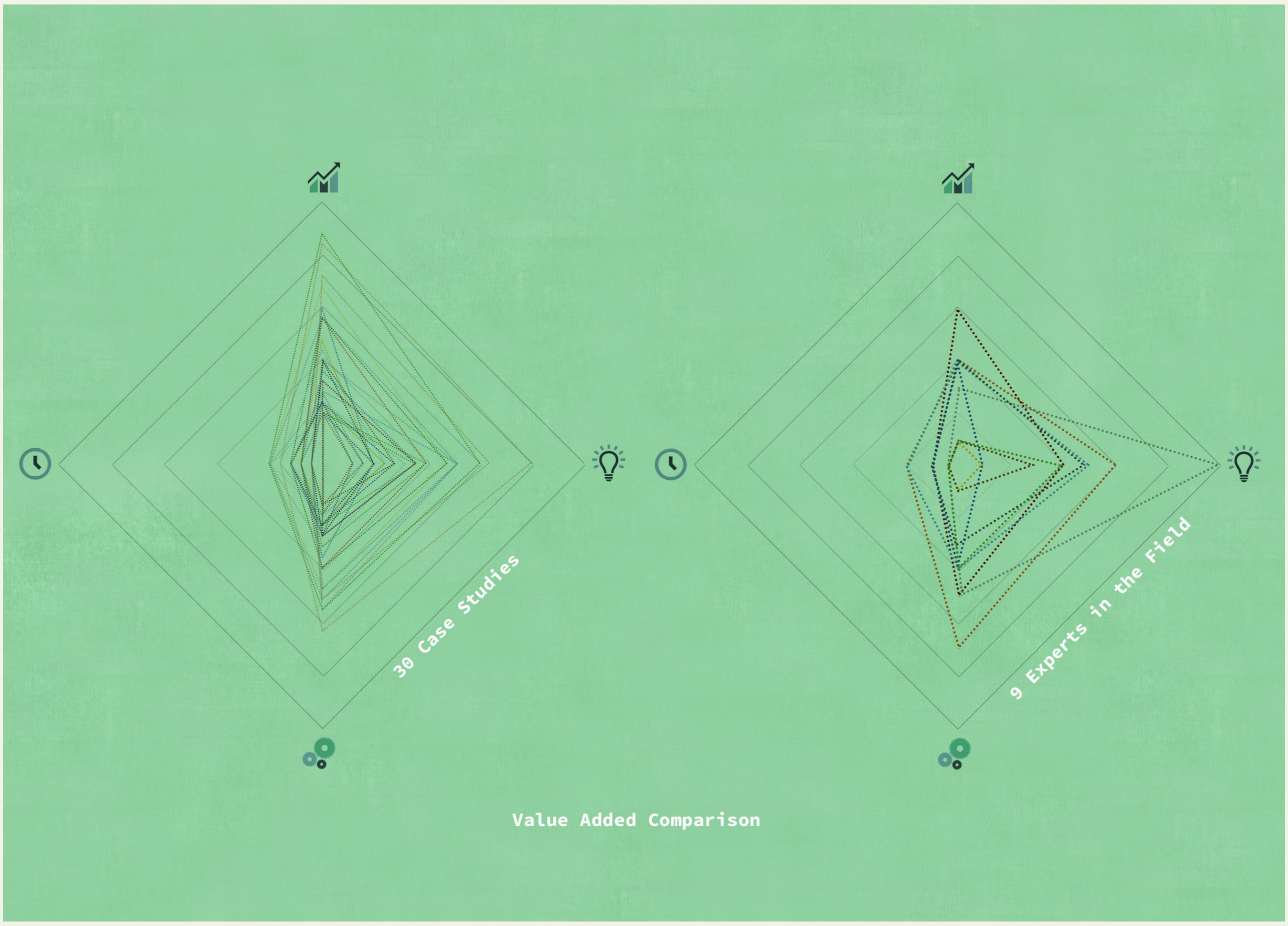


Figure 3.06
HFHFJ Reconstruction Workflow. Where arcihtects are perceived to work.

Figure 3.07
Adaptability of House Design

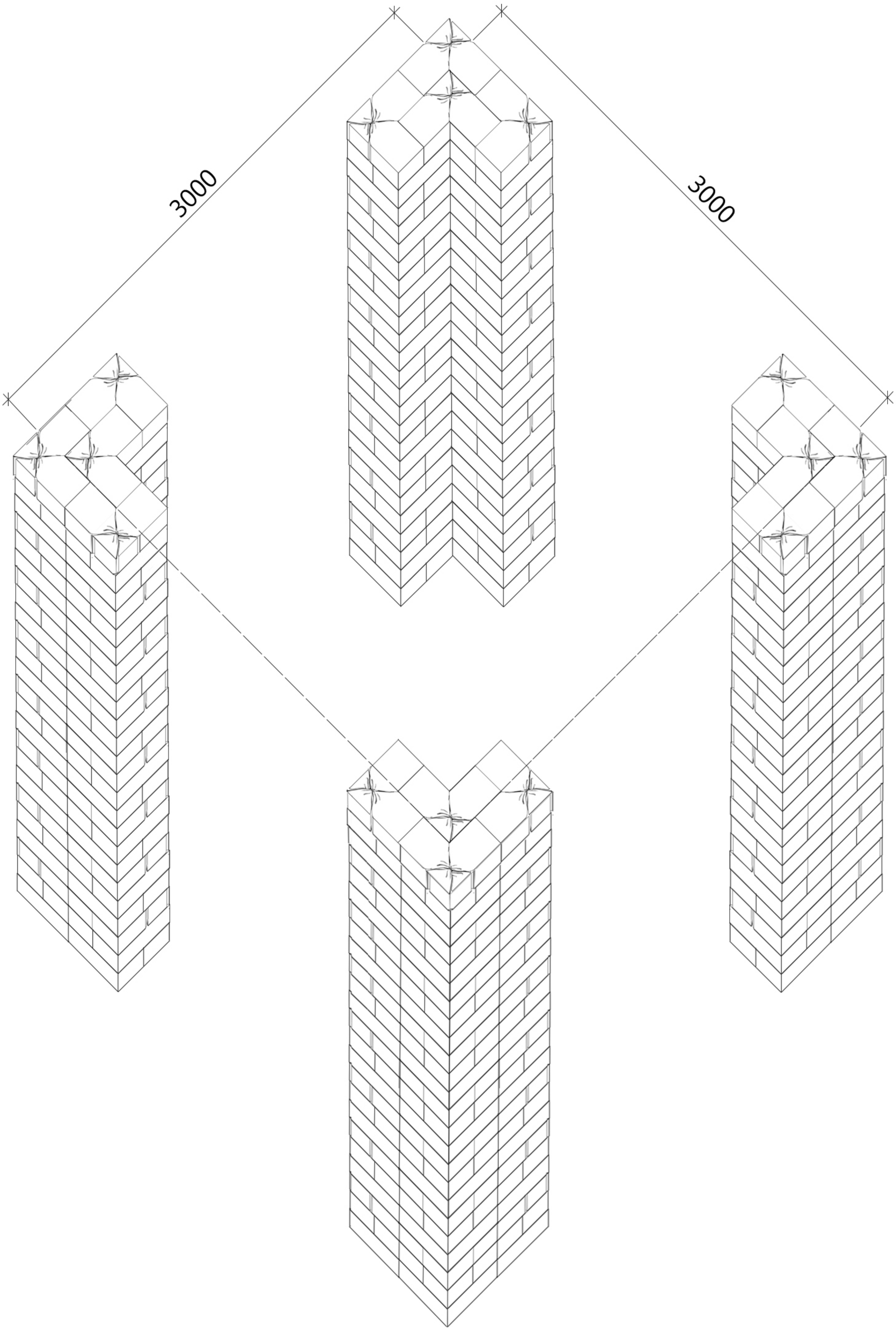
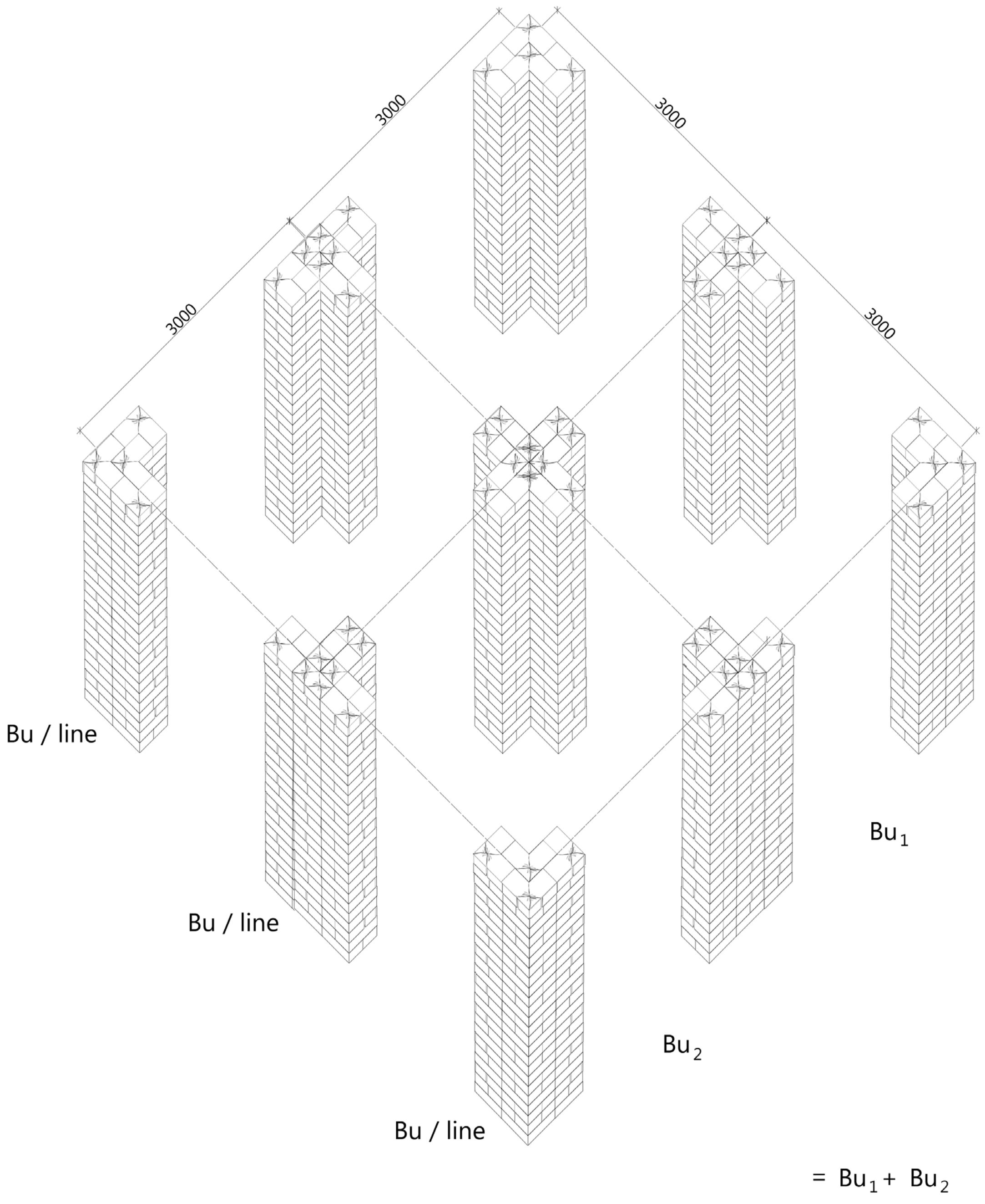


Figure 3.08
3 x 3 m Module

BU1 + BU2 equals the bracing along each BU line (NZS3604, 2011).
HFH transitional housing is based off of the 6 x 3 m module. To keep the sizing of the beams across the top of the walls to a minimum, it is suggested to keep to a 3 x 3 m module for the design. The small 3 x 3 m module can be expanded on by adding additional earthbag 'columns' in a 3 x 3 m grid. Spatially the 3 x 3 m grid appears more intimate.



Bracing unit (BU)
A unit of force used to value the overall bracing performance of a panel tested to the P21 test method. By definition, 1 kN = 20 bracing units.
It is also used in NZS 3604 to express the magnitude of wind and earthquake bracing demand.

Figure 3.09
3 x 3 m Module and Bracing Lines

Figure 3.10
Low-cost and Affordable Design

Figure 3.11
Ownership created by Community Participation

Figure 3.12
Building overall Resilience of Community through Development

Figure 3.13
HFHFJ House Catalogue:
Full Transitional & Transitional

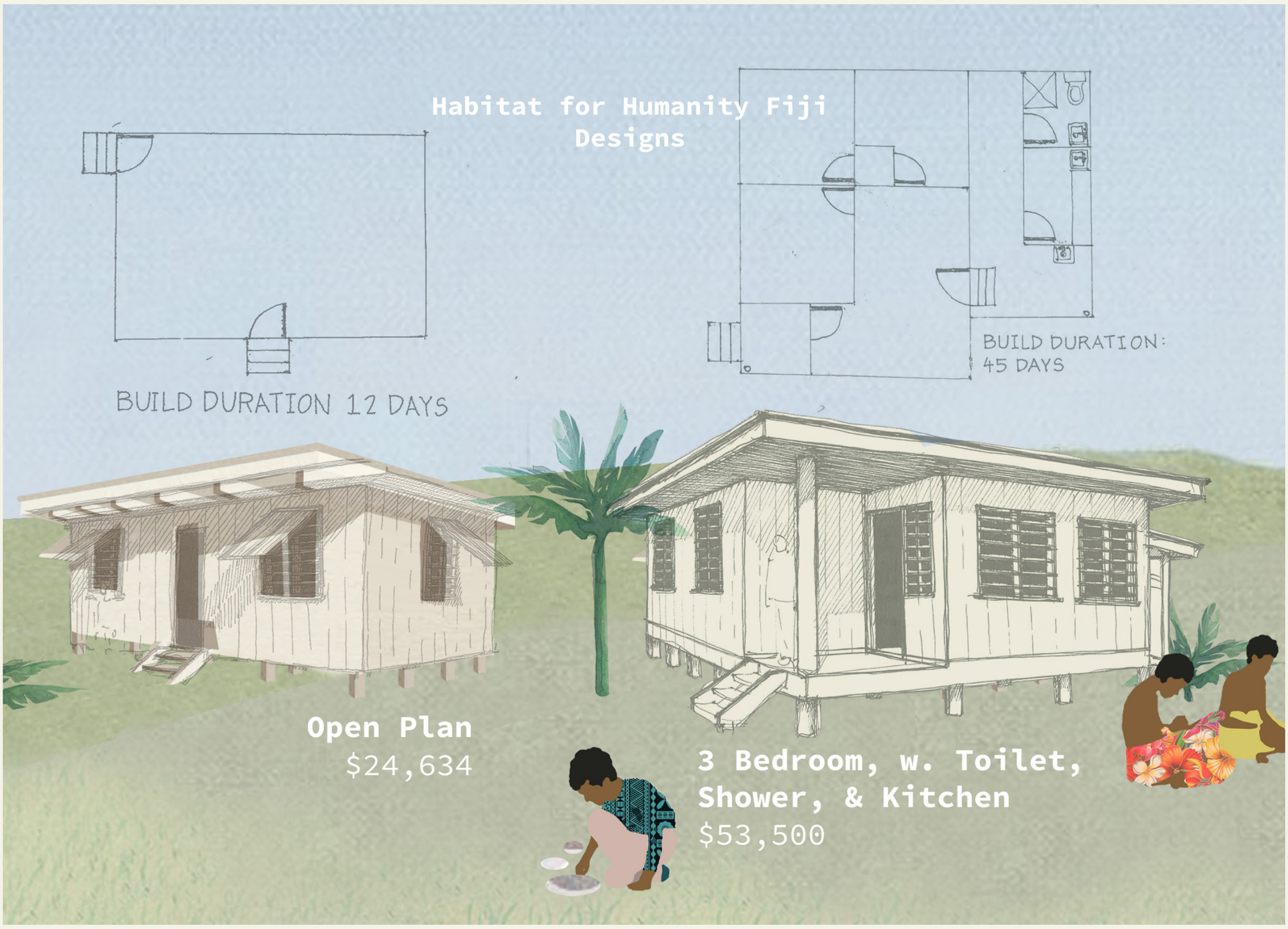


Figure 3.14
HFHFJ House Catalogue:
Open Plan & 3 Bedroom & Amenities

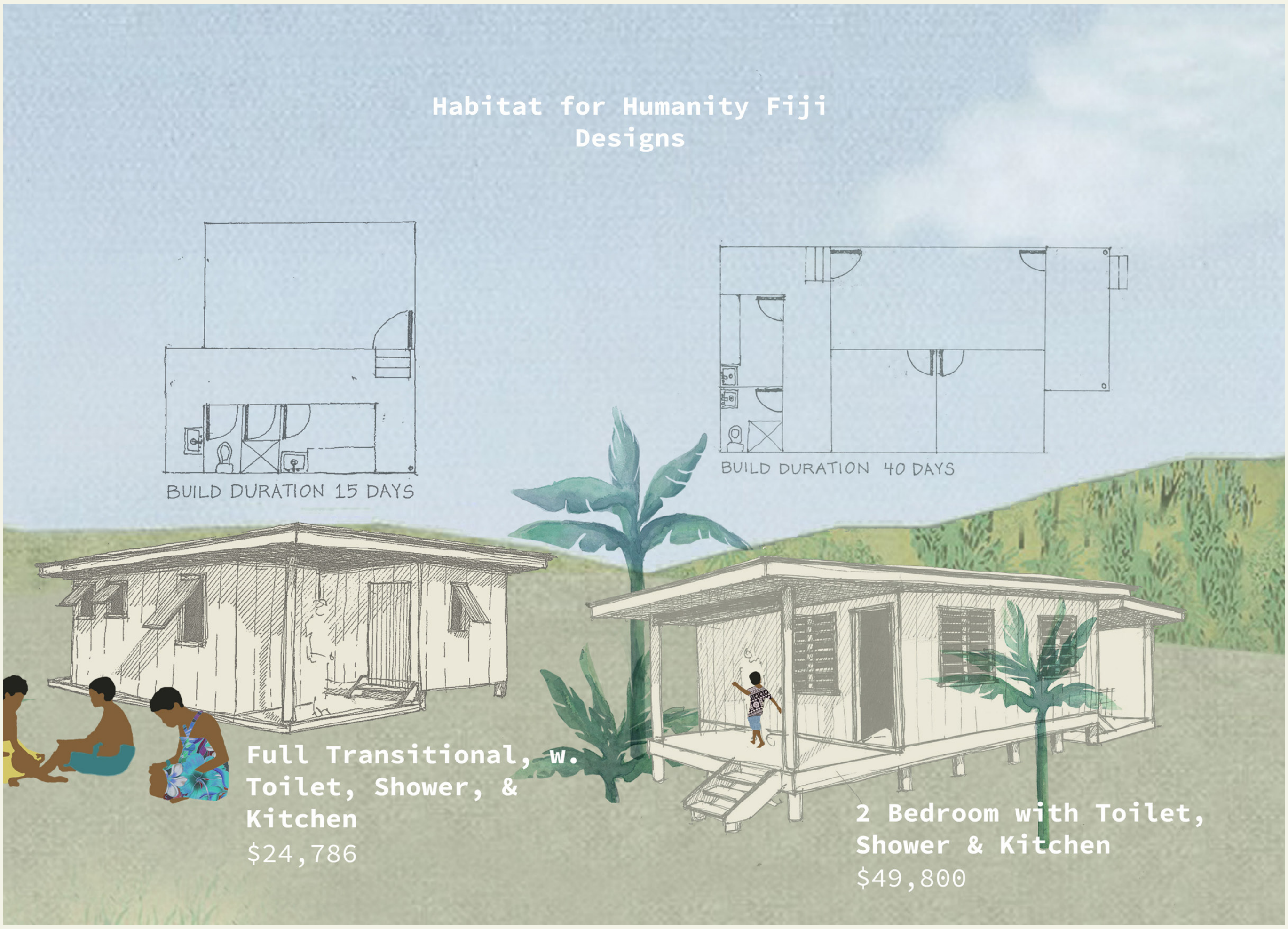


Figure 3.15
HFHFJ House Catalogue:
Full Transitional w. Amenities &
2 Bedroom w. Amenities

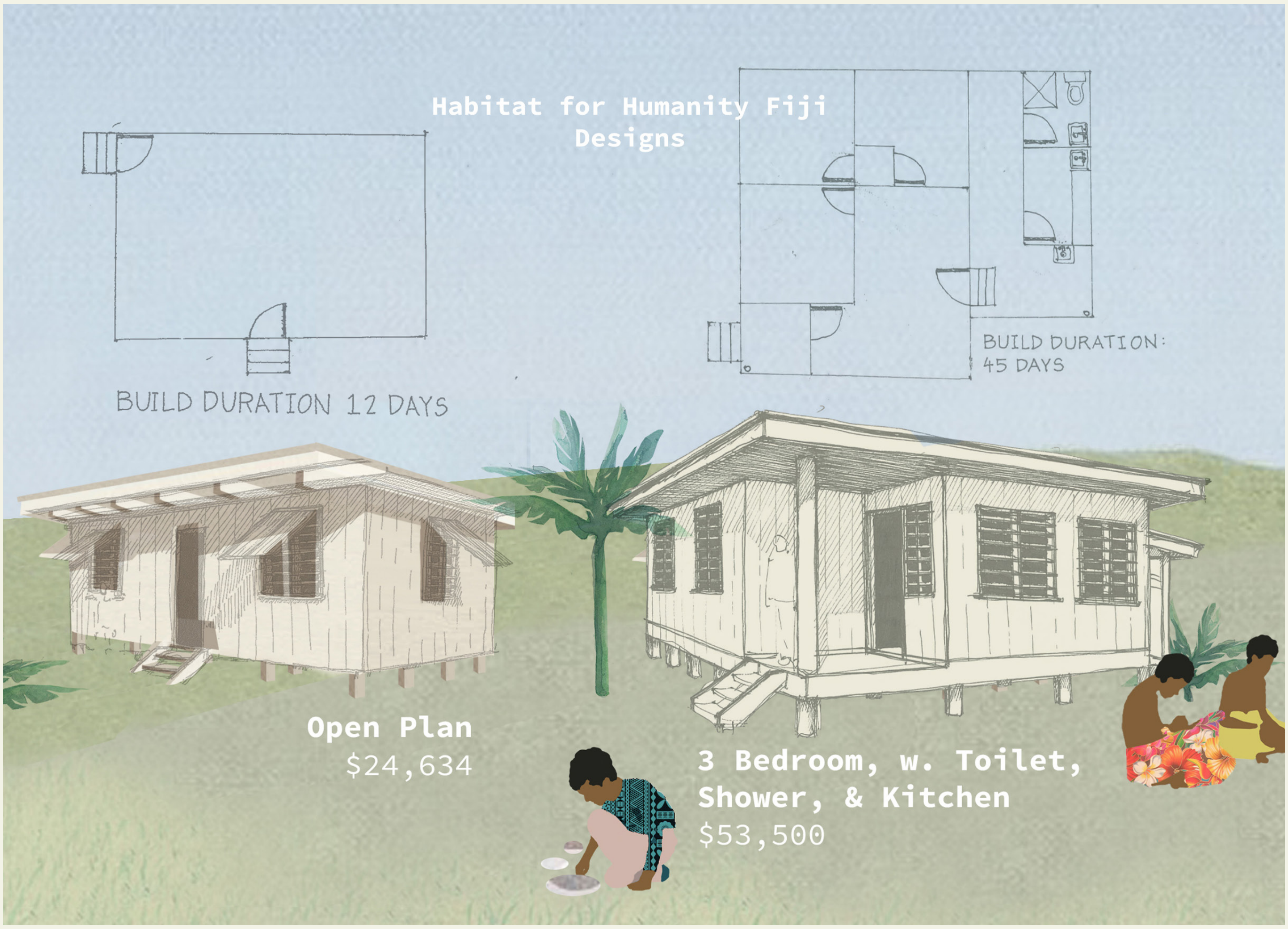


Figure 3.16
HFHFJ House Catalogue:
Open Plan & 3 Bedroom & Amenities

2 weeks - 2 months

Floorplan Scale 1:100

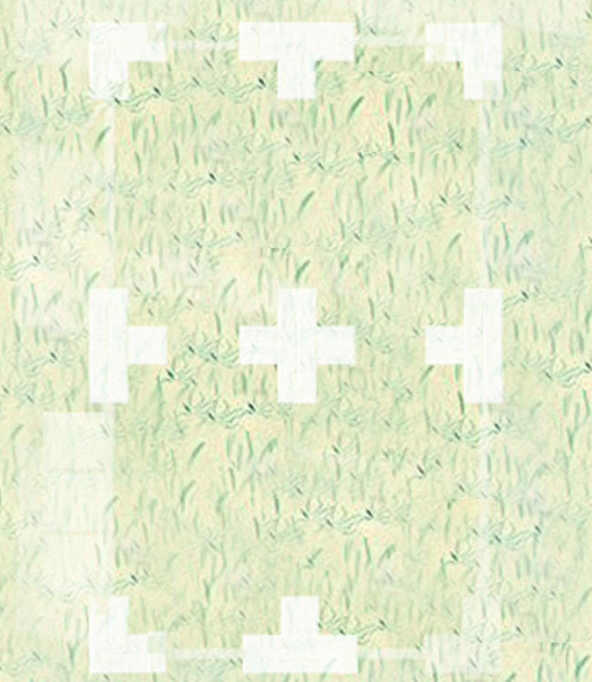


Figure 3.17

3 x 3 m Module with sacrificial material walls that fill the gaps between the columns

Figure 3.18
Adaptabilityof 3 x 3 m Module
Timeframe changes due to family circumstances and funding or ability to build

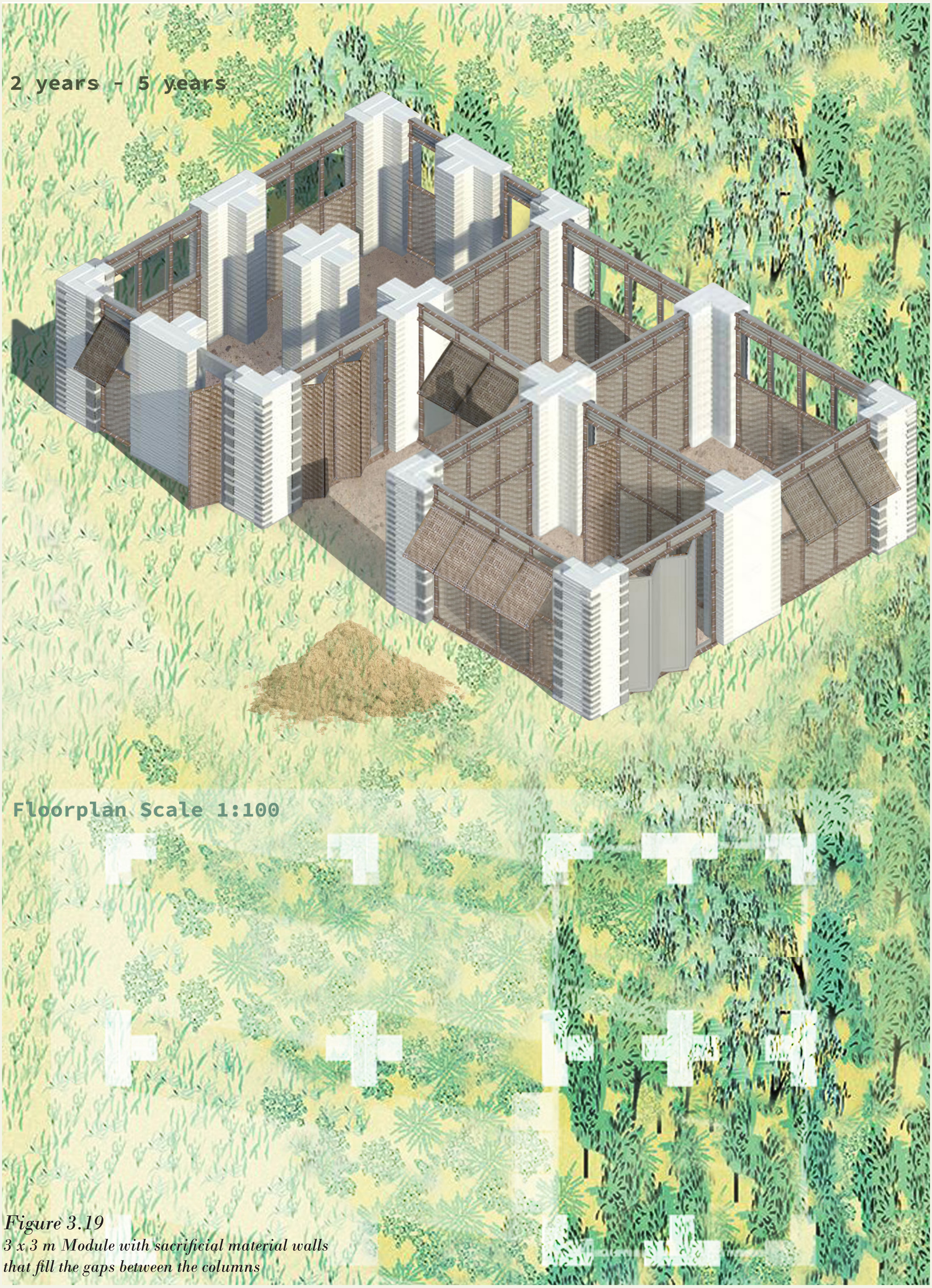


Figure 3.19
3 x 3 m Module with sacrificial material walls that fill the gaps between the columns

Figure 3.20
Adaptabilityof 3 x 3 m Module
Timeframe changes due to family circumstances and funding or ability to build

Figure 3.21
3 x 3 m Module with sacrificial material walls that fill the gaps between the columns

Figure 3.22
Adaptabilityof 3 x 3 m Module Timeframe changes due to family circumstances and funding or ability to build

Figure 3.23
Outdoor Spaces between House Modules

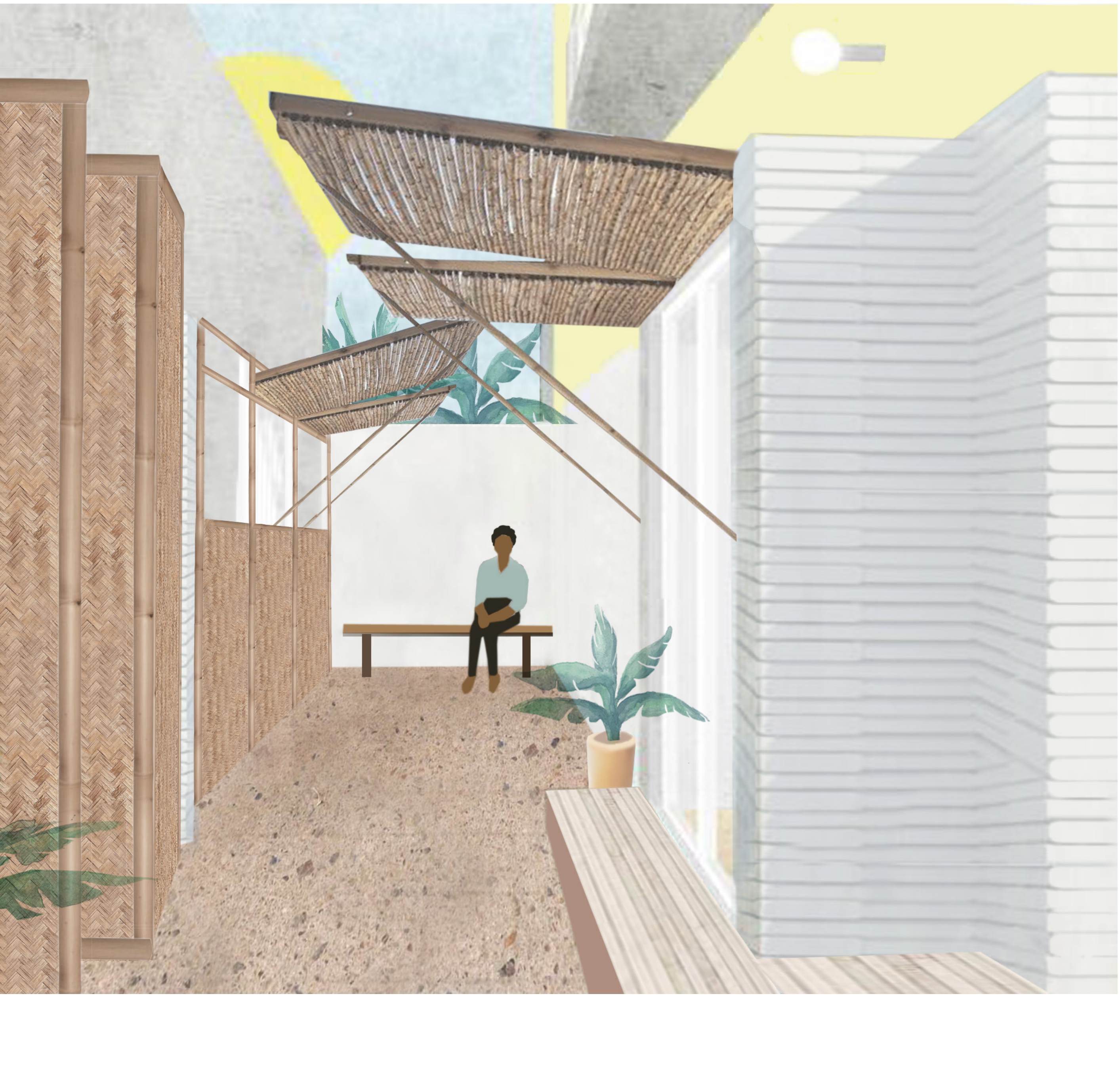


Figure 3.24
Interior perspetive of House Design

CHAPTER FOUR

Figure 4.0
Children from northern Efate at the wharf, Vanuatu, 2015.

3.4 CRITICAL REFLECTIONS

How can we (architects) provide architectural approaches in post-disaster reconstruction, that take into consideration the many complexities and irregularities of the post-disaster context?

So that we can be of help, and provide appropriate approaches, rather than providing temporary approaches that are detrimental to the community long-term?

It would seem that beyond the design of the house or the provision of a technical manual, the architect's role extends to all aspects of what makes a resilient community. This is achieved through the empirical analysis of the complexities in the disaster field, and research as to how the issues can be minimised through innovative approaches. As was the case in Nanokonoko village, earthbags innovatively solved complexities such as: affordability, accessibility, resourcefulness, low-tech construction, adaptability, sustainability, and in the long term requires little maintenance.

Moreover this thesis poses the research aim to investigate how architecture and architects globally can assist in reconstructing post-disaster communities. It does so through the research of existing reconstruction projects, the analysis of the affected community immediately after the disaster, and through their involvement in the entire reconstruction workflow. It focuses on the community of Nanokonoko, Fiji, while drawing from research in both Fiji and Samoa. Nanokonoko is a community that experienced first-hand the effects of TC Winston and the many complexities of the post-disaster context.

Throughout this thesis, the research gathered from literature, case studies, site visits, interviews, and tests established quantifiable theoretical determinants of the role of architects in post-disaster reconstruction. These determinants were applied to Nanokonoko to investigate whether complexities and irregularities could be minimised and how this is determined by the architect's role. This investigation and the diagnostic analysis used is an initial step in understanding the reconstruction of a community in the post-disaster context. The process of applying the presented quantifiable reconstruction process is one method for the investigation of the role of architects in post-disaster reconstruction.

<u>The Post-Disaster Context</u>

Here it was discovered in the interviews that alleviating the cycle of poverty starts with the most basic need of shelter. It is clear however from the literature review, case studies, site visits, and interviews that the disaster environment has irregularities that affect the reconstruction workflow at any stage. Essentially it makes the workload and role of the architect difficult and irregular, and prolongs the provision of shelter and resilience of a community. As a result it induces the cycle of poverty. Innovation then has a key role in alleviating a cycle of poverty in post-disaster communities.

The Role of Architects in Post-Disaster Reconstruction

The research gathered concerning post-disaster reconstruction and the architect's role was not easily measureable. The key quantifiable theories for determinants of resilient reconstructed communities was community participation; including financial literacy objectives, building local capacities and supporting local leaders, good communication between all stakeholders, the inclusion of community facilities and infrastructure, sustainable construction long term, and the active engagement of the architect from initial response to the end of construction.

Many of the discussed theories throughout the literature surveyed made no direct mention of the architect's role in reconstruction. There were guidelines provided for all construction related professionals as to what reconstruction roles would entail. Thus the research undertaken externally applied the quantifiable theories to the post-disaster context along with the internal perceptions of experts in the field and the affected communities to determine if such theories do quantify the role of architects in the post-disaster context. Nonetheless, it seems that architects do need and should seek to be involved throughout the design and construction of shelter or housing. It should be a 'cradle to grave', and potentially beyond.

Empirical Research

Through the external application of innovation and the reconstruction workflow theories on Nanokonoko village distinct cultural and social patterns were found that depict the variance in post-disaster reconstruction needs. The internal process of evaluating the community perceptions and expert opinions through interviews confirmed the variation in the external evaluation as accurate determinants of reconstruction. Through this first step of empirical research, it was determined that the village of Nanokonoko would be an architectural enabler for a complex post-disaster reconstruction project.

Testing

The earthbag wall construction proved a ductility more than twice that of timber framed walls. Seismic design therefore is less than that of timber frames. From the test it was also determined what method is required for creating the criteria set boundaries, and the 3 x 3 m module based off of the transitional 6 x 3 m module. Thus it represented an approach to codify earthbag design by connecting to NZS 3604.

Challenges/Possibilities to the Research

Little was found about the direct role of architect's in post-disaster reconstruction. There was however literature on what reconstruction involves, thus information was extruded and translated into the architect's role. In empirical research it was difficult to find more than 5 architects who engaged in post-disaster reconstruction in a small island nation. This meant that other construction related fields were interviewed for their wider perspective on the role of architecture in post-disaster reconstruction, their own role, as well as their view of the architect's role. The Value Added graphs of the Case Studies and Experts Knowledge in the Field (Figure 2.11) strongly suggest a 'decisive' architecture. One that allows self-determination for affected populations rather than one constrained (as they were) by a lack of skills, resources, and funding.

<u>Difficulties/Limitations</u>

Due to the site being in a remote overseas location there was limited but sufficient time available to observe communities and collect raw data. There were language barriers in different villages that made interviews problematic. Interviews had to be adapted where this was the case, resulting in the gathering of limited data. There was also difficulty in finding at least five architects in the field who had previously engaged in post-disaster reconstruction. Despite this challenges, the research and design was able to provide a map for the engagement of architects.

<u>Future Development/Improvement</u>

They could include the following:

- A full-scale test of house building.
- Further research into innovation in foundations, roofing and connection details, as well as testing of technology.
- Further research into house structure, including sacrificial material walls.
- Fill in the gaps that are not in literature in preparation of site visits immediately following disasters, such as: when on the ground draw site contours, measure the area. Such details are not readily available online in developing countries.
- Historical research into the community, oral traditions through empirical research, and more cultural, socioeconomic, religious, and political research to improve design iterations.

<u>Application to Practice</u>

This research is of relevance in applying architectural influence on post-disaster reconstruction projects. It can also apply to low socioeconomic communities, where seismic strength is required. The design research suggests a typology that is low-cost, extendable, low-tech, with the potential to be aesthetically pleasing and spatially 'larger' through an earthbag approach. This shows how low-cost approaches do not necessarily mean low-quality.

4.0 CONCLUSION

This thesis presents an insight into what the role of an architect could be in post-disaster reconstruction. The architectural process of reconstruction, looking at innovation to solve the many complexities of the disaster context are determinants as to what the role of the architect could be technical and social. The complexities of the field directed the design process and workflow. The research led design approach of the project determined the seismic approved design that is applicable to NZS3604 building standards; and this makes it potentially transportable into other contexts.

Architecture and architects in the post-disaster field are necessary for the community to regain resiliency, if they engage in the process from early response to final construction and evaluations. Thus architects do have a role in post-disaster reconstruction but it is one that is much longer and encompassing then what architects perhaps realise.

4.1 LIST OF FIGURES

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Figure 2.19 *Earthbag House Construction*
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4.2 APPENDIX

Post-Disaster – Architecture Firm Interview Sheet

General

Interview Date ___ / ___ / 2016

Organisation ____

Address ____

Interviewee's Name ________________________________ Phone _________________

What design and technical elements of the house makes it resilient?

How did the design incorporate cultural and/or social traditions of the community?

How did you involve the beneficiaries and/or community in the design process?

How did you allow for future expansion given the site conditions and growing population in the design?

How did you collaborate with other participating agencies in the design and reconstruction process? E.g. engineers? Water, sanitation and health? Local authorities? Organizations?

What community infrastructure was involved in the design and reconstruction process and did you have a role in this area?

Were the houses in-situ or resettlement? Why?

What approach/framework did you use for the planning process?

How did you measure/evaluate the effectiveness of the design solutions provided?

Was there an inventory of different housing typologies and who was involved in the development and design of these?

- What were the different typologies and why?
- Do you have a record of their designs that we may be able to look at?
- Where were these house designs implemented in Samoa?
- Would we be able to go into any of these communities to see these houses?

Did the reconstruction process involve any cash-for-work schemes?

How did you support, educate, and assist with the implementation of technical construction?

What did you and/or your agency develop for the long-term development of the area?

What were the project challenges that you found with this reconstruction project?

Were there any coordination challenges?

Did you find that there were ‘island benefits’ with one community being supported more than another?

Was there long-term livelihood and economic stability for communities? Instead of just cash-for-work programs which are short-term?

Were the government supportive of the reconstruction project? Issues with agencies there for the short-term, but government there for long-term.

What were the main lessons learnt from this/these reconstruction projects?

Post-Disaster – Professional Interview Sheet

General

Interview Date ___ / ___ / 2016

Organisation ________________________________ Agency / NGO / Company

Address ________________________________

Interviewee's Name ________________________________ Phone __________________

What role does your organisation play in post-disaster recovery?

What post-disaster projects has *your company* been involved in?

Who were the implementing agencies that were involved in this/these *post-disaster project*(s)?

Who were the donors for this/these reconstruction projects?

How much did it cost for the new house design?

How much did it cost for a new retrofit?

Were these the total costs of the design/retrofit, or only the costs funded/granted?

Were there additional monies that were required by the homeowners?

What was the average size of these houses?

Do you have any records/plans of these house designs that we may be able to look at?

Is it be possible for you to connect us to someone who could take us to see one (or more) of these house builds in person?

Would we able to get permission to conduct our surveys at these houses, to measure how well they have been designed to fit in with each family, and measure their satisfaction of the housing?

What type of post-disaster reconstruction projects were they?

- E.g. Stage reconstruction from temporary to permanent housing?
- Integrated neighbourhood approach for reconstruction?
- Resettlement and housing reconstruction?
- Reconstruction and rehabilitation?

- Repairs?
- Reconstruction and repairs?
- Community-based owner-driven reconstruction?

Who selected the beneficiaries for reconstruction and retrofitting? How did you go about the selection process?

How did you involve local builders, architects, community leaders, and/or beneficiaries in the design and reconstruction process?

How did you build their capacity for reconstruction?

How did you raise awareness for disaster-resistant construction?

When did the architect get involved in the reconstruction process?

What was the architect involved in in the reconstruction process?

Who and how did you provide supervision and construction management support for the community?

What physical planning and construction of community infrastructure was involved in the reconstruction, and who was in charge of this?

Did you and/or other agencies undertake community and action planning?

Did you and/or other agencies produce a rebuilding manual? How long did this take? How did go about the production of this? How did you go about implementing this into the reconstruction?

Was there an inventory of different housing typologies and who was involved in the development and design of these?

Are we able to get the contact details of the architect/engineer/set up an interview?

Do you have a record of their designs that we may be able to look at?

Where were these house designs implemented in Samoa?

Would we be able to go into any of these communities to see these houses?

What was the state of housing before the disaster?

Were there issues of land tenure? Informal settlements?

Did you or other agencies have to look at tenure security to enable reconstruction?

Did you work in any informal settlements?

Did local authorities give any land titles to house owners?

Were there any significant issues that you can recall, that occurred in this area?

Were there any cash-for-work programs that you and/or contributing agencies provided as part of the reconstruction project?

E.g. Removal of debris? Construction building work? Transportation of goods?

How long did the house design development stage take?

When in the reconstruction and planning process did the beneficiaries receive their funding?
Did they receive their funding in tranches?
When were the local builders appointed and trained for construction?
Who supervised and was in charge of this?

If the funding didn't cover the cost of the whole house design, what was left over for the beneficiaries to pay for?

E.g. painting? Mosquito screens? Window shutters? Plastering?

Post-Disaster – Household Interview Sheet

General

Interview Date ___ / ___ / 2016

Family Name ______________________ Your Name ___________________________

Village ______________________ District ___________________________

No. People living in the house ______ How long have you lived in this house ____ (Years)

Built /repaired by ____ Number of bedrooms ____

Kitchen Inside/Outside/None Bathroom Inside/Outside/None Fridge Yes/No

Shower Inside/Outside/None Toilet Inside/Outside/None TV Yes/No

Roof type ______________________ Material _______________________________

Ext Walls ______________________ Floor/Base _______________________________

Other facilities ____

Affordability

New house / Repaired (Circle one)

Have you returned to your original house/village location after the disaster Yes/No

Were your repairs sponsored Yes/No Who helped ___________________________________

How long did you wait for help ____________________ Sponsored amount $______________

What did they sponsor ____

____

Was the work fully finished Yes/No If No, explain _______________________________________

____

What did you pay for ____ Cost $ _______________

Did your family help with rebuild work ____

Are you still paying for repairs / build costs Yes/No How much $ ________________

What other costs are you paying ____________________________ How much $ ________________

How long will it take to pay off the repairs / build costs _______ (Years)

Who helps pay the costs - that live here ____

Who helps pay the costs - that live somewhere else ____

How satisfied (1=Bad, 3=Good, 5=Excellent) are you with **financial** help you have received from:

Government _____ Aid Agency _____ Family _____ Overseas Family _____ Church _____

Suitability

Were you able to make design decisions on the house before it was rebuilt   Yes/No

What design decisions were you able to make? ____

How many live in the house   Grandparents ___   Parents ___   Children ___

Others (who / how many) ____

Can all of your family fit in your house Yes/No.   If No, where do the others live ________________

____

Did you make changes to your **after** the repairs were finished Yes/No.   If Yes, what did you do

____

____

Does your current house have any issues with weather (rain/wind/flooding) Yes/No. If Yes, explain

____

Do you feel safe in your house from cyclones and other bad weather Yes/No.   If No, what would make you feel safe ____

What **household** activities do you have to do away from your house that you would ideally like to do inside the house if you could ____

____

What **cultural** activities did you use to do in your house before the disaster that you can't do now

____

Which space in your house did you spend the most time in, **before** the disaster ________________

____

Which space in your house do you spend most time in now, **after** the disaster ________________

____

Would you prefer rooms in your house that had less walls, so it feels more open OR do you prefer rooms in your house that have more walls, so the kitchen/lounge/rooms are separate

____

How does your house need to change to make it better suited for you and your family OR what would you change to improve the rooms/spaces in/around your home ________________________

____

How satisfied (1=Bad, 3=Good, 5=Excellent) are you with **the design** of your house: ____

Village / Community

Where do you celebrate cultural festivals with the rest of the community or friends ______________

____

Are there activities that you used to do with your neighbours/community **before** the disaster that can't be done any more   Yes/No.   What are they ____

____

What organisations rebuilt your village ____

What did they do ____

____

What does your village need that is missing ____

____

____

____

Help immediately after the disaster

Where did you take refuge during the disaster ____

____

Which organisations helped you/your village with after the disaster __________________________

____

How did they help you e.g. shelter, water, food, tools, materials for building, funding ____________

____

____

____

Any other comments to make things better next time a disaster strikes _______________________

____

____

____

Village Amenities

How many families live in your village? ____

Schools: Primary Yes/No College Yes/No Other ___________________________

Sports Fields etc ____

Places of worship: Church Denomination ______________________________

Church Denomination ______________________________

Church Denomination ______________________________

Church Denomination ______________________________

Church Denomination ______________________________

No. Shops ______

Community Halls ____

Is there a shared kitchen in your village? Yes/No If No, would you like one in your village? Yes/No

Swimming areas (river, springs, sea) ____

Where are people buried? ____

Water: Town Supply Yes/No Bore Yes/No Other ____________________________

Electricity Yes/No Town Supply / Generator Other ____________________________

Have you got any questions? ____

____

____

____

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